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inclusive pedagogy

Generative AI

MOOC

digital competence

learning outcome

data-driven higher education

peer assessment

Ida Dringó-Horváth

Judit Dombi

László Hülber

Zsófia Menyhei

Tibor M. Pintér

Adrienn Papp-Danka

Pál Szontagh

e-portfolio

learning support

virtual reality

Flipped classroom

AI guidance

constructivist pedagogy

differentiation

reflective approach

Ida Dringó-Horváth
Judit Dombi
László Hülber
Zsófia Menyhei
Tibor M. Pintér
Adrienn Papp-Danka
Pál Szontagh



Károli Gáspár University of the Reformed Church in Hungary – L'Harmattan
Budapest, 2026

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Methodology of Educational Technology in Higher Education. A pedagogic AI

**Ida Dringó-Horváth, Judit Dombi, László Hülber, Zsófia Menyhei, Tibor
M. Pintér, Adrienn Papp-Danka, Pál Szontagh**

<https://orcid.org/0000-0002-5212-4107>

<https://orcid.org/0000-0001-9278-9093>

<https://orcid.org/0000-0002-5125-9317>

<https://orcid.org/0000-0002-5192-4014>

<https://orcid.org/0000-0002-5212-4107>

<https://orcid.org/0000-0001-6714-9852>

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Editors

Ida Dringó-Horváth, Tibor M. Pintér

Authors

Ida Dringó-Horváth, Judit Dombi, László Hülber, Zsófia Menyhei, Tibor M. Pintér,
Adrienn Papp-Danka, Pál Szontagh

Reviewer

Zsuzsa Gonda

Translator

Johanna Szőke

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INTRODUCTION

Dear Reader,

Educational Technology in Higher Education – Methodological Considerations is a handbook promoting and supporting the conscious use of digital tools among instructors in higher education. The content of the volume has been composed in accordance with the **Digital Competence Framework for Educators** (DigCompEdu, Redecker, 2017¹).

In our interpretation, in a higher education environment the concept of educational informatics includes skills related to the use of infocommunication technologies in teaching and learning, as well as other activities related to education, like education management, related individual and organisational communication, and research activities (cf. Kárpáti & Hunya, 2009²).

The concept should be understood as part of the wider notion of digital competence, which “encompasses the confident, critical and ethical use of the technologies of the information society, and of the content made available and transmitted by these technologies in social relations, work, communication and leisure.” (NAT, 2012, p. 19) The European Council defines it as one of the key competences of lifelong learning, which is “linked to

logical and critical thinking, elaborate information management skills and advanced communication skills” (Demeter, 2006³).

The six chapters of the volume are organised around the six areas set out in the DigCompEdu Framework of Reference, which are interconnected in several ways (Figure 1).

As a foundation for the six areas outlined above, the volume opens with **Chapter 0, an introductory chapter which, besides presenting essential knowledge of higher education pedagogy**, offers readers practical tips and tasks to support competence development. This content is of particular importance, as most university instructors in Hungary do not have formal pedagogical qualifications, while reducing student dropout and increasing the effectiveness of the teaching and learning process are urgent tasks. Contemporary pedagogical knowledge, such as outcome-based planning, student-centred teaching and problem-based learning, can contribute to the renewal of higher education and support instructors’ professional development in a continuously changing knowledge environment.

Chapter 1 explores the field of professional engagement and provides ideas on how to use digital technologies to promote communication, collaboration and professional development, and scientific visibility. **Chapter 2 deals with digital resources** – how to find, create and share digital resources effectively in our educational and academic activities. **Chapter 3 discusses teaching and learning**, seeking to promote the management and coordinated use of digital technologies in teaching and learning by presenting specific good practices and useful applications. **Chapter 4 focuses on assessment** – how to increase the effectiveness

¹ Redecker, C. (2017). [European framework for the digital competence of educators: DigCompEdu \(JRC107466\)](https://ec.europa.eu/digital-storytelling/european-framework-for-the-digital-competence-of-educators-digcompedu-jrc107466). Seville, Spain: Joint Research Centre.

² Kárpáti, A. & Hunya, M. (2009). Kísérlet a tanárok IKT-kompetenciája közös európai referenciakeretének kialakítására – a U-Teacher Projekt II. Új Pedagógiai Szemle, 59(3), 83–119.

³ Demeter, K. (2006, Ed.). A kompetencia. <https://ofi.oh.gov.hu/tudastar/tanulas-tanitas/kompetencia#tart>. Budapest: Országos Közoktatási Intézet.

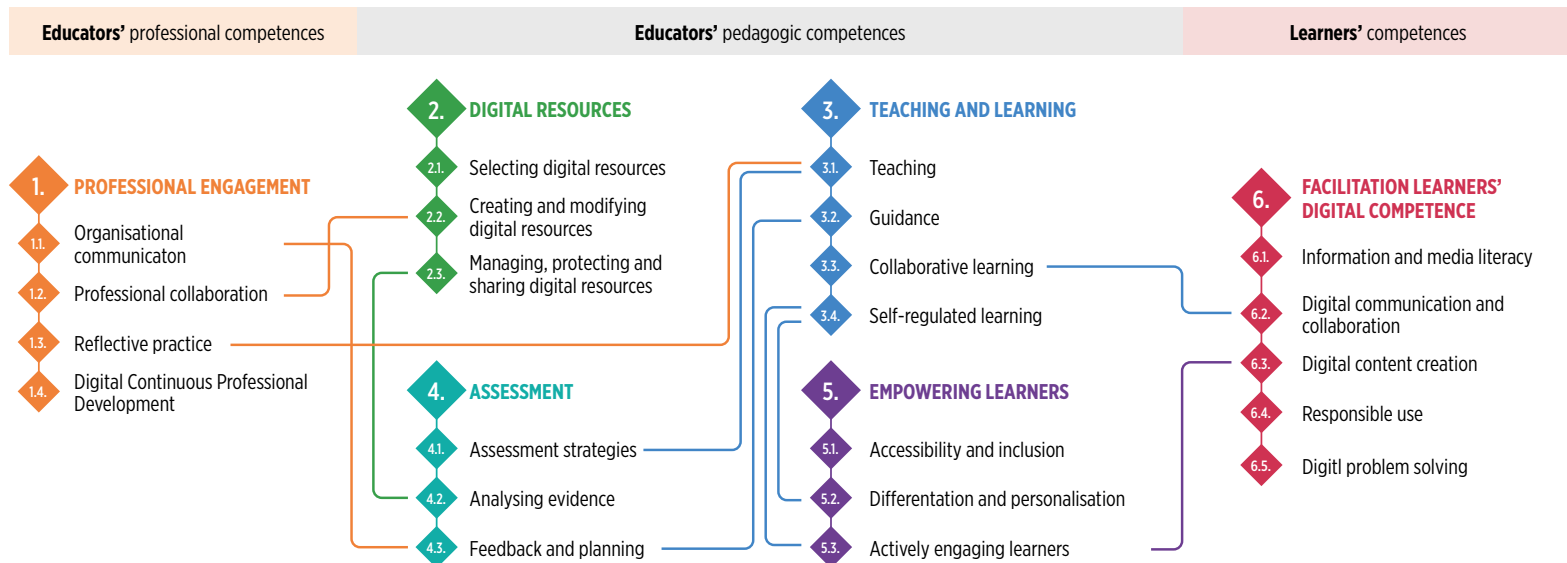


Figure 1. DigCompEdu Framework of Reference (source: Redecker, 2017)

of assessment by using digital technologies or strategies. The apt use of digital tools also contributes to increased inclusion, personalisation and student engagement, and the relevant opportunities are discussed in **Chapter 5 on different means to support learners**. Finally, **Chapter 6 explores how to support the acquisition of digital competences** – how to help students use digital technologies creatively and responsibly to obtain information, communicate, create different types of content and solve problems.

The structure of each chapter follows the activities defined in the DigCompEdu framework. In addition to a short explanation of the most

important theoretical notions, we provide ideas about how to implement each activity in a practical form, with methodological ideas, and examples.

The original Hungarian version of the book included interviews conducted for each chapter with acclaimed experts who also have teaching experience in higher education. Every chapter in the English translation features shorter English excerpts which provide additional knowledge and practical information for the given thematic unit.

Each chapter refers to the relevant results of a comprehensive research project carried out in 2019 by the KRE ICT Research Centre which relied on the cited framework to assess the digital competences of instructors in

Hungarian teacher training (Horváth et al., 2020, N=183). The figure below illustrates the results responding trainees achieved in each area through their self-assessment (Figure 2).

Before reading the handbook, it is advisable to perform self-assessment concerning where we stand in different competences, what our strengths are and where we might need to improve. If, based on our self-assessment, we have successfully identified the areas where we need to improve, it is advisable to study the relevant chapters of the handbook first. This is possible because the six chapters, while interconnected and cross-referenced in many cases, are independent units in themselves, so they may be approached individually, breaking the usual linear order of reading.

The assessment can be carried out in this multilingual self-assessment test.



Click / Scan

The test can be downloaded in different languages.



Click / Scan



Beyond the introductory chapter on higher education pedagogy, a further **new feature of the present edition is that the role and significance of artificial intelligence (AI) are addressed in relation to each area.** The role of AI in education has been discussed since the 1990s, and in 1997 the International Artificial Intelligence in Education Society (IAIED) was established as an international organisation dedicated to research in this field. The functions of AI in education can be classified in several ways, commonly according to how AI supports learner and teacher activities,

or how it contributes to the transformation of the teaching and learning process (Buda, 2024; Horváth, 2023⁴). In recent years, several empirical studies have examined the actual practices of AI use among instructors and students; in the Hungarian context, two recent large-scale studies provide a useful overview (Rajki et al., 2024⁵; T. Nagy et al., 2025⁶).

The specific skills required for the effective and ethical use of AI tools are referred to in the literature as AI literacy. Long and Magerko (2020: 1⁷) define this as a competence that enables individuals to critically evaluate AI technologies, communicate and collaborate effectively with AI, and use AI as a tool. These competences are represented either through dedicated pedagogical AI frameworks, such as UNESCO (2024⁸), or through AI-specific extensions of existing frameworks, such as TPACK AI (Mishra et al., 2023⁹; Ning et al., 2024¹⁰) and DigCompEdu AI (Bekiaridis & Attwell, 2024¹¹).

Drawing on the latter framework, this book presents the essential AI competences by thematic area and in relation to instructors' activities.

⁴ Horváth, L. (2023). Feltáró szakirodalmi áttekintés a mesterséges intelligencia oktatási használatáról. Pannon Digitális Pedagógia, 3(1), 5–17.

⁵ Rajki Z., T. Nagy J. & Dringó-Horváth I. (2024). A mesterséges intelligencia a felsőoktatásban – hallgatói hozzáférés, attitűd és felhasználási gyakorlat Iskolakultúra 7(7) pp. 3–22.

⁶ T. Nagy J., Rajki Z. & Dringó-Horváth I. (megjelenés alatt). Mesterséges intelligencia a felsőoktatásban – oktatói hozzáférés, attitűd és felhasználási gyakorlat. Iskolakultúra

⁷ Long, D., & Magerko, B. (2020). What is AI literacy? Competencies and design considerations. In Proceedings of the 2020 CHI conference on human factors in computing systems

⁸ UNESCO AI competency framework for teachers (2024)

⁹ Mishra, P., Warr, M., & Islam, R. (2023). TPACK in the age of ChatGPT and Generative AI. Journal of Digital Learning in Teacher Education, 39(4), 235–251.

¹⁰ Ning, Y., Zhang, C., Xu, B., Zhou, Y., & Wijaya, T. T. (2024). Teachers' AI-TPACK: Exploring the relationship between knowledge elements. Sustainability, 16(3), 978.

¹¹ Bekiaridis, G. & Attwell, G. (2024). Supplement to the DigCompEDU framework: Outlining the skills and competences of educators related to AI in education. University of Bremen: Institut Technik und Bildung (ITB)

Particular attention is paid to the use of AI tools in professional development, research, personalised teaching and learning, and assessment, while also addressing the related ethical considerations. Our aim is to foster an open, critical and ethical mindset among instructors, while supporting them in helping their students use AI safely and effectively, as also formulated as an objective in Hungary's national AI strategy¹².

We sincerely hope that the practical content, supplemented by multimedia elements gathered here, will provide real help for higher education instructors to put digital tools into practice in both their teaching and academic activities. Although its concepts had already been under formulation for some time, the Covid-19 pandemic lent the handbook particular relevance and currency. For inspiration, here are some tips from the experts:



How should an instructor start and then continue to use digital pedagogy? What are the first teaching and academic activities that should be supported by digital means?

Gábor Halász:

It is a fact that a significant number of our students are much better informed and prepared in this field than we instructors. They are characterised by a high degree of digital creativity, and such students should be supported in their use of these technologies in a creative way.



Judit Szivák:

Find a pair of students who can support you in this field and work together with them, taking small steps and trying out what you are learning in different scenarios. And you will need a good deal of patience as well! You cannot escape experimenting on your own, and a wide range of mistakes are inevitable.



Andrea Kárpáti:

It is best to deliberate on the kinds of teaching or research activities we are not satisfied with. So you have to look at where you want to improve and look for an educational IT solution for this!



András Benedek:

Some basic knowledge should be organised in a concentrated way. We should get involved in open educational structures and open educational courses.



Márta Turcsányi-Szabó:

If we want to start using digital tools, whether in teaching or research, we must be sure to choose the right tool for our own objectives and our own pedagogical methodology.



János Ollé:

I think that it is very important in the educational introduction of any use of ICT tools to look for different technological solutions for our existing pedagogical goals and tasks.



¹² Magyarország Mesterséges Intelligencia Stratégiája 2020-2030., Digitális Jólét Nonprofit Kft., ISBN 978-615-81665-3-9

Helga Dorner:

We should talk to colleagues with a similar philosophy, who teach in a similar way, and who already understand and feel some of the effects of these tools on learning and teaching: this is how methodological reflection and the use of tools themselves can meet.

**Éva Bodnár:**

Firstly, we should throw in some little things to make our classes more colourful. Once we have gained confidence, we can start reading about the methodology. It is not the tool itself that is important, but how we can integrate it into the teaching and learning process.

**Tibor Prievára:**

We should not expect immediate success; we have to keep trying, five, six, ten times even. Many good practices are now available and we can start with one of them.

**Gyöngyvér Molnár:**

It is crucial to see that technology is just a tool. Technology should not determine the direction of changes itself, but should be the catalyst for the changes, i.e. we should use digital solutions as a tool and not as a goal.

**Gyöngyi Bujdosó:**

Early career instructors should definitely use these tools for their own purposes first – in order to see how they can apply them, what they like about them and what they find inspiring. Only then should they start to introduce these digital tools in the curriculum.

**Attila László Főző:**

It is important that educators and instructors who are now opening up to digital technology should first let digital solutions into their own personal learning environments, and explore them – this requires time and a little perseverance.

**Johanna Szőke:**

The easiest way to develop a conscious and critical use of AI is to start using it, while continuously reflecting on the outputs it generates. If we keep in mind that AI is a data-driven, pattern-based machine, and that its responses should be treated as suggestions, we can learn to make genuinely effective use of it.



On behalf of the authors, I wish you all the best for the successful use of these new technologies.

Ida Dringó-Horváth (project manager),
ICT Research Centre,
Project "Education Informatics in Higher Education"

0. HIGHER EDUCATION PEDAGOGY IN THE DIGITAL AGE

Szontagh Pál

Introduction

The societal role of higher education has changed significantly in recent decades, and this change has not been fully reflected in the self-definition and operation of universities. In the minds of many, university education continues to be seen as something exclusive for a small intellectual elite, even though statistical data show otherwise. 'The expansion of higher education has sooner or later brought about a change in the inclusive approach to universities around the world, thanks to which student groups that are considered non-traditional in the literature, including students with disabilities, have appeared. (Hrabéczy & Pusztai, 2020, p. 3)

Below, the demographic and recruitment changes and the spread of artificial intelligence are highlighted among the challenges caused by the growth in student numbers. The discussion will address phenomena that are often mentioned today, such as student- and learning-outcome-centred higher education, and then list some possible methodological responses to these challenges, such as problem-based learning, group methods, and multi-teacher teaching. In the chapter, a brief overview of some good practices in Hungary and around the world is also provided.

0.1. A Changing World, Changing Higher Education

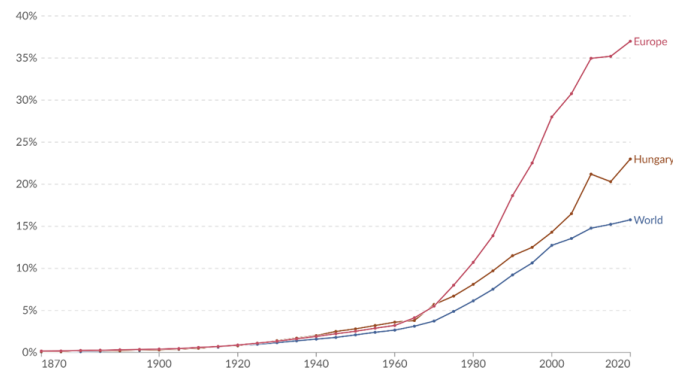
0.1.1. Demographic and recruitment changes

While in 1960, 2.7% of the world's population, 3.2% of Europe's population, and 3.6% of Hungary's population took pride in having completed higher education, by 2020, the proportion of graduates among the population aged 25 to 65 had risen to 15.8% worldwide, 37% in Europe, and 23% in Hungary. (Figure 0.1)

Share of the population with tertiary education, 1870 to 2020

Percentage of the population aged 25 to 65 years who have either completed or partially completed tertiary¹ education.

Our World
in Data



Data source: Barro and Lee (2015); Lee and Lee (2016)

OurWorldinData.org/global-education | CC BY

Note: Data for the years before 2015 are estimates, while data from 2015 onwards are projections.

1. Tertiary education: Tertiary education (International Standard Classification of Education Level 5 to 8) expands upon secondary education by offering specialized learning activities in various fields. It targets advanced levels of complexity and specialization, encompassing both academic and advanced vocational or professional education.

Figure 0.1. Percentage of people aged 25–65 with completed higher education worldwide, in Europe, and in Hungary between 1870 and 2020 (based on Our World in Data, compiled by the author)

In Hungary, in the last decade alone (from 2013 to 2024), the number of applicants increased by 26%, and the number of admissions by 24%, while the population aged 18 decreased by 17%. (source: felvi.hu¹, ksh.hu²)

The increase in student numbers has fundamentally changed the external and internal definition of higher education. Instead of/alongside an elite-oriented higher education, it has become increasingly common for universities to take on a kind of adult education role, for which they have not been prepared, or only to a limited extent, as the learning motivation and strategies of these student groups differ in many respects from those customary in academically oriented higher education. 'Higher education institutions, especially universities, were geared towards training a small number of elites and conducting research, but adult education must provide training that is sometimes aimed at disadvantaged groups and is always practice-oriented' (Engler, 2014, p.17).

At the same time, there is growing tension between employer expectations and the effectiveness of higher education. Students' skills often do not match what employers would expect. The expansion of higher education means that not only the labour market but also the needs of students are shifting towards employability rather than elite education. Higher education is now expected to provide competence-based development that can be quickly converted into 'hard cash' in specific positions through quick, market-oriented, and targeted training.

Although access is becoming more widespread, this only means limited representation of social groups with weaker advocacy skills and socio-culturally deprived student populations at universities. The data from the

Eurostudent international data analysis, which is repeated every three years, also show that 'social inequalities in higher education remain significant, and in many cases, the general improvement in access is accompanied by greater stratification within the higher education system' (Sági, 2024, p. 18).

0.1.2. Challenges and Opportunities in the Age of Artificial Intelligence

The accelerated technological changes of the last decade(s) have fundamentally changed the pedagogical and professional framework of higher education. Although these changes in educational technology will be analysed in detail later in this volume, the most significant change of our time, the impact of artificial intelligence on pedagogy, cannot be ignored in this introduction to higher education pedagogy.

A significant step in the technological paradigm shift in education was the Covid-19 pandemic of 2020, which rapidly forced the integration of digital technology at all levels of education and training, making artificial intelligence-based educational and assessment applications accessible and usable even to those who would not have been interested in these developments otherwise (Szontagh 2025).

The varying degrees, depths, and standards of distance learning were a shared experience gained simultaneously around the world, which made it widely apparent that advances in digital technology offer many new perspectives for the organisation of learning in public and higher education. At the same time, it also became clear that teacher presence and personal interaction remain indispensable at all levels of education (Schleicher, 2020).

Although AI may be able to replace humans in certain areas, it also offers unprecedented opportunities for the development of humans. In the future, teachers will not only be mentors but also companions to their students:

¹ <https://app.powerbi.com/view?r=eyJrJoiYjgxYTUwMzktYmJjZS00MTU0LWlzYjgtOTJiOTUxYjBhMmY3IiwidCI6Ijg3NTQzNjFjLWEOOWEiNDg5NCIiYzclLWRIYQ2YT1IMzZjMjImlmMiQjI9> (Downloaded 19-2-2025)

² <https://www.ksh.hu/interaktiv/korfak/orszag.html> (Downloaded 19-2-2025)

they will be both coaches and training partners who develop alongside their students (Zhu, 2022). 'Since interpersonal relationships cannot be replaced, machines cannot perform functions other than knowledge transfer, so these tools cannot develop social or emotional competencies in learners, and therefore the presence of teachers will continue to be essential.' (Demeter & Mező, 2023, p. 36) In this approach, it is precisely the teacher who will 'introduce society of the future to the appropriate use of digital and, in a narrower sense, artificial intelligence technology' (Szűts, 2024, p. 25).

In his study, Szűts (2024) describes society in terms of AI use as a kind of 'multi-speed humanity', where *leaders* consciously use technology to achieve their goals, developing their own competencies more and more effectively with personalised improvements. In contrast, *drifters* use AI out of convenience and routine, losing their ability to focus and, at certain ages, jeopardising their own cognitive development as victims of 'endless scrolling'. This is a serious social problem, especially when the skills lost in this way are not replaced by new and useful knowledge or performance. A smaller number of potential users are *deniers*, who consciously and deliberately distance themselves from the opportunities offered by AI due to technological or social fears. Finally, there are those who, for some reason—mostly existential, but sometimes social or ideological—do not have access to new technologies and thus remain *marginalised* and on the development curve of the 20th century.

As a student, the leader uses AI as a virtual assistant, while the drifter uses ChatGPT to write and submit homework assignments, project work, and even theses without proofreading or correction. In the role of the teacher, the drifter takes advantage of the possibility of automatic task generation and evaluation, making teaching impersonal. 'AI tools offer an extent of simplification of the learning and academic creative process that

can undermine commitment to analytical and critical thinking. (ELTE PPK, 2023, p. 3) In contrast, the leading educator consciously uses and controls AI, and uses it to achieve their own pedagogical goals.

If artificial intelligence technologies are properly integrated into higher education, this can bring enormous benefits not only to students, but also to institutions and the instructors who work there (Jani & Celaj, 2024). The use of AI is revolutionising teaching, primarily through the use of intelligent tutoring systems, support for personalised learning paths and habits, automated and adaptive feedback methods for assessment and evaluation, and more efficient administrative processes (Lu & Harris, 2018).

Personalisation, adaptive management of cultural and skill differences, and continuous and immediate feedback can reduce the risk of dropout among students who are at risk in any way. Image and sound recognition, sentiment analysis, and virtual assistants available to students with special needs open up opportunities for compensating for disadvantages and preventing dropout that even the best-equipped institutions with a wide range of specialized knowledge, educators, and assistant staff can only dream of today.

The use of AI has both advantages and disadvantages in the educational process. When used appropriately, it improves the quality of education and enables personalised learning, but at the same time, there is a risk of social and interpersonal relationships deteriorating. It cannot really be classified as positive or negative, but it is a fact that AI takes over certain roles of the teacher – in parallel with the previously mentioned transformation of the teacher's role (Horváth, 2023).

Ng and colleagues attempt to approach the issue of AI literacy in pedagogy through the so-called TPACK Model (Figure 0.2). According to this, educators must be equipped with up-to-date technological,

pedagogical, educational theory, and subject-specific knowledge related to AI (Ng et al., 2021).

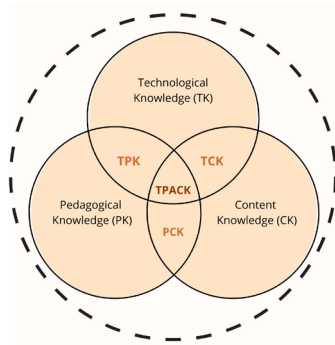


Figure 0.2. AI literacy within the TPACK framework
(based on Ng et al. 2021, edited by the author)

These competencies naturally influence one another: technological possibilities and constraints reframe methodological concepts. Mechanical test- or essay-based assessment, often used out of habit, is being replaced by tasks that encourage creative and critical thinking, frontal knowledge transfer by interdisciplinary and applied projects, and classroom communication is becoming multimodal (oral, written, video, etc.). An interesting paradox in this regard is that, in many cases, it is the development of digital technology that is (once again) bringing oral assessment to the forefront.

‘One of the most important questions for the future of education is what narratives educators and students will adopt about the future role of AI in education.’ (Bokor, 2023, p. 120) In order to prepare students for new challenges, higher education must also transform: ‘It should not only be a teaching facility, but also a research and intellectual hub, and even a

social, cultural, and sports centre, an inspiring living space that develops personality alongside knowledge and skills, and provides a supportive environment for networking through various events’ (Dietz, 2020, p. 59).

To this end, university education (also) needs to focus on developing critical thinking and problem-solving skills, familiarising students with AI technology, ensuring cooperation between human and artificial intelligence, and emphasising the development of digital competencies. It is important to emphasise that the aim is to educate students who are capable of asking questions through research, rather than teaching them to be programmers (Szűts, 2024).

Károli Gáspár University of the Reformed Church in Hungary
Guidelines for the use of artificial intelligence-based systems



‘Károli Gáspár University of the Reformed Church in Hungary, in line with its stated objectives and the mission of its sponsor, the Reformed Church in Hungary, is committed to value- and knowledge-based education that fosters community building. At the same time, it places particular emphasis on imparting knowledge, information, and skills to its students that will enable them to function effectively in Hungary and around the world, and to become successful adults and competent employees in their professions. They can only meet these challenges by possessing the most modern methodologies, technological developments, and competencies applied in their field of science. AI-based systems have become part of our everyday lives, which is why the University’s goal is to ensure that students learn about the opportunities available through AI, acquire the necessary compe-

tencies, and are able to apply them, but at the same time do so responsibly. The University continues to emphasise the importance of knowledge and independent achievement, while supporting the conscious, prudent, and responsible use of AI-based technologies. The University has established strict guidelines for the use of AI-based technologies to ensure ethical teaching and research activities. This document summarises the guidelines for ensuring scientific integrity, ethical procedures, and responsible use. The University follows technical and regulatory changes in the field of AI and AI-based technologies and considers the relevant domestic regulations to be authoritative. Accordingly, it regularly updates its internal regulations to ensure that they are in line with current legal and ethical requirements. The University supports students in acquiring the skills related to the use of AI-based technologies. It ensures that the necessary skills are acquired by making subjects, courses, training programmes, and workshops available, while emphasising ethical and responsible use.³

The introduction of virtual classrooms and artificial intelligence alongside/ instead of traditional lecture halls has brought about a paradigm shift in higher education. As a result, the dynamics of education need to be redefined on several fronts (Nurhasanah et al., 2024). Details of this can be found in each chapter of the handbook.

0.2. Student-centred Higher Education

Education, and especially higher education, has long been marked by the names and work of pioneering educators. Not exclusively for this reason, but not independently of it, it can be said that the central role of the professors has been unquestionable in higher education—until very recently. Meanwhile, many people think that “student-centred higher education” is just the other extreme of the exclusively teacher-focused academic approach, which is then equivalent to the dissolution of quality expectations, placing students in the role of customers, and thus the emergence of a service-oriented higher education system in the exclusively market sense. It is by no means that simple.

The service approach primarily means that universities must simultaneously transition from their traditional academic role to a role of economic development and cultural preservation (Szabó, 2022). The Bologna Process established the following principles: university autonomy, the unity of education and research, freedom of education, training, and research, and a humanistic approach to culture (Csekei, 2010). These can only be achieved by coordinating the expectations of individuals, the state, and the market in a kind of cooperative university model (Szabó, 2022). At the same time, this does not and cannot mean the primacy of student interests or expectations over scientific, academic, commercial or social expectations – rather, it is precisely these external and internal expectations and ‘orders’ that need to be harmonised. A results-oriented, cooperative university cannot compromise on the quality expectations it has set for itself, while there is an imperative need to redefine the quality of its management, teaching, service, and organisational culture. Through this, the institution has the eminent task of ensuring that the education provided to students is in line with the planned learning outcomes.

³ <https://portal.kre.hu/index.php/home/szabalyzatok.html?download=73:utmutato-a-mester-seges-intelligencia-alapu-rendszerek-hasznalatarol-2024-06-28> (Downloaded 21-3-2025)

If our teaching practices are not developed in line with changing societal and student needs, this can easily lead to a focus solely on lexical knowledge transfer, standardised, mass assessment, a decline in creativity and autonomy, excessive bureaucracy, and, as a result, declining learning outcomes, indirectly leading to high student attrition and/or a radical decline in standards (Jármai & Végh, 2017).

A serious limitation of an approach that focuses on the latent and explicit needs of students is that a significant proportion of university professors do not have a teaching degree, even though research shows that the pedagogical preparedness of educators has the greatest impact on higher education teaching practice. (Jármai & Végh, 2017, Korpics & Bajnok, 2023). In 2024/2025, only 116 (31.3%) of the 511 educators at Károli Gáspár Reformed University had a degree in preschool education, teaching, or pedagogy.

The aforementioned Bologna Process made it necessary for universities to switch from a purely content-based, rather organisational input-oriented curriculum design to a results-based approach. More information on this can be found in Chapter 0.3.

In student-centred higher education, the world of frontal lectures in huge lecture halls is being replaced by active learning. The instructor adapts the teaching material and methodology to the learning group or even to individual students, taking into account flexible learning paths and learning outcomes. The emphasis is thus shifted from teaching to learning. (Figure 0.3) This approach is naturally activity-based and includes students' evaluation of learning methods and their participation in developing them.

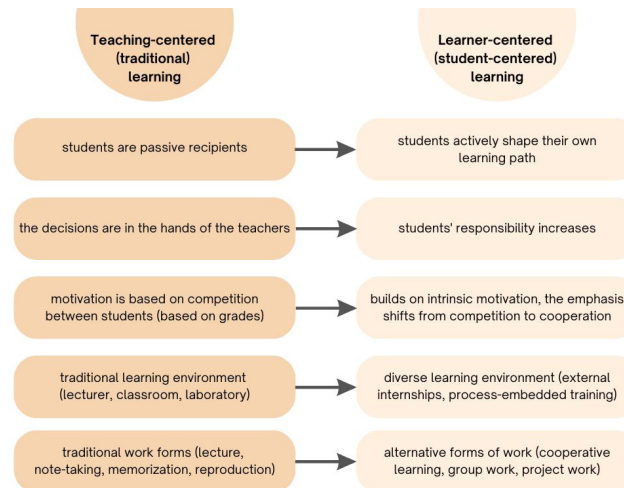


Figure 0.3. Comparison of teacher-centred and student-centred learning (based on Attard et al. 2010a, edited by the author)

In student-centred education, therefore, the teacher is not primarily responsible for imparting knowledge, but for supporting and guiding self-regulated student learning. This theory is closely related to constructivist pedagogical ideas, which are discussed in more detail in section 0.4 and chapter 3.3.

Student-centred education thus replaces purely transmission-based educational models with a results-based approach. Its most important elements are (1) the establishment of effective support and orientation structures, (2) a student-centred curriculum, and (3) the provision of flexible, individualised learning paths. This type of educational organisation promotes (1) transversal skills, (2) critical thinking, (3) active citizenship, and (4) current and future labour market placement (Gover et al., 2019).

This creates a shared responsibility between teacher and student. This responsibility includes selecting appropriate teaching methods, providing continuous feedback through formative assessment, and setting learning outcomes based on the skills and knowledge required by future graduates. For more on this, see Chapter 4. ‘Institutions must have a regularly reviewed interpretation of what learner-centeredness means in their particular context and be committed to its practical implementation.’ (Gover et al., 2019, p. 8)

The characteristics of student-centered higher education are summarised in Figure 0.4:

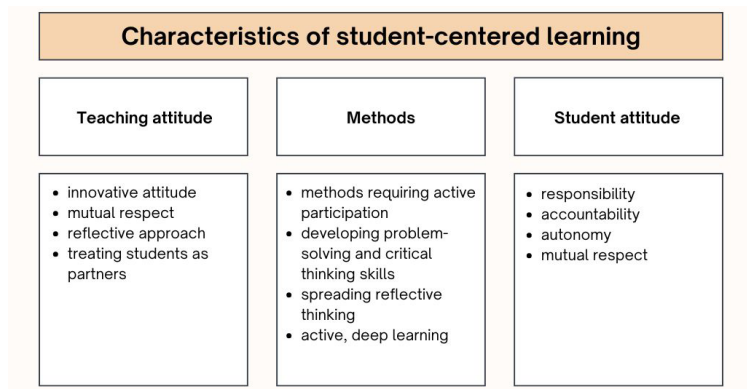


Figure 0.4. Characteristics of student-centred learning
(based on Hrubos, 2024, own compilation)

‘At first glance, putting students at the centre leads to a diminution of the role of teachers, while at the same time raising the risk of an increase in their workload. In fact, it increases their value and, at the same time, their responsibility.’ (Hrubos, 2024, p. 123)

Student-centred learning, teaching, and assessment



Institutions should ensure that the programmes are delivered in a way that encourages students to take an active role in creating the learning process, and that the assessment of students reflects this approach.

Guidelines:

Student-centred learning and teaching plays an important role in stimulating students' motivation, self-reflection and engagement in the learning process. This means careful consideration of the design and delivery of study programmes and the assessment of outcomes.

The implementation of student-centred learning and teaching

- respects and attends to the diversity of students and their needs, enabling flexible learning paths;
- considers and uses different modes of delivery, where appropriate;
- flexibly uses a variety of pedagogical methods;
- regularly evaluates and adjusts the modes of delivery and pedagogical methods;
- encourages a sense of autonomy in the learner, while ensuring adequate guidance and support from the teacher;
- promotes mutual respect within the learner-teacher relationship;
- has appropriate procedures for dealing with students' complain

Considering the importance of assessment for the students' progression and their future careers, quality assurance processes for assessment take into account the following:

- Assessors are familiar with existing testing and examination methods and receive support in developing their own skills in this field;
- The criteria for and method of assessment as well as criteria for marking are published in advance;
- The assessment allows students to demonstrate the extent to which the intended learning outcomes have been achieved. Students are given feedback, which, if necessary, is linked to advice on the learning process;
- Where possible, assessment is carried out by more than one examiner;
- The regulations for assessment take into account mitigating circumstances;
- Assessment is consistent, fairly applied to all students and carried out in accordance with the stated procedures;
- A formal procedure for student appeals is in place.⁴

At universities operating in this spirit, not only do classroom teaching and the nature, methodology, and even content of examinations change, but a student ecosystem develops that permeates the entire structure and culture of higher education. This naturally takes into account the targeted development of students from disadvantaged financial or educational backgrounds, support for part-time study, the promotion of lifelong learning, and the establishment of transparent quality assurance systems to support these (Hrubos, 2024).

⁴ The Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG) (2015, 1.3, in Gover et al. 2019, 19)

Conditions for student-centred learning:

- good practice in learning activities,
- teacher training courses,
- introduction of new, innovative learning experiences through projects,
- student evaluation of the programme,
- programme quality review,
- cooperation between students,
- supportive educational ICT environment (based on Attard et al., 2010a).

The self-assessment questionnaire at the end of this subchapter can provide further assistance in preparing for student-centred teaching.

It is important to note that in this model, ‘the student is not a consumer (whose favours are sought), and the teacher, support staff, and the entire institution are not mere service providers. This is a form of cooperation at a higher intellectual level, the nature of which must be understood and put into practice as a major task for the future. (Hrubos, 2024, p. 126) Therefore, it is clear that, although market-based service marketing and the pedagogical idea of student-centred higher education show similarities in several respects, the direction of development is not the same. The student-centred education model is based on pedagogical processes, learning outcomes, and general labour market and social needs. In this approach, the current market demands cannot be ignored, but they are secondary.

It is also necessary to note that the sharp contrast between research and education in strategic planning does not serve the development of higher education (pedagogy). These two activities must complement and support each other in institutions, without striving for the exclusivity of one or the other – this could lead to a paradigm shift in problem-based or research-based education.

The dichotomy between teaching (content to be learned) and learning (learning outcomes) is not a matter of choice either. As Hrubos (2024) points out, the positive aspects of Western (cooperative, student-centred) and Eastern (exam-centred, teacher-centred) educational traditions can be combined, and it is precisely this combination that can bring world-class results. ‘Combining ‘quiet, passive’ and ‘verbal, active’ learning (following both Confucian and constructivist pedagogical principles) seems to be the solution, which is a gigantic intellectual and practical task. (...) Singapore is a special example. In addition to its well-known amazing successes, it has also achieved relatively good results in the area of CLL [student-centred learning]. The powerful influence of the Western universities and campuses established here is obvious (and the presence of a population with diverse cultural and religious backgrounds also contributes to this), but the decisive factor is that, since 1997, the entire education system has been reformed (basically in a Western spirit).’ (Hrubos, 2024, p. 125)

Finally, the supplementary functions of student-centred higher education should also be briefly mentioned. These are primarily career support and alumni career services. If university citizenship is understood as a community, the organisation’s responsibility for students’ conscious and successful career choices also increases. The primary source of intellectual capital (*human capital*) produced at the university is, of course, well-trained (professionally competent) employees. They are the ones who are able to create new knowledge or absorb existing knowledge and apply it creatively to create value. (...) It is an obvious expectation that the higher education training system and philosophy should be transformed so that it becomes capable of developing competencies (knowledge, skills, attitudes) that, when mobilised, will enable future employees to live a life they consider

valuable, because only in this way can they become productive in socio-economic terms.’ (Vass, 2010, p. 10)

Although there is no uniform international protocol for alumni career tracking and career guidance, research results that enable synchronous and diachronic comparisons provide important input for higher education institutions regarding the effectiveness of their training. Based on the results, it is possible to adjust the training structure, curriculum content, or even teaching methods, contributing to the achievement of learning outcomes that meet student and societal expectations and to a reduction in career dropout rates.

Megatrends	Challenges	Necessary steps
Technological revolution	Strengthening the focus on higher education and institutions	Creating competition between training programmes, higher performance, quality, and motivating success experiences, involvement in technical innovation
Globalisation	Cooperation within institutions, between institutions, and with external partners	Transforming the institutional system based on the spatial structure of the Hungarian population in the country and the Carpathian Basin, further efforts towards internationalisation

Megatrends	Challenges	Necessary steps
Demographic processes	Reinterpretation of value-creating processes in institutions, decline in student numbers	Training provision and educational innovation based on demographic forecasts, support for quality strategies instead of quantity and growth strategies
Societal needs	Stronger representation of external demands in the internal structure of institutions	Profile refinement and specialisation, defined types of institutions and areas of competence
Limited (energy) resources	More efficient use of resources, generation of additional resources	Transformation of the institutional management system, introduction of new business and operating models

Table 0.2. Ludovika University of Public Service, Institutional Development Plan 2020–2025 (cited in Korpics & Bajnok, 2023, p.12)

Complete the checklist below. It will help to identify which elements of student-centred higher education are present in the institution's practices, and which areas may need improvement.



1. Consultation with Students

		Yes	No
1.1	Are there transparent procedures in place for students to be able give feedback on the quality of the educational process?		
1.2	Are students consulted on curriculum content?		
1.3	Are students consulted on the teaching and evaluation methods used?		
1.4	Are students involved in periodic programme quality reviews?		
1.5	Are students involved as full and equal members in committees where issues relating to the student experience are discussed at all levels (e.g. department, faculty, university, etc.)?		
1.6	Are straightforward procedures in place for students to appeal decisions regarding their academic attainment or progression?		

2. ECTS (European Credit Transfer System) and Learning Outcomes

		Yes	No
2.1	Are students consulted when learning outcomes are designed?		
2.2	Are student needs and the diversity of the relevant student group considered when designing learning outcomes?		
2.3	Are students informed on the intended learning outcomes before they start a course or programme component?		
2.4	Are ECTS credits used co-related with defined learning outcomes?		
2.5	Are credits transferable between courses and institutions?		
2.6	Are credits measured based on student workload, independent of contact hours?		
2.7	Are students awarded credits for activities that help them attain intended learning outcomes if conducted outside the institution?		
2.8	Does your institution refer its qualifications to a Qualifications Framework?		

3. Quality Assurance

		Yes	No
3.1	Are both staff and students consulted during the institutional quality assurance process?		
3.2	Are both representatives of teachers and students involved as full and equal members in the panels undertaking institutional quality assurance reviews?		
3.3	Do institutional quality assurance reviews and guidelines take into account the overall elements of teaching and learning?		
3.4	Do programme quality reviews take into account the use of learning outcomes?		
3.5	Do programme quality reviews take into account the assessment methods used?		
3.6	Do external quality assurance evaluations refer to the teaching and learning process?		

4. Mobility, Recognition and Prior Learning

		Yes	No
4.1	Are study periods conducted by students in other institutions within various mobility schemes recognised by your institution?		
4.2	Do incoming mobile students at your institution benefit from support in order to be able to cope with their new cultural and linguistic environment?		
4.3	Are examples of good practice in teaching and learning that mobile staff come into contact with discussed and disseminated at the institutional level?		
4.4	Is prior learning (in non-formal learning environments) recognised by your institution for the purpose of access into educational programmes?		
4.5	Is the process of recognition easy?		
4.6	Can recognition of prior learning be done without significant costs or bureaucracy?		

5. The Social Dimension

		Yes	No
5.1	Are special support measures in place in order to help students from disadvantaged backgrounds?		
5.2	Are learning paths flexible enough so as to permit combining work/family-life and studies?		

6. Teaching and Learning Methods

		Yes	No
6.1	Does your institution use peer assessment and peer learning?		
6.2	Does your institution have programmes for which it uses activity-based learning?		
6.3	Is group-work used in the learning process within your institution?		
6.4	Are extra-curricular activities of students accepted and recognised as an essential part of the learning experience?		
6.5	Is the development of transversal skills by students one of the objectives of the learning process in your institution?		

7. Student Assessment Methods

		Yes	No
7.1	Are the goals of the learning process agreed upon between teachers and students?		
7.2	Are peer- and self-assessment used as a method in the student assessment process?		
7.3	Are projects used in the assessment of students?		
7.4	Are simulations of tasks and real life situations used in the assessment of students?		

8. Learning Environment

		Yes	No
8.1	Do students have access to appropriate research and study facilities both on and off campus?		
8.2	Is information technology used within the learning process?		
8.3	Do librarians collaborate with teachers in order to enhance students' learning experience?		
8.4	Does your institution contribute to promoting a national/ regional culture of SCL (Student Centred Learning)?		

9. Professional Academic Development

		Yes	No
9.1	Does your institution have any guidelines on teaching and learning?		
9.2	Does your institution have a regular professional development programme for teaching staff?		
9.3	If yes, does this programme include a constructive discussion on the application of teaching methods?		
9.4	Does this programme use an SCL approach in providing training on the use of innovative teaching methods and studentcentred curriculum development?		

Table 0.2. Checklist for student-centred higher education
(Source: Attard et al., 2010b, pp. 13–16)

0.3. Outcome-based Higher Education

As is clear from the above, in the renewed higher education system, content-based, input-oriented planning is being replaced by a learning outcomes-based approach. Since the goal of the education system is to give meaning to teaching and learning and to improve the skills of the trained workforce, the content of higher education courses needs to be redesigned in terms of learning outcomes (Alyasin et al., 2023). This way of thinking follows organically from the student-centred learning (SCL) paradigm discussed in section 0.2 (Attard et al., 2010a). ‘In a knowledge-based society, the production, generation, and transfer of knowledge is an industrial activity, so the application of knowledge (know-how) has become increasingly important in all areas of life. Public and higher education are striving to adapt to these expectations of the economic sphere, which in practice means that the curriculum is increasingly taking labour market considerations into account in addition to professional considerations.’ (Dringó-Horváth, 2024, p. 12)

In the 21st century, the focus in higher education is increasingly shifting from the triad of research, teaching, and service to the teaching-learning function, or higher education pedagogy (*Scholarship of Teaching and Learning*) (Halász, 2021). The fundamental question in higher education today is no longer ‘*what did you do to earn your degree?*’ but rather ‘*what are you capable of now that you have earned your degree?*’ (Kennedy et al., 2006) ‘In an outcomes-based approach, the focus is not on what activities (related to learning) the student participates in, what subjects they study, who the professors are, how many hours they study, and what they have to read, but rather on what competencies they must possess upon graduation and what professional tasks they are capable

of performing. At the same time, it also expresses the view that the given results can be achieved in many ways, through many different paths, even outside of formal education.’ (Tót, 2017, p.15)

In recent decades, the labour market, as a customer/user, has found that qualification levels (degrees, diplomas, and certificates) alone are increasingly unable to describe the actual abilities of students. A considerable number of people have accumulated degrees and formal qualifications, but they are increasingly unable to meet the real challenges of the labour market, whether these be technical, communications or simply professional innovation challenges. This phenomenon, coupled with the fact that an increasing proportion of a given age group is participating in higher education—and is therefore missing from the population entering the labour market after obtaining a secondary vocational qualification—has become not simply a question of the quality of education, but also a matter of national economic importance, which is why the vocational training function of higher education must be strengthened. This requires a change in the pedagogical approach to higher education. ‘International trends in education policy show that, overall, attention is shifting from the expansion and massification of higher education to its effectiveness. This means that, in addition to issues related to student numbers, the development of student competencies is coming to the forefront; not only professional competencies, but also general competencies (e.g., digital, entrepreneurial), and 21st century competencies (e.g., resilience, virtual collaboration, innovative, and adaptive thinking).’ (Kálmán, 2021, p. 17)

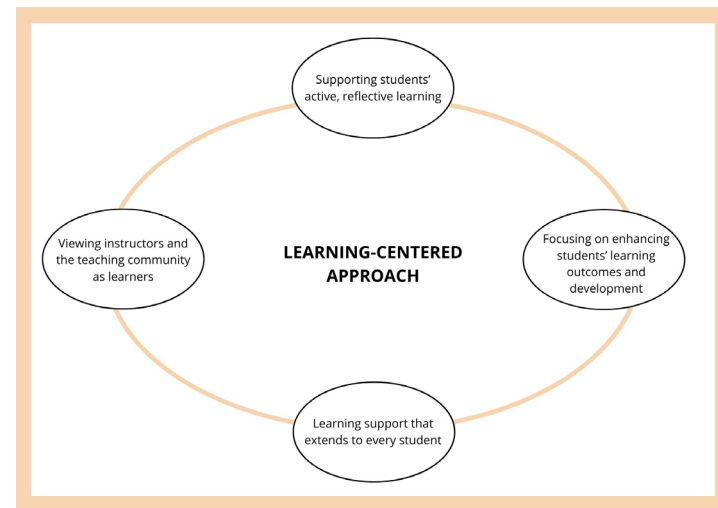


Figure 0.5. Conceptual framework of learning-centred higher education pedagogy (based on Kálmán, 2017, p. 27, edited by the author)

For a long time, international university rankings based primarily on research performance had been the determining factor in higher education quality management, but as a result of the Bologna Process, teaching and learning performance, i.e., higher education pedagogical performance, has also come to play an important role in quality assurance. According to the 2015 amendment to the European Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG), ‘institutions should ensure that programs are designed in such a way that they can be effectively implemented and that the learning outcomes can be achieved.’ Student-centred learning and teaching play an important role in stimulating student motivation, self-reflection, and participation in the learning process.

This requires careful consideration in the design and implementation of study programmes and in the assessment of outcomes. Assessment should enable students to demonstrate the extent to which they have achieved the intended learning outcomes. (ESG 2015, p. 12)

The three key elements of output-based regulation of learning outcomes are as follows:

1. It defines in terms of competencies the level of preparedness of students at the end of the training process, thus reflecting the institution's own mission.
2. The output requirements identify both academic and labour market expectations. This presupposes that universities and colleges work in partnership with those who define the competencies required of future practitioners. At the same time, the autonomy of higher education institutions is fully respected with regard to the implementation of traditional training objectives and values and the means of achieving output results.
3. Training and Output regulation identifies the outcome of training and does not restrict the finding of the most effective paths and training methods to achieve it. This allows for the flexible design of training methods, the application of individual solutions, and the enforcement of institutional characteristics (Tót, 2017, p. 9).

Definition

Learning outcomes describe what a student is expected to know, understand, and be able to do upon successful completion of a given learning stage, as well as what attitudes they will have and what degree of professional autonomy and responsibility they will possess in situations related to the elements of competence (Tót, 2017, p. 15).

In Hungary, learning outcomes (Training and Output Requirements) are defined by the Hungarian Qualifications Framework (MKKR, Government Decree 1229/2012 (VII. 6.)). This framework specifies the competences (including the necessary knowledge, skills, and attitudes) for each level of training and the corresponding degree of autonomy and responsibility (Figure 0.6).

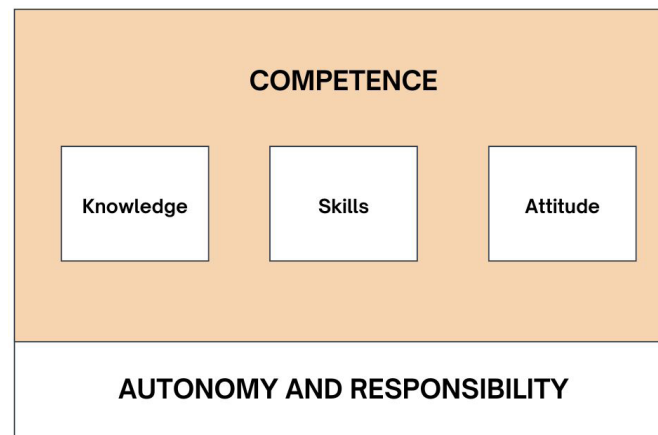


Figure 0.6. Interpretation of competency elements (MKKR descriptors)
(based on Tót, 2017, p. 12, edited by the author)

Although defining learning outcomes is essential in order to provide a clear and accountable framework for all participants in higher education, formulating them is by no means an easy task.

According to the definition of the European Credit Transfer and Accumulation System (ECTS), learning outcomes should express the level of competence achieved by the student and verified by assessment. These are statements about what the student knows, understands, and can do after completing the learning process. These statements must be measurable and verifiable. The ECTS recommends the following when formulating the outcomes of individual teaching programmes and courses:

- The learning outcomes should adequately reflect the context, level, scope and content of the programme.
 - The statements of learning outcomes have to be succinct and not too detailed.
 - The learning outcomes have to be mutually consistent.
 - The learning outcomes should be easily understandable and verifiable in terms of what the student has actually achieved at the end of the programme.
 - The learning outcomes have to be achievable within the specified workload.
 - The learning outcomes have to be linked with appropriate learning activities, assessment methods and assessment criteria.
 - There are no rules on the ideal number of learning outcomes at programme level. Experience suggests that between 10 and 12 is appropriate.
 - A widely accepted way of formulating learning outcomes is based on three essential elements.
- Use an active verb to express what students are expected to know and be able to do (e.g. graduates can 'describe', 'implement', 'draw conclusions', 'assess', 'plan').
 - Specify what this outcome refers to (object or skill e.g. can explain the 'function of hardware-components', or can present the 'design of a living-room by hand').
 - Specify the way of demonstrating the achievement of learning outcomes (e.g. 'to give an overview of the materials most often used in electro-engineering'; 'to develop a research design by applying up-to-date scientific methods', etc.). (ECTS, 2015, p. 23)

The accurate formulation of learning outcomes enables students to make informed decisions when selecting courses or modules that are appropriate for them, as they can identify their previous studies that are relevant for the recognition of academic credits, and thus link their previous learning to the next expected stage of learning (Purvis et al., 2023).

Tót recommends the following criteria for formulating learning outcomes:

- They take into account both academic and labour market considerations.
- They use clear wording that can be understood by students, employers, and other professionals.
- When formulating each learning outcome, the level at which the program is classified within the framework should be considered (in line with the available 'higher-level' documents).
- In the case of sequential programs, particular care should be taken to clearly distinguish between lower and higher levels.
- General formulations that are problematic in terms of assessability should be avoided (Tót, 2017, p. 21).

TRADITIONAL APPROACH	OBE APPROACH
teacher-centered	student-centered (autonomous learning with teacher support)
curriculum/content/process	outcome/knowledge building
input-based	output-focused
summative/final assessment	formative assessment, continuous correction

Figure 0.7. Comparison of traditional and learning outcome-based approaches (based on Balogh, 2023, p. 65, edited by the author)

In outcome-based education (OBE), the entire educational process, from the curriculum to the organisation of teaching and assessment, is derived from the competencies that graduates will need in the labour market. In this sense, learning outcomes are the minimum requirements expected of the average student (Tót, 2017; Purvis et al., 2023). Therefore, the spread of project-based and problem-based learning in university education (see section 0.4 for more details) and the increasing role and importance of blended learning, simulation, and real-world practice are of crucial importance in the teaching-learning process.

In the outcomes-based approach, the boundaries between disciplinary knowledge areas, which are constrained by strict frameworks, become blurred. This applies to both content and organisational frameworks. ‘Learning outcomes are not unique or isomorphic with objectives, as a learning outcome can be aligned with multiple objectives. The alignment process is logical, rational, and interpretable, where cognitive learning objectives found in learning are more likely to be semantically close

to the objectives.’ (Alyasin et al., 2023, p. 1597) The time of isolated scientific research groups, faculties, institutes, or departments is over: learning outcome-based education can only be effective if all participants in education are aware of and contribute to the teaching and learning objectives, recognize and creatively incorporate into their work the knowledge and skills that students acquire in other areas of university education. This requires the coordinated operation of multidisciplinary professional teams (including both teachers and students), which calls for a completely new understanding of roles and cooperation protocols from all participants in higher education. ‘Due to the customary autonomy of faculties, developing a shared vision for the future can be challenging, especially given the remarkably broad and diverse nature of faculty ideas regarding the need for change.’ (Kang et al., 2020, p. 281)

Halász Gábor: We work on problems in multidisciplinary teams, which in some cases better describes what actually happens than if it were to say that I am conducting research. While the activity is the same: I formulate hypotheses, problems to be solved, research questions, collect data, prepare measuring instruments, perform analyses based on my data, set up models, and confirm or refute those hypotheses. The norms and rules of scientific research are followed, for example, the reliability and validity of measurements are crucial; the work builds on what those who have dealt with this problem before have already discovered. However, in reality, I solve problems that occur in real life. This is different from conducting research based on personal research interests. People bring real problems to the me and ask me to help solve them. It is clear from the outset that I cannot solve these problems within my own discipline; I have to collaborate with representatives of

other disciplines. The utilisation of research results is essentially a given, since a real problem is presented in the first place, but how effectively and efficiently existing knowledge can be applied in such a situation depends largely on how effectively communication about it can be organised. So, the communication element becomes very important. (Halász, 2013, p.11)

This is not only about organisational frameworks, but also about overcoming different approaches, terminological differences, and certain rigid professional protocols. ‘We need to step out of the professional “silo” in which we usually work.’ (Halász, 2013, p. 10)

Beyond the internal world of universities, we would like to draw attention to two other important areas of open and flexible cooperation. One is the world of international cooperation (e.g., Campus Mundi, Diaspora Higher Education Scholarship Program, Erasmus+, Pannonia Scholarship Program, Stipendium Hungaricum, etc.) (Durmics-Szabó et al., 2022). The other is the importance of knowledge sharing and knowledge transfer with the labor market and the field of research. This can be achieved through a service-oriented higher education institution, which ‘not only teaches and researches, but also produces and ‘sells’ knowledge: it does all this using appropriate higher education teaching methods that reflect these aspects well’ (Szabó, 2021, p. 133). The role of higher education in economic development presupposes networking, multifaceted cooperation, ensuring interoperability for students and lecturers, and the mutual recognition of studies and acquired skills (Szabó, 2021).

When discussing inter-institutional cooperation, cooperation between universities cannot be ignored. Although universities are naturally competitors in a market where student numbers are declining, they are still

part of the same social subsystem and their development is unimaginable without cooperation. In public education, sharing good practices is already commonplace, but in higher education, it is more of an occasional occurrence, typically within the framework of tenders or projects. Good practices that go beyond this are largely related to educational IT and digital developments (M. Pintér, 2021).

Outcome-based education poses a serious challenge for professors. First and foremost, it requires them to abandon their previous routines. The most fundamental change is that the planning process is reversed. The first step is not to define what the teacher will do in class, but to define the desired learning outcomes. Based on this, it is necessary to consider and plan the methods that are most effective in achieving the desired outcomes (Tót, 2017, p. 16).

It is a serious challenge for educators to ensure that teaching methods, assessment techniques, assessment criteria, and learning outcomes are aligned. Student feedback shows that clear expectations are an essential part of effective learning (Kennedy et al., 2006).

Assessment will be discussed in more detail in Chapter 4, but it is important to note here that the place and role of assessment in the teaching-learning process differs from the perspective of the teacher and the student. While, for the teacher, assessment takes place at the end of the process, for the student it takes place at the beginning. By this, we mean that students will primarily learn what they know or think will be part of the final assessment. In contrast, for teachers, the curriculum and teaching outcomes are primary, with assessment being only the final act in the teaching-learning process. If the curriculum and learning outcomes are reflected in the assessment, then harmony can be created between the two perspectives (Figure 0.8).

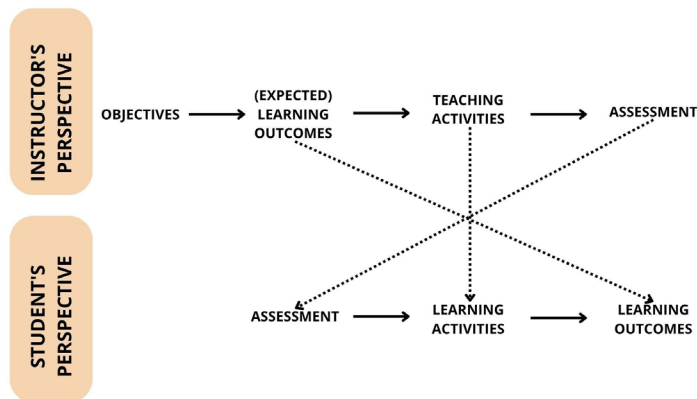


Figure 0.8. Differences between educator and student perspectives
(based on Kennedy et al., 2006, p. 19, edited by the author)

It cannot be denied that there are critics of the learning outcome-based approach. Due to space limitations, we cannot present all the relevant positions here, but we would like to note that the method itself, the new concepts, definitions, or aids are not sufficient for a paradigm shift in education. Learning outcomes are a good starting point when considering the formulation of learning opportunities and the development of resources, but it should not be assumed that learning can be defined and formulated with exact and universal validity. 'At best, learning outcomes should be seen as a general idea of where students and educators think they might end up. They are like suggested destinations on a journey of discovery. And although the captain may have some idea of how to reach the planned destination, the actual route and destination depend on many factors, such as the weather and the abilities of the crew.' (Scott, 2011, p. 6)

Further information on the digital aspects of outcomes-based education is available in sections 3.1 and 4.1.1.

Kodolányi János University



The quality of education is fundamentally determined by the curriculum and the related set of requirements. The content of the curriculum must correspond to the training objectives, most importantly to the precise definition of the expected knowledge output. This means that students must be aware upon admission of the level of knowledge that mastering and completing the training content represents. (Periodic adjustments, if necessary, should be considered standard practice.) The curriculum must include appropriate professional methodology, subject-specific pedagogical principles, and specific requirements, on the basis of which the methods and processes of knowledge transfer and acquisition, as well as the expected results, are understandable and decodable for everyone. The latter means that each student can participate in this process in a manner tailored to their own learning abilities and characteristics. (Educators, mentors, and others involved in the students' work can provide advice on this.) The acquisition of theoretical knowledge usually involves the completion of practical tasks. Educators must provide information about the purpose, content, and organisational procedures of the subjects so that students can interpret theoretical and practical knowledge as the implementation of a common programme. The joint work of educators and students is a prerequisite for

students to participate in teacher-student or independent student and/or student group research work. Although participation in such research work is not a requirement for graduation, it can be presented as a significant asset when applying for a job and can also be an input for a career in which research and publication play a significant role (Szabó, 2022, pp. 136–137).

Knowledge	Knows... Understands... Has an overview of... Is familiar with... Comprehends... Is well-informed about. Is aware of... Interprets ... in context Possesses knowledge related to... Distinguishes between...
Ability	Is able to... Performs ... tasks Routinely applies the methods of... Handles... Plans... Selects... Applies... Uses... Creates... Operates...

Attitude	Open, receptive, interested, and committed to ... Strives for ... Critical of ... Self-critical about their own work. Empathetic, sensitive, accepting, appreciative, proactive, and considers something important. Recognises values, the values of the profession... Supports... Has a need to expand their acquired knowledge, understands, keeps in mind, and requires...
Responsibility, autonomy	Responsibility is felt or taken for ... Performs ... (tasks) under supervision or independently Accepts the framework of cooperation. (Performs)... under managerial guidance. Is capable of self-monitoring. Makes independent decisions. Manages and evaluates the work of others (individuals, groups). Makes suggestions...

Table 0.3. Verbs and other fixed expressions used in field-specific descriptions (based on Tót 2017, p. 27, edited by the author)

Complete the checklist below to formulate the learning outcomes.

Checklist	
Is the learning outcome linked to the objectives of the course/module/learning activity?	
Is the learning outcome linked to the overall outcomes of the course/module/learning activity?	
Is the learning outcome specific and measurable in terms of concrete actions, behaviours, or knowledge?	
Does the learning outcome clearly define what students will be able to do after completing the course/module/learning activity?	
Does the learning outcome match the qualification level?	
Is the wording clear and easy to understand? If terminology is used, is it understandable to students?	
Can the learning outcome be assessed?	
Have you avoided writing a learning outcome that would be more effective as an assessment criterion?	
Have the learning outcome(s) been discussed with the relevant colleagues, students, or other stakeholders?	
Is the balance of learning outcome types appropriate for the course/module/learning activity?	
Is the number of learning outcomes reasonably assessable?	
Did you avoid repetition (e.g., use of synonyms)?	
Are the learning outcomes achievable within the time frame?	
Did you avoid making any of the learning outcomes too broad to be easily assessed?	
Did you avoid making any of the learning outcomes too narrow or restrictive to be easily assessed?	

Table 0.4. Checklist for formulating learning outcomes (based on Purvis et al., 2023, p. 9, edited by the author)

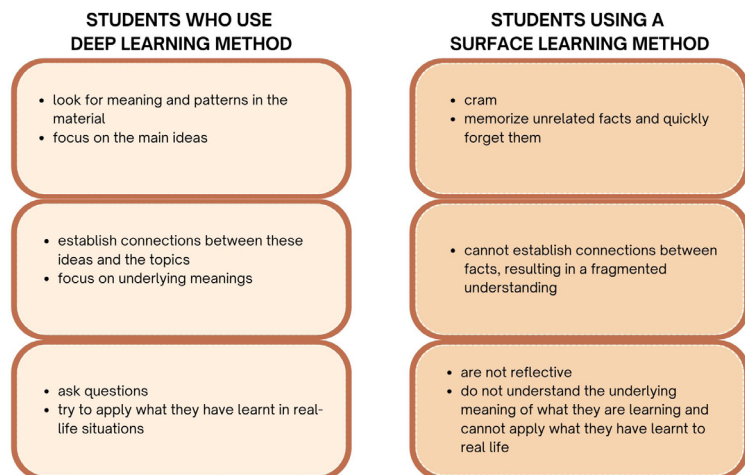
0.4. Problem Based Learning, Group Work, Co-Teaching

Different theories and views on learning, as well as their own experiences and insights as learners/students, determine the methodology used by the educator. 'According to behaviorism, learning takes place through imitation and feedback, while according to cognitivism, learning means insight and recognition. According to constructivism, learning takes place through personal experience, experimentation, and interpretation. Of the various views on learning, constructivism and the good practices that stem from it have the greatest impact on modern pedagogy.' (Sherwin et al., 2023, p. 10)

According to the constructivist approach, learners are not passive recipients, but actively participate in the construction and development of their own knowledge, primarily using their own experiences in this process. The digital aspects of constructivist learning theory and the related connectivist pedagogy are discussed in Chapter 3.3.

Beyond simply memorising information and recalling it in exam situations, the emphasis is increasingly shifting to the ability to process information. This not only requires students to adopt a different learning methodology, but also calls for a shift in focus in teaching and testing. If assessment requires recall, that is what is produced; if assessment requires constructive use of information, deep learning is encouraged (Wood, 2008).

A 'superficial' approach to learning involves accumulating information and factual knowledge without 'digesting' it in any way. The 'deep' approach to learning is the intention to understand and process what has been learned so that it results in a change in the learner's worldview (Figure 0.9) (Thorley & Gergory, 2012).



*Figure 0.9. Comparison of deep and surface learning methods
(based on Sherwin et al., 2023, p. 12, edited by the author)*

There are numerous elements to the methodology of constructivist learning theory, but for the sake of brevity, we cannot cover all the methods that are well suited to university teaching here. Several excellent Hungarian-language publications on this topic are now available online for those interested. (e.g., Bencéné Fekete & Schlichter-Takács, 2022, 2024; Kövecsesné Gősi et al., 2023) From the toolbox of modern pedagogy, the present discussion focuses here and now – somewhat arbitrarily – on problem based learning and the project method, small group work and cooperative learning, as well as flipped and team-teaching approaches.

0.4.1. Problem Based Learning and the Project Method

Problem-based learning (PBL) is ‘a curriculum design approach that confronts students with practical problems, thereby stimulating their desire to learn. PBL is an educational method that challenges students to learn how to learn, work in groups, and solve real-world problems. These problems are suitable for stimulating students’ interest and guiding them to learn about a given topic. It prepares students for critical and analytical thinking and for finding suitable learning resources. PBL is a development and learning management method based on complex problems that are inherently multifaceted and complex, requiring research, information gathering, analysis, change, and experimentation, and do not have predetermined, preformed, ‘correct’ solutions.’ (Veres, 2009)

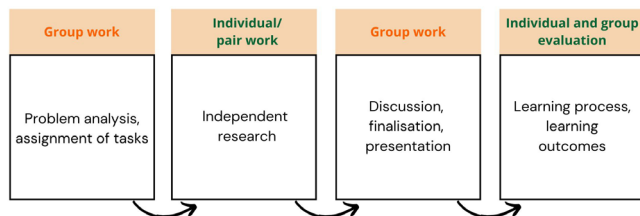
In higher education, problem-based learning focuses on solving real or realistic simulated professional problems, thereby simulating real-life working conditions instead of the traditional classroom teaching and learning model. The problems raised must meet the following criteria:

- they spark students’ interest and address real challenges;
- they have multiple possible solutions, i.e., they are open-ended;
- they are not straightforward, their solutions are complex and require multi-faceted thinking;
- they build on prior knowledge and experience;
- they are related to the subject material and the expected learning outcomes, and they promote the development of cognitive and collaborative skills.

When raising the problem, the educator pays attention to connections with the curriculum (stage, subject matter, and topic) and the specified learning objectives. The task is to raise and introduce the problem, define

and evaluate the analysis procedures, and determine possible planning and action methods. During the process, the teacher must also create the necessary teacher and student aids.

Students analyse the problem in groups, determine the specific steps necessary to solve the task, and assign responsibilities for these steps. They work on the subtasks individually or in pairs, then discuss the solutions to the subtasks in a group, coordinate their results, agree on their task-solving strategies, and finally present the solution to the task. At the end of the process, it is important that they reflect on the learning process and compare it with the expected learning outcomes. (Figure 0.10)



*Figure 0.10. The process of problem-based learning
(based on Veres, 2009, edited by the author)*

Problem-based learning develops the following competencies in students:

- ability to work in a group,
- project planning and management skills,
- oral and written communication,
- knowledge and evaluation of group processes,
- independent work, independent learning,
- critical thinking and analysis,
- research and information literacy.

Problem-based learning has been used longest and most frequently in higher education in healthcare (Wood, 2008, Yew & Goh, 2016), but it is becoming increasingly widespread in other segments as well. At the same time, the method is not a panacea and cannot be applied in all educational situations. ‘One of the most important considerations before using this method is to assess its effectiveness in the given circumstances and whether it is suitable for achieving the learning objectives. Another question to be decided is whether all learners are fit for this method. (Csimáné Pozsegovics & Schlichter-Takács, 2024, p. 30)

The most common method of problem-based learning is the project method. A pedagogical project is ‘the processing of a complex topic through independent student activity. Both the raising of the topic and the engagement with it are based on the genuine independence of the children, with the role of teachers and experts being to support this independence. The processing of individual topics as projects has unique characteristics that are subordinate to the pedagogical process at hand’ (M. Nádasi, 2010, p.9).

The main stages of the educational project are as follows:

- maturing the project idea, incubation stage,
- launching the project
 - defining the project,
 - planning the project,
- implementing the project,
- closing the project
 - presentation,
 - evaluation (M. Nádasi, 2010, p. 21).

According to Pálvölgyi (2015), pedagogical projects can also be made more effective through the conscious application of project management tools.

This requires a clear definition of the project's objectives, the establishment of sub-objectives and those responsible for them, the planning of interdependent tasks, a realistic inventory of resources, and the definition of correction and check points built into the process. 'The project typically involves the implementation of such a novel task which usually disrupts the usual division of labour and roles. If these are not replaced by a new structure, it will result in confusion and the participants will not find their place. Teachers therefore need to act a little like project managers in order for project-based teaching to have a positive impact and for participants to truly experience the motivating effect of joint project success.' (Pálvölgyi, 2015, p. 170)

Create a timeline for problem solving. Keep in mind that there will be changes to the timeline. Flexibility is essential, but students must recognise that there will come a time when they will need to finalise their ideas, conclusions, and evaluations. When creating the timeline, consider the following questions:



- What time frame should be allowed?
- When will the group meetings take place?
- Should time frames be set for each stage?
- Set learners up for success with the following:
 - Help students who may not be aware of time constraints.
 - Set benchmarks.
 - Provide guidance to students on time management.
 - Teach them how to schedule their tasks.
 - Remind them of the time frame.
 - Help them set deadlines!
- Consider prior knowledge and whether students are able to learn independently!

- Encourage students to explore new directions, but guide them back when they seem to be straying from the right path. When a group seems to be going in a different direction, invite the students to explain the reasons behind their actions. They may have insight into a solution that has not yet been considered. Help students stay on track, but be careful not to set limits!
- If you want to maintain control without preventing students from taking responsibility for their work, the following are recommended:
 - Encourage students to cooperate.
 - Assign flexible roles to group members.
 - Have students choose their primary roles, but they should take responsibility and interaction for all group roles.
 - Remind them that every part of the process belongs to every individual and that full participation from all students is necessary.
 - Provide resources and guidance.
 - Monitor students and their progress.
 - Evaluate the process, teamwork, and individual work. The team evaluation includes the expectations of each team member: Observe the group dynamics. How do members participate in the process? How do they contribute to the process? Evaluate the outcome. The following questions can be used to evaluate the process: What is needed to complete the task? What is the final product like?
- Make the requirements clear to students so that they can all successfully meet them. (Csimáné Pozsegovics & Schlichter-Takács, 2024, pp. 36–37)

0.4.1. Group work, cooperative learning

As we have seen, one of the hallmarks of 21st-century higher education is that, in addition to/instead of frontal knowledge transfer, it places increasing emphasis on interactive knowledge construction based on personal experience. Nowadays, 'the prerequisite for effective learning is that the trainer or instructor not only conveys a static set of information, but also offers opportunities for sharing and summarising experiences at various points' (Csóka, 2017, p. 36). A good tool for this can be the use of group work in a diverse teaching environment.

'In higher education, the basic prerequisite for effective, independent learning is the acquisition of the appropriate key competencies so that independent learning becomes a skill. Of the five most important competencies, the first is *adequate information literacy*, which includes the selection of reliable source documents. The second competency is *independent information gathering* and processing of scientific texts, followed by the *systematisation of acquired knowledge*, on the basis of which reports and studies must be prepared. The fifth competency is *effective time management*.' (Bencéné, 2022, p.106)

In addition to effective learning performance, group work can also develop motivation and social skills, improve problem-solving abilities, and, ideally, increase student involvement and sense of belonging. 'Group work is a form of collaborative activity in which the activities of group members are driven by group dynamics. It is excellent for teaching, learning social interactions, enhancing intellectual performance, and increasing effectiveness. As a result of social interactions, the cognitive performance of group members becomes more structured, as students learn to coordinate their activities during group work. In the process of acquiring knowledge in

this way, students internalise cognitive changes and are able to recall and apply this knowledge later in other situations.' (Bencéné, 2022, p. 111) It is an important task for educators to ensure that all students can contribute to the successful completion of tasks when defining tasks and assigning group roles and responsibilities.

Group work provides a pedagogical environment where the curriculum can be fully incorporated, explored and integrated into the student's existing understanding of reality. Personal responsibility towards fellow students can be a motivating factor in dealing with the problem as thoroughly as possible (Thorley & Gregory, 2012).

In terms of group organisation, *spontaneous* and *planned* groups can be created. In spontaneous group formation, students organise themselves into small groups randomly or based on their own choices, while in planned group formation, the educator determines the composition of the groups in advance, depending on their pedagogical goals. In this case, a distinction is made between *heterogeneous* and *homogeneous* groups. While homogeneous groups consist of students who are similar in terms of their prior knowledge, abilities, sociocultural background, age, or interests, the aim of heterogeneous group formation is precisely to ensure that the groups represent individual differences in terms of the above factors. Research shows that low-competence students achieve higher learning outcomes when they are in heterogeneous groups, while medium- and high-competence students perform equally well in both types of groups. Students of all competency types and social backgrounds have a more favorable attitude toward group work in heterogeneous groups (Donovan et al., 2018; O'Brian & Graham, 2021).

A specific type of group work is *cooperative learning* (for more details, see Kagan, 2000; Kagan & Kagan, 2009). The four basic principles of cooperative learning are *constructive interdependence*, *individual accountability*,

equal participation, and *parallel interaction*. ‘Cooperative teaching is a pedagogical method that places great emphasis on group work, joint problem solving, and the creation of realistic situations. It promotes cooperation, communication, and interaction among students, while providing opportunities for knowledge transfer and learning about different perspectives. Students learn primarily from each other and are guided by a common goal. Everyone has a task and role within the group, which creates interdependence, where the individual is as responsible for the group’s results as they are for their own. The cooperative method contributes to the development of self-awareness, self-assessment, stronger social relationships, and a positive attitude toward the university among students, thereby reducing dropout rates. (Kövecsesné Gösi & Horváth, 2023, p.122)

Figure 0.11 clearly illustrates the difference between traditional group work and cooperative learning.

COOPERATIVE LEARNING GROUPS	TRADITIONAL LEARNING GROUPS
Positive interdependence	No interdependence
Individual accountability	No individual accountability
Heterogeneous group composition	Homogeneous group composition
Shared leadership	One designated leader
Shared responsibility	The individual is responsible only for themselves
The task and its support are emphasised	Only the task is emphasised
Social skills are taught directly	Social skills are taken for granted or neglected
The teacher supervises and intervenes	The teacher does not monitor the group's activities

Figure 0.11. Comparison of cooperative and traditional group learning organization (based on Bakó & Simon, 2010, p. 13, edited by the author)

You can read more about the digital aspects of collaborative learning in Chapter 3.3.

Choose a topic that will be covered in group work.



- Form heterogeneous groups. To assess prior knowledge, create a short online quiz to test their level. Based on the results, form groups of four with different abilities, ensuring that students with different abilities are in the same group.
- Prepare tasks of different levels for homogeneous groups of students grouped according to their abilities.
- Put together tasks of the same level but different content for four small groups to review a given topic. (Bencéné, 2022, p. 118)

0.4.2. Flipped learning

In the educational institutions of the future, it will become increasingly common for the current practices to be reversed: students will go home to study and come to school to “play,” that is, to meet with their peers, discuss and interpret what they have learnt at home (either individually or with the help of a virtual assistant).

The flipped classroom “is a pedagogical approach in which instruction moves from the group learning space to the individual learning space, and the resulting group space becomes a dynamic, interactive learning environment where the educator guides students as they engage with different concepts while creatively participating in the processing of the topic” (Tóth, 2014, p. 2).

Using the acronym **FLIP**, the most important features of the flipped classroom methodology can be summarised as follows: a flexible teaching environment that differs from the traditional one (**F**: Flexible Environment); a learner-centered learning culture that differs from traditional classroom teaching (**L**: Learning Culture); the use of active learning strategies and ensuring access to the content necessary for learning (**I**: Intentional Content); professional, reflective pedagogical practice, immediate feedback, and formative assessment (**P**: Professional Educator).

In higher education, the flipped classroom method means that student activities that traditionally require a passive receptive role (e.g., listening to lectures) are transferred to a home setting (e.g., watching video lectures), while the motivational and processing phases that require activity and interaction take place in face-to-face university teaching. Active presence and educator assistance are required for the introduction, topic presentation, involvement, and motivation, which may be followed by the individual processing of learning content available in the digital space (with educator/tutor support if necessary) and, in some cases, the creation of some kind of independent student product. In the final contact phase, students have the opportunity to discuss any questions that arise and present their products in person. The digital possibilities of this method are discussed in more detail in section 3.1.

According to Tóth's experience, 'the activities of students and educators using the flipped classroom teaching method change significantly compared to traditional ones. The teaching-learning process has become more effective, and the development of appropriate time management has also become a key factor. (...) With the help of flipped learning and the classroom model - and with appropriate educator preparation - they can adequately supplement and diversify the processing of the given curriculum.' (Tóth, 2024, 13.)

International experience with the method also reports similarly positive results. Thanks to the method, the failure rate in a biology course at Washington University was reduced from 17% to 4%, and the number of students performing at an excellent level increased from 14% to 24%. Physics students at the University of British Columbia in Canada who were taught using flipped teaching performed more than twice as well on a multiple-choice test measuring their understanding of the material as the control group taught using traditional methods. When comparing the performance of mathematics students at the University of Michigan between flipped and traditional courses, it was found that students in the flipped course were able to progress twice as fast (Aronson et al., 2013).

0.4.3. Co-teaching model

The essence of *Co-Teaching*, also known as the collaborative teaching or two-teacher model, is that instruction takes place with the simultaneous participation of two teachers. "Teachers who are new to the two-teacher model sometimes remark that this method of organizing learning requires a great deal of time and energy. At first glance, this may indeed seem to be the case, but all the work invested pays off in full from the perspective of the students involved, their peers, and the teachers." (Gelencsérné Bakó, 2024, p. 107) We can distinguish several forms of implementation of this method as listed below.

One teach, one observe This strategic approach allows one teacher to observe the students as well as the co-teacher. The observation criteria must be defined in advance to determine what information to focus on, and these are then analyzed together after the lesson. The lesson is taught in a frontal, teacher-centred manner.

Possible applications:

- in new teaching situations,
- when monitoring and comparing student progress,
- when evaluating student activity and reactions.

One teach, one drift One instructor leads the lesson, while the other assists and motivates students who are falling behind or lack self-confidence. Roles are less likely to be switched during the lesson. The lesson is taught in a frontal, teacher-centred manner.

Possible applications:

- for students with atypical developmental trajectories,
- for the purpose of providing personalised assistance,
- when explaining the subject matter in a way that promotes understanding.

Parallel teaching Both instructors teach the same content and use the same method; they lead the class simultaneously but “divide” the class. This provides the teacher with more opportunities to support classroom activities. Despite the division into two groups, the lesson is organised as a frontal teaching session.

Possible applications:

- facilitating the acquisition of knowledge,
- supporting student activity, communication, and assessment of knowledge levels.

Station teaching Teachers divide up both the lesson content and the students, but they work with each group in turn, like a revolving stage. There is one “station” that is independent, where each teacher works with students individually or in pairs. The lesson is conducted as group work.

Applications:

- when teaching complex but non-hierarchical content,
- for review and summarisation purposes.

Alternative teaching This teaching strategy provides every student with the opportunity to learn and process the same syllabus, but in different ways. One instructor follows the planned syllabus with the larger half of the group, while the other approaches the same content with the smaller group using different methods and tools. Applications:

- an excellent method of differentiation for students with different ability profiles,
- same content, but using different methods and tools.

Team teaching Both instructors are active participants in the lesson; they teach as equals and divide responsibilities in advance. They coordinate the lesson plan beforehand, divide tasks and instructions, but they can also complement each other and look for opportunities to assist one another. The lesson is taught in a frontal, teacher-centred manner.

Applications:

- presenting different perspectives on new material by the teachers,
- two teachers monitor opportunities to provide support.

Supplemental Teaching In this strategy, one instructor follows the prescribed syllabus, while the other may expand students’ knowledge with additional content or re-teach and review certain sections. Possible applications:

- re-teaching sections of the syllabus,
- supplementing content with new information.

(Based on Cook and Friend, Gelencsérné Bakó, 2024, pp. 103–106)

Plan (with a co-teacher) how to teach a selected lesson using one of the strategies of the co-teaching model!



- What organisational tasks need to be coordinated with the co-teacher when planning the lesson?
- What challenges should you be prepared for, and how can you eliminate them through prior coordination during co-teaching? (e.g., clarification of roles, differences in teaching styles, group assignments, etc.)
- How can assessment be implemented in the classroom when using co-teaching? (Gelencsérné Bakó, 2024, p. 107)

References

- Alyasin, A., Nasser, R., El Hajj, M. & Harb, H. (2023). Assessing Learning Outcomes in Higher Education: From Practice to Systematization, *TEM Journal* 12(3) 1593-1604, ISSN 2217-8309, DOI: 10.18421/TEM123-41
- Aronson, N., Arfstrom, L. M. & Tam, K. (2013). Flipped Learning in Higher Education. <http://flippedlearning.org/wp-content/uploads/2016/07/HigherEdWhite-Paper-FINAL.pdf>
- Attard, A., Di Iorio, E., Geven, K., Santa, R. (2010a). *Student Centered Learning. An Insight Into Theory And Practice*, Bucharest. <https://www.esu-online.org/wp-content/uploads/2016/07/2010-T4SCL-Stakeholders-Forum-Leuven-An-Insight-Into-Theory-And-Practice.pdf>
- Attard, A., Di Iorio, E., Geven, K. & Santa, R. (2010b). *Student-Centred Learning. Toolkit for students, staff and higher education institutions*, Brussels <https://esu-online.org/publications/student-centred-learning-toolkit-students-staff-higher-education-institutions/>
- Balogh, E. (szerk.) (2023). *Induljunk ki az eredményekből! A tervezés és értékelés hatékonyságának növelése a tanári munkában. Oktatói segédanyag kurzuszvezetők részére*. Budapest, Oktatási Hivatal ISBN 978-963-328-519-0 https://www.magyarkepisesites.hu/pub_bin/Induljunk_ki_az_eredmenyekbol_-_Oktatoi_segedanyag.pdf
- Bakó, B. & Simon, K. (2010). *Kooperatív tanulás Segédlet a kompetencia alapú pedagógus-képzés módszertani megújulásához*, Nyugat-Magyarországi Egyetem https://www.srpszkk.hu/tamop412b/kooperativ_tanulas/index.html
- Bencéné Fekete, A. (2022). A csoportmunka Kis csoportok tanulása, a csoportmunka jellemzői, In: Bencéné Fekete, A. és Schlichter-Takács, A. (szerk.) (2022): *Módszertani eszköztár a felsőoktatásban tanító oktatók számára*. MATE Press, Gödöllő. 105-121. ISBN 978-963-623-017-3 <https://press.mater.uni-mate.hu/81/>
- Bokor, T. (2023). A mesterséges intelligencia alkalmazása az oktatásban – kihívások és következmények technológiaiinvariáns szempontból. In: Kovács, Z. (szerk.): *A mesterséges intelligencia és egyéb felforgató technológiák hatásainak átfogó vizsgálata*. Katonai Nemzetbiztonsági Szolgálat, Budapest, 114–129. ISBN 978-615-6128-18-8
- Csekei, L. (2010). Közös európai válasz a közös európai problémákra: a bolognai folyamat és az Európai Felsőoktatási Térség, *Felsőoktatási Műhely*, (1) 9-22.
- Csimáné Pozsegovics, B. & Schlichter-Takács, A. (2024). A problémaalapú tanulás. In: Bencéné Fekete, A. & Schlichter-Takács, A. (szerk.) *Módszertani eszköztár a fel-*

- sőoktatásban tanító oktatók számára 2. MATE Press, Gödöllő. 23–41. ISBN 978-963-623-091-3 <https://press.mater.uni-mate.hu/186/>
- Csóka, E. (2017). Tudástranszfer, a csoportos tanulás élménye. Tudásmegosztó alkal-
mak a Cselekvő közösségek projektben, *Szín* 22(2) 34–38. [https://matarka.hu/
klikk.php?cikkmutat=2641787&mutat=http://epa.oszk.hu/01300/01306/00145/
pdf/EPA01306_szin_2017_2_34-38.pdf](https://matarka.hu/klikk.php?cikkmutat=2641787&mutat=http://epa.oszk.hu/01300/01306/00145/pdf/EPA01306_szin_2017_2_34-38.pdf)
- Demeter, Zs. & Mező, K. (2023). A mesterséges intelligencia pedagógiai használatára
vonakozó hajlandóság vizsgálata gyógypedgógus hallgatók körében. *Különle-
ges Bánásmód*, 9(2) 31–45. doi: 10.18458/KB.2023.2.31
- Dietz, F. (2020). A mesterséges intelligencia az oktatásban: kihívások és lehetőségek.
Scientia et Securitas 1(1) 54–63. doi: 10.1556/112.2020.00009
- Donovan, D.A., Connell, G.L. & Grunspan, D.Z. (2018). Student Learning Outcomes and
Attitudes Using Three Methods of Group Formation in a Nonmajors Biology
Class. *CBE Life Sciences Education* 17(4) 1–14. [https://doi.org/10.1187/cbe.17-12-
0283](https://doi.org/10.1187/cbe.17-12-0283)
- Dringó-Horváth, I. (2024). Oktatásfejlesztési innováció és hálózatépítés a magyar-
országi felsőoktatásban. Trendek, irányadó eredmények, adaptálható jó-
gyakorlatok. Budapest, L'Harmattan. ISBN 978-963-646-188-1 [https://doi.
org/10.56037/978-963-646-188-1](https://doi.org/10.56037/978-963-646-188-1)
- Durmics-Szabó, K., Jánosik, O., Kasza, G., Keresztes, A., Kirkósa, Á., Kovács, L., Lakatos,
L., Mester-Takács, T., Simon, Á., Tweneboah, G. & Vörös, A. (2022). A felsőokta-
tás nemzetköziesítése. Kézikönyv a nemzetközi hallgatótoborzáshoz és az intéz-
ményi kapcsolatépítéshez a felsőoktatásban. Budapest, Tempus Közalapítvány.
ISBN 978-615-5319-90-7 [https://tki.hu/kiadvany/2538/a-felsooktat-as-nem-
zetkoziesitese](https://tki.hu/kiadvany/2538/a-felsooktat-as-nem-zetkoziesitese)
- ECTS (2015). *ECTS Users' Guide*. Luxemborg, European Union. ISBN: 978-92-79-
43559-1 [https://op.europa.eu/en/publication-detail/-/publication/da7467e6-
8450-11e5-b8b7-01aa75ed71a1](https://op.europa.eu/en/publication-detail/-/publication/da7467e6-8450-11e5-b8b7-01aa75ed71a1)
- ELTE PPK (2023). *A mesterséges intelligencia-alapú tartalomgenerálás használata
a Karon*. [https://www.ppk.elte.hu/media/db/85/bcbaff38de2ac32cc0bc-
1bf203bd65503f3a83f2dc2fcd0ca90e89d980fc/Ml%20kari%20iranymuta-
tas%20HU.pdf](https://www.ppk.elte.hu/media/db/85/bcbaff38de2ac32cc0bc-1bf203bd65503f3a83f2dc2fcd0ca90e89d980fc/Ml%20kari%20iranymuta-tas%20HU.pdf)
- Engler, Á. (2014). *Hallgatói metszetek: a felsőoktatás felnőtt tanulói*. Debrecen,
CHERD-H, ISBN 978-615-80077-0-2, <http://mek.oszk.hu/14500/14513/14513.pdf>
- ESG (2015). *Standards and Guidelines for Quality Assurance in the European Higher
Education Area*. Brussels, EURASHE. ISBN: 978-9-08-168672-3 [https://www.
enqa.eu/wp-content/uploads/2015/11/ESG_2015.pdf](https://www.enqa.eu/wp-content/uploads/2015/11/ESG_2015.pdf)
- Gelencsérné Bakó, M. (2024). Integrációs lehetőségek a felsőoktatásban – a kéttanáros
modell. In: Bencéné Fekete, A. & Schlichter-Takács, A (szerk.) *Módszertani
eszköztár a felsőoktatásban tanító oktatók számára* 2. MATE Press, Gödöllő. 101-
108. ISBN 978-963-623-091-3 <https://press.mater.uni-mate.hu/186/>
- Gover, A., Loukkola, T. & Peterbauer, H. (2019). *Student-centred learning: approaches to
quality assurance*, Brussels-Geneva, European University Association. [https://
www.eua.eu/publications/reports/the-quality-assurance-of-student-cent-
red-learning-approaches-to-quality-assurance.html](https://www.eua.eu/publications/reports/the-quality-assurance-of-student-centred-learning-approaches-to-quality-assurance.html)
- Halász, G. (2013). A felsőoktatás-pedagógiai trendjei (interjú, készítette: Kálmán Orso-
ly), *Felsőoktatási Műhely* (2), 7–14.
- Halász, G. (2021). A tanulás és tanítás minősége és eredményessége az egyetemeken.
Magyar Tudomány 182(11) 1477–1487. DOI: 10.1556/2065.182.2021.11.7
- Horváth, L. (2023). Feltáró szakirodalmi áttekintés a mesterséges intelligencia okta-
tási használatáról. *Pannon Digitális Pedagógia* 3(1) 5–17. doi: 10.56665/PADI-
PE.2023.1
- Hrabéczy, A. & Pusztai, G. (2020). Fogyathéssal élő hallgatók tanulmányi pálya-
futása a felsőoktatási adminisztratív adatok tükrében. *Iskolakultúra*, 30(11),
3–23. <https://doi.org/10.14232/ISKULT.2020.11.3>
- Hrubos, I. (2024). Új megközelítések a felsőoktatási tanulásban és tanításban, *Educatio*
33 (2), 118–128. DOI: 10.1556/2063.33.2024.2.2
- Jani, G. & Celaj, D. (2024). Exploring the Influence of Artificial Intelligence on Higher
Education: Case study in University of Brighton. *Journal of Educational and So-
cial Research*, 14(4), 75. <https://doi.org/10.36941/jesr-2024-0086>
- Jármai, E. & Végh, Á. (2017). Motivációról a felsőoktatásban – az oktatói és tanu-
lási motiváció kapcsolata, In: Bukor, J., Strédl, T., Nagy, M., Vass, V., Orsovcics,
Y. & Dobay, B. (szerk.): *A Selye János Egyetem 2017-es „Érték, minőség és
versenyképesség – a 21. század kihívásai” Nemzetközi Tudományos Konfe-
renciájának tanulmánykötete: Pedagógiai szekciók*, Komarno, Selye János
Egyetem 63–83.
- Kagan, S. & Kagan, M. (2009). *Kagan kooperatív tanulás*. Önkonet. ISBN: 9789638662354
- Kagan, S. (2000). *Kooperatív tanulás*. Budapest, Önkonet. ISBN: 963-216-659-0
- Kálmán, O. (2021). *Tanulásközpontú felsőoktatás*. Budapest, ELTE PPK–L'Harmattan.
ISBN 978-963-414-790-9 <http://doi.org/10.56037/978-963-414-790-9>
- Kang, S. P., Chen, Y., Svihla, V., Gallup, A., Ferris, K., & Datye, A. K. (2020). Guiding
change in higher education: an emergent, iterative application of Kotter's chan-
ge model. *Studies in Higher Education*, 47(2), 270–289. [https://doi.org/10.1080/
03075079.2020.1741540](https://doi.org/10.1080/03075079.2020.1741540)

- Kennedy, D., Hyland, Á. & Ryan, N. (2006). *Writing and using Learning Outcomes. Bologna Handbook, Implementing Bologna in your Institution*. Luxembourg: Office for Official Publications of the European Communities, C3.4-1: 1-30. https://www.academia.edu/62880219/Writing_and_using_learning_outcomes_a_practical_guide
- Korpcsics, M. K., & Bajnok, A. (2023). Változásmenedzsment a felsőoktatásban. Pedagógiai célú változások a Nemzeti Közszerzői Egyetemen. *Neveléstudomány | Oktatás – Kutatás – Innováció*, 11(2), 7-19. <https://doi.org/10.21549/NTNY.41.2023.2.1>
- Kövecsesné Gósi, V. & Horváth, D. (2023). A kooperatív tanulás szerepe és jelentősége a felsőoktatásban. In: Kövecsesné Gósi V., Makkos, A., Lőrincz, I. & Bognár, A. (2023): *Felsőoktatás-pedagógia a gyakorlatban*, Győr, Széchenyi István Egyetem. 106-124. ISBN 978-615-6443-12-0 https://www.academia.edu/117091734/Fels%C5%91oktat%C3%A1s_pedag%C3%B3gia_a_gyakorlatban_M%C3%B3dszertani_k%C3%A9szlet%C3%B6nyv
- Lu, J. J. & Harris, L. A. (2018). *Artificial Intelligence (AI) and Education*. Congressional Research Service, Washington. https://digital.library.unt.edu/ark:/67531/me-tad/c1228526/m2/1/high_res_d/IF10937_2018Aug01.pdf
- M. Nádas, M. (2010). *A projektoktatás elmélete és gyakorlata*, MATEHETSZ.
- M. Pintér, T. (2021). Oktatásinformatika a felsőoktatásban – Kooperáció és párbeszéd a jó gyakorlatok megteremtésében. *Gyermekeknevelés Tudományos Folyóirat*, 9(2), 399-403. <https://doi.org/10.31074/gyntf.2021.2.399.403>
- Ng, D. T. K., Leung, J. K. L., Chu, S. K. W. & Qiao, M. S. (2021). Conceptualizing AI literacy: An exploratory review. *Computers and Education: Artificial Intelligence* (2) doi: 10.1016/j.caeai.2021.100041
- Nurhasanah, F., Nugraheni, A. S. C., Kusharjanta, B., Ardiansyah, R., Widono, S. & Saddhono, K. (2024). A Design of Virtual Classrooms Through AI, ML and DL to Improve the Level of Learning, *4th International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE)*, Greater Noida, India, 940-945, <https://doi.org/10.1109/ICACITE60783.2024.10616641>.
- O'Brien, T. & Braham, A. (2021). Diversity and Inclusion in Higher Education: Two Case Examples. *TR News* (333), 22-25. <https://onlinepubs.trb.org/onlinepubs/trnews/trnews333DiversityEducation.pdf>
- Pálvölgyi, L. (2015). Projektpedagógia projektmenedzser szemmel. *Pedagógusképzés*, 169-171. <https://doi.org/10.37205/TEL-hun.2014-2015.13>
- Purvis, A. & Winwood, B. (2023). *A guide to writing learning outcomes in higher education*. The National Teaching Repository. <https://shura.shu.ac.uk/32056/1/A%20Guide%20to%20Writing%20Learning%20Outcomes%20in%20Higher%20Education%20-%20NTR%20.pdf>
- Sági, M. (szerk.) (2024). Eurograduate 2022 Magyarország. Kutatási zárókötet. Oktatási Hivatal, ISBN 978-963-436-536-5 https://www.felvi.hu/pub_bin/dload/felsooktatasi-muhely/eurograduate/Eurograduate_2022_zarokotet.pdf
- Schleicher, A. (2020). How can teachers and school systems respond to the COVID-19 pandemic? Some lessons from TALIS. <https://oecd-edu-today.com/how-teachers-school-systems-respond-coronavirus-talis/>
- Scott, I. (2011). The Learning Outcome in Higher Education: Time to Think Again? *Worcester Journal of Learning and Teaching* (5). <https://rteworcester.wp.worc.ac.uk/wp-content/uploads/2017/05/iscott.pdf>
- Sherwin, H., Sipos, J., Makkos, A., Németh, K., Kulcsár, N. & Bognár, A. (2023). Irányelvek a felsőoktatás-pedagógia sikerességéhez. In: Kövecsesné Gósi V., Makkos, A., Lőrincz, I. & Bognár, A. (2023): *Felsőoktatás-pedagógia a gyakorlatban*, Győr, Széchenyi István Egyetem. 9-28. ISBN 978-615-6443-12-0
- Szabó, P. (2022). A kooperatív egyetemi modell, egy lehetséges válasz a 21. századi felsőoktatás-pedagógiai kihívásokra – A felsőoktatás szerepvállalása az ezredfordulón: akadémiai szerepkörből gazdaságfejlesztő és kultúramegtartó szerepkörbe. *Közösségi Kapcsolódások* (1), 131-141. <https://doi.org/10.14232/kapocs.2022.1.131-141>
- Szontagh, P. (2025). Teacher candidates' fears and expectations about the use of artificial intelligence in education. *Practice and Theory in Systems of Education* 20(1), 34-44. <https://doi.org/10.63145/ptse.v20i1.32>
- Szűts, Z. (2024). A mesterséges intelligencia hatásai: remények, félelmek, foratókönyvek és megoldások. *Educatio* 33(1) 24-33. <https://doi.org/10.1556/2063.33.2024.1.3>
- Thorley, L. & Gregory, R. (2012). *Using Group-based Learning in Higher Education*. London: Routledge. <https://doi.org/10.4324/9781315041506>
- Tóth, R. (2014). Tükrözött osztályterem, az információs társadalom pedagógusának egyik innovatív tanulószervezési módszere. *Fluentum* 1(3) http://www.fluentum.hu/fluentum_1_3_tothrenata.pdf
- Tót, É. (2017). *Segédlet a tanulási eredmények írásához a felsőoktatási szektor számára*. Budapest, Oktatási Hivatal. ISBN 978-615-80376-2-4 https://www.oktatas.hu/pub_bin/dload/LLL/ekkr/Tanulasieredmenyek_HE.pdf
- Vass, V. (2010). Kompetencia alapú felsőoktatás: mentsvár vagy börtön? In: Dobó, I., Perjés, I. & Temesi, J. (szerk.): *Korszerű felsőoktatási pedagógiai módszerek, törekvések*, Budapest, Budapesti Corvinus Egyetem Közgazdaságtudományi Kar

Nemzetközi Felsőoktatási Kutatások Központja, 9-20. ISBN 978-963-89082-0-9
https://unipub.lib.uni-corvinus.hu/1231/1/NFKK_5_vegleges.pdf

Veres G. (szerk.) (2009). *Az integrált természetismeret tantárgy keresztntanervi tartalma*, <https://ofi.oh.gov.hu/problemaalapu-tanulas>

Wood D. F. (2008). Problem based learning. *BMJ (Clinical research ed.)*, 336(7651), 971.
<https://doi.org/10.1136/bmj.39546.716053.80>

Yew, E. H. J. & Goh, K. (2016). Problem-Based Learning: An Overview of its Process and Impact on Learning, *Health Professions Education* 2(2) <https://doi.org/10.1016/j.hpe.2016.01.004>

Zhu, Y. (2022). *The Future School. Redefining Education*. McGraw-Hill Education. ISBN: 978-981-3311-40-4

1. PROFESSIONAL ENGAGEMENT

Ida Dringó-Horváth and Tibor M. Pintér

Introduction

When we talk about the digital competence of educators, a fundamental aspect is to suitably exploit the opportunities technology offers for professional communication with colleagues, students (or, if necessary, the families of students) and third parties of the university, as well as for their continuous professional development and the improvement of related professional communities (Council of the European Union, 2017).

Institutional support is a key factor in this process, and the positive effects it has on teacher competencies are corroborated by test results (cf. Dringó-Horváth, Hülber, M. Pintér, & Papp-Danka, 2020). Putting digital competencies into practice requires the right infrastructure and tools, but most of all the right approach, involving a strategic thinking that recognises the importance of digital competencies and their development (even incorporating them into the quality assurance process), and a certain leadership attitude. This system-wide approach includes training programmes, curricula and teaching materials that are in line with digitally assisted educational models (European Commission, 2018).

Equally important is the responsibility of educators for their own development and, in this context, for the continuous development of their digital competencies. Continuous professional development is much

needed in all fields, but especially in the area of digital competencies, since technological development is gaining ground in higher education, creating a growing demand for the acquisition and skill-level application of various new teaching competencies – especially in teacher education (Khvilon & Patru, 2002). One of the cornerstones of professional development is regular and effective self-reflection, the level of which correlates with the development of the educator's digital pedagogical competencies (Dringó-Horváth et al., 2020). Analytical, critical reflection and evaluation concerning our digital education practice and that of our teaching community helps us to become active players in the development of digital competencies.

The first topic is explored in Chapter 1.1., *Organisational communication*, which deals extensively with the role of institutional support in the development of digital competencies, emphasising the importance of the understanding of institutional digital strategies and the development opportunities they open up. In connection with this, Chapter 1.2., *Professional Collaboration*, presents the opportunities offered by digital tools to facilitate cooperation, communication, and knowledge sharing between colleagues, as well as to update teaching practices with digital methods. The final two subchapters focus on the importance of individual responsibility. Chapter 1.3., *Reflective Practice*, concerns the possibilities of reflection on our digital education practice and the practice of our teaching community, as well as the possibilities of active participation in the improvement of this practice, while some further aspects of professional development that can be effected with digital tools are discussed in Chapter 1.4., *Continuous Professional Development with Digital Support*.

We interviewed the professors and educational experts Dr. Gábor Halász, DSc (Eötvös Loránd University, Budapest) and Dr. Judit Szivák (Eötvös Loránd University) about the topics in this chapter.

AI competencies related to the field, based on the DigCompEdu reference framework supplement (Bekiaridis & Attwell, 2024, p. 35):

AI competencies in this area mean that educators are able to use AI tools to support their professional development, communication, and collaboration. This includes using AI to build personal learning networks (PLNs), staying up to date with educational applications of AI, and using AI-based communication tools to connect with colleagues and other stakeholders.



AI offers new opportunities for educators in terms of professional development, communication, and collaboration. Personalised learning platforms support them based on their individual needs, while AI-based tools simplify administrative tasks, enabling more efficient communication with other educators and students. AI solutions also support the building of global professional networks, thus facilitating the exchange of innovative educational solutions.

At the institutional level, AI can assist in data-driven decision-making, for example by analysing student performance or resource utilisation. Educators can learn about developments in AI technologies and their ethical implications, including data protection, algorithmic bias, and the fair use of technology. The integration of AI can therefore contribute to a more efficient, conscious, and ethical educational environment.

1.1. Organisational Communication

To use digital technologies to enhance organisational communication with learners, parents and third parties. To contribute to collaboratively developing and improving organisational communication strategies. To use AI tools for scheduling, email management, or data analysis in their own team or institution, then to evaluate the tools' effectiveness, and to share experiences with colleagues.

An institution with digital awareness has its own channels specifically designed for institutional communication where – in addition to the digital content needed for education – documents relating to the institution and the educators also appear, while communication with third parties is established as well. Such an institution typically pays attention to the digital communication behaviours of different age groups and social strata, and develops several different communication platforms accordingly. Starting from the website of any major university, we mostly see that not only the websites of the individual faculties and organisational units can be accessed, but that we can also find the university's Instagram, Facebook, YouTube, LinkedIn and X links. It is also typical that the staff and students of the university are kept up to date through digital newsletters.

Constantly updated contact details for instructors and lists of their scientific activities and publications can be an integral part of the digital communication of the institution. In addition, important content can be displayed on the personal websites of educators, researchers and other staff working in the institution.

The Covid-19 pandemic in many ways amplified the digital presence of educational institutions and the flow of online information. Online education has encouraged educators' use of digital solutions for communication and

content sharing, increasing the use of tools that were previously used less often, or hardly at all, be they learning management systems (LMS), webinar software, or other web 2.0-based tools.

The idea of the digital footprint is a multifaceted concept, representing not only content published online, but also our entire online presence, such as public searches, liking content, or the transparency of personal data regarding email accounts and registrations. The digital footprint is actually a social factor – a behaviour pattern, a specific form of behaviour in society – that can be compared to the way we dress, and it can be either passive (generated unintentionally) or active (when intentionally submitting something online) (McDermot, 2018). In our teaching activity, we act both as instructors and individuals, and these two spheres of activity may converge very frequently. It matters how we present ourselves to others and what we allow them to see of us, and we should thus be consciously present in both professional and personal digital space as we can (even if inadvertently) serve as role models.



How important is it for teachers to leave digital footprints during their digital activities, and how should they do it?

Judit Szivák:

The first question is how to deal with the fact that it is impossible not to leave a mark. Nowadays, the boundaries between personal and professional space are terribly blurred. It is important for students to understand that while they are preparing in a typical student role for a typical non-student role, they must learn what footprints they can leave and how to present themselves online.



Gábor Halász:

Those involved in research or teaching, those who create knowledge and share it with others, have a fundamental interest in the preservation of their information. For example, an educator or a researcher simply must have a personal website, where they share not only their CV, but may store knowledge content. They can record their reflections or write a blog. Every researcher or educator who wishes to disseminate their knowledge must have a digital sphere where it is possible to store this and share it with others. That's how people can learn from them.



An educator who uses organisational-level digital communication effectively can be characterised as possessing the following abilities:

To use digital technologies to make additional learning resources and information available to learners and third parties, to communicate organisational procedures to learners and e.g. rules, appointments, events, and to inform learners on an individual basis, e.g. on progress and issues of concern.

More about the diversity of digital content and the various ways it can be used can be found in Chapter 2.2, but here, it is useful to distinguish between organisational and personal space. From the point of view of organisational and institutional space, institutional web pages have a special significance, since with their help we can share news and information both within the institution (with teachers and students) and with third parties. Creating such pages is rather simple. Content management systems such as [Drupal](#), [Joomla](#), [Plone](#) or [Django](#) are easily installed on an institution's server and they are constantly updated by developers. With such pages, design is not

necessarily as important as the information they display. One of the main advantages of digital information interfaces is that they can be updated quickly, which is a basic expectation of today's users.

It is necessary, therefore, to keep personal and professional websites (e.g. on [linkedin.com](https://www.linkedin.com), [researchgate.net](https://www.researchgate.net), [GoogleScholar](https://scholar.google.com) or [academia.edu](https://www.academia.edu)), or institutional and departmental pages up-to-date. Regularly maintained digital interfaces allow for quick access to regulations by tracking changes (e.g. final exam requirements sorted by year of admission). They can also provide an opportunity for the personalised management of students' work. The transparent documentation of student progress can be facilitated, for example, by providing personal access to assessments, which can even be done (with the right sharing settings) using Google Docs.

The advantage of shared folders is that students' work is easily accessible, and the assessment process can be tracked: in addition to assessment notes, student reflections can also appear and peer assessment can be easily carried out (see Chapter 4.3). Due to this, the systematisation, storage and evaluation of student work is much easier and transparent than in the case of materials submitted on paper or sent by email.

Personalised information sharing can work well either via email or through the Canvas, Moodle or Neptun systems (see Chapter 2.3 and Chapter 5.2).

With regard to information sharing, a primary task is to regularly maintain the interfaces and set up passwords. When using passwords, it is a good idea to change them regularly (every two months, say) or, if possible, use two-step verification (Figure 1.1) (it is also possible to check whether your email account has been compromised – one such site is [Have I been pwned?](https://haveibeenpwned.com)).

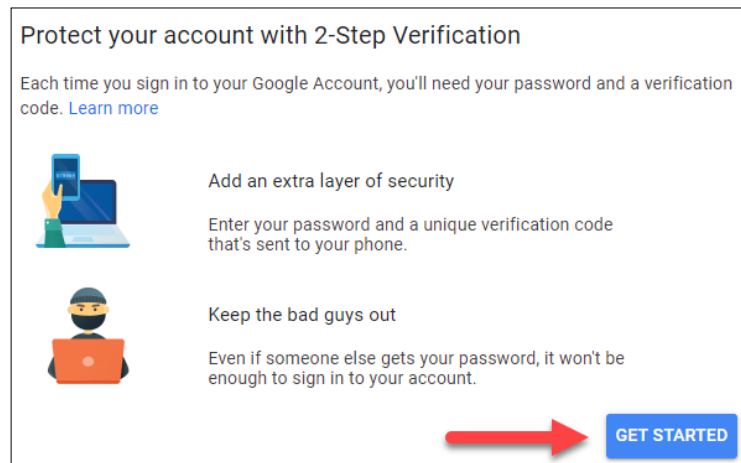


Figure 1.1. Two-step verification in Google

To contribute to collaboratively developing and improving organisational communication strategies. To examine and critically evaluate the digital practice and regulations of the institution, and actively participate in its inception and development.

To participate in professional decision-making processes related to the institutional use of AI tools, and to support responsible and ethical use of AI in pedagogical practice.

The IT (often ICT) strategy of institutions and their regulations summarise the prescribed roles and functions of digital technologies in institutional communication, education, research and publications. Related to this, an institutional IT strategy may also be present, in which the digital

competence of teachers is a basic expectation, but at the same time continuously improved, enabling and encouraging the use of digital pedagogy and providing appropriate infrastructural parameters, curricula, regulations and internal training systems. To facilitate this, there are centres for educational IT support for teachers, the main purpose of which is to provide advice and training on educational and research processes, as well as on their application in higher education. A significant majority of foreign universities have such a center, and it is gratifying to see that more and more Hungarian institutions are also adopting this organisational unit: a 2024 survey identified 27 units, working groups or committees with this specific function (Dringó-Horváth, 2024). These units have become more prominent in Hungarian higher education since 2015, but the majority of them (70%) were established between 2020 and 2024, partly as a result of the technological and pedagogical challenges posed by the COVID-19 pandemic. Typically, they operate under the central control of the rector or vice-rector, and their main activities include the development of educators' methodology and digital skills in the form of workshops, projects and one-to-one consultations, but they also perform a number of other tasks (e.g. strategic consulting, curriculum development, calls for teaching awards – cf. Dringó-Horváth, 2024).

We should find out if our institution has a similar organisational unit and learn how to make use of its services and support in our educational and research activities, or how to apply them to a specific issue or problem. It is also worth looking for similar services in other institutions and using them as much as possible.



The content of an institution's digital strategy has an impact on its communication strategy as well. Digital support for internal communication (e.g. newsletters for teachers, information pages, university community forums, knowledge-sharing platforms for research groups, etc.) is becoming more and more frequent, while external communication is also increasingly characterised by the use of digital tools (different types of institutional online presence, networks established with professional partners and communities, connection to international online networks, online operation of alumni networks, etc.). The communication strategy also sets out the general rules for institutional communication, which allows the individual organisational units (faculty, institute, department, research group) to act in a unified way and to show a unified image to students and third parties. This may feature the use of uniform visual elements but also includes the ethical and legal regulations of communication, such as the time within which teachers are required to respond to a student forum entry in an institutional LMS or to an email sent to their institutional mailbox. It is also part of the communication strategy that the institution informs the students of which organisational unit or member of staff to turn to regarding a particular problem, and what communication tool (email, forum, etc.) is to be used.

Digital space has its own characteristic rules of behaviour, so it is a good idea to learn about the concept of netiquette (see Chapter 6.2). In this respect, it is useful if educational and institutional presence can, as far as possible, serve as a positive example.

It is a good idea to lay down the codes of conduct in digital space, and to know and apply them naturally. Our expert has some tips concerning the rules of communication between the instructor and the student, or the organisation and its members:



What are the main guidelines for using the digital space?

Gábor Halász:

Leaking private data or losing confidential information, knowing what I can access as an educator or as a student, and similar matters raise a range of ethical and regulatory issues. But regulations alone cannot keep these things in order; we need to create a culture of data management, where people are no longer motivated by rules, but routinely and instinctively know what is acceptable and what is not. In the light of this, formal regulations and building an organisational culture must run in parallel because the latter plays a much greater role in shaping people's behaviour than formal rules do.



The emergence of AI in education raises new legal and ethical questions. The first comprehensive legal framework related to this area is [EU Regulation 2024/1689](#), which aims to promote reliable AI in Europe. It sets out risk-based rules for developers and users of various AI applications. However, individual areas of expertise must create regulations that are aligned with this but tailored to their specific needs.

The proper integration of (generative) AI into higher education learning, teaching, and research processes thus requires additional regulations. At the time of writing, however, only a fraction of Hungarian institutions have publicly available AI guidelines, and these are often limited to individual faculties. Regulations have become increasingly complex over time, and contain more and more practical reference materials. They deal with the basic concepts of AI, its potential uses, advantages, and ethical and legal challenges. A common theme is the difficulty of detecting unethical AI use, which necessitates a transformation of teaching and assessment practices (see Table 1.1). Regulations that include practical examples, citation rules,

and sample student statements of use are particularly useful. Several institutions give special attention to the protection of sensitive data and encourage the development of subject-specific guidelines. As a related activity, online courses and discussion forums are sometimes used to promote a shared understanding and practical applications.

Date	Institution	Type of document, page number	Useful supplementary material
April, 2023.	Eötvös Loránd University, Faculty of Education and Psychology	position statement, p. 7.	Citation guide, statements of use
September, 2023.	University of Debrecen, Faculty of Humanities	position statement, p. 1.	-
June, 2023.	Károli Gáspár University of the Reformed Church in Hungary	guide, p. 19.	Citation guide, integration proposal into the course description, online course for educators and students, tool collection
September, 2023.	Corvinus University of Budapest	manual, educators' p. 22, students' p. 17.	User manual for educators and students, statements of use
2024.	Budapest Business University, Faculty of Finance and Accountancy	guide, p. 52.	Best practices, tool collection
September, 2024.	Eötvös Loránd University, Faculty of Economics	guidelines, on the website + downloadable attachments	Citation guide, statements of use, online course and forums for students

Table 1.1. AI regulations available on the websites of Hungarian higher education institutions, in chronological order (2023–2025)



On this subject, it is worth listening to the following conference talk given in the Hungarian Parliament (Ida Dringó-Horváth, Christian Civil Forum, 2024).

We should find out if our institution has a digital strategy and/or an AI policy. Based on its detailed practical description, we can usually identify how important the role of educational technology is in our institution, and it can also help to identify how consistent our own use of tools is with the current and future ideas of our organisational unit.

An extensive study of our institution's digital strategy can help us to recognise if our own educational-technological expertise and practices can contribute to the development of the current strategic ideas, and it is worthwhile forwarding our suggestions for development to those responsible, following an appropriate official route. In doing so, it is advisable to refer to both the research and literature on innovative teaching that supports our proposals and the cooperation with potential colleagues and researchers during the evaluation of innovative methods and the development of proposals.



In any activity that involves innovation – be it at the level of institution, institute, department, or professional research group – the following questions supporting the analytical evaluation of innovation may be very useful (Szivák, 2014, p. 82):

- What are the professional and personal reasons and motives behind the innovation?

- What are the conditions for initiating the innovation (external, internal factors)? What preparations have been made?
- How can we analyse the situation or problem that is the subject of the innovation?
- What is the purpose of the innovation?
- What is the cooperation of the participants in the innovation like?
- How does the introduction of the innovation take place (creating a development plan and conditions)?
- How does the innovation take place: testing solutions, analysing experiences, corrective options?
- How is the innovation received (by the educational community, parents, students, etc.)?
- What are the accomplishments and difficulties during the implementation of the innovation? Is the innovation successful?
- In what forums do we share the innovation? In what forums would we like to share it in the future? How sustainable is the innovation?

1.2. Professional Collaboration

To use digital technologies to engage in collaboration with other educators, sharing and exchanging knowledge and experience, and collaboratively innovating pedagogic practices. To use AI-based communication platforms for teamwork and professional discussions, and to participate in online forums or professional networks dealing with the role of AI in education.

At all levels of education, only continuous professional development ensures the efficiency and success of teaching, a cornerstone of which is cooperation

between colleagues and the sharing of knowledge. In the past, this was achieved in a narrow circle only, traditionally within the professional communities of the given institution. Today, however, educators are increasingly taking advantage of participation in virtual communities, as these are not limited in space and time, and the range of participants is significantly expanded (and is growing continuously). Within such a framework, we can quickly and efficiently share learning resources, our own curricula and our best practices. The introduction of professional online collaboration is of particular importance when other tasks, mainly of administrative nature may make these activities more difficult or marginalised.

The definition of professional communities organised for the purpose of mutual learning, regardless of the level of education or the form of participation or media, is, according to Stoll et al. (2006, p. 223), as follows: “a group of people sharing and critically interrogating their practice in an ongoing, reflective, collaborative, inclusive, learning-oriented, growth-promoting way; operating as a collective enterprise.”

Even though our continuous professional and methodological-pedagogical development is primarily a personal process, the active participation in professional communities and networks is paramount in bringing about change. The DigCompEdu framework lists the following abilities, among others, as characteristic of an educator experienced in professional cooperation:

To use digital technologies to engage in collaboration with other educators on a specific task or project.



What kind of digital communication strategy should an educator develop with colleagues, students and professional partners?

Szivák Judit:

There are relatively well-established platforms for communicating with colleagues. What is really a success story is document editing on a common interface, which was a qualitative leap in scientific work. For me, there are two important communication channels with students: email and Canvas. Among many other rules, we always set this out at the beginning of the semester. Students can only reach me through these channels and they can only expect feedback from me through them. Recently, I have been increasingly shifting this communication towards Canvas because, as a collaborative workspace, it has the huge advantage that everyone will find everything there.



Halász Gábor:

This raises the question of whether we are thinking of educators, a community of educators, or an organisation made up of a community of educators. I would encourage everyone to move their thinking towards the last-mentioned category and not to envision isolated teachers and trainers, but communities where knowledge is constantly being shared and communities which digital technology can dramatically strengthen.



In the tools used in the course of international scientific and educational collaboration, digital technology occupies an increasingly important place both in terms of information sharing, support of communication and cooperation, and regarding joint creation and the storage of products. The use of these methods offers many new opportunities for the efficient implementation and administration of activities.

We should develop well-functioning protocols and frameworks for online collaboration in our own professional community. It is advisable to agree on the tools to be used, on how to schedule and announce online meetings, and on the online means of administration. If we wish to make recordings, we must ask for the prior consent of all participants and agree on the availability, storage method and preservation time of the recordings. Recordings of the cooperation processes and discussions allow those absent to be informed of the proceedings, and they can also serve as a useful reminder for the participants themselves.



Communication methods for collaboration can be synchronous (real-time, e.g. *online meetings*, video conferencing) and asynchronous (e.g. email, forums, blogs). The use of digital tools can also help the transparency and proper monitoring of communication processes and projects, e.g. by using [Trello](#).

Using online voting and appointment scheduling applications such as [Doodle](#), [Congregar](#) and [Dudle](#) can help when organising online meetings. [IdöPont.net](#) (Figure 1.2., click on the flag for the English version) offers a similar function, but provides a different solution: if we enter the email addresses of participants and the possible dates, the system will automatically notify the participants, offer the most suitable time(s) based on the received feedback, and then notify the invitees of the final date(s). In some apps we can also link the invitation to a specific Calendar (e.g. Google, Outlook). The event will appear as a calendar entry for all those invited and we can see the final number of participants from the feedback (yes, no, maybe). [Foodle](#) is a matching service with federated identity ([EduID](#)), suitable not only for matching dates, but also for matching ideas and lists.

Once we have entered the parameters for the area to be negotiated (for example, “invitees”, “to be procured”, etc.), participants can vote on it and Foodle summarises the results in a clear way.

The screenshot shows a web form for creating a new event. It includes fields for 'Event title', 'Invitees e-mail addresses', and 'Dates'. The 'Dates' section features a calendar for January 2021, with dates 18 and 19 highlighted. To the right of the calendar are dropdown menus for 'hour' (00-23) and 'minute' (00-55), a 'Duration' dropdown set to '1 hour', a 'Timezone' dropdown set to 'UTC', and a 'Comment' text area. At the bottom are two orange buttons: 'Add date' and 'Add deadline'.

Figure 1.2. Creating a new event by [idöPont.net](#) – [idopont.net/newEvent.php](#)

For information on suitable and safe ways to share digital resources, see Chapter 2.3. To jointly edit content, prepare project results and create products, we can use online content sharing and editing interfaces. The two most popular services in this field are [Google Drive](#) and [Microsoft OneDrive](#). These are cloud-based file sharing sites that allow you to store any content you upload or produce in your service provider’s hosting space and, with the appropriate permissions, edit them with others. In addition to web access, applications can be installed as desktop and mobile applications, so they can be accessed from a variety of devices – in the same state of editing, thanks to the built-in sync feature.

To learn more about digital tools for the joint presentation of the results of professional projects, see Chapter 2.2; for ideas on how to create and use interfaces (blogs, project websites, etc.) for the publication and long-term accessibility of such results, see Chapter 2.3.



AI can help with efficient communication in many ways, like reducing repetitive tasks or automating certain activities.

Intelligent email filters and categorization systems, such as [Superhuman](#) or [SaneBox](#), can help manage emails faster and more efficiently by setting priority levels and alerting to tasks, or by automating them. They can be integrated into major email client applications (Outlook, Gmail, Yahoo, etc.), while these applications are also developing similar features (Outlook: features called *Focused Inbox* and *Quick Steps*, Gmail: features like *Priority Inbox* and *Smart Compose*).

In project management, AI algorithms can be used to automate scheduling tasks, such as monitoring deadlines, setting priorities, and managing calendar events. The calendar functions of major office applications ([Google Calendar](#), [Microsoft Outlook Calendar](#)) help with scheduling by providing AI-based smart appointment suggestions that take into account users' calendar events. [TimeTree](#) is a community calendar application that automatically synchronises users' appointments and events, and sends alerts about upcoming meetings. Task management and prioritisation can also be done with AI-supported tools.

At Microsoft, the AI-based features of [Outlook Tasks](#) and [Microsoft To Do](#), and at Google, that of [Google Keep](#) and [Google Tasks](#), help prioritise tasks and automatically recommend actions based on the user's daily workflow, taking into account deadlines, task importance, and previous user activity. This is complemented by smart reminders and the synchronisation of tasks with other

applications within the company group. For Apple users, the [Notes](#) app can be a similar aid, providing valuable assistance in collaborative task management, voice memo creation and the successful management of daily tasks.

Trello, mentioned above, with the help of its AI-based [Butler](#), is also capable of automatically managing and prioritizing tasks, as well as assigning deadlines to projects. Among the countless similar tools, we can highlight [Asana](#), which supports efficient task management and collaboration on joint projects by using AI to monitor progress and notify collaborators as deadlines approach. A similar but visually supported project and workflow management tool is [Monday.com](#), which uses AI to automatically update and track project status, helping participants work efficiently.

Collaboration platforms are also being expanded with increasingly more AI features to support effective knowledge sharing and increase productivity, saving time for more meaningful work. From automating meeting notes to task assignment, we can get a glimpse of the many possibilities offered by a specific tool, [Microsoft Teams](#), by reviewing its AI features:

- meeting transcription and automated note-taking,
- intelligent task assignment with auto-creation of tasks discussed,
- real-time captioning with live translation (in multiple languages),
- quick reply suggestions for efficient communication,
- chat assistants, automation of frequent tasks (e.g., scheduling, reminders),
- team performance metrics for tracking collaboration and efficiency,
- AI-based noise filtering to improve audio and video quality,
- sentiment analysis to monitor the mood, engagement, and well-being of collaborators,
- intelligent AI-based calendar management to schedule meetings and resolve potential clashes.

In addition, there are applications that speed up our work by performing tasks based on voice commands, whether it's sending emails or adding calendar events or tasks. One example of this is [Google Assistant](#), which uses AI to tailor its responses and recommendations based on the user's previous interactions.



How can built-in AI features in mainstream productivity tools enhance the workflows of researchers and educators?

Johanna Szőke:
The most common features include chat and email summaries, meeting transcriptions and notes, and various autofill options.




Click/Scan

To use digital technologies to share and exchange knowledge, resources and experiences with colleagues and peers. To use digital technologies to collaboratively develop educational resources.

Collaborating groups are characterised by a jointly undertaken and continuously synchronised common task, shared resources, procedures, problems and glossary, as well as close working relationships (Lengyelne Molnár, Kis-Tóth, Antal, & Racskó, 2015). An important element of most cooperations, including professional collaborations, is the creation of a common product: the common activity, the common object of knowledge created by teamwork (Lengyelne Molnár et al., 2015).

Online communities and networks that cooperate in this fashion can be found on the Internet in the form of institutional or independent portals, as

well as on social media platforms related to all fields, including all forms of scientific and professional activity. Visiting these regularly and subscribing to their newsletter and information services can help us stay up to date concerning the release of new content and the organisation of important events (conferences, webinars, etc.).

The importance of reciprocity must be emphasised: through regular and active participation, the knowledge base of professional communities expands and becomes a useful field for self-education and professional further training for a growing audience. We should therefore ensure that we take part in these communities not only as end users, but also as contributors by offering our own content, good practices and training programmes.



Regardless of our specific professional field, the following higher-education-related portals are useful starting points for cooperation and knowledge sharing:

- [COL](#) (*The Commonwealth of Learning*) is the only intergovernmental organisation in the world dedicated exclusively to the promotion and development of distance and open learning.
- [EHEA](#) (*European Higher Education Area*) is an international cooperation network related to higher education, in which the modernisation and quality transformation of higher education is carried out through joint development and mobility projects and the development of quality assurance elements.
- [EPALE](#) (*Electronic Platform for Adult Learning in Europe*) is an open community of professionals involved in adult learning. The portal of

the organisation features professional materials, projects and good practices. There are several professional communities within the organisation, but we can create our own professional community related to our activities according to individual needs.

- The [Higher Education Methodology and Educational Technology Forum](#) has been operating as a task force of the Hungarian Rectors' Conference since January 2024. Its aim is to share experience, knowledge, and best practices for the development of national higher education through regular meetings of the heads and staff of Centres for Teaching and Learning.
- The [Higher Education Pedagogy Subcommittee](#) was established in the fall of 2023 within the framework of the Hungarian Academy of Sciences' Pedagogical Scientific Committee. Its task is to support national higher education pedagogy research by organizing professional programmes such as workshops, conferences, and roundtable discussions.
- [Hochschulforum Digitalisierung](#) is a community of professionals involved in the digitisation of higher education, helping to keep people interested in the topic by the frequent publication of articles and the regular organisation of webinars and conferences.

Further higher education development organizations and related useful national and international events are listed in [Dringó-Horváth \(2024\), Appendices 4 and 5](#). The interactive, regularly updated annual conference calendar is [available here](#).

The significance of active online communities and groups dealing with higher education methodology lies mainly in quick assistance, problem solving and effective information transfer based on reciprocity (e.g. the announcement of upcoming events). In line with the topic of AI, several

groups on social media share ideas, experiences, and practical teaching materials related to the application of AI in education, as well as professional news and event information.

To use professional collaborative networks to explore and reflect on new pedagogic practices and methods.

To participate in professional learning communities where the role of AI in education is a key topic, and to work on joint projects aimed at the innovative use of AI in education.

The task of teachers dedicated to research and innovation is to continuously develop and train themselves in their subjects and pedagogical and methodological activities. A proper understanding of our pedagogical practice, methodological repertoire and professional skills is an essential precondition for progress and development in these areas. There are several ways to receive feedback on the effectiveness of our teaching and research work (e. g. through discussions with colleagues and students, questionnaires administered either collective or individually centred on our work, communicating in online professional forums or just reading literature), yet all this feedback can only have a developmental effect and be incorporated into our practice after proper reflection (cf. Szivák, 2014; for the significance of individual and collective evaluation and reflection, and suggested methods, see Chapter 1.3).

A great example of how to build professional networks focusing on the methodological training of teachers is the [European Higher Education Area and Bologna Process](#) (EHEA, see above for details).



What opportunities for the development of digital pedagogical competences do Hungarian higher education institutions offer their teachers?

Gábor Halász:

They are setting a good example when they do not hold traditional training programmes, but rather organise activities and workshops which are frequented because the participants want to meet people who have similar problems and want to know how others solve them.



Our pedagogical-methodological toolkit can be updated by completing various online courses and taking part in workshops (for details on online courses – MOOCs – see Chapter 1.4). The ever-expanding range of online courses at the [European Schoolnet Academy](#) can be used for this purpose. For the development of digital competencies specifically, we can choose from the following list, which includes items that focus on public education:

- With the help of [Google Digital Workshop](#), we can learn the basics of online presence and digital marketing, two competencies that can be important in several ways for those working in higher education.
- [E-teaching.org](#) is a non-commercial initiative of the Leibniz-Institut für Wissensmedien (Tübingen). The portal (which is available in German only) collects scientific and professional material, and practical information and good practices related to the opportunities presented by digitisation in higher education, and also provides information on the most important related events.
- The [DIGICOMP project](#) is dedicated to the development of a set of open educational resources (OER) for training teachers in the field of digital



How should educators develop their digital competencies?

Gábor Halász:

Every single educator has their own unique approach. It would be very difficult to make uniform conclusions about this question. Personally speaking, I do not plan my development in advance, but when I run into a problem, I seek knowledge, or improve my skills to solve it. I feel that if we do not try an idea out in practice, if we do not experiment with it, we will learn very little from it. Of course, others prefer the systematic acquisition of knowledge. Within an institution, the best solution is probably to support people's learning from each other as much as possible.



The role of AI in education has been a topic of interest for learning and development specialists since the early 1990s; the [International Artificial Intelligence in Education Society \(IAIED\)](#) has been active in this field since 1997 (Horváth, 2023).



In the Hungarian context, the [AI Coalition](#) is particularly noteworthy. It was formed in 2018 and works in cooperation with nearly 70 Hungarian and international organizations on the directions of AI development in Hungary, contributing to the creation of [Hungary's AI Strategy for 2020–2030](#). They promote AI through awareness raising campaigns, events, educational programs, and materials, most of which are available free of charge.

Chapter 5 of Fekete's (2025) book presents empirical findings on the level of digital and artificial intelligence literacy among educators, its correlation with professional development, and the characteristics of different educator profiles.

To use professional collaborative networks as a source for one's own professional development.

The evaluation of the work of educators and researchers working in the academic sphere (when rewards, promotions and accreditation processes are considered) depends to a large extent on various bibliometric indicators such as the number of publications, citation index, journal index (impact factor or SJR index) or Hirsch index – to mention only the most important ones. All these are heavily influenced by the online presence of the educator, the proper publication of their scientific and professional work, and the extent to which they can reach a given professional community.

International scientific community networks are quite useful in this field, and their positive effects on scientometrics (mainly on citation indexes) have been confirmed by research (cf. Van Noorden, 2014; Niyazov et al., 2016).

By the number of registered users, the following services are considered to be the most popular in this field (Sasvári & Urbanovics, 2019).

- [Google Scholar](#) has become very popular mostly for finding and listing references. The “cited by” feature allows you to list documents that cite the original article, modelled on citation indexes.
- Founded in 2007, the main function [Mendeley](#) is to collect and organise literature. We can upload documents directly from the browser or from our own computer, organise them online and access them from anywhere at any time. Another important feature is that we can sort references, citations, and bibliographies across a wide range of journal styles with just a few clicks.
- The services of [ResearchGate](#) were launched in 2008 and are free to use, although registration requires an institutional email address. The aim of the site is to facilitate professional community relations – by sharing our most important professional data and uploading our publications, we can help the exchange of ideas of professionals in the same field and contribute to creating a network of contacts (Figure 1.3.).
- [Academia.edu](#), also founded in 2008, works in a similar fashion. Registered users from a given field can connect with each other and share their data and announcements. This site, however, is profit-oriented, and some features must be paid for.
- On a related note, we can also mention LinkedIn, which was originally designed for business professionals, but has since expanded to serve the professional knowledge and networking needs of higher education. Active participation in groups with different focus areas or in news feeds is key to professional development: we can quickly and easily connect with professionals who share similar interests and discuss current issues. This helps us stay up to date professionally, especially in rapidly changing fields, such as artificial intelligence.



A common characteristic of scientific community networks is that they provide feedback on the use of the data and content we have uploaded through various statistical analyses, which may also entail the classification of users and a certain degree of ranking. Through network activities and communication, however, the professional activity carried out in a given scientific field can be easily traced, including the online presence of our own institution or work (provided our activity is sufficient).

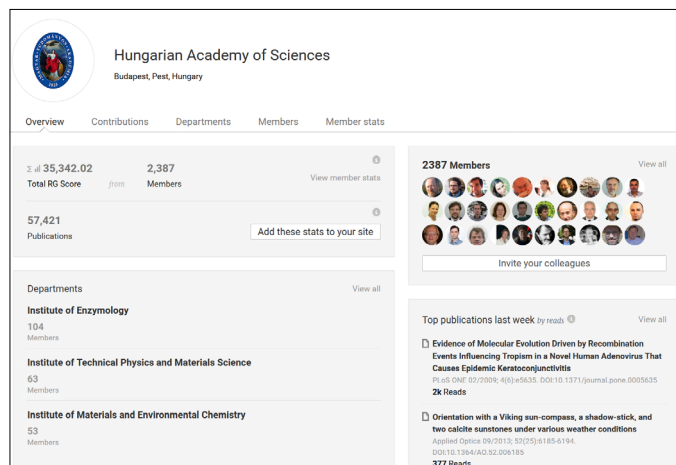


Figure 1.3. Overview of the institutional presence of the Hungarian Academy of Sciences on ResearchGate, as of January 2021.

The use of AI opens up new opportunities for professional networking and collaboration, for example through innovative ways of searching and processing academic literature, often using visualisation tools. Below are some examples of the functions of well-known applications in this field:

- [Connected Papers](#) is a visualisation tool that helps map scientific writings related to a given field. Based on a selected paper, the application generates a graph of related works, thereby facilitating a deeper understanding of the topics and the discovery of new research directions.
- [Elicit](#) enables a question-based search and compares results based on key information. It is particularly useful for preparing systematic literature reviews.
- [Litmaps](#) is an interactive scientific search tool that displays literature related to a given topic on visual maps. It is particularly suitable for identifying research trends and mapping connections between relevant publications.
- [Research Rabbit](#) offers interactive visual graphs that show the connections between studies, authors, and topics, thus facilitating a deeper insight into individual research areas.
- [Scholarcy](#) automatically summarises the content of scientific papers, highlights key points, and creates a structured abstract. The tool helps users quickly understand new studies and contextualise existing research.
- [Scite.ai](#) allows users to understand how other researchers cite a particular study. The application shows whether citations are positive, negative, or neutral, helping researchers identify relevant and reliable sources.
- [Semantic Scholar](#) specifically indexes scientific articles. The service highlights key concepts, citations, and influential connections in studies, making literature review more efficient, especially when dealing with large amounts of text.
- [Scopus AI](#) is a chatbot developed by Elsevier based on the Scopus database (see below). It answers questions in natural language and recommends relevant publications, highlighting essential content from scientific articles related to the answers.

- Perplexity is a more general AI question-answering tool, but it is also excellent for research purposes, as it provides sourced, concise answers and can recommend relevant studies from various databases. For each query, it generates new, related questions.

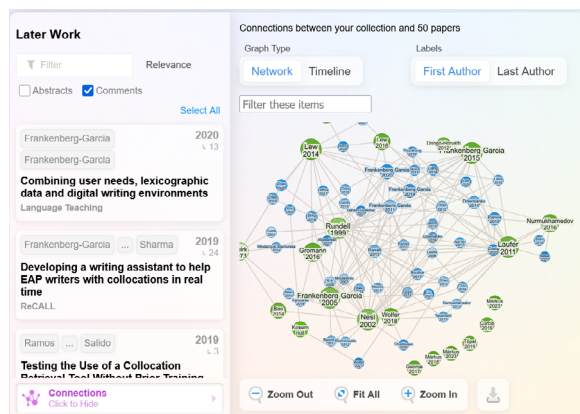


Figure 1.4. Network of research paper connections within the topic of dictionary didactics, Research Rabbit, 2025

Sample prompts:

To narrow down the research topic: “What more specific, researchable subtopics relate to ethical issues of artificial intelligence in education, with particular regard to student data protection and assessment?”

To collect and organise current literature: “Collect peer-reviewed studies published after 2020 on AI-based prediction of student performance in higher education and organise them according to methodology, sample, and main results.”

To explore citation relationships and relevance: “Show how the most frequently cited studies on learning analytics and predictive modelling are related to each other, and which are the most influential key articles.”

We can increase the readership of our scientific work by registering in a scientific community network and sharing our most important publications there. By choosing to appear publicly, our work becomes available for download and review by registered users. It helps to build network connections by tracking the activities of registered users who work in our field of interest – this can help others to follow our work, thereby increasing our visibility within the network. We can also present our ongoing projects to the professional community in order to connect with research which is relevant to us as soon as possible. This also enables us to start a professional exchange of opinions about our results, even before their actual publication.

How can generative AI accelerate the research process and improve the relevance of source discovery?

Johanna Szőke:

With the help of GenAI, in addition to the usual search for keywords and authors, you can ask complex questions in natural language and receive a generated summary along with the relevant sources.

Click/Scan

If we wish to publish our scientific work internationally, it is advisable to publish it in internationally listed journals. A good starting point is to search in international cataloguing databases, which record journals and publications on the basis of a strict set of requirements, and then organise them by discipline. Two of the most important databases in this regard are [Web of Science](#), maintained by Clarivate Analytics, and [Scopus](#), owned by Elsevier.

The journals listed by Scopus are ranked by the [Scimago Journal and Country Rank \(SJR\)](#), which has become an increasingly important classification indicator in addition to the impact factor (IF, a measure of scientific impact) that had previously long been dominant. The system classifies journals into four quality categories according to the quartiles of discipline rankings (from Q1 to Q4, based on the first, second, third and fourth 25%, cf. Sasvári & Urbanovics, 2019). In addition to the classification, the site contains useful statistical data and graphs related to the listed journals, and the resulting country-ranking data can be searched as well (Figure 1.4.).

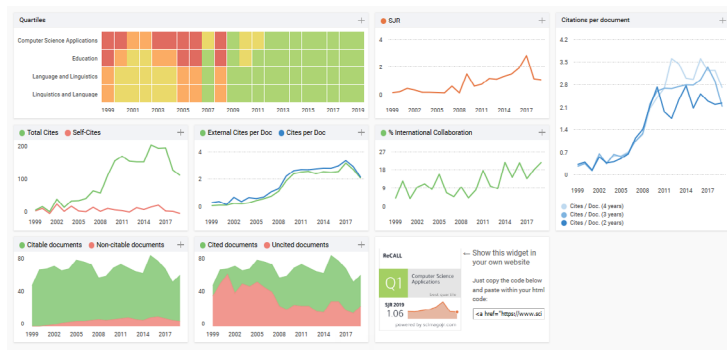


Figure 1.5. Classification and statistics for the journal ReCALL based on Scimago

The question of whether our study will be accepted by a reputable journal is easier to answer if we can discern the relevance of our topic to the given journal. This is simpler if we use journal search systems, which, based on the information provided (mostly titles and abstracts), suggest journals that typically publish studies similar to ours.

Based on Sasvári & Urbanovics (2019), such freely available online services, which have since been supplemented with AI features and expanded with AI-based search engines, include:

- [Elsevier Journal Finder](#)
- [Springer Journal Suggester](#)
- [Wiley Journal Finder Beta](#)
- [Edanz Journal Selector](#)
- [Welcome to Jane \(Journal/Author Name Estimator\)](#)
- [JournalGuide](#)
- [IEEE Publication Recommender](#)
- [Trinka Journal Finder](#)

When we talk about the spread of open access journals, we need to address a source of danger: the emergence of so-called predatory or parasitic journals, which, without any particular scientific background, have been founded with the direct goal of financial gain and seek out researchers by their online data, trying to persuade them to publish in the journal, or become members of an editorial board. Unfortunately, they typically use sophisticated, very clever advertising tricks that can easily be deceptive.

If we receive a suspicious request, we should check the journal in question in the international databases described above and in the [Directory of Open Access Journals](#). The [Directory of Open Access Books \(DOAB\)](#), which is a

community-based sister site of DOAJ, should also receive close attention as it provides access to peer-reviewed, open access journals and books. In addition, predatoryjournals.org contains a register of parasitic journals, although it is difficult to keep up with their rapid growth. Appropriate data representation greatly contributes to transparent, easily interpretable data communication and, thus, to quicker publication. The [Scimago Graphica](https://scimago-graphica.com/) application helps with this, offering a number of exciting data visualisations on its free and easy-to-use interface.



Figure 1.5. Detail from the Scimago Graphica data visualisation catalogue

It is also worth familiarising oneself with AI tools for writing papers, the ethical and conscious use of which facilitates and accelerates individual workflows, from processing the literature to writing papers and managing references, as illustrated by the examples below. Intelligent chat assistants,

such as [SciSpace](https://scispace.com/), [Chatpdf](https://chatpdf.com/), or [ExplainPaper](https://explainpaper.com/) are capable of extracting and interpreting PDF-based scientific texts and answering related questions. They can also be used to simplify texts, create definitions and explanations of terms, or to generate source citations in a specific format.

Writing assistance applications, such as [Jenni AI](https://jenni.ai/), are AI tools that make suggestions for continuing paragraphs stylistic corrections, and content additions. Through continuous machine learning, they adapt to individual writing styles, providing personalised assistance in academic writing. Applications such as [Writefull](https://writefull.com/), [Grammarly](https://grammarly.com/), [Quillbot](https://quillbot.com/), and [DeepL](https://deepL.com/) mostly have writing assistance features: they check academic English usage, suggest stylistic and grammatical corrections, and provide examples based on large academic corpora – however, hallucinations cannot be avoided, so it is worth reviewing and checking every translated or stylised-rewritten text passage. The typical features are summarised in the table below (as of May 2025):

Tool	Dictionary features	Features aiding academic writing
Writefull	✓ sample sentences, synonyms	✓ academic style, structure, corpus-based corrections
Grammarly	✓ synonyms, definitions, suggestions	✓ academic style checker in the premium tier
Quillbot	✓ thesaurus, definitions	✓ paraphrasing, academic style in the premium tier, citation generator
DeepL	✓ glossary created during translation, alternatives	✗ paraphrasing, academic style in the premium tier

Table 1.2. Comparison of AI-based translation, stylisation, and writing assistance applications

SciSpace's writing module, [SciSpace Write](#) (formerly [Typeset](#)), enables professional editing and automatic formatting of manuscripts in accordance with various journal styles. With built-in AI features, researchers can not only write their work, but also immediately adapt it to the requirements of their target journal.

AI is particularly useful for managing citations, whether for individual or collaborative research projects. Professional citation management applications, such as [EndNote](#), [Mendeley](#), or [Zotero](#) help organise and insert citations into text, as well as automatically format reference lists. They typically integrate with various text editors and can automatically capture source data found on the internet with browser add-ons. In addition to the above, the [Notion](#) application also combines note-taking, task management, and collaboration functions, making it useful for research groups for efficient work organisation and content management due to its integrated interface. Studies examining trends in dictionary use in higher education show a clear and continuous shift towards the use of online dictionaries and AI-based translation applications with dictionary functions (cf. P. Márkus & Dringó-Horváth, 2023; P. Márkus, Fajt & Dringó-Horváth, 2023).

1.3 Reflective Practice

To individually and collectively reflect on, critically assess and actively develop one's own digital pedagogical practice and that of one's educational community.

Quality teaching work, regardless of the level and scene of education, is inconceivable without a reflective attitude or the ability and continuous development of reflective thinking. Reflection upon our practice helps us to find meaning and make sense of what we are doing, which requires us to understand ourselves (Ghaye, 2011). Reflection in education is “a disciplined enquiry into the motives, methods, materials and consequences of educational practice. It enables practitioners to thoughtfully examine conditions and attitudes which impede or enhance student achievement.” (Norton, 1994, quoted in Taggart and Wilson, 2005.) Reflective teaching in this manner means “a thinking and practice that continuously and consciously analyses pedagogical activity, ensuring the continuous self-monitoring of educational activity and its improvement.” (Szivák, 2014, p. 13.)

Improving reflection is also important at the organisational level: “... the organisational effectiveness might be increased by synchronising the individuals' professional development with the development of the whole organisation.” (Verderber, Szivák, & Vámos, 2016, p. 23.)

While the significance of pedagogical reflectivity is becoming increasingly important in relation to primary and secondary education, it is much less frequently discussed in relation to university and college teachers. Although its practical advantages are significant in higher education at both the individual and organisational levels, it is of paramount importance for teacher training due to its value as an example to others.

In the light of the above, self-reflection is essential in the development of any competence. An educator who is open to effective self-analysis and a critical approach is characterised as possessing the following abilities:

To critically reflect on one's own digital and pedagogic practice. To identify competence gaps and areas for improvement.

Irrespective of the subject of reflective practice, based on the work of Taggart and Wilson, three levels are distinguished in this process (Taggart & Wilson, 2005; illustrated below using the examples of self-reflection questionnaires from Dringó-Horváth et al., 2020):

- **Technical level:** Not conscious, systematic, identifying practical difficulties only (e.g. “How should I prevent my students from using Facebook in my classes?”)
- **Contextual level:** Focusing not only on practical difficulties, but also on solving them in order to be able to develop routine activities (e.g. “What could be the reason for my students using Facebook in my classes?”)
- **Dialectical level:** Systematically analysing oneself as a teacher, able to objectively judge an educational activity or a problem situation, even by questioning one's assumptions and ideas (e.g. “Do students use Facebook in my classes because it is an elementary need for Generation Z? What is my responsibility in this matter as a teacher?”)

We should note that the particular emotional events and situations that almost automatically make us think and reflect vary individually. It is worth striving for some awareness in this, and not only looking for possible causes in connection with problem situations and failures, but also linking reflective

activities to specific stages of the educational process (Szivák, 2014). In connection with higher education, reflective practices can be linked to the following initial and final stages of education and other events (cf. Dringó-Horváth et al., 2020):

- When preparing for the lesson (planning phase)
- Immediately after class
- Following a larger unit or at the end of an educational stage (e.g. at the end of a course)
- When a learning organisation problem emerges (e.g. a smaller number of students than planned)
- When an educational or methodological problem emerges during teaching
- In connection with student reactions and feedback (e.g. based on course evaluation)
- In relation to learning outcomes (e.g. based on assessment results)



Based on the participants of reflection, we can distinguish between self-reflection – when instructors perform the analysis on themselves – and dialogic reflections conducted with others (dialogues with students, colleagues, professional communities, etc.). For both types, we can talk about oral and written reflection (Szivák, 2014). Here are some examples from higher education (Figure 1.5):

	Written	Oral
Monologic / Individual	• teacher portfolio / e-portfolio • reflective written assignments • research projects, action research	• mental self-reflection
Dialogic / Social	• asking students to complete a course evaluation questionnaire and discussing it with them in writing (e.g. in the learning management system) • written exchange of experiences with colleagues (e.g. on a professional forum or social site)	• oral discussion of the course evaluation questionnaire with the students (e.g. at the end of the course) • oral exchange of experiences with colleagues (e.g. in a department meeting)

Figure 1.5. Types of reflection (authors' own edit after Szivák, 2014, and Dringó-Horváth et al., 2020)

Reflective skills are improved in various ways (individually and with others), in various situations, and with the involvement of various participants. We should find out in which situations we are likely to employ reflection and what form it typically takes (individual or social) and then consciously try another reflective situation and form we have less experience of. It is worthwhile selecting the situations that seem most effective and practising our reflective activities consciously, regularly and diversely.



In higher education, we can apply different methods to the written individual forms of reflection, from which a few specific options are selected below (Szivák, 2014, for dialogic modes, see the following section):

- **Self-reflection questionnaire:** This helps to record feelings, events, opinions and thoughts related to the given activity by answering questions.

This can be used, among other things, for a regular review of our digital competencies or for a focused analysis of the tools used in the classroom.



- **Reflective textual analysis:** While studying a text, we can describe any reflections and analytical thoughts that are related to the text. (This is not necessarily only an individual task; it can also be done in pairs or in a professional community.)

This can be used to efficiently explore and utilise any literature, curriculum or other text we have seen on a professional community site or in a blog entry related to digital pedagogy.



- **Mind maps / tree diagrams:** These allow us to display structures, concepts, and their internal relationship. A mind map helps us to organise our associations completely freely, while a tree diagram requires that we organise a specific list of concepts, or record our thoughts on a given diagram for the given concept circle.

Both methods can help to systematise the large number of new concepts related to digital pedagogy.



- **Preparing a personal development plan:** This is a personal document that describes the (continuous) professional development path in a reflective form, presenting the main goals and stages of development. (For the benefits and reflectional advantages of creating individual student learning plans, see Chapter 5.2)
- **Teacher's portfolio / e-portfolio:** This is an organised collection of works related to a given activity, accompanied by reflections.

In order to improve our command of digital tools, this may include a review of related literature, the administration of content development, communication and assessment, related (self-) assessment questionnaires, reflections on the topic with students or the faculty, etc. (For the digital tools of e-portfolios, see Chapters 4.1 and 6.2; for student e-portfolios, see Chapter 3.4)



- **Action research:** This is a problem-centred, focused reflection process that facilitates self-monitoring and self-improvement by conducting targeted research.

For the analytical evaluation of our activities and possible problems related to the use of digital devices, we can use the action research template of Taggart and Wilson (2005):



- Identify the problem.
- Define the central question or topic.

- Define smaller and larger goals.
- Select control techniques for research.
- Collect and analyse the data. Communicate findings effectively.

Analytical thinking related to the lesson should be performed in the following steps (after Szivák, 2014):

- An overview of the lesson-planning process, with particular reference to the preliminary objectives related to the topic of the analysis.
- Reflection on the events in class that are relevant for analysis.
- Analysis of the results and problems of the completed learning process.
- Identification of the areas for improvement and the necessary steps to be taken.

To seek the help of others in improving one's digital and pedagogical practice. To help others in developing their digital pedagogical competence.

It is also a good idea to learn about the possible forms of dialogic reflection and to consider trying out different methods or incorporating some effective solutions into the system of our work community. In higher education, there are typically two key areas of this kind of reflection: reflection with colleagues in pairs, small groups or even a larger teaching community, and dialogue with students for professional self-development. A typical form of the latter is the course evaluation questionnaire, which is either part of a central, institutional survey, or an individual initiative. Centrally-organised student evaluations are usually part of the mandatory quality assurance system for higher education institutions and can be downloaded from the websites of several universities or as an appendix to the regulations.

For the tools of digital questionnaires and feedback options, see Chapter 4.1; specific examples can be found in *Good Practice 5.3: Feedback through infographics* (Chapter 5).

The role of active professional communities is significant at all levels of education: by initiating conscious professional dialogues and consultations, they encourage reflectivity and professional improvement, which is needed at all stages of the teaching career. In higher education, this can take the form of conversations or the exchange of experiences in the narrower or wider institutional environment, but the range of participants and activities in the digital space is considerably larger – through professional community portals, blogs, mailing lists and newsletters, experience sharing and reflection (see also Chapter 1.2).

Below are some dialogic reflection methods taken from public education mentoring and work community activities, the conscious application of which can also be useful in higher education. Their possible applications to the field of digital competencies are also presented below (Szivák, 2014).

- **Joint experimentation:** The mentoring and the mentored colleagues work together to solve a task (e.g. selecting the right digital tools to achieve certain educational goals, or building a professional online presence).

We should help our colleagues to articulate their goals and find the appropriate tools, and then test them together in our own courses. At the end, the success of the idea can be evaluated (considering the method, digital device and procedure) in a joint reflection session, which might possibly generate further ideas to be tested.



- **Case discussion:** During this process, one of the participants presents a situation or a specific case that is problematic for them, which is then analysed in pairs or groups. In a productive case discussion, we can gain a deeper understanding of the problem and of our emotional involvement, and may thus find novel, creative solutions more easily.

We should feel free to use this method to solve problems with the use of digital tools in a focused way with the involvement of expert colleagues from our organisational unit or institution.



- **Debate:** A clash of opinions and arguments elicited to solve a problem. The focus is on communication, on trying to convince one another by stating arguments and counter-arguments.

This is a particularly useful method for discussing the methodological purpose, function, advantages and disadvantages of the use of digital devices or even the factors influencing efficiency. It can take the form of a verbal discussion or can be done in writing (on professional pages, forums, etc.).



- **Thinking aloud:** The core of this method is to articulate any relevant thoughts we may have during an activity. By doing so, our individual thinking and decision-making mechanisms are revealed, and our motives and problems related to the activity, as well as our reactions to them also emerge. With this method, we can avoid using routine, stereotypical solutions, and it allows us to look at problematic situations from a new perspective, presenting several aspects during the decision-making process.

The above factor is why we can use thinking aloud effectively in the systematic, conscious and methodologically accurate acquisition of the application of new technologies. Whether we engage in a dialogic reflection as mentors or the one being mentored, or perform a self-analysis, it is important to have a positive experience that enables the participants to “analyse, define, and, if necessary, transcend their own ‘reality’”. When that is present, people focus on what they want to create, not on what they want to avoid.” (Szivák, 2014, p. 25) It helps if we do not focus on negative aspects or mistakes, but analyse the positive features and strengths, e.g. along strength-focused questions. The difference between the two is illustrated in the table below; with this we can easily formulate appropriate questions for the analysis of any activity or problem concerning digital pedagogy (Ghaye, 2011; Szivák, 2014):



WEAKNESS-BASED QUESTIONS

- What’s wrong?
- What were the causes of the problem?
- What do we need to stop doing to fix the problem?
- What behaviours do you need to change?

STRENGTH-BASED QUESTIONS

- What has been successful?
- What led to the success?
- What do we need to keep doing to remain successful?
- What behaviours do we need to strengthen and how do we go about this?

To seek targeted training and use opportunities for continuous professional development. To seek to continuously expand and enhance one’s repertoire of digital pedagogical practices.

It is quite revealing that further training programmes and workshops on educational informatics take place regularly within colleges and universities, mostly in a freely chosen form, but there are institutions where such training is a part of the quality assurance process and as such, its completion is rewarded in some way. As for the topic of training programmes, it is satisfying that they are related not only to the technical management of tools, but also to their conscious methodological application (Dringó-Horváth et al., 2020).

Our expert points out the ways to improve digital competencies in an institution even more efficiently.



What opportunities do Hungarian universities and colleges offer to develop the pedagogical digital competencies of their educators?

Judit Szivák:

Basically, every university and college is working hard to improve the digital competence of educators. Courses are organised to discuss various issues, which are then held at beginner and advanced levels. I would certainly make the development of a digital culture for university teachers project-based, which means that I would organise it around a range of issues related to education. I would not separate the learning space from the professional community, but take the focus down to smaller professional communities who already think about certain issues together every day.



If it has regulations and recommendations built into the relevant quality assurance system or reward system in order to maintain and continuously improve the quality of teaching, a university or college can greatly facilitate the self-training process of its teachers and their participation in further training. This kind of knowledge and competence should be given more emphasis in promotions at the institution, as well as in the assessment of habilitation procedures. It can be especially effective to disseminate such good practices within the teaching community and reward them (e.g. with teaching awards). The University of Vienna's [Univie Teaching Award](#) is a good example here. Students and teachers, as well as (vice) directors of studies and (vice) deans for teaching are invited to nominate courses they consider excellent and each award winner (individual or group of teachers) receives a considerable sum of money to dedicate to future teaching activities. Applications are evaluated by an official committee and the award ceremony takes place at the end of each academic year. Several institutions in Hungary have launched similar initiatives. For example, the [Innovative Educator Award](#), introduced by the ICT Research Centre at KRE in 2024, is unique in that it is closely linked to the institution's internal training programmes. Applicants must demonstrate innovative and creative teaching practices that promote student learning and development, and for which they have acquired the methodological or digital skills in one of the Research Centre's courses. The application materials and demonstration video of the first-place winner of the first application cycle can be found at [this link](#).

Similarly, this process is often positively influenced by strengthening the research on the topic within the institution, e.g. by means of calls for proposals or by encouraging participation in a central tendering opportunity.

Research shows that the basic prerequisite for the proper development of pedagogical digital competence and the development of a new methodological culture is a positive attitude towards new digital content, tools and methods (Khvilon & Patru, 2002). The support of our professional community and institution can also play a role in this process. Useful strategies for the leadership to achieve lasting change are listed below (according to Khvilon & Patru, 2002, p. 157 – here referring to teacher educators, Figure 1.6):

Attributes of Innovations	Leadership Strategies
Relative advantage	Try to demonstrate that ICT-enhanced learning is more effective than traditional approaches to teaching and learning.
Compatibility	Try to demonstrate that ICTs are not at variance with current views, values and approaches. No technology is culturally neutral, and so it is important to address this attribute openly and honestly.
Complexity	Try to demonstrate that ICTs are relatively easy to implement in teaching. To do this implies that leaders have some knowledge of ICTs, or can call on assistance as needed.
Trialability	Give teacher educators the opportunity to try out ICTs in a way that is not threatening. Time is required here, as is further technical assistance.
Observability	Give teacher educators the chance to see the use of ICTs in teaching. It would be useful to see leaders using ICTs or to see other teacher educators using ICTs.

Figure 1.6. Continuous professional development through digital support (authors' own editing after Khvilon & Patru, 2002)

1.4. Continuous Professional Development with Digital Support

To use digital sources and resources for continuous professional development.

An important aspect of the [European Commission's adult learning policy](#) is lifelong learning and, as part of this, the promotion of regular, conscious further training for professional development, which Member States seek to achieve through a number of national and international calls, tenders and projects. However, an external support system is only effective if it is coupled with an internal need and a readiness for continuous professional development. The path of professional development lies in trying not to adhere to old habits and practices that have been imprinted on us and have over the years become routine behaviours, but to upgrade our professional practice regularly and consciously.

Digital space offers several new opportunities for higher education in this regard, especially in the wide range of online courses, webinars and conferences that are easily and quickly accessible from anywhere and at any time. In this chapter, we present the opportunities digital space offers for the development of teachers' professional competencies, give tips and come up with specific recommendations on how to use them effectively in teaching and research work.

An educator who is seeking continuous professional and methodological development in using digital technology is characterised as possessing the following abilities:

To use the Internet to identify suitable training and professional development opportunities, to search for and identify digital resources which support professional development. To use the Internet to update one's subject-specific competencies and to learn about new pedagogical methods and strategies.

We can greatly facilitate exploration, research and further training for the purpose of continuous professional development with the help of digital tools, especially with the use of the Internet. An important aspect in this process is the systematisation and the careful and transparent storage of information, of the useful tools and applications (on our own devices), as well as creating access paths (in the case of cloud-based online data storage; see Chapters 2.1 and 2.3 for details). Storing information on our own devices is definitely safer from a data protection point of view, but cloud-based solutions are more appropriate for the educational process and for sharing experience and knowledge with colleagues, as information can be easily accessed and giving opinions, joint editing and cooperation helps to develop and spread good practices.

When organising our selected resources, it is a good idea to use online individual or social bookmarks, which allow us to annotate, systematically organise, access, and share collected content anywhere and at any time, regardless of the device or browser (see Chapter 6.1 for more details).

Some prefer to search for content with social bookmarks rather than with commercial search engines, since relying on the personal experience of the user community and taking frequency of use as a measure of satisfaction yields more reliable and more relevant content (cf. Papp-Danka, 2013).

Online bookmarks can be used primarily with the following functions in our teaching work (cf. Papp-Danka, 2013): 

- to organise and quickly access online content (when preparing for courses, research work or class activities with students);
- to create an annotated bibliography;
- to share content and evaluate it, to exchange professional community information and experience, cooperation;
- to publish personal works and the activities of our students (possibly in groups).
- Making a collection of our most frequently used online content on our browser's home page speeds up access to it.

The online options for methodological-pedagogical development, especially the targeted development of digital competencies, are discussed in Chapter 1.2.

Professional international journals related to higher education, adult and vocational training and the development of these areas, such as the [International Journal of Lifelong Education](#), the [International Review of Education](#), and [ELM MAGAZINE](#), can provide a good starting point for professional exploration and for disciplinary and methodological development.



The International Journal of Artificial Intelligence in Education ([IJAIED](#)), the official journal of the organisation of the same name (see section 1.2), focuses on the use of artificial intelligence for educational purposes—to name just one example from its wide range of topics. For more information, it is useful to do focused searches using various journal databases and search engines (see Chapter 1.2).

To use the exchange in digital professional communities as a source of professional development. To use online training opportunities, e.g. video tutorials, MOOCs, webinars, etc.

To participate in workshops, webinars, or online courses on the educational applications of AI, as well as in personalised development through educational platforms focused on AI.

Perhaps the easiest method of further training and professional development is when we find guides, descriptions, or good practices relating to our problem or our educational goal that have been uploaded by others, and we expand our understanding in the matter by reading, watching or listening.

There are several opportunities to complete systematically structured curricula, courses, or even entire training programmes online. One way to do this is by participating in an online meeting or a video conference, during which we use a synchronous communication device to take part in the training at a given time. The term ‘webinar’ is sometimes used in this sense, but the concept also includes the real-time transmission of online meetings or presentations via the Internet, as well as the publication of the recording in archived form.

One of the best-known forms of complex online courses are MOOCs (Massive Open Online Courses), an open education system in which participants have unlimited and free access to online courses. [This video](#) nicely illustrates the concept.

This new type of distance learning first appeared in 2008, and by 2012 it had become widespread. The training programmes are sometimes initiated by universities or non-profit organisations, and sometimes by individuals

or professionals – in the first two cases we can expect more reliable, more professionally controlled content. It is advisable to start online distance learning with such courses. In the case of courses held by private individuals, caution is advised and we should do some research into the lecturers and the content before we begin learning.

As it is not always easy to choose from such a wide range of courses, the following twelve factors may help us to evaluate the courses on offer: “the degree of openness; the scale of participation (massification); the amount of use of multimedia; the amount of communication; the extent to which collaboration is included; the type of learner pathway (from learner-centred to teacher-centred and highly structured); the level of quality assurance; the extent to which reflection is encouraged; the level of assessment; how informal or formal the course is; autonomy; and diversity.” (Conole, 2014, p. 10)



Courses can also be placed in various categories (for details on each type, see Conole, 2014). Another important difference is the access we are given and with the time frame in which we can complete a course:

- In **self-paced training programmes**, following registration, we get access to the entire curriculum and we can work on each topic at our own pace.
- In **timed training programmes**, specific times and deadlines are given for enrolment, for the timetable and for the completion of the course.

There are also **archived courses**, where we are given access to the material of a previously completed course and work on it independently, without a tutor, classmates or deadlines.

Here is a list of some major MOOC providers who offer a variety of courses under a partnership agreement with universities, colleges or other organisations. They typically have a well-developed search interface and significant user feedback (evaluation) to help orientation; most of the study materials are free of charge, but if a certificate or degree is required, it usually has to be paid for.

- [Coursera](#): Its first course was launched by Stanford University in 2012; since then countless training sites have joined the initiative and offer courses on a variety of topics.
- [edX](#): Launched by Harvard and MIT, also in 2012; the number of courses available today exceeds 2500 through a collaboration of 140 institutions.
- [Cognitive Class](#): This site mainly offers courses related to data mining and cognitive computing.
- [Lynda.com/LinkedIn Learning](#): One of the oldest portals, it has been offering courses as a basic service since 2009, with a free one-month trial.
- [Udacity](#): Also launched in 2012, this site offers IT courses.
- [Open Learn](#): This is the online distance learning portal of the Open University; it mainly features a collection of written materials. [iTunes U](#), which is also linked to the university, was created with the help of Apple, where, in addition to courses in higher education, a large number of primary and secondary education courses are also available.
- [Alison](#): On this site, professional experts offer courses that provide certifications or degrees in a variety of topics, but they can be completed for individual learning purposes, too.

With the help of [Mooclis](#), we can use multiple criteria to find MOOCs and free online courses in a wide range of categories and subjects from Coursera, edX, FutureLearn, Udacity and other top providers and universities.



In recent years, it has become increasingly popular to hold scientific and professional events and conferences online. The main advantage of this – for both the organisers and the participants – is cost-efficiency and flexible participation, regardless of location or time. This trend was boosted by the Covid-19 pandemic, which resulted in a significant increase in the number of online conferences and professional events, offering countless opportunities for quick and easy access to professional, scientific training and knowledge sharing. As with face-to-face conferences, knowledge sharing takes the form of plenary, sectional and poster presentations, as well as workshops.

The annual hybrid conference series [Educational Informatics in Higher Education](#) organised by the KRE ICT Research Centre illustrates this well. The founding members and organisers talk about the exciting history and innovative nature of the conference series [in this video](#).

We can also take part in a virtual exhibition, where we can visit online stands, view multimedia information, download content, and exchange text, image or audio messages with the exhibitor. The following exhibitions are highly recommended: [Virtual Expo V2.0](#), [DaFWEBKON 2018](#), [Virtual Exhibition, opening](#) (Figure 1.6).



Figure 1.6. Deutsche Welle's exhibition stand at the DaFWEBKON 2020 conference – [dafwebkon.com](#)

After logging in and possibly registering (especially at workshops), we can join the online events and activities, and if needed, we can ask for a certificate of participation in the conference.

There are numerous national and international workshops on the various educational and research applications of artificial intelligence. Begin the search at your institution's centre for teaching and learning, as, according to a 2024 national survey, these centres treat the topic as a priority area in their training calendar (Dringó-Horváth, 2024).

The continuous development of the field justifies the need to develop our professional knowledge related to AI with the help of information sources that enable quick publication and flexible access. Not only through reading, but also in the form of videos and podcasts, for example, using the search functions on YouTube or Spotify, or even via specialised professional groups and portals (see section 1.2).



The basis for communicating with AI systems is learning how to use the so-called prompts appropriately, for which the course called [Basics of AI Prompt Creation](https://www.skillgo.io/courses/ai-prompt-engineering-basics/en/dashboard) can be a useful start. The course material presents the possible uses and structure of prompts and, through practical examples, helps students learn how to write effective prompts, from beginner to advanced level strategies. It also covers the limitations of AI responses, promoting conscious and effective use. Further, similar courses, among many, are [Effective Prompts for AI: The Essentials](#) (MIT, Sloan Technology Services), or [Writing good prompt](#) (Leeds University)

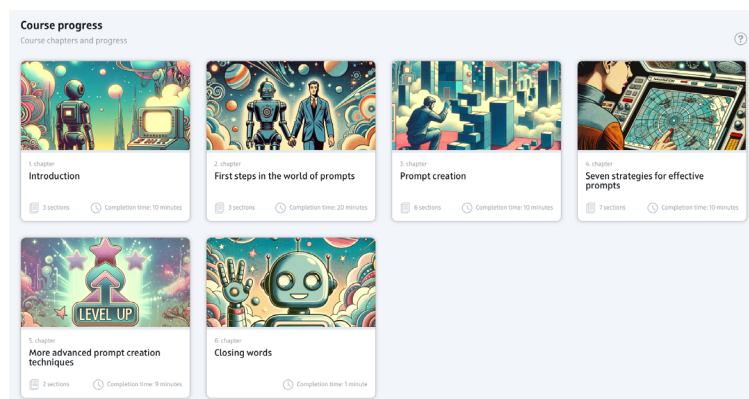


Figure 1.7. Home screen of the course entitled 'Basics of AI Prompt Creation' (Source: <https://www.skillgo.io/courses/ai-prompt-engineering-basics/en/dashboard>)

To use digital technologies and environments to provide training opportunities for colleagues and peers. To develop and disseminate guides and supporting materials that promote the application of AI tools in

professional development, and to share their own experiences and best practices with professional communities. To organise discussions or study groups on the ethical use of AI for educational purposes, and participate in workshops and seminars that examine the ethical implications of AI.

If we want to support the professional development of others, our first step may be to disseminate our own good practices and share them within the university. One of the simplest ways to do this is to create a guide for others to the tools and applications we use. This might be a written description (with or without accompanying images) or a video, which would make it even easier for others to learn about each function. The content created by this activity can be stored and published on various file sharing portals (see Chapter 2.1) or within professional community portals mentioned above (see Chapter 1.2). The applications that may prove useful in the process – e.g. a screen recorder, video recording for presentation, etc. – are discussed in Chapter 2.2.

A more complex way to share knowledge is for us to advertise a further training programme, workshop or conference for the colleagues in our professional community, in which we share our own experiences related to a given topic (digital pedagogical methods, tools, applications, etc.) and help to develop our colleagues' digital competencies through various (interactive) projects. With the help of an online meeting or webinar, we can use a synchronous communication tool to provide further training for our narrower or wider professional community, or stream our presentations in real time and make them available later in archived form (for more details, see Chapter 5.1). When conducting a video conference with the involvement of colleagues, we can organise events on several topics which may even run in parallel.

Small-scale online events can be hosted by software that is suitable for a simple webinar (e.g. [Adobe Connect](#), [Google Meet](#), [MS Teams](#), [Zoom](#), [FB Messenger](#), or [Viber](#)). However, more complex conference management software not only supports the organising of and participation in online presentations, but also provides other services that are an essential part of conference organisation – whether the event is held face-to-face or virtually. Such services include managing registrations, announcing, managing and evaluating presentations, and arranging participation fees, payments and other administration (invoicing). Apps with such complex services are provided, for instance, by [Confware](#).

When selecting the application, an important quality aspect is the extent to which it supports the activity of participants, which is paramount for the effectiveness of online events. Interactivity is enhanced if participants can exchange messages with each other individually or in groups, or if interactive elements (surveys, participant questions, etc.) can be incorporated in the presentation. When used for practical educational activities (seminars, workshops, etc.), we should always consider whether breakout rooms can be created during the meeting. This video is an example.

In the preparation phase, it is a good idea from a methodology viewpoint to include as many interactive elements as possible (see the description of related good practice). One of the pioneers of large-scale international conferences that are only held online is the [DaFWEBKON](#) for German language teachers, which has been organised with great success every year since 2012. (In connection with this chapter, see also Good Practice 1.3: How to hold online professional training programmes, webinars and conference presentations.) International centres for teaching and learning in higher education (e.g., [HELTASA](#), [Hochschulforum Digitalisierung](#), and [POD Network](#)) and local events on teaching and learning in Hungary (e.g.,

[Educational Informatics in Higher Education](#) and [Methodology Workshops for Higher Education](#)) also offer online components. These organisations typically play a pioneering role in introducing new conference formats, such as *Birds-of-a-feather* or *Workshop-in-a-box*. So-called *un-conferencing* events, which prefer such formats, typically take place within a more flexible framework, focusing on interactivity, direct knowledge sharing, and spontaneous networking, while participants take an active role in shaping the content (for details, see Dósa et al. 2025).

If we feel that we lack experience and would prefer not to organise a conference on our own, we can find several commercial service providers on the Internet that offer full online conferencing solutions, from registration and the provision of information to applicants, to technical support during the event and post-production (recording the conference, editing the recordings or making the presentations available online).

Another option for sharing knowledge is to launch our own online course, perhaps as a MOOC. Complex online course materials can be created and uploaded by commercial portals such as [Course Builder by Google](#), [Open MOOC](#) or [LearnDash](#). Although online learning requires self-regulation and independent work, it is essential that the educator plays a significant role in helping the participants achieve their learning goals. In the creation and management of online courses, our tasks as teachers are basically centred on three areas (Lengyelné Molnár et al., 2015):

- **Content elements:** This area includes the writing and editing of the curriculum, the elaboration of the methodological elements (e.g. student work, tests, etc.), and the compilation of any related notes, background materials and lists of recommended reading, as well as their adequate circulation.

- **Contribution:** During the course, it is important to help learners achieve their learning objectives. The educator's main tasks include motivating and encouraging self-directed learning (see Chapter 5.3), providing tutoring or mentoring support to complete the tasks (assigning tasks, scheduling, testing), managing potential conflicts using appropriate communication strategies, and monitoring the progress of participants.
- **Documentation:** It is a good idea to begin documentation before starting the course by assessing the participants' prior knowledge, but documentation is always present in the form of progress reports and task evaluations. At the end of the course, the educator's task is to verify the success of the participants, and comments and feedback can be collected with the help of a satisfaction survey, which facilitates evaluation (see Chapter 5.3).



A useful resource for sharing knowledge related to AI is the international initiative called [TeachAI](#), which offers guidelines and curriculum guides for teachers on introducing AI, supplemented by useful workshops and other content.

References

- AI Act: Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act)
- Bekiaridis, G., & Attwell, G. (2024). *Supplement to the DigCompEDU framework: Outlining the skills and competences of educators related to AI in education*. University of Bremen: Institut Technik und Bildung (ITB). <https://doi.org/10.26092/elib/2708>
- Conole, G. (2014). A new classification schema for MOOCs. *International Journal for Innovation and Quality*, 2(3). Special Issue on MOOC.
- Council of the European Union (2017). *Council Conclusions on a renewed EU agenda for higher education*. Brussels: European Commission. [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52017XG1214\(01\)&from=LT](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52017XG1214(01)&from=LT)
- Dósa, K., Dorner, H., Dringó-Horváth, I., & Papp-Danka, A. (2026). Az előadás után: Interaktív műfajok a magyar felsőoktatási konferenciákon. *Neveléstudomány / Oktatás – Kutatás – Innováció*, 14(1), 54–69. <https://doi.org/10.21549/NTNY.52.2026.1.5>
- Dringó-Horváth, I., Hulber, L., M. Pinter, T., Papp-Danka, A. (2020). A tanárképzés oktatási kultúrájának több szempontú jellemzése, Pécs: MTA Pedagógiai Tudományos Bizottság, PTE BTK Neveléstudományi Intézet, 129–142. <https://nevtud.btk.pte.hu/sites/nevtud.btk.pte.hu/files/files/ukn2019magyar.pdf>
- Dringó-Horváth, I. (2024). *Oktatásfejlesztési innováció és hálózatépítés a magyarországi felsőoktatásban: Trendek, irányadó eredmények, adaptálható jógyakorlatok*. Budapest: L'Harmattan Kiadó. <https://doi.org/10.56037/978-963-646-188-1>
- Dringó-Horváth I. (2024). Mesterséges Intelligencia és oktatás. Konferenciaelőadás, 27. Keresztény Civil Fórum, 2024, Parlament, Budapest
- European Commission (2018). *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions*. Brussels: European Commission. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018DC0022&from=HU>
- Fekete, I. (2025). *Artificial Intelligence Literacy in Higher Education: Theory and Practice from a European Perspective*. Multilingual Matters
- Ghaye, T. (2011). *Teaching and learning through reflective practice*. London: Routledge.

- Horváth, L. (2023). Feltáró szakirodalmi áttekintés a mesterséges intelligencia oktatási használatáról. *Pannon Digitális Pedagógia*, 3(1), 5–17. <https://doi.org/10.56665/PADIPE.2023.1.1>
- Horváth, L., M. Pintér, T., Misley, H., & Dringó-Horváth, I. (2025). Validity evidence regarding the use of DigCompEdu as a self-reflection tool: The case of Hungarian teacher educators. *Education and Information Technologies*, 30, 1–34. <https://doi.org/10.1007/s10639-024-12914-6>
- Khvilon, E., & Patru, M. (2002). *Information and communication technologies in teacher education: a planning guide*. Division of Higher Education, UNESCO. <https://unesdoc.unesco.org/ark:/48223/pf0000129533.locale=en>
- Lengyelne Molnár, T. Kis-Tóth, L., Antal, P., & Racsko, R. (2015). *IKT innováció*. Eger: EKE Nyomda.
- McDermot, M. (2018). Digital footprints: Creation, implication, and higher education. *FDLA Journal* 3(11). <https://nsuworks.nova.edu/fdla-journal/vol3/iss1/11>
- Niyazov, Y., Vogel, C., Price, R., Lund, B., Judd, D., Akil, A., Mortonson, M., Schwartzman, J., & Shron, M. (2016). Open Access Meets Discoverability: Citations to Articles Posted to Academia.edu. *PLoS ONE*, 11(2). <http://dx.doi.org/10.1371/journal.pone.0148257>
- Papp-Danka, A. (2013). Tanulás és tanulásmódszertan az információs társadalomban. In Sasvari, P., & Urbanovics, A. (2019). *A tudományos publikálás alapjai*. Budapest: Nemzeti Közszerológiai Egyetem, Államtudományi és Közigazgatási Kar.
- P. Márkus, K., & Dringó-Horváth, I. (2023). Developing Dictionary Skills through Monolingual and Bilingual English Dictionaries at Tertiary-level Education in Hungary, *Lexikos*, 33, 350–381.
- P. Márkus, K., Fajt, B., & Dringó-Horváth, I. (2023). Dictionary Skills in Teaching English and German as a Foreign Language in Hungary: A Questionnaire Study. *International Journal of Lexicography*, 36(2), 173–194.
- Szivák, J. (2014). *Reflektív elméletek, reflektív gyakorlatok*. Budapest: ELTE Eötvös Kiadó.
- Stoll, L., Bolam, R., McMahon, A., Wallace, M. & Thomas, S. (2006). Professional Learning Communities: A Review of the Literature. *Journal of Educational Change*, 7(4), 221–258.
- Taggart, G. L., & Wilson, A. P. (2005). *Promoting Reflective Thinking in Teachers: 50 Action Strategies*. SAGE Publications.
- T. Nagy J., Rajki Z., & Dringó-Horváth I. (2025). Mesterséges intelligencia a felsőoktatásban – oktatói hozzáférés, attitűd és felhasználási gyakorlat. *Iskolakultúra*, 35(7), 3–20. <https://www.iskolakultura.hu/index.php/iskolakultura/article/view/46352>
- Van Noorden, R. (2014). Online collaboration: scientists and the social network. *Nature*, 512(7513), 126–129. <https://www.nature.com/news/online-collaboration-scientists-and-the-social-network-1.15711>
- Verderber, J., Szivák J., & Vámos Á. (2016). Understanding Professional and Pedagogical Problems and Reflections of Teachers by Professional Capital Model. Karlovitz, J. T., & Torgyik J. (Eds.), *Some Issues in Pedagogy and Methodology* (pp. 23–33). Komárno: International Research Institute. <http://www.irisro.org/educonf2016may/>

2. DIGITAL RESOURCES

Ida Dringó-Horváth and Tibor M. Pintér

Introduction

The range of digital materials available for educational and research purposes is almost unlimited, and the textbook industry shows a clear tendency towards making learning materials available in exclusive or optional digital form (Allen, 2015; Dringó-Horváth & Menyhei, 2021). The ambiguity concerning the plethora of learning material available on the Internet should always be kept in mind: such materials are not only searchable and queryable, but we may also upload our own materials, which, however, imposes newer requirements on instructors' knowledge and abilities: new skills are needed, for example, in the fields of organisation, sharing of learning materials, and technological expertise (see Priatna et al., 2020), while the organisation and operation of online educational spaces presents new challenges (regarding the challenges of operating online spaces, see, for example, Obelia & Kadlečík, 2020, or Gordon & Wilttrout, 2021). The quality of the digital learning materials and the learning environment determines efficiency, so both the precise selection of materials and the didactically and methodologically sound production of learning materials must be mastered (Recker et al., 2013). As a result, the acquisition of skills and abilities related to the creation, selection, processing and use of digital resources is becoming increasingly valued (Ehlers & Kellermann, 2019).

The inclusion of information and communication devices in education is a welcome pedagogical development, but its true educational potential can only be achieved through appropriate and targeted use. Therefore, when planning the educational process, the goals and pedagogical benefits of the tools and software involved in teaching should always be carefully considered.

Nevertheless, it is important to bear in mind that the content of the umbrella term 'digital resources' varies, depending on the context in which it is used. Even with regard to the tools used in digital pedagogy, there is no uniform scientific consensus (cf. Heine et al., 2023). In our case, we have adopted the definitions set out by the DigCompEdu framework (which will be explained in more detail later), although the categories in this framework might not be totally valid in other contexts. While this chapter does not intend to deal with the general clarification of the content of digital resources, it is essential to note that there should be a distinction within the concept 'digital resources' between tools used for content creation (generation, modification) and content distribution (sharing), as they are based on different knowledge, skills, and abilities.

Chapter 2.1., *Selecting and managing digital resources* is designed to help with this issue. It provides guidance on the selection of digital content and related tools, and their integration into educational and research activities. Chapter 2.2., *Creating and modifying digital resources* focuses on creating our own digital content and on adapting the resources available online to our own educational context. In connection with this, it is essential to find ways to effectively manage and safeguard digital resources. These questions are explored in Chapter 2.3.

We interviewed the university teachers Dr. Andrea Kárpáti, DSc (Corvinus University of Budapest) and Dr. András Benedek, DSc (Budapest University



of Technology) about the topics in this chapter. As an introduction, here are some of their opening thoughts on the differences between the use of digital content inside and outside the classroom:



What differences can you identify between the uses of digital content in and out of the classroom?

Andrea Kárpáti:

There is a huge difference, because these two genres exhibit fundamentally different characteristics. Classroom materials are typically short, and they are related to the curriculum. Out-of-classroom learning materials, on the other hand, are typically much more flexible. Those who view them are interested, so they are willing to spend more time on them. We can supplement, or expand them, and even push them in a different direction, add our own materials to the activities of a class or include current topics that have not yet been included in the textbooks. So we can make the curriculum personal. This is why such digital content is worth developing.



András Benedek:

The highest bandwidth is provided by communication in person: each lesson has its own special charm. What the teacher explains there, and executes at an appropriate pace, following a certain logic, with a board layout and diagrams, is a type of experience that even video cannot replace. Personal experience is crucial.



The legacy of artificial intelligence

The emergence of generative AI has also repositioned the management of digital resources. This has created not only new opportunities but also new

competencies, which are summarised by Bekiaridis & Attwell (2024, p. 35) as follows:



Click / Scan

Competencies in this field are mainly related to the generation, evaluation, and adaptation of digital resources created with AI. Educators need to be aware of the potential of AI tools in developing and customising teaching materials, and they need to recognise and evaluate the quality of content created with AI, as well as know how to manage and share the digital materials produced in this way.

Educators today need to be aware that AI is becoming increasingly prevalent in education: new technologies enable them to create adaptive or personalised learning materials that meet different learner needs. At the same time, AI can assist educators not only in creating teaching materials, but also in the effective management and organisation of digital resources. It is clear that AI, when properly managed and integrated into the teaching process, plays a crucial role in evaluating and improving the quality of digital resources. When used in the right way, it allows for the continuous improvement of educational content, ensuring that it remains attractive and pedagogically appropriate (for example, by automating the detection of copyright issues or managing user rights). By incorporating AI into the management and development of digital resources, educators can not only provide a more engaging and effective learning experience, but also contribute to the responsible and ethical distribution of educational content. It is also important to note, however, that integrating AI into the process of creating and managing digital

resources presents a number of challenges that must be addressed in order for AI to be effectively integrated into education.

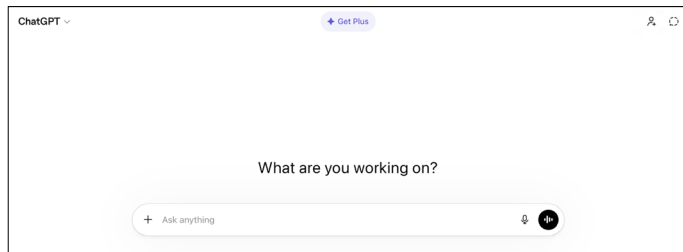


Figure 2.1. ChatGPT

2.1. Creating and modifying digital resources

To identify, assess and select digital resources to support and enhance teaching and learning. To consider the specific learning objective, context, pedagogical approach and learner group when selecting digital resources and planning their use.

The modification of the learning environment and its digitisation requires instructors to employ innovative educational methods. The altered *personal learning environment* (see *Chapter 6.5*), the resources available in the /// digital toolkit (Burden, K. & Kearney, 2018, pp. 4–11) or even the virtual classroom immensely challenge teachers who are less inclined to use digital devices (see Mishra & Koehler, 2005). Managing the educational process so that every participant feels comfortable and even at home – while

preserving the basic parameters of content and information transfer – is not a simple task, yet it is by no means impossible.

The first step in choosing the right digital content is to properly identify, evaluate and select the resources that will support teaching and learning. When selecting digital resources and planning their use, the specific learning objective, context, pedagogical approach and, above all, the unique features of the learner group should be considered.

When choosing and organising documents to be used in education, we should make sure that the resources used:

- adequately support the teaching and learning process;
- are approachable, scientifically and pedagogically credible, and reliable for the participants in education;
- are easily accessible and usable (copyrights, file format, technical prerequisites and requirements, etc.) for the participants in education, or
- are visibly useful and tangible (they correspond to specific learning goals, the characteristics of the student group and the teaching style of the teacher).

The digital resources and methods used should correspond to the educational and learner competences expected in digital education (on these, see Falloon, 2020, pp. 2455–2457).

To ensure that the participants in the educational process achieve their various goals, it is vital that both the instructor and the student can manage the resources. (For more information on providing access, see *Chapter 5.1*).

In connection with the conscious use of digital resources in education, it is worth learning about the history of AI technologies, ethical and legal issues, and the role of AI literacy in education. More detailed information on the



conceptual, ethical, and theoretical framework of the educational application of AI technologies can be found in Chapter 2 of Imre Fekete's (2025) book.

Recognising the opportunities offered by AI may be the key to its successful role played in education. The personalisation of digital resources and AI's involvement in the pedagogical planning process are some of its positive aspects that make it worthy of use. Just think of the speedy analysis of all available data and the possibility to find correlations, which was not possible in the pre-AI era. The analysed data can then be used in the planning of teaching materials and learning processes, or even in differentiation (cf. Malik et al., 2019; Celik et al., 2022).

The DigCompEdu framework characterises an instructor experienced in creating and editing digital content as possessing, among other things, the following abilities:

To formulate appropriate search strategies to identify digital resources for teaching and learning.

Search strategies can be interpreted as knowing the location of the content we are looking for (for example, familiarity with important databases and collections of resources), but search strategies can be expanded by an awareness of the different types of keyword searches that are available in browsers. Narrowing or refining our web search can be very helpful, whether we are filtering according to keywords, web pages, language, or file type. Boolean operators also greatly help targeted searches: they provide the means for more complex searches and the ability to pre-filter the information we are not interested in. For more accurate results, we can use the following operators during our search.



- Quotation marks: words in quotation marks are treated as a single unit, i.e. the browser treats them as exact matches (i.e. “digital pedagogy” results in results that include the word pair ‘digital’ + ‘pedagogy’);
- the expression and or: the or element between words expresses alternative relationship, while the and element expresses addition (i.e. digital and pedagogy yields results that contain the words ‘digital’ and ‘pedagogy’ – it must be noted that as a default, web search engines treat consecutive words as if there was and between them, so its real benefit is in conjunction with other operators; digital or pedagogy gives results that contain either the word ‘digital’ or ‘pedagogy’);
- narrowing with a minus sign: with the minus sign in front of words we can exclude words that we do not want to see in the results list (the digital -pedagogy search shows results that contain ‘digital’ but not ‘pedagogy’);
- file format: with the ext: operator, keyword results will only contain the desired file type (digital ext:pdf results in a list of PDF files where the file name contains the word ‘digital’);
- language: the lang: operator narrows results to the desired language (digital lang:en will only find English-language sites containing ‘digital’);
- narrowing to web page: the site: operator narrows the list of results to the desired web page (the search ‘digital site:researchgate.net’ yields results that contain ‘digital’ but only from the site ‘researchgate.net’);

- truncation: the * character substitutes any other character (the search digital * pedagogy yields results where 'digital' appears at the beginning and 'pedagogy' at the end);
- body text, title, URL search: the keyword can be searched only in the body text with allintext:, the title with title: or only in the URL with allinurl: searches (for example, the search intitle:digital will yield results where the title of the page contains the word 'digital', whereas allintitle:digital pedagogy will yield web pages where the title contains the phrase 'digital pedagogy').

To select suitable digital resources for teaching and learning, considering the specific learning context and learning objective.

It is important to bear in mind that the use of digital resources is not uniform, and that different stages of learning (for example, the presentation of new knowledge, or the deepening of existing knowledge) call for the use of different digital resources. The conscious instructor carefully considers the choice of a resource, and selects digital content that is consistent with the material to be presented and the existing knowledge of the target group. Given that most student groups are in many respects heterogeneous, it is important to be aware of the fact that digital resources and digital learning materials are not necessarily supposed to work within the context of contact lessons (in some learning organisation styles, they are designed for use outside the contact lesson – see, for example, the *Flipped Classroom* section of Chapter 3.1). No matter what resources we use, it is extremely important to obtain feedback afterwards, and to constantly monitor the results of the learning process, as the fact that the instructor feels at home in the digital world, or that the

contact lesson was successful does not necessarily mean that the use of digital content was also successful.

In addition to using appropriate search strategies, an instructor confident in the digital space also knows the content aggregators and repositories related to their own field of expertise. Such services can be classified, for example, according to the following categories:

- **Educational portals:** Educational portals publish diverse content related to various (pedagogical) processes related to education. Examples include the [FutureLearn](#) site, which offers high-quality professional training courses and learning materials supplemented with digital publications, or the [Times Higher Education](#) portal, or perhaps the [European Commission's content on higher education](#).
- **Digital libraries and archives:** High-quality educational (course) materials not only exist in paper format, many theoretical and practical learning materials and books are available online. For example, many essential books are to be found at the [Project Gutenberg international database](#), where various special searches can be made through tagged content. [Bookbook](#), the [University of Pennsylvania online library](#), or even the pages on [Scribd](#) are other valuable sources of content for educational use. Useful repositories can also be found at major universities, for example, the repositories of the [University of Cambridge](#) and the [University of Oxford](#).
- **Image, audio and video sharing services:** Digital content can be enhanced not only with images, but also with audio or audiovisual material. Examples of content sharing services include [Pinterest](#), [Photopeach](#), [YouTube](#) for

movies and audio, or the Hungarian repository of academic lectures [Videotórium](#), while audio material is available, for example, in [Jamendo](#). The most efficient tool for the creation of visual and audio content that can be customised for pedagogical purposes is the smartphone.

- **Presentation services:** We can share our presentations on our own website, but it may be more useful to use dedicated presentation sharing pages. Popular cloud-based presentation making or sharing services include [Prezi](#) and [Slideshare](#). The value of such sites lies not only in cloud-based storage, but also in tagging, which is useful for targeted content searches.
- **Personal pages:** Researchers' personal pages and websites can provide useful and interesting content, such as essays, articles, blogs with personal reflections and thematic Facebook or X (ex-Twitter) pages. It is also worth following individual researchers' YouTube or podcast pages.

Using a smartphone to record and upload pictures and videos has countless advantages. During lectures and tasks, it can be useful to create images and videos about reports related to project work, the results of student (group) work, board layouts, etc. for future teacher and student use, or even for assessment purposes. When preparing for a lesson, recording a relevant picture or a short video can make the material to be learned more personal and up-to-date, which can have a positive impact on students' learning processes and motivation. 

To critically evaluate the credibility and reliability of digital sources and resources. To critically evaluate the reliability and authenticity of digital content and sources modified with AI.

The reliability of content in the digital space depends on several factors, but its absolute value and efficiency can chiefly be measured in relation to the pedagogical goal. The possibilities of the digital space must always be in line with the learning and teaching goals, i.e. the title and description of an item of content does not guarantee its suitability and practical use for the given course.

Repeated use of individual resources increases confidence and efficiency, so when introducing digital content (be it software, text, image or video), we should first test it on a smaller sample or group, make sure it works and that students have access to the content and the technology (see *Chapter 5.1*), and establish that the resources fulfil our pedagogical expectations, while the results should be later fed back into the educational process. 

The reliability of the digital content available online is not always clear-cut. Authentic and reliable materials are recognised by the presence of various benchmarks (pages or features that are authentic or convey authenticity). Such a *benchmark* can be a website in itself (the websites of departments and institutes are usually supervised), but there are also quality-assurance features on various content sharing sites as well: On Wikipedia, for example, these include the checkmark in the upper right-hand corner of the article, and the “seriousness” and verifiability of the source list.

But what criteria should we employ when choosing and evaluating digital content? The answers of our two experts may help us here.



What criteria should be used to evaluate a digital resource?

Andrea Kárpáti:

The very first assessment criterion is the site of the source. If it is familiar and scientifically credible, we can be sure that the information displayed is being reviewed, edited and supervised by someone. The second step is to check the author of a particular source. If the site is credible, if the author is reliable and respected, and if the genre is suitable, then the next evaluation criterion is whether the work concerns what we need. One last aspect I recommend is the reading of the abstracts.



András Benedek:

It is very important to look at the origins of digital resources, the background of the service provider and the related quality assurance guarantees, since they are based on standards that must be adhered to. Another important element is the validation processes that are built into these systems, since it is still easier to assemble materials in an amateur manner than to adapt existing ones and validate them, if you like, to tailor them according to different demands.



For example, we can use the following [playful task](#) for the qualitative evaluation and analysis of online resources.



What guidelines should be followed when an instructor uses digital content created by others?

Andrea Kárpáti:

When we develop digital material, we need to know the copyright implications of all content. It is best to use socially shared images, sounds and movies. That is because different types of Creative Commons licences prescribe if the content can be used in an unchanged form, if it can be translated, or if it can be used completely freely. These are big differences.



AI can be used successfully to detect plagiarism, but it can also be used to recognise realistic, believable fake (deepfake) content. There are now several types of software available for detecting fake content (e.g., [Deepware](#) – see Figure 2.2), but more general applications are also capable of detecting plagiarism or fake content. For text content, the [QuillBot](#) plagiarism checker can be useful, while the AI detectors of [Trinka](#) and [QuillBot](#) can be used to filter out AI-generated content. Even though there are plenty of AI detection software on the market, it is crucial to point out that these detectors are highly untrustworthy, resulting in almost as many false positives as false negatives; therefore, their detection reports should not be taken at face value (Menyhei & Szoke, 2025).



Figure 2.2. Deepware recognition start screen

For the historical, conceptual, ethical, and theoretical framework of the educational application of AI technologies, as well as the role of AI literacy in education, see Fekete (2025), Menyhei & Szoke (2025) and Chapter 2.

What are the known limitations of AI detection tools, and why should educators approach their results with caution?

Johanna Szőke

While these websites are continually improving their detection algorithms, they can still produce false positives as well as false negatives.

Click/Scan

To consider possible restrictions to the use or reuse of digital resources (e.g. copyright, file type, technical requirements, legal provisions, accessibility).

In general, the use of digital content is governed by two requirements: the associated copyright requirements and the technological background. When using digital materials created by other people, we should be aware of the permissions granted by the licenses. The most common free use licenses in pedagogical practice are the different *Creative Commons* (CC) licenses, designed to encourage the creative use of our own content in the community (see also *Chapter 6.3*). Thus, when creating and publishing our own material, we should determine the conditions under which it is allowed to be reused, and we should also adhere to the conditions under which others' content can be processed.

To define a [Creative Commons](#) license, we can use the different combinations of the following four restrictive conditions:

- Attribution (i.e. the information related to the work must be indicated as specified by the author)
- No Derivative Works (i.e. the source cannot be modified or reworked)
- Share Alike (i.e. the source can only be distributed under the same license as the current one, or one that is interchangeable with it)
- Non-Commercial (i.e. the source cannot be used for commercial purposes)

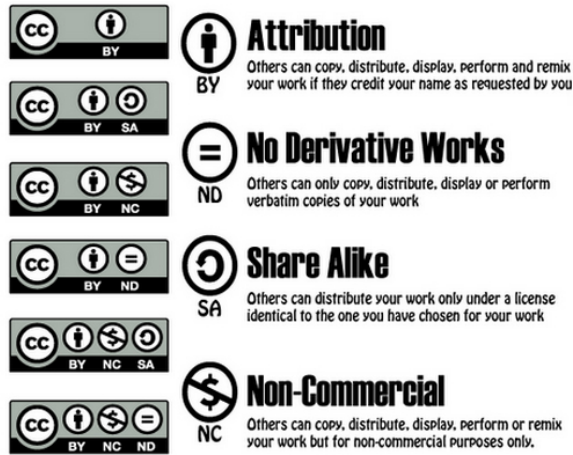


Figure 2.3. Creative Commons licenses, version 4.0 (source: <http://images.huffingtonpost.com/2014-03-25-creativecommonslicenses-thumb.jpg>)

In addition to CC licenses, there are other licenses that allow free use or modification. Overviews and descriptions of free use licenses are available in several places, for example, in [the relevant Wikipedia entry](#).

Licenses are easy to use: knowing the features of the license, it is enough to place the name of the license on the finished digital content, or to link to a detailed description of the license (as digital content). For example, if we use the *GNU General Public License*, we indicate the version number (v3.0) and refer to the publicly available description on the Internet (GNU GPL v3.0).

When using visual content, it is advisable to consult the image sharing pages in advance, and become familiarised with the conditions of using the resources they offer. The use of AI-generated images is already accepted

today, but considerations and restrictions related to their use are still largely awaiting finalisation. The following image sharing sites all use the CC license, and they provide category and keyword search based on the tagged content:

- Free Stock Photos: high resolution photos by skilled photographers
- [Freerange](#): high quality photos that can also be used for commercial purposes
- [Openphoto](#): no registration needed, browsing images based on transparent categories
- [Unprofound](#): quality images for free use, organised by colour

There are free images on the following image search sites as well, which are either free to use, or expressly state their copyright status – see *Chapter 6.3* for more information.

- [Flickr](#)
- [Stocksnap](#)
- [Gratisography](#)
- [Freepik](#)
- [Unsplash](#)
- [Pexels](#)
- [Pixabay](#)

A free image search can be useful: free to use images can be searched for using various web search engines (such as Google) or even by simply typing the *free photo* keywords in our browser. Another way to search for free image content is to use the image



search feature of search engines such as Google. We search using the “Images” tab, click on the “Tools” button, and select “Creative Commons licences” from the “Usage rights” drop-down menu (instead of “All”). Results can be further refined using the “Size”, “Colour” and “Type” menu.

In addition to pictures, plenty of free audio files, music and videos are available; here are some options:

- commons.wikimedia.org can be used to search for sounds, images and videos published by users of the Wikimedia website
- jamendo.com contains music shared by artists for free
- audiyou.de contains a large selection of different sound effects and music, downloading requires a login
- freeplaymusic.com offers free to download acoustic music
- videvo.net contains video, music, and audio

To assess the usefulness of digital resources in addressing the learning objective, the competence levels of the concrete learner group, and the pedagogic approach chosen. To take into account copyright and data protection restrictions related to the original source when using AI-generated content.

When creating digital content, besides the content itself, user experience, ease of use and an intuitive interface are also important, and the content must be adapted to the pedagogical needs and goals of the instructor and the students. The conscious instructor is familiar with the value-creating activities carried out on online platforms, is aware of their impact, and is also aware of the ethical and legal aspects of actions carried out with digital

tools, i.e. they are capable of “doing the right thing at the intersection of technology innovation and accepted social values” (O’Brien, 2020, p. 12; for more on ethical dilemmas, see Buchanan, 2019). Digital materials created or modified by a conscious instructor fit the specific pedagogical goals and are not used for their own sake: the impact of the knowledge transfer or classroom work they are intended to support can be measured by all participants.

2.2. Creating and Modifying Digital Resources

To modify and build on existing openly-licensed resources and other resources where this is permitted. To create or co-create new digital educational resources. To consider the specific learning objective, context, pedagogical approach and learner group when designing digital resources and planning their use. To evaluate the suitability of digital resources created by AI for various educational purposes. To explore various AI tools for developing digital resources in collaboration with others.

The creation of digital content is of great importance for both parties involved in the educational process. The subject of this subchapter is the use (creation or modification) of digital content from the instructor’s point of view, while the student perspective (learning activities and tasks implemented by creating or transforming digital content) is discussed in *Chapter 6.3*.

Present-day students (and some of their instructors) are members of Generations Y and Z, i.e. they have been actively using information communication and digital tools from an early age. Digital tools not only

affect their everyday lives and entertainment choices, but also their learning habits. However, since during their own university training, a significant proportion of teachers gained next to no experience in the use of digital content and tools, a high degree of creativity and imagination is needed to create effective learning materials and to use the appropriate tools in a proficient manner.

Creating digital content and using AI tools to generate new tasks or transform existing ones requires new types of teacher competencies. Chapter 6 of Fekete's (2025) book offers specific examples, practical advice, and a list of tools for educators with the aim of demonstrating how generative AI (e.g., prompt writing, collaborative learning, discussing ethical considerations in class) can be integrated into the teaching-learning process.

According to the DigCompEdu framework, an instructor competent in the creation and modification of digital content possesses, among other things, the following abilities:

To modify and edit existing digital resources, where this is permitted. To combine and mix existing digital resources or parts thereof, where this is permitted. To modify existing digital resources using generative AI.

The first step towards creating digital content is to customise and adapt existing resources. In doing so, generally by implementing a few simple modifications, we can make the digital source created by others fit into our educational context. A frequent example of this is editing various task sheets, surveys and ready-made presentations, customising their content according to our own pedagogical goals and target groups, typically using office software. During such modification, we should always act in an ethical

way: on the one hand, we should only modify freely available content (see Chapter 2.1), and on the other hand, we should indicate copyright information according to the extent of our modification.

In the same way, we can modify existing digital media using the appropriate editing software. Fortunately, several excellent media editing programs are available for free or as part of a freemium. Various image editors - now equipped with generative AI features (such as [Photoshop](#), [GIMP](#), [Canva](#), [Pixlr](#), [SumoPaint](#)) can be used to generate AI-based data visualisation ([Napkin AI](#)), modify the image content, and some of these can even produce infographics ([Infogram](#), [Easelly](#), [Visme](#)). The [Microsoft Photo Story](#) image editor allows us to create high-quality slide shows. These image editing programs are also suitable for creating personalised feedback (see) and student products (see *Chapter 5.1*).

When creating images, the size and resolution should be optimised according to our requirements. Most publications require good quality images and diagrams, usually with a resolution of 300 dpi or more. However, we may need to reduce the size for online publication (e.g. on social media, image or video hosting sites, personal blogs or educational frameworks) or even for digital transmission (e.g. via email). This task can usually be done with image editing programs, but not in all cases, and in the interests of saving time, it may be easier to learn about the use of simple resizing programs. These provide a way to quickly and simply change the size of our images according to our predefined settings, so that they can be used on both desktop and mobile devices.

It is important to bear in mind that while it is always possible to render a high-resolution image at a lower resolution, the inverse process is more complicated. Accordingly, if several original



resolutions are available, it is advisable to obtain our media files in the best available quality or to create media files in higher resolution and better quality on our own devices – even at the expense of larger storage capacity. JPG files are recommended due to their color processing and widespread use, and because they are relatively small in size due to their ‘compression’. PNG files are typically used for graphic design or website creation due to their transparent background.

Web-based services ([ResizeImage](#), [Shrink Pictures](#), [Resize Pic](#), [Resize Your Image](#), [Web Resizer](#)) can resize images online, while downloadable software ([Graphics Converter Pro](#), [Plastiliq ImageResizer](#), [High Quality Photo Resizer](#), [FastStone Photo Resizer](#)) can be installed on our own computers. [Paint](#), which is a standard application for editing and resizing images on all Windows-based computers is also worth mentioning. Before resizing an image, we must not forget that the process reduces their quality, so it should be used with caution.

With audio and video editors we can also modify and edit these file formats to customise the ready-to-use digital resources. The [audacity](#) app is a reliable audio editing software, while for video editing or screen recording purposes, [Camtasia](#) or [Microsoft Movie Maker](#) are recommended. If we create recordings with smart devices, it is best to use built-in apps or online services. If we need a specific file format, our existing files can be easily converted to the appropriate format: [CloudConvert](#) is a versatile online converting service for almost any audio, video, document, e-book, archive, image, spreadsheet or presentation file content. The file we want to convert can be selected from our computer or from a cloud-based file sharing service (Google Drive, OneNote, Dropbox), or we can specify the

Internet link (URL) to access the file. [YouConvertit](#) is another great online tool for file conversion.

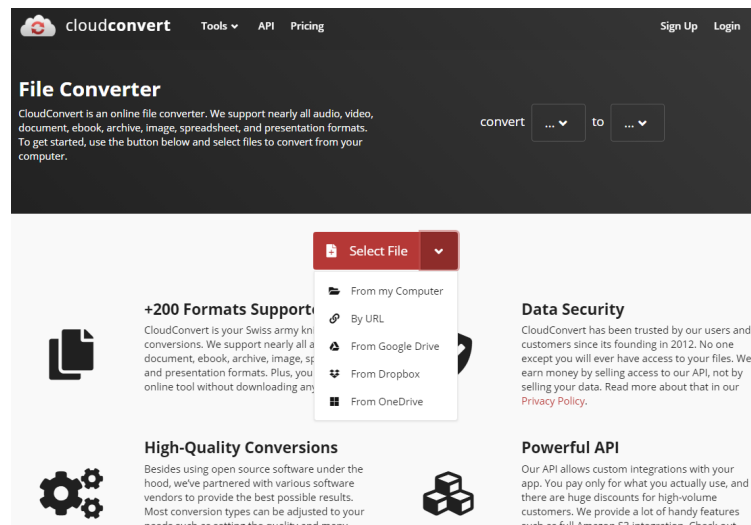


Figure 2.4. Online file converter

To create new digital educational resources individually or jointly with others.

In the practice of higher education, the creation of presentations or handouts and task sheets is an instructor's most typical creative activity. In both cases, we can distinguish between static, mostly teacher-oriented digital materials presented or distributed in print, and digital materials, which are interactive and enhance student-engagement.



A versatile tool that can be used in various parts of the educational process is QuillBot: an AI-powered writing assistant that offers a number of features to make writing and editing more efficient. In addition to creating supporting materials, a particularly useful feature is the ability to paraphrase newly created or older materials in different styles, or to shorten and summarise texts. Grammar checking also aids editing (as language modules are constantly changing, the performance of individual programs requiring linguistic analysis varies; what does not work today may be fully functional in a few months). This AI-based software can also be integrated with platforms such as Google Docs, Microsoft Word, and Google Chrome, so it can even be used directly in a familiar work environment. A similar AI tool is Trinka, which is a great option not only for generating texts and grammar and style checking, but also for plagiarism screening.

various tools, we should also pay attention to the utilisation of generative AI (in an educational context, it is also worth addressing the social and emotional well-being provided by AI as a learning companion, although this is not the focus of this volume). The precise and targeted integration of AI into pedagogical processes is closely related to proper prompting: that is, the process of prompting must also be learned and taught. This is all the more important because successful prompting is closely related to logical and critical thinking, creativity, empathy, and communication skills (cf. The World of AI Prompts, 2023; Bognár 2023).

The prompt used in chatbots (such as [ChatGPT](#), [Copilot](#), and [Google Gemini](#)) is a short, targeted text fragment created in natural language: primarily commands and questions. As Amália Bognár writes (Bognár, 2023, p. 21), effective planning and prompting are based on the following steps:

- clear instructions (*Summarise.*)
- restrictions – on style and length (*Summarise in four short sentences.*)
- experimenting with examples (*Summarise the difference between X and Y in four short sentences based on the following example...*)
- understanding the difference between open and closed questions (*closed: Who translated the Vizsolyi Bible?; open: What impact did the Vizsolyi Bible have on the Hungarian language?*)

For successful prompting, it is important to know basic verbs that can be used to give clear instructions (for more on this, see White et al., 2023). And, from the point of view of energy efficiency, we don't have to thank the AI system for its work (since using and processing expressions such as *please* and *thank you* also require energy on the server side).

**How can researchers make use of generative AI-enhanced writing assistants to produce more natural sounding texts?**

Johanna Szőke
AI-based text co-creation is a good example of human-AI collaboration. We write and ask for AI's assistance within the same document, creating a more seamless workflow.




Click/Scan

AI is playing an increasingly important role in education: it is present in almost every process, from planning to implementation. In addition to using

PROMPT FRAMEWORK for AI for Education STUDENTS: The FIVE "S" Model

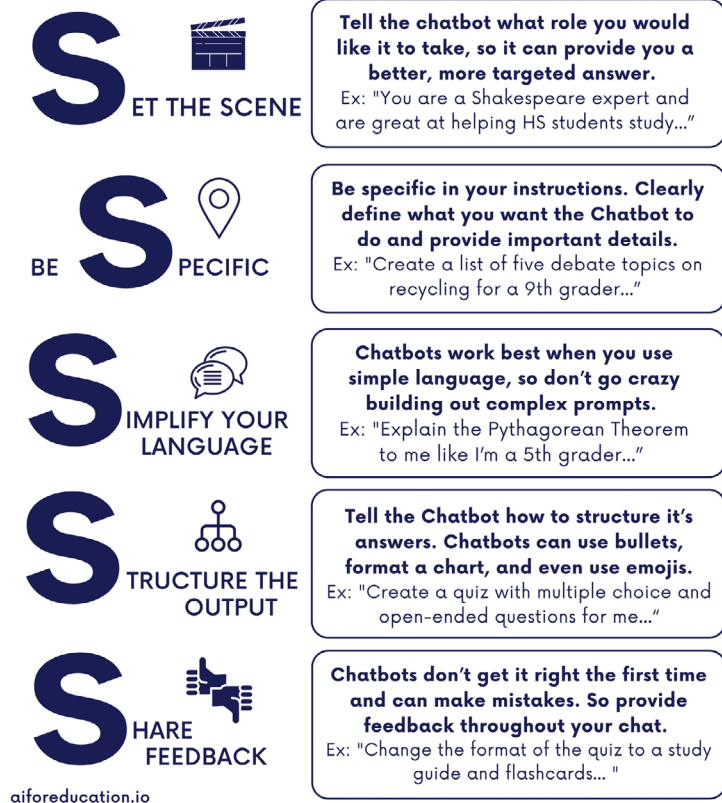


Figure 2.5. The five "S" model for prompt writing (source: [AI for Education](#))

Creating pictures, diagrams and movies

In all of these activities, creating our own images, diagrams and movies is essential if we want to generate unique content that cannot be found in any database or course repository (see *Chapter 2.1* and below). As it provides real-time collaborative drawing with others, the *Drawpile* drawing tool can be useful in this regard, as can [Sketchpad](#), a drawing and painting software, and [Gliffy](#), a versatile online drawing and chart editing app.

We can even create animations, but in the case of more professional software, usually only a restricted trial period is available for free. [Wideo](#), [Powtoon](#) (already containing several AI features), [Animoto](#) and [Vyond](#) are useful for animation and video production, and we can export the completed content in mp4 and GIF file formats.

Apps for creating word clouds and mind maps are particularly useful for representing relationships and associations.

With the help of a *word cloud* (*tag cloud*), textual data can be visualised in an appealing way: a given set of text (sentences, phrases, keywords) can be turned into a spectacular image, where the most important things (the most frequently occurring elements) can be highlighted using colour, font size, typeface or other typographic tools. In addition to simple, cloud-like word images, most apps can transform the text into a different, even completely unique image.



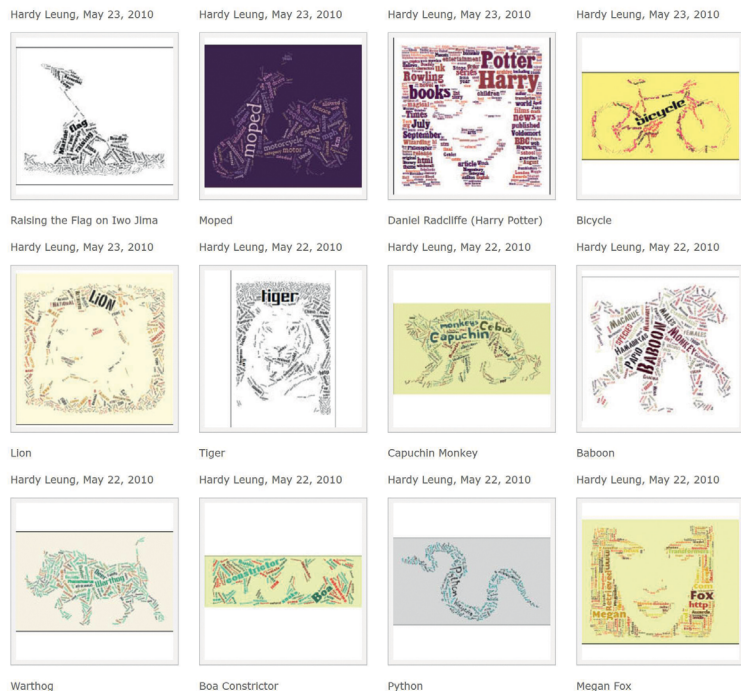


Figure 2.6. Examples from the gallery of the [Tagxedo](#) word cloud generator

When designing a word cloud, we should bear in mind that the end result is more powerful if we choose an image that fits the words of the given topic, and the layout of the words can also be important. By studying the settings of each application, we can discover additional useful functions such as displaying multiple words together (e.g. by using underscores: digital_competence).



The most popular word cloud generators are: [Wordle](#), [WordItOut](#) and [WordArt](#), while [Jason Davies](#) spectacularly organises elements in different angles. Some word cloud services (such as [Tagxedo](#)) are interactive: we can click on each element to display Google search results or custom links related to any given word or phrase. Additional options are available in [TagCrowd](#), where we can create word clouds without entering our own text, but rather by simply specifying a web address (URL). Word clouds can usually be saved in different formats, and they can be printed or embedded in a web page.

The purpose of a *mind map* or concept map is to link different subconcepts to a central idea and thus map the grid of conceptual associations that are formed in our brain in relation to the given subject. Online mind maps are similar in many respects to the original paper version, but may offer several advantages:

- they can also feature multimedia elements (images, sound, videos, links, even attached files);
- most of the time they cater for collaborative creation and editing with participants who are distant from each other in space and time;
- they can be quickly shared with others across several channels and can be commented by others if needed;
- some applications also provide the interesting option of tracing the process: if the creation of the mind map is played back, the chronological order of each element added, and the stages of the map's development can be revealed, even (in the case of registered users) with names and dates.

[Mindmeister](#), [XMind](#), [bubbl.us](#), [Popplet](#) and [Mindomo](#) are popular applications for editing digital mind maps. [Cmap](#), [eDraw](#) and [VUE](#) are freely downloadable solutions for use on PCs. The original service that best reflects the ideas of the inventor of the method is [Ayoa/iMindMap](#), about which this

[video](#) contains further information. The most typical uses of mind maps in (higher) education are discussed in *Chapter 3.3*.

We should also mention a significant and increasingly popular trend in the production of visual content: the electronic technology known as *Virtual Reality (VR)* and *Augmented Reality (AR)* is well suited to all levels of education. [HP Reveal](#) and [QuiverVision](#) are interactive applications where we can scan images or QR codes to display 3D content on our mobile devices. The visuals can be rotated, and with the help of camera technology we can even zoom in and out, or view them “from the inside” (see the next [video](#)).

Perhaps the best AI-based image editors available today include Adobe Photoshop (with Fireflies AI integration), Canva (with Magic Edit), Fotor AI, and Runway ML. These tools are designed for different levels of users, but their use is aided by the fact that the built-in artificial intelligence significantly simplifies image editing.

When using the built-in AI feature in Adobe Photoshop, the user selects the area of the image to be modified and then uses a simple text command, such as ‘*put a lake in front of the mountains*’, to specify how the image should be changed. Photoshop then generates several possible versions, from which the user can select the one they like best.

Canva is a much simpler, extremely user-friendly solution that is ideal for those who want to quickly create visually appealing images. In Canva, the Magic Edit feature allows users to replace or add elements within an image. The editing process is simple: you upload an image, select the part to be transformed, then enter what you want to add—for example, ‘a red balloon in the sky’—and the system automatically generates a few options.

Fotor AI is also easy to use, especially for those who want to quickly edit portrait photos or make basic image modifications. After uploading an image to the website, users can choose from options, such as automatic

correction, face retouching, or background removal with a single click. The process is fully automated, requires no technical knowledge, and the final result can be downloaded immediately.

Runway ML is primarily recommended for creative, experimental users. You can generate images or even videos based solely on text descriptions. For example, if ‘a sci-fi city with floating buildings at night’ is typed in, the system will create a matching image. A reference image can also be provided, based on which the AI creates a new image in the desired style. One of the most exciting features of Runway ML is its ability to produce animated videos from images (see Figure 2.9 for an example).

Sample prompt:

“A serene beach at sunset, with warm orange and pink hues in the sky, gentle waves washing onto the shore, palm trees swaying slightly in the breeze, and soft golden light reflecting on the water — ultra-realistic, high detail”

Result:

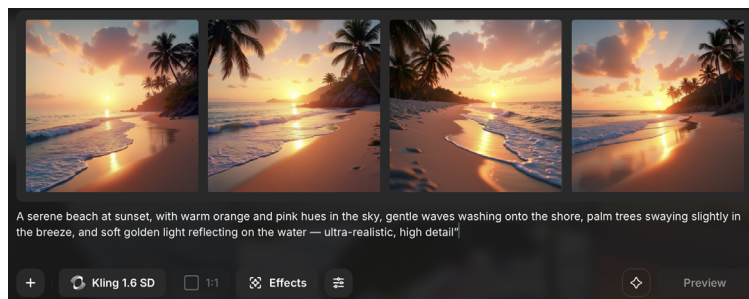


Figure 2.7. Example of a Runway ML image

These four tools have been designed for different purposes: Photoshop is the most professional, Canva and Fotor are easy to use and fast, while Runway ML offers almost unlimited possibilities for creative, experimental work. It is worth trying them out to see which one best suits your (educational) needs.

Creating presentations

The concept of what a presentation is varies from discipline to discipline. In essence, it is a complex and interactive method of giving a lecture, but it can also be seen as a trifold system consisting of the presenter (the creator), the presentation (the content) and the presentation (the process). Yet, a fourth element is also necessarily involved: the recipient, i.e. the audience, who, during a properly interactive performance, can affect the presenter, the presentation method, and even the content presented.

The key advantages of digital presentation materials are their multimedia formats and the fact that they allow collaborative editing and quick and easy sharing. We can embed links into the presentation and enrich its content with additional resources (images, sound, text, videos, etc.). Such an enriched presentation is highly suited to the predilections of *Generation Z*, and as a consequence we may be able to motivate our students more (see also *Chapter 5.3*).



Simple interactive presentation posters featuring multimedia and hyperlinks can be created with [Glogster](#) or [ThingLink](#). A similar but slightly more complex solution is provided by [Sway](#), a part of the Microsoft Office suite,

with which we can create high quality interactive presentations featuring multimedia to be displayed on different platforms. Like other applications in the product line, it can be used online and also downloaded, and we can load and convert existing PDF or PPT files. [Adobe Spark](#) is a similar application, providing the means to create images with captions, blog post presentations, and videos compiled from images and related text. [Emaze](#) is also suitable for creating slightly more complex presentations, web pages, digital postcards, blogs and photo albums.

One of the oldest and therefore most widely used presentation applications is [Microsoft PowerPoint](#). It was first released in 1987, and in recent years it has been expanded with an increasing number of popular features: more *templates* and animations, voiceover and video dubbing, and support for online collaborative work via Microsoft 365. Another *cloud-based* presentation editor is [Google Slides](#), which, among other things, can convert PowerPoint files to Google Slides for collaborative editing (and later convert them back to their original PowerPoint format).

The use of a cloud-based presentation can greatly contribute to the success of a lecture: sharing the presentation before the event helps the participants to prepare, and it can be used for individual or joint note-taking during the lecture itself (see *Chapter 6.1*). At the end of the process the presentation may form the basis for further related activities in a manner accessible to all participants. Comprehension can be supported by the use of non-linear presentations, which make complex notions easier to digest by the employing different images and audio, interesting effects and animations, and creative spatial layout.





One such unique, non-linear presentation software is the AI-powered Prezi. In the web application, the presentation can be edited using a simple browser program, even on mobile devices, and if necessary, it can be downloaded in a portable format for offline playback or exported as a PDF. Editing is like freely placing the different elements of the presentation (text, pictures, sound, animations, videos, links) on a large poster or mind map, and we can demonstrate relationships by zooming in and using camera effects, which are the trademarks of Prezi (warning: zoomed content might be more difficult to follow for students with vision problems, see *Chapter 5.1*, and also [here](#)). Only the version offering basic features is free, but it is sufficient for the ultimate goal of creating non-linear presentations.

It is worth trying out the AI features of Prezi and PowerPoint, which make it easier to create effective and visually appealing presentations and significantly reduce the time spent on presentation creation. However, while these slides are automatically generated based on the parameters we specify and contain professional design elements and content suggestions, it is always advisable to review and adapt them to your own needs.

We can experiment with other AI-based presentation generators, such as beautiful.ai, and Tome. Both allow you to create spectacular, well-structured presentations using prompts.

The AI used in beautiful.ai automatically adapts to the content and designs the slides almost by itself. It is very easy to use: the user creates a new presentation, then specifies the topic or uploads the desired content, such as headlines, text content, or images. Based on this, the AI builds the layout, animations, and design of the slides so that everything looks consistent and professional. There is no need for manual editing or formatting, as the system automatically ensures the right proportions and an aesthetic appearance.

In contrast, Tome relies even more heavily on generative AI. All you need to do is type in a short text description, and Tome will instantly create a complete presentation that is not only logically structured, but also contains text, images, and even interactive elements. The slides can then be customised, the text modified, or new prompts entered to fine-tune the content. One of the great advantages of Tome is that presentations can also be shared on the web, so they can be presented as live links, not just as static slides.

The purpose of both tools is to allow users to quickly create impressive and logical presentations with minimal effort, whether starting from a rough draft or a detailed source text. It is also worth noting that these systems are primarily designed to create English-language texts, so texts generated in less widely spoken languages will need to be corrected. It is important to check AI-generated output, as hallucinations, i.e., inappropriate or incorrect content, can sometimes occur.

In addition to the above, there is also the Gamma presentation and document creation tool, which uses artificial intelligence to create content quickly and impressively. It offers an alternative to traditional PowerPoint or Google Slides with its ease of use and fast workflows. Based on keywords provided by the user, the system automatically creates an outline and then generates matching text and visual content (e.g., graphics, icons). The software also allows for the use of collapsible sections, links, and embedded multimedia elements (e.g., videos, GIFs, diagrams). Gamma is available not only on computers but also on mobile devices, and it provides opportunities for collaboration and for saving finished materials in multiple formats.

If we have elaborate PowerPoint presentations, we can take advantage of the conversion option, but if we wish to create more thoughtful presentations that optimally utilise the capabilities of Prezi, it is worth producing our presentation independently, based on the PPTs. Whatever presentation software we choose, we should also regularly devote time to evaluating our presentation skills in the interests of constant improvement. This can be done by requesting direct feedback from the participants, or by studying materials that discuss presentation techniques, and consciously incorporating the relevant points into our presentation.



[These lectures](#) are an ideal starting point.

More and more programs support the possibility of showing not only the presentation, but also the presenter (e.g. PowerPoint video recording or Prezi Video).

We may use this opportunity to increase personal presence during distance learning, or to support students in a flipped classroom environment (see *Chapter 3.1*) and those who are absent for a lengthy period (students on an exchange programme, foreign students, students with health problems). Additionally, this solution might help us to improve our own presentation skills and techniques. [With AI, it is possible to go even further: using Microsoft Speaker Coach, we can receive personalised feedback on details such as tone of voice, use of filler words, and speaking pace.](#)



The active involvement of the audience can be facilitated by integrating interactive elements into our presentation via the online quiz and task

generators and polling applications listed below, or we can use presentation software with interactive elements already integrated (e.g. [Mentimeter](#), [AhaSlides](#)) or flipped classroom applications with similar functions (see *Chapter 3.1*). The role of the above tools in assessment is discussed in *Chapter 4.1*, while their use in *supporting learning* is discussed in *chapters 5.2* and *5.3*.

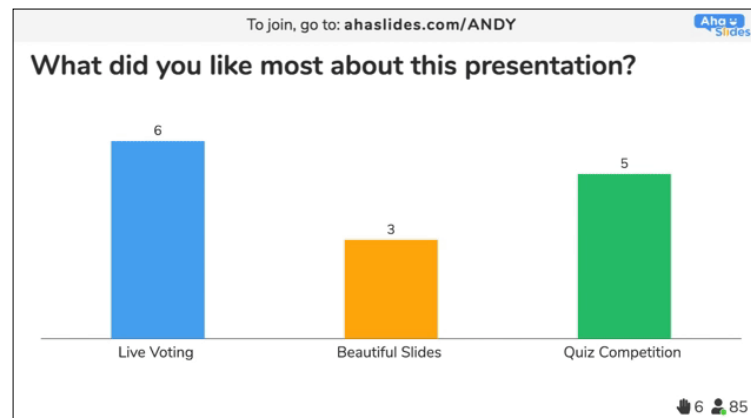


Figure 2.8. Diagrams with live voting results from a presentation (ahaslides.com)

Practice and test sheets, and task sheet editors

One further major area in the production of learning materials as mentioned in the introduction is the creation of practice and test tasks. These are typically created using simple office software. An alternative to the widespread [Microsoft Office](#) suite in this case is [LibreOffice](#), a free open source office suite that contains word processing, spreadsheet, and

presentation software. However, when preparing educational presentations and learning materials, certain processes can be automated, and tasks may also be automatically generated. In this area, we can distinguish between task sheet generators, which mainly create static, printable content and //creative suites, with which we can create complex interactive learning activities with multimedia, without any programming knowledge.

Task sheet generators typically create visually appealing tasks that are already familiar from textbooks and workbooks (e.g. crossword puzzles, word searches, gap-filling and pairing exercises) in a matter of seconds from our own specified content, mostly in DOCX or PDF format. Some of these generators focus on one specific type of task, such as crosswords ([EclipseRossword](#), [CrosswordLabs](#), [Crossword Puzzle](#)), word searches ([Word Search Maker](#)) or triominos ([Triomino Generator](#)), while other worksheet generators are specially designed for one discipline, like the [Math Worksheet](#) which generates a variety of mathematical tasks. In addition, there are generators that can create and even merge different types of task (e.g. [Quickworksheets](#), [Theteacherscorner](#), [tutary.de](#)). Interactive quiz and task generators (e.g. [Quizizz](#), [Kahoot!](#), [LearningApps](#), [Hot Potatoes](#), [Socrative](#), [Mentimeter](#), [Jeopardylabs](#)) are not only capable of creating a variety of quiz questions or interactive versions of the basic task types listed above, but they also often support the creation of more complex exercises such as (competitive) multiplayer tasks (e.g. hangman, memory games, competitive word finders) or joint tasks based on group knowledge sharing (e.g. voting, collaborative notes, message boards). Of course we can find applications that produce both printed and digital interactive versions of these tasks, so after creating an exercise, we can deliver it in the medium most appropriate to our specific goals, the students' needs and the available technical background (e.g. [WordWall](#)). Varied, customisable tasks can help

quantitative differentiation in the classroom (see *Chapter 5.2*) and have a particularly motivating effect on students (see *Chapter 5.3*).

Similarly, we can use the [Quizlet](#) application to create word lists and glossaries related to specific learning content, which students can then memorise with various interactive tasks automatically generated for the word list. The application's QuizletLive game, where participants solve quiz tasks together using their smart devices, is particularly motivating. We can use this activity for revision, preparation for a test, or even for playful testing (an interesting example can be seen [in this video](#)).

(For the effective use of the listed apps in measurement and assessment, see *Chapter 4.1*.)

Databases suitable for sharing (interactive) tasks are usually grouped around the content of a course or a training programme, but there are also more comprehensive, multi-disciplinary collections covering several subjects (e.g. [Worksheetworks](#)).

Creating digital content and using AI tools to generate tasks or transform existing ones require new types of teacher competencies. Chapter 6 of Fekete's (2025) book offers specific examples, practical advice, and a list of tools for educators on how to integrate generative AI (e.g., prompt writing, collaborative learning, discussing ethical considerations in class) into the teaching-learning process.

Producing learning materials with learning management systems

Internet-based online resources "are often aggregated, curated, and made available in resource collections. The vision is that, supported by this increasingly available infrastructure, teachers and students can access, create, connect, and share knowledge in ways that fundamentally transform practice." (Recker et al., 2013). By using *content management systems*, we

can provide our materials for the users directly inside the system or through learning management systems. The smallest unit produced for the system is the *learning item* or *learning object* (Benedek, 2020a, 2020b), i.e. smaller thematic units independent of the curriculum and the syllabus. The main types are as follows (based on Hülber, Lévai & Ollé, 2014):

- **Texts:** These are typically digital text networks, which can be divided into primary (learning materials) and secondary (*learning support*, e.g. instruction manuals, methodological guides) texts according to their function;
- **Images:** According to their pedagogical purpose, these are either independent carriers of information or they can be used as a supplement to textual information (for purposes of explanation, clarification and demonstration, etc.);
- **Audio materials:** These may be the subject of learning, or may have a learning support function – depending on this, they may be independent of or related to other materials in order to improve learning efficiency;
- **Multimedia elements:** The use of multiple media within one platform facilitates cognition through multiple channels in an efficient way;
- **Interactive content:** Such content enables the modification of *learning objects* subsequent to student interaction and can provide immediate feedback during the learning process;
- **Tasks:** Complex *learning objects* capable of interactivity contain the help needed to solve the task, and display the correct and incorrect solutions (feedback);
- **Collections:** These are interrelated *learning objects* based on certain organising principles (e.g. glossaries, collections of texts);
- **Links:** These reveal the internal (structural) and external (connection to other learning materials) relationships in the form of hyperlinks.

In order to be properly organised and searchable for the users of the relevant *content management system*, *learning objects* must be provided with descriptions known as *metadata* (the main features of the content, such as title, category, keywords). *Social tagging* and the users' ratings can further facilitate searching. Digital *learning objects* are digital learning materials, i.e. they are educational materials which rely on pedagogical principles and utilise the possibilities of information technology according to the educational goals (Hülber, Lévai & Ollé, 2014). The greatest advantage of *content management systems* is that in the case of an active user community, the number of available materials is constantly expanding, and users (instructors and even students) can create learning materials from existing items according to their individual needs, modifying them as and when required (in accordance with the indicated license, see *Chapter 2.1*). *Content management systems* (e.g. [Learning Resource Exchange](#)) are more typical in public education, but such systems often contain materials that can be used in higher education, too. Familiarity with such systems is also important for teacher training courses, as participants should be taught how to use existing learning materials and how to produce and upload their own.

There are content management systems specifically designed for higher education, one of the most popular being the English-language Labxchange which facilitates the development and distribution of high-quality digital resources in a higher education setting. Uploaded content can be browsed by discipline, content type or source, and after logging in, we can upload our own higher education *learning objects*.

The [OER Commons](#) educational portal offers materials from preschool age through primary and secondary school to higher education, complemented by other areas of adult education. In addition to keyword searches, we can search by discipline, educational level and educational standards, and in

addition to the author's profile and the date of upload, the results will also display the evaluations of the user community.



Figure 2.9. List of search results on the [OER Commons](https://oercommons.org/) educational portal

The high price of commercial textbooks limits access to learning materials for higher education students, while open educational resources (OER) offer a low-cost alternative and, according to research, are no less effective than commercial materials. The use of shorter, targeted OER materials has proven to be particularly effective, as it reduces cognitive load and time spent on tasks without compromising performance (Spencer et al. 2025).

International trends in the field of content and methodology based education development have increasingly moved towards the creation of learning materials with an open structure, featuring the constructive contribution of those actively involved in learning and the provision of mass access through interactive online interfaces, during which the role of mobile devices and applications is constantly expanding (see Horváth Cz., 2016), a phenomenon which facilitates the development of *microcontent* optimised for mobile devices (micromedia), i.e. adapted to the relatively small size of the displays.

The electronic notes and learning materials created in this way open up completely different perspectives than the previous method, i.e. the digitisation and e-learning adaptation of the existing printed learning materials. Open structure electronic learning materials can be supplemented with tasks and demonstrative materials, which can make the students processing the learning material in a group environment within a study framework think together. The development of learning materials with the involvement of students has immense motivational power and it increases the efficiency of personalised knowledge acquisition (Benedek, 2020a, 2020b). For more details about the engagement and motivation of students, see Chapter 5.3. Here is the opinion of one of our experts on how to appropriately design, upload and manage repositories of learning materials:



Does an instructor need to create his own digital content?

András Benedek:

When we look at repositories of learning materials that are the benchmark in terms of learning, we often see that access is subject to strict rules: not everyone can upload, there are “gatekeepers” who monitor the content. Creating such interfaces on the Internet today is easy, but making sure that they can be properly tagged and linked, that they properly handle different file formats, and that they are responsive are issues which are definitely challenging. For proper use, a culture of sharing must also be developed.



Creating collaborative online learning content

More complex educational content includes the creation of *collaborative* online learning activities (e.g. wikis, blogs) that can be created using standalone online applications or embedded in an existing educational framework (e.g. [Moodle](#), [Canvas](#), etc.). Some recommended user-friendly blog services are described in *Chapter 2.3*.

The highest level of creating digital educational content is when instructors develop their own application or game. This may be necessary when even from the vast range of digital learning materials and related services, we cannot find a solution appropriate for our educational goal. However, such an undertaking requires considerable technical and methodological skills, which can be obtained from relevant training courses.

Knowledge sharing and a transparent, traceable culture of collaboration is supported by creating educational content together with our colleagues, using the collaborative editing interfaces presented above.

To consider the specific learning objective, context, pedagogical approach and learner group when adapting or creating digital learning resources.

In order to achieve different pedagogical goals, it is essential to select tools and content that are best suited to the goal, the learning context, and the specific characteristics of the learning group in question. In some cases, digital resources created by others must be modified and adapted to the given pedagogical goals.

Variety is an important aspect when using digital content, as the monotonous use of even the most innovative digital tools and applications that initially trigger a great response can quickly lead to a decrease in student motivation.

One key to ensuring diversity is to offer different digital resources to the same student group at specific intervals, or to use the same resources with different tools and forms of work. Feedback should never be neglected: after using a newly introduced tool or curriculum, it is advisable to reflect on how efficient, effective and motivating the experience was; at the same time, it is also important to request continuous feedback regarding applications that are being used regularly.



If our goal is to promote learning oriented and learner oriented processes that are increasingly based on student activity during education, we can take advantage of the opportunity presented by students producing learning materials themselves. With the proper pre-selection of tasks, students can also become involved in the production of learning materials, thereby ensuring their more active participation in the development of the content and material of their lessons (see *Chapter 6.3*). Supporting students' production of learning materials also helps us to build a constantly expanding and up-to-date learning repository related to a particular topic.

To understand the different licences attributed to digital resources, and the implications of reusing such resources.

When we create simple, printable learning materials or more complex interactive content online, we usually have the option to restrict the availability of our materials. In the case of private use materials, only those who create the materials (and persons specifically selected by the creator) can access materials, while publicly shared material will be available for the members of the respective group of users. The advantages of the latter

may be constructive community criticism (e.g. in the form of ratings and comments on the file sharing site), joint development and mutual assistance, but one disadvantage is the possible abuse of the material, including its improper modification (on licenses and their proper use, see chapters 2.7 and 6.3).

Innovative content and curriculum development requires substantial background knowledge and energy investment from instructors, but – as we can see in many other learning situations – adequate practice leads to increasing confidence and more efficient work. According to our experts, the main driving force and motivation in the course of the activity is to increase the efficiency and success of the learning and teaching process.



How can higher education instructors be motivated to develop innovative content and learning materials?

Andrea Kárpáti:

Money is not the first thing I would mention, although it does not hurt to get paid for such a demanding task, but time has unique motivational power. I would definitely consider the creation of digital learning materials as an educational activity in itself, for which a separate timeframe should be provided. However, the greatest motivating force is the interest of the students themselves.



András Benedek:

The answer is simple: in my opinion, success. It can be professional, individual or internal success. After holding a class or a lecture, instructors should draw up a personal balance sheet evaluating the participants' levels of attention and activity, and examining the comments they made and how well they understood the tasks. Success is a basic motivation in this profession, and it is something upon which we can build. The other thing is to take advantage of all available tools: tell the participants to bring their own devices and use them in a purposeful way! In this way, students are also able to produce microcontent and they remain motivated. In good microcontent the learning unit is connected to the knowledge we want to convey, but perfect imprint is achieved in a multimodal fashion, with a joint complex experience. True success is when something is triggered in the students and we achieve a feeling of pleasure that we make available with this digital content.



2.3. Managing, Protecting and Sharing Digital Resources

To organise digital content and make it available to learners, parents, and other educators. To effectively protect sensitive digital content. To respect and correctly apply privacy and copyright rules. To understand the use and creation of open licenses and open educational resources, including their proper attribution.

Managing digital content requires a specialised strategy from instructors. The successful management of content placed in the digital space is primarily the task of the instructors (they create the content and the methodological assistance that goes with it). The appropriate management of digital content and participation in digital education requires knowledge from the students as well: developing this knowledge and the relevant skills,

and facilitating their acquisition is also the task of the instructor. Successful strategies are already reflected in the preparatory tasks involving digital materials. Instructors make digital content (including administrative and student data, if necessary) accessible to students and even colleagues in a *responsible manner* via email, online platforms, websites, blogs, etc. They also ensure adequate data protection, respecting privacy, copyright and other sensitive data. One of the first steps in the responsible management of data placed in the digital space (such as tests and task banks) is finding the right platform.

The management of digital learning materials depends on a number of factors. In terms of their function, learning materials can be of assistance during lessons, and also serve to provide and deepen knowledge outside the classroom. The active and successful use of digital learning materials and interactive online environments in education additionally depends on the efficient pursuit of a variety of ICT-related activities. In what follows, we discuss activities that promote the secure and legal sharing and handling of digital content.

When sharing digital content, we must be sure to preserve the security of the content: rather than open systems with no password protection, closed systems with password requirements are preferable (whether using university servers or external, but reliable software – for example, Google considers security of content to be increasingly important). We should also be careful when choosing closed systems: the data management policy of the hosting company should guarantee that the file cannot be transferred to unauthorised users. Data processing information is usually available in the *Privacy Policy* located in the footer of such websites.

Open systems are particularly sensitive to data security as they are spaces where content can be accessed by a mass audience. Our expert discusses a unique form of protection:

 **How can I protect my own digital content? Do I even need to protect my content?**

András Benedek:
I will give a peculiar answer. When teaching open systems, we always tell instructors that if they upload to open systems, they should be aware that others can use the upload. However, the content can also be protected by various techniques. We are moving towards putting electronic badges on these systems.




Click / Scan

Managing digital resources is a complex task: the appropriate use and distribution of already existing materials, as well as copyright issues, raise many questions. Section 1.1 *Organizational Communication* aims to answer most questions related to ethical and legal matters. With a broader understanding of the legal and ethical framework, and in connection with local institutional regulations, it is necessary to address the use and sharing of digital resources (whether created by oneself or by AI).

When it comes to copyright protection, allegations of plagiarism arise from time to time. There are a number of software programs available for such plagiarism detection (the QuillBot plagiarism checker mentioned above, and the Trinka and QuillBot detectors for filtering out AI-generated content, but Turnitin's or Justdone's plagiarism detector and AI detector may also be useful for flagging up potential cases).



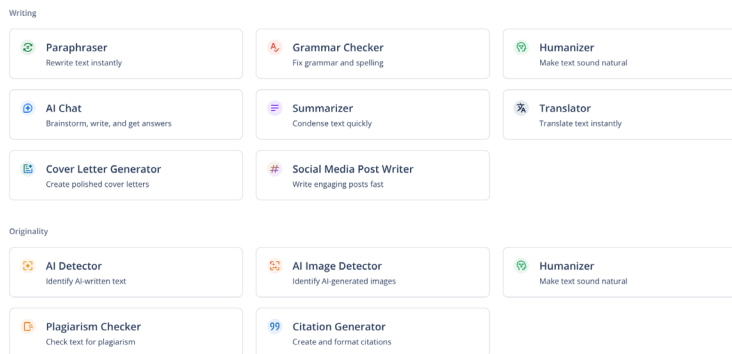


Figure 2.10. QuillBot features

To share resources using links or as attachments, e.g. to e-mails.

The two most basic ways of sharing digital resources are to send the material itself, or just a link to it, via email. An important difference is that while the resources that are sent are preserved, the materials sent as a link are lost when the upload is deleted or modified, and the link itself can change if the content is altered. Despite this, digital resources sent as links can be easily organised in their original location. A password protected interface (whether [GoogleDrive](#) or [Moodle](#)) may be perfect for this task, but it is also important to properly set the access permission for the content. In the case of long, hard to read links, consider sending an html-formatted link or use a link shortener service (e.g. [tinyurl.com](#), [bit.ly](#)).

Short, concise URLs are easier to manage and remember (they can be shared verbally or even on a blackboard), and they are more inviting for the users. Another advantage is that as part of their premium services

some providers (e.g. [bit.ly](#)) also give statistics on the content behind the abbreviated link, which can be used to analyse and assess the efficiency and use of the given resource.

Larger files cannot be shared as attachments, because email clients usually come with upload restrictions. The efficient way to send large files is to share links. If we use Gmail, for example, files larger than the permitted size will be uploaded to the sender's Drive storage, and the recipient will only receive a link with which to download the content. [Dropbox](#) and [OneDrive](#) are similar: after uploading the material, a sharing link can be generated. If we do not want to burden our own storage space with large files, we can use online file sharing services, but the security of non-international companies is always a question. It is always best to consult and study online privacy policies before using them.

To share resources on online platforms or personal or organisational websites and blogs. To share personal repositories of resources with others, managing their access and rights as appropriate. To respect copyright restrictions.

Sharing online content is no longer an actual challenge for students and instructors inhabiting a digital space. Besides content requirements, however, quality assurance requirements should also be met. In addition to bulk content sharing pages, a unique quality is maintained by moderated pages, where the content displayed is screened by machines or people. Closed online social networking sites with only registered users are usually moderated, which makes them more reliable sources, and they typically offer quality content. When it comes to sharing digital content, it is always better to use our own personal or institutional pages: on the one hand, they are easier to access, on the other hand, the content sharing service provider

can offer assistance in the case of problems (the same applies to paid services, where we usually buy background *support* with our subscription).

Personal pages can be created with free blogging services. Notable free blogging engines are [blogger.com](https://www.blogger.com), [wordpress.com](https://www.wordpress.com), [Wix](https://www.wix.com) and [TwitterBlog](https://twitter.com). However, before we start blogging, there are two things that need to be taken into consideration: the *privacy policy* of the site and the security of our Internet access. It is advisable to use pages beginning with https and avoid http, since data on the latter is more vulnerable, and the content (and personal data) stored can be more easily accessed by phishing schemes. Creating websites is simple and free, but paid services such as [Webnode](https://www.webnode.com) provide aesthetically pleasing and functionally versatile sites.

Over time, those instructors who create their own digital content will build up a collection, the real benefits of which will be revealed if the collection is more widely shared. When sharing content, it is useful to tag the content we want to place in the public online space – these keywords will make it easier to find and contextualise content. When sharing our own content, the conscious instructor also controls its rights of use through licenses and it is therefore very advantageous to familiarise ourselves with the possibilities implicit in the various licenses (see *Chapter 2.1*).

The rights of access to and organisation of the materials we upload to different digital learning repositories should also be carefully managed.

Services where we can create student groups and within them student accounts (e.g. LearningApps, Quizlet) usually provide tracking of the activity of the participants, including their use of learning materials (tasks performed, statistical data, etc. – see *Chapter 4.2*).



Access rights vary: compared to the access available to the instructor who created the group, student access is limited. We should study the rights associated with instructor and student accounts in every interface used for producing learning materials; instructors can typically monitor participants' activities and they can share the materials created by the participants with the other members of the group. Before starting to use a service, we should also review the publishing conditions – for example, there are certain sites where all materials are privately accessible by default (e.g. [LearningApps](https://www.learningapps.org)).

To appropriately reference sources when sharing or publishing resources subject to copyright. To attribute (open) licenses to self-created resources.

Free content sharing is a positive thing. It contributes to cooperative work, boosts the flow of knowledge, and also stimulates creativity. In the process of community knowledge sharing, users not only give, but also receive. This is why it is important to use open licenses so that all users who are part of the community can benefit from the knowledge. Importantly, teachers should not be averse to the sharing of knowledge: it is no different from writing essays or books, because in those cases we also share our thoughts.

The concept of open or free licenses and the use of licensed resources are described in detail in *Chapter 2.1*. If we wish to provide our own digital resources with such licenses, we can use the creativecommons.org page, where we can freely download the buttons and icons for all CC license types.

CC		Some rights reserved	
BY		BY	
NC		BY SA	
NC (EU)		BY ND	
NC (JP)		BY NC	
		BY NC EU	

Figure 2.11. License icons and buttons

When uploading to media hosting services, licenses are set up in the given user interface: we usually need to fill in a datasheet containing a brief description of the media (text, image, audio, video), the source (author and original location, e.g. website address), and we can also specify the license that regulates usage.



In the case of digital resources created with the help of AI, it is also advisable to indicate the name of the tool used in the creation process and that it was created with the help of AI. For maximum precision, it is useful to share the model version as well as the link to the generated product.

To take measures to protect sensitive data and resources (e.g. students' grades, exam papers, etc.).

One of the great advantages of closed systems ([Moodle](#), [Canvas](#)) is a higher degree of security. The content hosted by such systems can only be accessed after registration: registration regulates the scope of access to the content and the rights to manage the interface and the content. The conscious user is aware of data sensitivity and the fact that certain types of data require more careful protection, and should be stored in systems secured by passwords or privileges.

Data concerning students' grades and progress paths is both important and sensitive. Such information can be stored in evaluation tables, even in a shared Google spreadsheet (a more detailed related good practice can be read in Chapter 4.3). When storing data in evaluation tables, we should pay attention to who can view it (we should set the table up in a way that the content stored there can only be seen by the learner whose data is stored). Here, too, before sharing student data with other students (for example, because we cannot ensure that only the students concerned will see their actual data), it is advisable to ask them for their written permission.

Not only account numbers, passwords and user names are sensitive data – personal rights also apply to the use and distribution of visual representations of people, such as photographs. This is why we should follow the advice of our expert about the use of pictures or diagrams created by others:



How can students' personal data be protected? What are some of the typically problematic situations?

András Benedek:

Images are particularly sensitive things in this regard. It should be known that likeness right is quite strict. Both consent and documentation are required. The rules that apply to instructors must also be kept by students. Just as we expect the teacher to create original microcontent, students should also use their own (however, the use of diagrams requires some knowledge).



An interesting question is whether students (possibly related to their special needs – see *Chapter 5.1*) should be allowed to make video or audio recordings during teaching (e.g. videoing a whole lecture or taking a picture of a slide that is being projected). The recording of a part of a lesson is usually regulated at institutional level, and the rules of recording are conventionally laid down by the institution or university. Unless otherwise stated by the university or institution, the recording of the content heard or seen is subject to the written permission of the teacher or the students. That is, not only the instructor, but also the student is obliged to ask permission from those present before making a recording. If students want to record content created by the instructor, they must ask for the instructor's written permission (the easiest way is to write a letter of consent beforehand and then ask for the instructor's signature), and if the instructor wants to record any part of the lesson, they must also ask for the students' written consent. If the student makes a recording in which other students can be seen and heard, they must also be asked for their written consent.

References

- Allen, Ch. (2015). Marriages of convenience? Teachers and coursebooks in the digital age. *ELT Journal*, 69(3): 249-263.
- Az AI prompt-ok világa (2023). *Pallas 70. Oktatási és Vizsgaközpont*. <https://pallas70.hu/kepzes-hirek/cikkek/az-ai-promptok-vilaga> (2024. 04. 30.)
- Benedek A. (2020a). New content development for and by VET teachers. In Nägele, Ch., Stalder, B. E., & Kersh, N. (Eds.) *Trends in vocational education and training research, Vol. III. Proceedings of the European Conference on Educational Research (ECER)* (pp. 43–51), Vocational Education and Training Network (VETNET)
- Benedek A. (2020b) Digital Transformation in Collaborative Content Development. In Auer, M., & Tsiatsos T. (Eds), *The Challenges of the Digital Transformation in Education. ICL 2018. Advances in Intelligent Systems and Computing*, vol 916. Springer, Cham. https://doi.org/10.1007/978-3-030-11932-4_6
- Bognár, A. (2023). A generatív mesterséges intelligencia promptolása, egy új képesség fejlesztése az oktatásban. *Pannon Digitális Pedagógia*, 3(2), 17–26. <https://doi.org/10.56665/PADIPE.2023.2.2>
- Buchanan, R. (2019). Digital Ethical Dilemmas in Teaching. In Peters, M. (Ed.), *Encyclopedia of Teacher Education*. Springer. https://doi.org/10.1007/978-981-13-1179-6_150-1
- Burden, K., & Kearney, M. (2018). Designing an Educator Toolkit for the Mobile Learning Age. *International Journal of Mobile and Blended Learning (IJMBL)*, 10(2), 88–99. <https://doi.org/10.4018/IJMBL.2018040108>
- Dringó-Horváth, I., & Menyhei, Zs. (2021). Changes in coursebook publishing: Exploring the digital components of foreign language coursebook packages, *Teaching English with Technology*, 21(2), 18–41.
- Ehlers, Ulf. -D., & Kellermann, Sarah A. (2019). *Future Skills-The Future of Learning and Higher education. Results of the International Future Skills Delphi Survey*. Karlsruhe. <https://nextskills.files.wordpress.com/2019/03/2019-02-23-delphi-report-final.pdf>
- Falloon, G. 2020. From Digital Literacy to Digital Competence: The Teacher Digital Competency (TDC) Framework. *Educational Technology Research and Development*, 68(5), 2449–72. <https://doi.org/10.1007/s11423-020-09767-4>
- Fekete, I. (2025). *Artificial Intelligence Literacy in Higher Education: Theory and Practice from a European Perspective*. Bristol: Multilingual Matters.
- Gordon, D. G., & Wiltrout, M. E. (2021). A Framework for Applying the Learning Sciences to MOOC Design. *Frontiers in Education*, 5:500481. <https://doi.org/10.3389/fed-uc.2020.500481>

- Horváth Cz., J. (2016). Micro-content Generation Framework as a Learning Innovation. In Benedek, A., & Veszelszki, Á. (Eds.), *In the Beginning was the Image: The Omnipresence of Pictures: Time, Truth, Tradition* (pp. 171–181). Peter Lang GmbH, Internationaler Verlag der Wissenschaften.
- Heine, S., Krepf, M., & König, J. (2023). Digital resources as an aspect of teacher professional digital competence: One term, different definitions – a systematic review. *Education and Information Technologies*, 28, 3711–3738.
- Hülber L., Lévai D., & Ollé J. (2014). *A digitális tankönyvek összehasonlítása és értékelése*. Menyhei, Z., & Szoke, J. (2025). *AI Literacy in the Language Classroom: Facilitating Critical, Ethical and Responsible Use*. Stuttgart: Delta Publishing.
- Mishra, P., & Koehler, M. J. (2006). 'Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge'. *Teachers College Record*, 108(6), 1017–1054.
- Obonya, J., & Kadlecik, M. (2020). Assessing the Intensity of the Usability of the Course Content within the Virtual Learning Environment. *International Journal of Emerging Technologies in Learning*, 15(17), 165–180, <https://doi.org/10.3991/ijet.v15i17.13715>
- O'Brien, J. (2020). Digital Ethics in Higher Education: 2020. *EDUCAUSEREVIEW*, 2 https://er.educause.edu/-/media/files/articles/2020/5/er20_2103.pdf
- Recker, M., Sellers, L., & Ye, L. (2013), Teacher Design Using Online Learning Resources: A Comparative Case Study of Science and Mathematics Teachers, *Education Research International*, 2013, 243248. <https://doi.org/10.1155/2013/243248>
- Priatna, T., Maylawati, D., Sugilar, H., & Ramdhani, M. (2020). Key Success Factors of e-Learning Implementation in Higher Education. *International Journal Of Emerging Technologies In Learning*, 15(17), 101–114. <http://dx.doi.org/10.3991/ijet.v15i17.14293>
- Redecker, C. (2017). *European framework for the digital competence of educators: DigCompEdu (JRC107466)*. Seville, Spain: Joint Research Centre.
- Spencer, C., Angra, A., Dósa, K., & Jones, A. (2025). Undergraduate Learning Gains and Learning Efficiency in a Focused Open Education Resource. *The International Review of Research in Open and Distributed Learning*, 26(2), 184–204. <https://doi.org/10.19173/irrodl.v26i2.8117>
- Tóth-Mózer Sz., & Misley H. (2019). *Digitális eszközök integrálása az oktatásba Jó gyakorlatokkal, tantárgyi példákkal, modern eszközlístával*. Budapest: ELTE Eötvös Kiadó.
- White, J., Fu, Q., Hays, S., Sandborn, M., Olea, C., Gilbert, H., Elnashar, A., Spencer-Smith, J., & Schmidt, D.C. (2023). A Prompt Pattern Catalog to Enhance Prompt Engineering with ChatGPT. *ArXiv*, <https://doi.org/10.48550/arXiv.2302.11382>.

3. TEACHING AND LEARNING

Zsófia Menyhei

Introduction

When discussing *teaching* and *learning*, an indispensable starting point is how the information society and the changing technological environment have shaped the way we think about these two activities. The *activity* of the learner in the digital age is particularly important: the goal is to make students able to critically select information, solve problems while constructing their own knowledge, collaborate with others, take responsibility for their own development and learn in a *self-regulatory* way (ISTE, 2024). Their instructor should support this process – according to carefully appointed goals – with the appropriate methods and tools, and consciously build on the possibilities of different learning environments. All of this perfectly echoes the learning concept of *constructivist pedagogy*, as we will frequently see in the current chapter. One of the basic assumptions of the chapter is that the key to teaching and learning in the twenty-first century is the combination of modern pedagogical ideas and digital technologies that assist their practical implementation.

At the same time, one of the most pressing tasks of higher education globally is to provide meaningful responses to the needs of the information society and to incorporate the ideas outlined above into daily practice. This obviously requires renewal at several levels, such as that of institutional

culture. At the level of the instructor, this means, among other things, the targeted application of technologies that support teaching and learning with appropriate methodologies, which is the primary topic of this chapter. Chapter 3.1., *Teaching* discusses the topic in more detail through practical examples. In this context, the potential of different educational environments and the *flipped classroom* will also be discussed. Chapter 3.2., *Guidance* discusses the practical implementation of the instructor's role as a guide and facilitator, and how *learning management systems* (LMS) can support these roles. Chapter 3.3., *Collaborative learning* outlines the organisational questions, tools and benefits of collaborative student work, while *Chapter 3.4. Self-study* proposes solutions which support students' self-regulated learning. As this brief overview of the topics in the chapter shows, the relevant third area of DigCompEdu is more general in its focus compared to the other areas, because topics like digital resource management (Chapter 2), assessment (Chapter 4), or empowering learners (Chapter 5) are all constituent elements of the teaching-learning process.

We interviewed the experts Dr. Márta Turcsányi-Szabó (Eötvös Loránd University, Budapest) and Dr. János Ollé (University of Pannonia, Veszprém) about the topics in this chapter.

AI competencies related to the area, based on the supplementary document (Bekiaridis & Attwell, 2024, p. 36):



Click / Scan

AI competencies in this area mean that educators are able to integrate AI into teaching strategies and learning activities. Educators should be skilled in how to use AI to support personalised learning experiences, apply AI-based tools for interactive and engaging teaching, and understand how AI can help in different educational settings.

The use of AI in teaching and learning offers numerous opportunities, but perhaps even more challenges. It makes it much easier and quicker to create personalised, adaptive content, and also promotes inclusive education (Walter, 2024). At the same time, our interactions with chatbots can result in incorrect, inaccurate, or even biased responses, which can have serious consequences if not critically evaluated and reviewed (Touretzky et al., 2019). An important question is for what purpose and how often educators and students should rely on generative AI tools, and whether their excessive use has a negative impact on writing skills and cognition (Chan, 2023). In addition, a number of other issues arise in relation to data security, copyright, and the growing digital divide (Szabó & Szoke, 2024). All this underscores the need to develop both teachers' and students' AI competencies in a targeted manner, for which there are several practical examples in the following chapters.

3.1. Teaching

To plan for and implement digital devices and resources in the teaching process, so as to enhance the effectiveness of teaching interventions. To appropriately manage and orchestrate digital teaching interventions. To experiment with and develop new formats and pedagogical methods for instruction.



What is the attitude of students to the use of digital technologies to support learning?

Turcsányi-Szabó Márta:

Students' attitudes towards digital devices, whether in or outside of class, always depend on the nature and relevance of the task. If students are given a task that they could solve without a computer, but they do have to solve it with a computer, they will, of course, be reluctant to do it. However, if technology can inherently facilitate the solution, they will love it, and sooner or later realise that solving the task becomes much easier.



In the DigCompEdu framework, the first component of the third area, *teaching*, is referred to as the most important competence of the area – and perhaps the whole framework (Redecker, 2017, p. 20). This is perhaps not surprising, as the oft-cited “ground rule” for classroom integration of digital technologies, according to which the use of tools must be truly justified and methodologically relevant, is nowhere as prominent as in this area. As emphasised in the above quote, digital technologies should only be incorporated in the teaching-learning process if they bring some added value and if they can help in the implementation of an activity. There are many examples of this (see the methodological ideas and good practices

in this handbook), but it is ultimately the instructor's responsibility to judge – during a conscious planning process taking into account the goals, the context and the participants of the course – when it is necessary to rely on digital technologies.

What exactly does conscious planning of the use of digital technologies mean? As a first step, we should apply a *learning outcomes* approach, meaning that our lesson or course should clearly articulate what competencies the student is expected to be able to cultivate at the action level by the end of this learning phase. In other words, the starting point is not what we will teach in a given lesson (e.g. “I will teach figures of speech”), but what the student will gain in terms of concrete, measurable outcomes (e.g. “by the end of the lesson, the student will be able to distinguish metaphor from metonymy”). For this, we should map our prior knowledge of our students, using, for example, a *diagnostic assessment* (see *Chapter 4.1*). Because well-defined *learning outcomes* often contain verbs expressing student action, a modified version of the Bloom taxonomy that operates with verbs may help us to define them (Anderson & Kratwohl, 2001). The *learning outcomes* approach focuses on the outcome rather than the process, but in the next stage of planning we must naturally concentrate on the teaching process itself: the teaching-learning strategies, methods and tools. It is important to consider what activities will lead to the desired result, what methods of feedback we will use and whether at some point technology can improve on these.

One of the key issues in the planning of the process is the selection of the relevant student activity. In most cases, the short answer to the question of what is “relevant” is that it must promote productive activity with the given goals in mind (Smith Budhai & Brown Skipwith, 2017). It has often been suggested that the learning concept of pedagogies based solely on knowledge

transfer and demonstration is incompatible with the changing demands on education. Of course, this does not mean that the methodological solutions of such pedagogies should be disposed of – a logically structured, highly demonstrative, and suggestive lecture may have a considerable impact on a student sitting in a lecture theatre. However, in most teaching-learning situations, it is essential to build on student activity, for example, through tasks embedded in real contexts, which are often made easier, faster, and more feasible with the use of digital technologies. This might even mean that the students are tasked with blogging, commenting, making a movie, doing something on social networks, and so on.

Where appropriate, students can be involved in the planning of activities, and as the course progresses we can ask them for feedback on the relevance of the tasks (how useful, entertaining or challenging they were), using, for example, [Google Forms](#) or the polling feature of our *learning management system* (see chapters 3.2, 5.2, 5.3).

Another key issue in conscious planning is how the teaching-learning process can be optimised with technology. Obviously, as instructors, we can only judge whether the use of tools is really justified for a particular activity if we are aware of the potential of the technology in question. The aim of this chapter is to present some practical examples of the relevant opportunities and the added value they incorporate, such as the easier activation of students, support for personalised learning and guarantee of transparent work processes. Regarding the *teaching* competence area of the DigCompEdu framework, instructors should possess the following abilities:

To use classroom technologies to support instruction (e.g. electronic whiteboards, mobile devices).

The extent to which classroom technologies should be used depends on different factors, but one of the most fundamental questions is the availability of devices at institutional level. Despite this, the *BYOD (Bring Your Own Device)* concept can provide a solution to deficiencies of infrastructure, although stable Internet access can be a crucial requirement in this case as well. The point of BYOD is that since most students already have a smartphone and/or laptop, these tools can be called upon to support learning in the classroom. The added value of technology often lies in activating students – smart devices can even be used as a kind of “classroom polling system”, but they can also prove useful in the implementation of many other objectives.

In a university lecture, for example, audience engagement can be significantly boosted with the combination of interactive presentation software (e.g. [Mentimeter](#), [Nearpod](#)) and mobile devices. With such software, our presentation can be enhanced by interactive slides asking students questions. The students answer these on their mobile devices, and the results appear in real time in the presentation, i.e. on the projector (Figure 3.1). Certain applications (such as Mentimeter, mentioned previously) have been enhanced with AI-based features, allowing presentations to be created in seconds using a prompt. Such interactive presentations can be useful for several different purposes: when we want to receive quick information about our students’ prior knowledge of a topic, when we are curious about the associations they make and their opinions, or when we wish to encourage them to ask questions and think, the process characteristically goes more smoothly when it is anonymous. Since the given answers are visible to the whole group, they can provide a good starting point for a joint discussion. One significant advantage of a tool being available to all the participants, is that each of them can become individually engaged (for more information on engaging students, see *Chapter 5.3*).

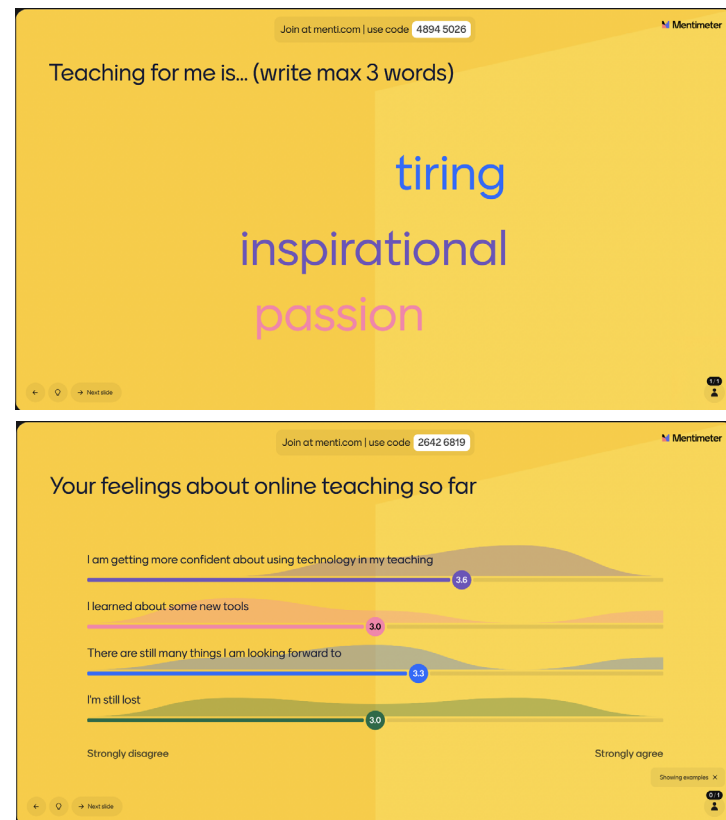


Figure 3.1. A slide type with different answer options in Mentimeter

Of course, not all students may have the necessary devices (for the importance of ensuring equal access, see *Chapter 5.1*), and students should not be expected to download the myriad of different applications we recommend on their own devices.

As a compromise for the former problem, groups of three or four can work on one device, while the latter issue can be addressed by consciously aiming for applications that require no download (for example, in [Mentimeter](#) and [Nearpod](#), with the use of a code, interactive slides can be directly accessed on the web interface).

Further potential drawbacks of *BYOD* include potential security risks and the need to develop an institutional-level strategy to address this issue (NMC Horizon Report, 2016).

The use of *BYOD* in education is supported by the fact that personal devices are always at hand, typically small in size (so they do not break the personal space between participants in the same way as the desktops in a classic computer room), and since these are their own devices, students are generally fully conversant with their use. Interactive presentation is just one of the many solutions to realise students' productive activity. There are additional ideas in our handbook, such as the use of digital exit cards (see *Chapter 4.3*) or creating shared lesson notes (see *Good Practice 6.1: Collaboratively edited lesson notes*).

In addition, there are a number of classroom techniques that help to engage students without relying on their smart devices (see, for example, *Good Practice 5.4: Jeopardy*). A teacher's computer and a projector are sufficient for showing word clouds – images created from keywords or phrases that allow us to easily visualise textual data (see *Chapter 2.2*) – yet such a relatively simple concept can be employed in the classroom in multifarious ways.

For example, before introducing a topic, you can create a word cloud at home from the keywords associated with it. Projected in class, students can be guided to focus on the most important elements of the topic and their prior knowledge can be assessed by asking them to share their associations concerning the words. Different font sizes can be used to indicate the core points and the more peripheral elements of the topic. The same word cloud can be useful later, when summing up: we can provide a unique overview of the topic and make students aware of the specific gains in their knowledge. Meanwhile, we are also helping them to memorise the learned material and to be able to recall it later. Word clouds can support not only the introduction or summary of a topic, but also its revision (*Good Practice 3.3: Word cloud and mind map bank*). However, they can also be used for more light-hearted purposes, for example, at the beginning of a series of seminars or an entirely online course, the instructor and students can create a word cloud about themselves (their activities and interests) as a personal introduction (see *Figure 3.2*). Other participants can ask questions about a student's word cloud in order to get to know them better, or if everybody is already well acquainted at the beginning of the course, we can make a quiz where the students guess which word cloud belongs to whom. In this use, therefore, the word cloud has a group dynamic function as an “icebreaker”.

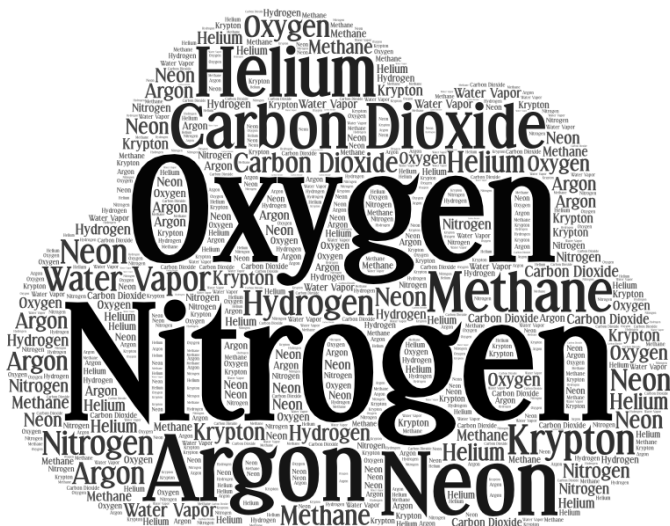


Figure 3.2. A personal word cloud for a student, AI-generated with WordArt

To set up learning sessions, activities and interactions in a digital environment.

The above examples demonstrate how digital tools can support work in a contact class, but technology can obviously help students to learn outside the classroom as well. On the one hand, technology-assisted learning already takes place outside the framework of formal education, which is natural and self-evident, but in institutional education we tend to underestimate or completely ignore its importance. On the other hand, formal education can also take place in different spaces, and hybrid and online educational environments both have their own possibilities.

The concept of *blended learning* can be linked to the hybrid environment, which means that part of the teaching-learning process takes place within a traditional classroom environment, while another part is carried out as online distance learning. The extent to which the course relies on the different environments depends on the regulatory environment of the institution, as well as the various aspects, objectives and participants of the course itself, but the ultimate goal is to make the activities taking place in the different environments complement each other. The competence quoted above is partly founded on the fact that by realising the huge potential inherent in *blended learning*, instructors consciously exploit the advantages of both traditional contact classes and online education. Contact classes, for example, are excellent for participants to become personally familiar with each other, become emotionally involved, and perform activities with a practical focus that can only be conceived through personal attendance. The online environment provides opportunities for, among other things, the processing of the learning material at an individual pace and with individual methods, and it also facilitates online communication, knowledge sharing and collaboration. One way to implement *blended learning* is to create a *flipped classroom*, which is described in more detail below.

In contrast to the hybrid learning environment, in a wholly online environment the teaching-learning process is entirely independent of classroom space and time, and this is often realised with the help of a learning management system (*Chapter 3.2*). As distance learning became the last resort for educational institutions during the Covid-19 pandemic, such an environment is most likely familiar to everyone. Many educators probably believe that the effectiveness of distance learning lags far behind that of regular education. In the case of certain activities this might hold

true – as mentioned earlier, it fosters emotional involvement, and physical presence is essential for some forms of experiential learning. At the same time, it is important to realise that probably the most important condition for the effectiveness of distance learning is preparation for the process, an opportunity which was denied to the majority of instructors during the aforementioned global crisis. By preparation, we primarily mean that in addition to sharing resources, we also consciously plan students' learning activities, select the targeted individual or *collaborative* tasks which can ensure student activity (Smith Budhai & Brown Skipwith, 2017), and discover ways to maintain motivation (see *Chapter 5.3*), which is the main driving force behind *self-regulated learning*. Examples and methodological ideas are provided in the following subchapters (3.2 to 3.4). In an online learning environment we might also strive to support students in the construction of their own *personal learning environment* (PLE), which is discussed in more detail in *Chapter 6.5*.

To experiment with and develop new formats and pedagogical methods for instruction (e.g. flipped classroom).

The *mirrored classroom* (also known as the flipped classroom) is the reverse implementation of the currently most common educational practice. In this form of learning organisation, activities in which students are mostly passive recipients of the curriculum (e.g. listening and taking notes during a traditional university lecture) are implemented as extracurricular, home activities in a digital environment. Thus, significantly more time is available in the contact class to deepen and apply knowledge.

One typical manifestation of the *mirrored classroom* can be described in four stages (Ollé, Ruszkai, & Hülber, 2017; cf. Bergmann & Sams, 2012). In the first stage, tuning in to the topic and the tasks, as well as experience-based involvement takes place within the framework of a contact class. This is followed by learning – with teacher support – about the content made available by the instructor in the online digital learning environment. This content is typically a digitally recorded presentation by the instructor or an instructional video from another source (good examples can be found on the [Khan Academy](#) website or [here](#)). However, any auxiliary material that helps the acquisition of knowledge related to the topic can also be used. In the third stage of learning organisation, the student interprets the content outside the contact hours, in an online environment, actively processing it and often creating a product (e.g. notes, reflections, an explanatory video) individually or in collaboration with group mates. In the fourth and final stage, we return to the classroom to build on the knowledge acquired at home, and facilitate the deeper (joint) processing of the topic, the discussion of the issues that arise, and the presentation of the finished products. Therefore, the contact activity is practice-oriented and characterised by shared learning.



Of course, innovative solutions supported by digital technologies cannot be expected to provide an answer to all pedagogical problems or to work equally well for all courses. This situation is no different in the *mirrored classroom*, but in some instances it can lead to a significant improvement in quality as it has a number of advantages that in many respects coincide with

the ideas of modern educational theories. On the one hand, the *mirrored classroom* supports students' active and *self-regulating learning*, builds on their responsibility for their own learning and represents a learner-centred approach. The extracurricular activities provide an opportunity for individual scheduling and progress at an individual pace – if necessary the tutorial video can be replayed multiple times, yet some students may even process material faster than when they are in a conventional classroom environment. In the contact class, students can receive more personal attention and help from the instructor and their fellow students, and interactivity can be exploited. In summary, in the *mirrored classroom*, personalised learning is more significantly present in both the out-of-class and the contact stages compared to the classic classroom solution (Bergmann & Sams, 2012).

There are naturally drawbacks to the concept as well, and in fact the very advantages of the strategy might in some cases be manifested as disadvantages: *self-regulatory learning* and responsibility may seem foreign to students at first as most will have probably participated in any such model during their previous studies. Similarly, the instructor may also have reservations concerning their new role of having to support and monitor student activity not only in the contact class, but also online.

The following good practice tips may prove useful in *designing a flipped classroom* solution:

- We should take the time to tune in. At this stage, we can even openly discuss the advantages the new kind of learning organisation with the students, and highlight potential difficulties and concerns.
- If the nature of the course allows it, we should let the student choose from the content to be processed or decide how to process it (e.g. what product to make).

- We should try to activate students in the extracurricular phase of learning the content with the help of interactive tutorial videos (see *Good Practice 3.1: Interactive video-based presentation in a flipped classroom*).
- The activities that feature in the different stages should be structured so that they build on each other (e.g. students have to in some way prove that they have learned and processed the learning content of the previous stages). The majority of students can be efficiently motivated in their home activities with relevant tasks supporting self-expression, but an important question arises when the content has not been properly explored and processed in the extracurricular stage. Some instructors use online tests for this purpose: students can only take part in the practical lesson (or, in the case of a score-based assessment system, only get points for home activities) if they pass the test. Other instructors try to form mixed groups in the contact class, in which students who have completed their homework work with those who have not.

To organise workshops and classroom activities related to AI literacy, addressing topics such as how AI works, its ethical use, and its societal impact.

AI technologies are now widely used in various fields, from finance to healthcare, and are expected to play an increasingly important role in several industries in the future (Cazzaniga et al., 2024). Education is no exception. In recent years, several large-scale, cross-country studies have examined how higher education students use AI-based tools in their studies (see, for example, Ravšelj et al., 2025). Some of these studies found that 86% of students use AI-based tools, yet most feel that they lack sufficient knowledge and skills in this area (Digital Education Council, 2024). All this



shows that it is extremely important to develop our students' AI literacy. Meanwhile, a lot of educators might feel like they are not properly prepared for this. The AI competency frameworks found in the literature can be a good starting point, even though most of them were made specifically for public education. One of the best known is 'Five Big Ideas in AI' (Touretzky et al., 2019), which summarises what students in public education need to know about AI. Another important starting point for AI literacy is the framework developed by Long and Magerko (2020), which describes a total of 17 AI competencies across five main topics. The five topics are as follows:

- What is AI?
- What can AI do?
- How does AI work?
- How should AI be used?
- How do we relate to AI? (Long & Magerko, 2020).

The UNESCO framework (Miao & Shiohira, 2024) is more recent than the two competency frameworks discussed so far, and its aim is to help integrate AI-related learning objectives into national curricula. All three frameworks include key competencies related to responsible, ethical use, and the societal impacts of AI. These competencies can be developed effectively in higher education, as discussed in this chapter and in Chapter 6.

For example, students can be assigned to conduct individual or group research projects on the following topics:

- What impact could AI have on a particular field of study or profession? What changes could it bring about, and what opportunities and challenges could it create?

- What tasks does AI perform well in a given field of study or profession, and which ones still require human labour?
- How can AI-generated content be referenced in student work?
- What types of information or content can be considered safe and ethical to share on an AI-based platform (e.g., publicly available online documents), and what types should not be shared (e.g., materials containing personal data or protected by copyright)?

3.2. Consulting

To use digital technologies and services to enhance the interaction with learners, individually and collectively, within and outside the learning session. To use digital technologies to offer timely and targeted guidance and assistance. To experiment with and develop new forms and formats for offering guidance and support.

It is a cliché about the information society – and one of the foundations of the DigCompEdu framework – that teachers are no longer the exclusive source of knowledge: their role is being redefined and their responsibilities in supporting and facilitating learning are growing ever greater (ISTE, 2017). In practice, such a statement covers a wide range of pedagogic knowledge and activities: for example, knowing when to intervene and not, helping students to become independent and cooperative learners, providing frameworks, guidance and advice, and developing critical thinking. These activities are excellently supported by digital technologies and are extremely well integrated with learning *management systems* (e.g. [Canvas](#), [Moodle](#), [Google Classroom](#), [Edmodo](#)). In this section, we focus on the potential of

these systems, paying special attention to how they can help us in our work as guides and mentors.

An organic part of our teaching work is to share learning content with students, communicate with them by email, solicit their feedback, create tests, and evaluate submitted materials. *Learning management systems* provide a comprehensive solution to carry out the listed activities on the same platform. The distinct advantage of these interfaces is that the learning materials can be found in one place, in a structured form – for example, you can upload your own presentations, notes and multimedia content, and share links to external applications and resources in a modular fashion; we can make a weekly breakdown or organise our resources according to other principles. Of course, students can also share content with their instructors or with all participants in the course, and even with smaller groups, as most systems also support the creation of subgroups. Learning products are available and evaluated on the same interface, eliminating the chore of sending emails at every step of the process. *Learning management systems* also reduce administrative tasks, such as attendance sheets, grades, and a calendar function, which also provides students a reminder of the deadline for submitting tasks.

According to the DigCompEdu framework, competent instructors in their *guidance*-related role can be characterised as possessing the following abilities:

To use digital communication tools to respond promptly to learners' questions and doubts, e.g. concerning homework assignments.

A number of synchronous and asynchronous communication tools are available for instructors with which they can communicate with their

students outside of contact classes. If simultaneous interaction is required, we can use, for example, a device that allows instant messaging or *video conferences*, but if non-real-time communication is more appropriate, communication may take place on a message board or forum, or by email. As instructors, it is advisable that we develop a strategy regarding when to be available on different interfaces, and we need to inform our students accordingly.

Learning management systems integrate most of these tools on the same platform (see *Chapter 6.2*), so it is an obvious choice to predominantly rely on the tools available within the given system (e.g. personal messages, forums). At the same time, these functions not only facilitate communication between an instructor and their students, but also make discussion and cooperation between the group mates smoother. For example, a forum built into a *learning management system* can be used by group members to discuss issues that arise (e.g. related to homework), which is an important part of community learning, and a measure of students taking responsibility for their own learning. This also relieves the instructor to some extent, as they do not have to answer the same question several times in multiple emails. Of course, we can monitor an ongoing discussion and intervene if necessary, but letting students tackle the problems can be solved within the group may be the preferred option. On the other hand, there is no doubt that it is the instructor who has to boost the communication on the forum with questions, targeted tasks, and active participation – without such input, this function of the system will almost certainly remain unused. In most cases, this type of instructor intervention is only needed during the introduction of the course interface, and its intensity can be subsequently reduced.

As an example of the above, we might stimulate communication by asking participants to share an introductory image, video, blog or article related to the topic of the course. Later we can encourage students to respond to those items with which they most closely identify. Students can then be motivated to make use of the system's other services in the same way (see *Good Practice 3.2: LMS treasure hunt*).



In conclusion, we could say that in a *learning management* system, the presence of the instructor as a facilitator is very important, whether we use the LMS to support an entirely online course or to supplement contact classes. Our expert emphasises the same:

János Ollé:

A forum is a community interface where interactive communication needs to be shaped on an ongoing basis, in which the instructor has a prominent role and serious responsibilities. So the instructor must be present, too. The response to this from most instructors is, obviously, that communicating with students has always been severely time-consuming, and now the workload is multiplying, you have to be available for students day and night. But that is not what this is all about. The instructor should set limits that can act as an example to students: we are not constantly present, we do not react immediately, but we are only actually available at certain times and in certain situations.



To set up learning activities in digital environments, having foreseen learners' needs for guidance and catering for them.

Learning management systems are useful in both distance and *blended* learning environments, but the course interface must be carefully designed. Typically, participants access content, tasks and tests grouped together in separate blocks on the interface (see Figure 3.3). It is important to include, on the one hand, *collaborative* tasks that are essential for the development of a well-functioning online learning community, and, on the other hand, guidance, supporting content and modules.

The screenshot shows the Moodle LMS interface for a course titled 'Az angoltanári IKT fejlesztése'. The top navigation bar includes 'KRE moodle' and 'magyar (hu_old)'. The main content area is divided into two columns. The left column, titled 'ADMINISZTRÁCIÓ', lists various course management tasks such as 'Kurszus kezelése', 'Beállítások szerkesztése', 'Szerkesztés bekapcsolása', 'Kurszus teljesítése', 'Felhasználó', 'Jelentések', 'Biztonsági mentés', 'Helyreállítás', 'Importálás', 'Kérdésbank', 'Tárhelyek', and 'Lomtár'. The right column, titled 'Folyamatjező', shows a list of activities with checkboxes for completion. The activities are grouped into two sections: '1. Bevezetés' and '2. Receptív készségek fejlesztése'. The activities listed are: 'Tanulástámogató alkalmazások használata - felmérés', 'Technológiahasználat az iskolában - vélemény', 'Receptív készségek kvíz (10 pont)', 'Feladat a Rewordify-jal (30 pont)', and 'Személyes szöveghő készítése (10 pont)'.

Figure 3.3. Content and activities arranged in modules on Moodle

In a digital environment, the aforementioned guidance and support can take different forms.

Some instructors share frequently asked questions (FAQs) and their own instructional videos with the students on the *learning management system*. For some complex tasks, student work may be supported by step-by-step instructions in a tutorial document. 

For example, in the case of a score-based assessment system, students can voluntarily collect points by creating a FAQ document for the course, expanding it, maintaining it, and possibly creating an instructional video or quiz for their peers. 

However, the above might be more of a barrier in task types relying on individual creativity. When designing the course interface, it is important not to control every step of the learning process. If the nature of the course allows it, students should be given a free hand in the selection and processing of content in these interfaces (for example, with open-ended, problem-solving tasks). There are different ways to implement these tasks, and they not only provide space for student creativity, but also work as a strong source of motivation (for more information on project work and related digital solutions, see *Chapter 3.3*).

Another form of online instructor support is to incorporate regular formative (developmental) assessment modules into the learning management system. These can take the form of, for example, playful self-assessment tests or tasks that the instructor prepares in advance and then integrates into the interface using either external task editing applications (see *Chapter 2.2*) or interactive response systems (see *Chapter 4.1*). 

It may sound strange, but the instructor can also support online learning by building on the supportive activity of the participants.

Of course, students may need guidance and support that we have not been able to provide in advance.

We can rely on, for example, the polling function of a learning management system or an external tool that provides a similar service (e.g. [Google Forms](#)) to assess and more easily respond to such needs, and to involve students in the decision-making processes.

To use digital technologies to remotely monitor student progress and intervene when needed, while allowing for self-regulation.

The added value of digital technologies used in education lies in making students' progress more transparent and traceable. This is also true for most *learning management systems*. In these systems, a variety of data about student activity is automatically recorded, for example, when they last logged in to the interface, how much time they spent there, what tasks they completed, etc. (see *Chapter 4.2*). Thanks to logging, we can also track document editing processes in [Google Docs](#), or the tasks of a project in [Trello](#), making students' individual contributions transparent in *collaborative* tasks as well (see *Chapter 3.3*). Logged activities thus provide an insight into certain aspects of the participants' learning processes and the instructor can recognise if a student is in difficulty or needs more support. This does not mean that we ought to monitor and account for every moment of the students' online work, as the goal is their *self-regulated learning* (see

Chapter 3.4.). The supporting role of teachers therefore also means that we should strive to maintain an optimal level of instructor and student control, which is, admittedly, not an easy task. However, it helps to be aware of the services that are available.

3.3. Collaborative Learning

To use digital technologies to foster and enhance learner collaboration. To enable learners to use digital technologies as part of collaborative assignments, as a means of enhancing communication, collaboration and collaborative knowledge creation.

In higher education, *collaborative* learning activities are important in several respects. On the one hand, after graduating it will be important for most of our students to be able to participate effectively in work performed together with others and to resolve potential issues or conflicts. On the other hand, *collaborative* tasks presuppose a twenty-first century approach to learning: they enable participants to learn actively, requiring them to take responsibility for their own work and that of their peers, while the instructor's role as facilitator comes to the fore. *Constructivist* and *connectivist* learning theories serve as a good starting point for a deeper understanding of all this.

According to the *constructivist* view, learning is a personal, active and internal process of construction in which the learner interprets new information using their existing knowledge (Pritchard & Woollard, 2010, p. 5). The approach focuses on the learners: their own activity and autonomous actions are crucial in their learning, and prior knowledge plays a decisive role. On the other hand, social constructivism holds that the social nature

of learning, interactions and group processes are the decisive factors. Although these are two separate theories, in a sense, the latter “inherits” *constructivist* theorems about individual cognition (Nahalka, 2002, p. 77). The ideas briefly outlined here, call for the creation of the following essential conditions for effective learning:

- rich experience opportunities;
- tools supporting individual learning;
- social learning, collaboration, community creativity, diverse group processes;
- true to life, provides authentic problems, embedded in a real context;
- application of knowledge;
- differentiation – in terms of goals, tasks, assessment, etc. (Honebein, 1996; Nahalka, 2002; Pritchard & Woollard, 2010).

Linked to social constructivism, yet different in many respects, connectivism is considered to be the learning theory of the digital age. According to this theory, knowledge is organised in a network, and it is created from interactions and relationships between people (Downes, 2008); in other words, learning means the creation and development of new relationships. This presupposes a horizontally organised, multi-channel form of learning based on learner autonomy and the spontaneous exchange of knowledge. From a practical point of view, this means that students use different *web-based services* to share content with each other, make connections about it, tag it, evaluate it and edit it together – this is what we call community-based knowledge construction.

Connectivism has received criticism for various reasons. Some argue that it cannot be called a new theory of learning, while others question

its applicability in institutionalised education (Kop & Hill, 2008). Perhaps unsurprisingly, experience to date has been gathered primarily in adult education, which by its nature allows for looser organisation. At the same time, the theory undoubtedly outlines some thought-provoking ideas about twenty-first century learning, and some projects designed in a connectivist system are also conceivable within an institutionalised educational framework. The digital technologies and solutions described in this chapter work very well with *constructivist pedagogy* and its approach, and they are largely essential elements of connectivist practice.

There are many benefits to incorporating carefully planned and well organised *collaborative* tasks into our courses. In working together, students can not only learn from each other on the content level, but their learning methodology toolkit can also be expanded based on what they see from each other. They can also gain experience in cooperation, organisation, /// *social assessment* and conflict management, and develop skills in relation to these matters. What are the features of a task that facilitates all this? A good *collaborative* task is primarily relevant to and frequently connected to a real-life problem. Ideally, several solutions should be possible, i.e. the task should allow group members to solve it creatively, using processes which ensure that the different interests and strengths of each student can come to the fore. As evidenced below, this aspect was also discussed by our experts.



Do you consider it an appropriate form of learning for students in higher education to seek and process information independently, in groups?

Márta Turcsányi-Szabó:

If we really accept that students with different profiles can work together, wonderful group work can be developed. Everyone can add their individual knowledge to the process, resulting in significantly more innovative, creative and unique work. In this case, it is clearly important for the teacher to assign the group a task that is open-ended – there should always be more than one possible solution.



Digital technologies offer excellent opportunities to promote *collaborative* learning by, among other things, facilitating information sharing and collaborative editing, and making the workflow transparent and traceable for all participants. Collaborative research can rely on an inexhaustible repository of online resources, while content sharing is supported by the *learning management systems* mentioned earlier, or *cloud-based* file sharing sites (e.g. [Google Drive](#), [OneDrive](#)). *Web applications* such as [Mindmeister](#) or [Padlet](#) are important tools for structuring shared knowledge and brainstorming, while the coordination of *collaborative* tasks is extremely well supported by [Trello](#). All of these things are discussed in more detail in the following sections.

The DigCompEdu framework characterises the instructor supporting *collaborative* learning as possessing the following abilities:

To implement collaborative learning activities in which digital devices, resources or digital information strategies are used.

As mentioned previously, some *collaborative* learning activities are much easier to perform in a digital environment. One such example is using *web-based services*: thanks to these, we can easily create, share and comment online content, all in collaboration with others in a transparent process. Thus, such services can be considered technologies that promote learner-centred education and *collaborative learning*. Some are probably already part of our students' *personal learning environment* or will be integrated into it during the course. For example, many people use [Google Docs](#), a cloud-based file-sharing site that allows for shared document editing. This practice allows multiple users to work on the same textual product, either simultaneously or at different times. A versatile tool, it is also suitable for making joint class notes, collecting ideas in groups or documenting research work in teams (for teacher use, see *chapters 1.2 and 2.3*).

In some courses, it may be useful to give our students editorial permission for a blank document before class. During the class itself, they may enter their questions on this document via their own smart devices, and at the end of the session the group will try to provide answers (see *Good Practice 6.1: Collaboratively edited lesson notes*).

As an alternative to text-based class notes, our students can make group notes in the form of a digital mind map using a suitable interface (e.g. [Mindmeister](#), [Coggle](#) see *Figure 3.4*). Even a paper-based mind map has many advantages: the visual presentation and structuring of thought elements can greatly help in the deeper understanding of connections, and in memorising and recalling information. Furthermore, it improves critical thinking as well as comprehension and focusing skills (see Buzan & Buzan, 2009). Mind mapping

apps offer even more possibilities, as they can be jointly edited, and additional text, links, comments and images can be added at any time.



Figure 3.4. Mind map generated with AI in Mindmeister

Mind maps are excellent for providing a detailed picture of participants' prior knowledge when introducing a topic – students can even create their own maps and share them before the class, providing the lesson with a point of departure. At a later stage of the learning process, mind maps created earlier can prove highly useful in recalling the learning material (*Good Practice 3.3: Word cloud and mind map bank*), and when summarising a topic they can be used to illustrate the new knowledge the participants gained during the course (i.e. by comparing their initial mind map with their mind map edited during the summary). Mind maps are also capable of supporting student or teacher presentations, but – to stick to collaborative work – they are also suitable for the joint



planning of certain tasks and work processes. (See *Chapter 2.2* for additional ideas related to mind mapping).

Naturally, students should not be expected to be immediately proficient in the use of professional text editors, mind map applications or any other *web-based* tool that is new to them. Although these are exceptionally user-friendly interfaces, students must still be given some time to explore them.

If we are planning the classroom use of such technology, we should assume a student's perspective, and consider the practicalities involved. For example, in order to edit a Google document on their mobile device, they must first download the related app (if they agree to this), so you should to ask them to do so before the class begins.



In some cases, students may not share our enthusiasm about a certain application. This is not necessarily a problem, as the ultimate goal is effective *collaborative* learning for students, which can often be accomplished by other means, especially if they are already an integral part of the students' *personal learning environment*.

To employ digital technologies for collaborative knowledge exchange among learners. To support group projects in which students use AI-based tools for research, data analysis, or creative tasks.

The specific examples described so far in this chapter have mostly referred to smaller-scale *collaborative* activities, but a course may pursue goals that can be achieved more effectively through project work. This usually means a complex task based on a joint activity, the end result of which is

a presentable product: e.g. a comparison chart, tutorial video, podcast, summary of an inquiry, etc. (see Larmer, Mergendoller, & Boss, 2015). Project work often consists of distinct steps:

- definition of goals;
- planning and organisation related to activities, responsibilities, duration, etc.;
- implementation, with phases like data collection, processing and product compilation;
- closure, i.e. the presentation and evaluation of the project.

In the case of such complex tasks, carefully selected digital technologies can be a source of invaluable assistance for the coordination of the workflow, the creation and presentation of the output, and the evaluation of the collaboration. Similarly, they can likewise become a crucial tool for knowledge sharing between students, which can be achieved by using certain functions of *learning management systems*, but also by the use of external, *web-based applications*. During the data collection and processing phase, for example, ChatGPT's 'Deep Research' function is particularly useful, as it can significantly reduce the time spent gathering information. Such an AI-supported task also provides an opportunity to educate students on the critical use of AI and make them aware that it is always worth checking the authenticity of the information and sources they receive.

As an example, a blog or an online bulletin board is an excellent way to document joint research and publish its results (*Good Practice 4.1: Using a blog-based digital portfolio*). With an online bulletin board (e.g. [Padlet](#), [Lino](#)) students can collect and organise content in different formats (links, audio files, text, photos, their own drawings, etc.) on the same eye-catching, freely customisable interface (see Figure 3.5). They can share their online



bulletin board with their peers, and – with the appropriate settings – receive feedback in the form of comments and *likes*, which have a strong motivating force (for the role of feedback in motivation, see *Chapter 5.3*).

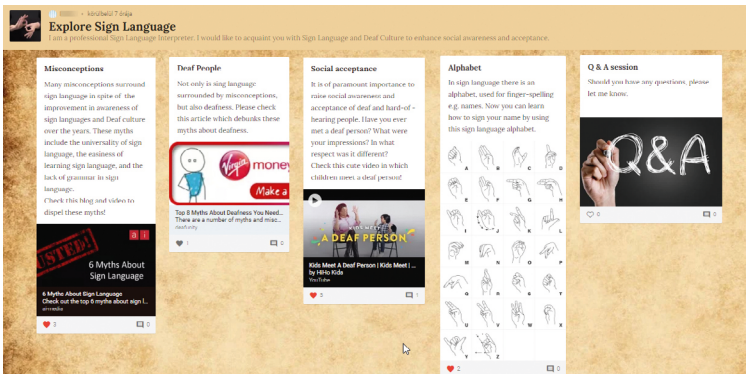


Figure 3.5. A student's bulletin board in Padlet

presentation can be shared with others via a link or exported, for example, as an editable PowerPoint presentation.

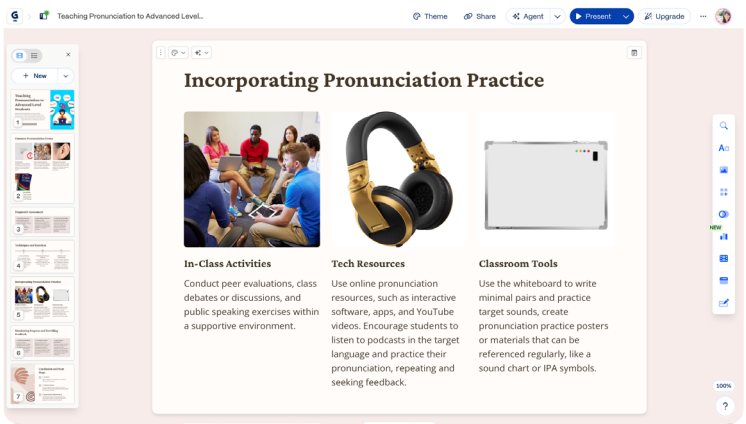


Figure 3.6. The editor's view in Gamma



Finished projects can also be presented in the form of presentations, which students can create much more easily and quickly using AI-based presentation generators (e.g. Gamma). With these, a sophisticated, well-structured presentation can be created in seconds or minutes either by using an uploaded or imported document (e.g. PDF or Google Doc) or even just a one-line prompt. After uploading the file or entering the prompt, the application generates an outline, so the information that will appear on the slides of the finished presentation can be viewed and modified. Here, students can set the language of the presentation, the number of slides, the amount of text on the slides, and the source of the images (e.g., AI-generated images or stock photos). The finished AI-generated



How can educators use AI-assisted presentation tools to refine and extend their existing teaching materials?

Johanna Szőke

One of the biggest advantages of GenAI-assisted presentation software is the ability to redesign your existing handouts or slides. You can make your materials less crammed, more accessible, and more visually appealing.



Click/Scan

To monitor and guide learners in their collaborative knowledge generation in digital environments.

We have already discussed one of the most important added values digital technologies bring to teaching and learning: that they make the workflow transparent. The same is true of many tools used to support collaboration. For example, in [Google Docs](#), activity is logged during document editing, so we can easily keep track of who contributed to a specific collaboration. At the same time, transparency can be further enhanced by certain methodological solutions used in parallel with technology.

For example, in the case of a project, it is a good idea for group members to sign a written group agreement, and a schedule of the steps of the project, and make these available to the instructor.



Both are a means of taking responsibility for the shared learning.

The group agreement is a useful starting point and reference for *collaborative* work. The agreement may declare (whether through instructor questions or a template in [Google Docs](#)) the responsibilities and roles of the group members, the channels and regularity of meetings, and the way to handle problems, for example, if a member is late in submitting their assignment. A project schedule, on the other hand, summarises activities and deadlines. This can also be created in a collaboratively edited document, but there are also design tools developed specifically for this purpose, such as [Trello](#) or [Asana](#).



With these applications, the individual tasks in the project can be listed, and responsibilities and deadlines can be assigned (see Figure 3.6). Students open a planning interface for their project where they can create lists (e.g. “To Do”, “In Progress” or “Completed Tasks”). Cards can be added to these lists with a brief description of the task, but they can also include file attachments, links, comments and checklists. With the help of the application, students can decide which card and task to assign to which member of the group, who can then opt to receive email alerts about related developments and deadlines. With the comments feature of the cards, group members can give feedback to each other or indicate if they encounter a problem during the process. If necessary, the instructor can be added to the project’s planning interface, but often we do not need to intervene. (An application that supports project work can be viewed in action [here](#).)

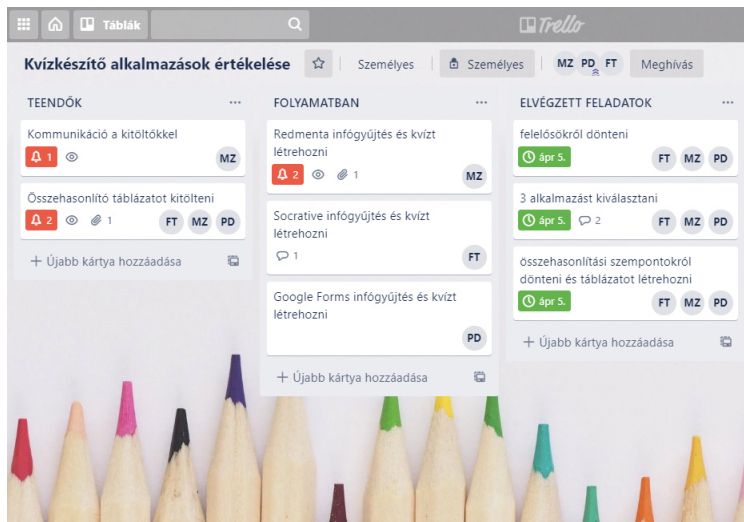


Figure 3.7. A design interface to coordinate project work created in Trello

To use digital technologies for peer-assessment and as a support for collaborative self-regulation and peer-learning.

Peer assessment and peer-learning play a major role in an individual's development and one of the benefits of *collaborative* tasks is that they provide a comparatively natural background for this. For example, a project abounds with opportunities for students' *formative* evaluation of one another: in shared document editors, they can support each other with comments and suggestions for changes, while on online bulletin boards, *likes* or textual evaluation can be added to the individual products making up the comprehensive task. As all this is going on, the instructor can see who gave what feedback to whom.

Here, too, it is true that the use of technology coupled with the right methodology is the best way to take advantage of these opportunities.

On the one hand, it is important that course participants are aware of the criteria the instructor will use to evaluate the collaboration or its product. It is advisable to make these benchmarks clear at the beginning of the work process, and if they are agreed on collectively, the students will also be able to give each other feedback according to the same criteria. On the other hand, the guidelines for constructive *peer assessment* should also be clarified with students (see *Chapter 4.3*). This kind of social feedback is efficiently supported by the pedagogical solution in which a student receives extra points in the final assessment for a constructive comment or suggestion that in some way contributed to the progress of their group mates. Constructive peer feedback can be motivated by informing the students that its purpose is to provide reciprocal assistance during the final stages of the construction of their work, prior to the instructor's evaluation. Of course, *collaborative activities* can be evaluated not only in terms of the work done and the output produced. Students can also reflect on the work process itself, e.g. the reasons why cooperation with certain of their peers was particularly effective or the causes of the difficulties they encountered.



3.4. Self-regulated Learning

To use digital technologies to support self-regulated learning processes, i.e. to enable learners to plan, monitor and reflect on their own learning, provide evidence of progress, share insights and come up with creative solutions.

In modern pedagogical thinking, the teacher-centred approach is replaced by learner-centredness, i.e. rather than teaching, the learning processes become the crucial factor. The teacher is present as the organiser and supporter of the learning process, while the active, *self-regulated learning* of the students is given precedence. We have already referred to *self-regulated learning* several times in this chapter, and under the label “learning to learn,” it has also become one of the key competences for lifelong learning (European Commission, 2019). One of the most important basic assumptions about *self-regulated learning* is that students are active participants in the learning process and are able to regulate their cognitive, motivational and emotional processes (Pintrich, 2004). One way to approach this notion is to examine its components and constituent abilities (e.g. efficient time management), but in one of the most common interpretations it appears as a cyclical process of three distinct phases.

1. Planning: in this phase, among other things, goals are defined and learning strategies are selected, while a role is also played by factors closely related to motivation, such as the learner’s belief in their own ability to learn (*self-efficacy* – see Bandura, 1977).
2. Implementation: this phase is characterised by self-control (e.g. focus on attention, constant monitoring of the learning process) and

self-perception (e.g. perception of how the learner’s own performance changes when they change their strategies along the way).

3. Self-reflection: as part of this, the learner performs self-assessment (e.g. in relation to their abilities and learning strategies) and attributes different reasons to their performance while reacting to the process in an adaptive or defensive way (e.g. by modifying less effective strategies as an adaptive reaction). The cyclical structure suggests that the processes of the self-reflection phase may affect motivation or further learning goals that feature as part of the next planning phase (Zimmerman, 2002, pp. 67-68).

According to the DigCompEdu framework, an instructor who sufficiently supports independent learning possesses the following abilities:

To use digital technologies (e.g. blogs, diaries, planning tools) to allow learners to plan their own learning.

Students may need support in how to plan their own learning. This type of assistance can take many forms, depending on how much freedom we wish to give them in choosing goals and modes of attainment, and on whether we are dealing with short or long-term plans (e.g. a plan to complete a task or planning what they want to achieve during the entire semester).

Student independence, responsibility, and motivation are also aided by the *learning contract*, which is a kind of agreement between the instructor and the student regarding the learning process (Hunt, Wiseman, & Touzel, 2009, pp. 176-177). The learning



contract declares students' learning goals, the activities through which they want to achieve these, and the ways to demonstrate that the knowledge was acquired – that is, this approach caters for *differentiation* and the free choice of different individual learning paths (on *differentiation*, see *Chapter 5.2*). In practice, this often means that, in addition to one or two compulsory assignments, the instructor offers a range of different types of assignments (see *Good Practice 5.1: Alternative student products*), and the student chooses which of these to complete in line with the defined goals.

Take, for example, a course aimed at developing the educational ITC competence of prospective language teachers: some participants will probably want to learn more about learning management systems, while some might already be familiar with them, and may prefer to explore tools supporting *collaborative learning*. The *learning contract* provides a separate framework for these different needs, but, of course, presumes a shift in the role of the instructor and entails more thorough planning. It is obviously not a practical solution for a survey lecture with a hundred students, but it may be the key to a more effective, personalised form of learning in smaller, practice-oriented courses.

Whether offered as an optional task in the *learning contract* or a compulsory assignment, students will receive great help during planning and execution if they are familiar in advance with the assessment criteria for a given assignment (or, where appropriate, if they develop self-assessment criteria with instructor or AI support). Some people find it easier to plan following examples and ready-made solutions: for example, student products made in the previous semester, which, depending on their nature

or our own preferences, can be stored in a *cloud-based* file-sharing service (e.g. [Google Drive](#), [One Drive](#)), on an online bulletin board (e.g. [Padlet](#), [Lino](#)), or within the learning management system in use.

Some guiding questions about the task in question are often helpful. Examples include:



- What is the purpose of the task? What do I want to achieve with it?
- What are the distinct phases and subtasks?
- How much time is needed to complete each phase and subtask?
How can progress be documented at the end of each phase?

These questions can be answered by students in a Google document and then continuously expanded as the task is completed, supplemented with reflective comments (e.g. if something is particularly difficult for them during the process, or if they try out a new strategy), and in this way we are already talking about a learning diary.

What's more, with planning tools such as [Trello](#) or [Asana](#), students can create a transparent, instructor-friendly plan for individual or shared assignments. Here we can list subtasks and assign deadlines, and one possible use of the comment function is to establish a dialogue between a student and the instructor about the challenges and achievements related to the subtask.

To use digital technologies to allow learners to collect evidence and record progress, e.g. audio or video recordings, photos.

In higher education, it is customary to supervise students' learning through text-based reports (e.g. home assignments, theses). Thanks to intuitive, user-friendly interfaces and applications, however, students can now also prove their progress with podcasts, videos, infographics, word clouds or mind maps, for example, following individual or joint research, or content processing (see *Good Practice 3.3: Word cloud and mind map bank*, 5.1. *Alternative student products*, and 5.2. *Summary Collage*). Students can also create products that are traditionally the task of the instructor: screen videos (e.g. [Loom](#), [Screencast-o-matic](#)), interactive videos (e.g. [Edpuzzle](#), [PlayPosit](#)), interactive worksheets or quizzes (e.g. [LearningApps](#), [Kahoot](#); see *Good Practice 2.2: The development of interactive learning material using creative software*, and *Good Practice 4.2: Test and quiz making with students, with a reliable scoring system*).



Do you consider students seeking and processing information independently or in groups to be an appropriate form of learning in higher education?

János Ollé:

In higher education, if we develop a working digital educational culture, we need to get to the level which is not only a culture of information gathering and sharing, but also a culture of production. Ideally, productivity should predominate, so we not only structure and select existing information from which to construct learning tasks, but at the same time, a new product, a new knowledge item, is also created. In the best case, this is not necessarily textual – students could express themselves in virtually any media format.



The huge advantage of content creation is that through this process, the application of knowledge comes to the fore. In addition, by giving students the opportunity to choose between such solutions, we are taking a step towards differentiation – bringing important aspects of *constructivist pedagogy* into play (see *Chapter 3.3*). All the same, it is undeniable that this type of task requires thorough background work on the part of the instructor (see the description of the previous activity). One of the conditions of creative work is that students use the technology needed to create the product with confidence. An instructor's support may be needed in this, and the best solution is to help the participants “remotely”, e.g. by setting up a forum where the students can answer each other's questions. They may be additionally supported with assistance in building and using their personal learning network (see).

To provide AI-based, personalised learning materials for students (e.g., adaptive tests, interactive learning modules).

One of the greatest opportunities offered by AI technologies is that they promote personalised learning, differentiated instruction (Chan, 2023; Mishra et al., 2023; Walter, 2024, see Chapter 5.2), and support independent learning. Students can use generative AI tools (e.g., [ChatGPT](#)) as personal tutors to process and practice the material, ask for explanations, ideas, and feedback.



For example, they can ask a chatbot for help with the following prompts:

- To explain complicated processes and concepts—e.g., *Explain the steps of [meiosis] in a simple way!*

- To organise the curriculum - e.g., *Create a comparison table from the theories in the attached lecture notes! Use the following criteria: [...].*
- To create materials for independent practice - e.g., *Create printable flashcards for the following key concepts: [...]!*
- To help them practice and test their knowledge, e.g. *Write 5 multiple-choice questions about [meiosis]! Do not mark the correct answers yet.*

In some cases, it is more effective to communicate with the chatbot using voice rather than text, for example, using the ‘voice chat’ feature of [ChatGPT](#). If a student is preparing for an oral exam, they can ask the chatbot to ‘ask’ questions about the material or to play the role of the examiner – even by asking exam questions based on uploaded notes or teaching materials. It is important to make the student aware that it is worth going into detail in the prompt: for example, what type of questions they expect from the chatbot, how complex they should be, whether they would like to receive feedback, and if so, according to what evaluation criteria or rubric, etc.

AI-based note-taking and content processing tools such as [Google Notebook LM](#) can also aid independent learning. The application creates summaries, timelines, mind maps, infographics, and even natural-sounding podcasts from documents uploaded by the user (e.g., PDF or [Google Docs](#)). For example, it can help students organise, understand, and visualise class notes or the literature covered in a given course. The generated podcast allows them to familiarise themselves with the course material even while on the go or doing other tasks.

That said, the applications mentioned here also require conscious, critical use on the part of the user, so it is a good idea to set aside time during

the lesson to experiment with them together. For example, you can analyse together how reliable a summary or podcast [Google Notebook LM](#) can produce from a well-known document, or what quality questions it asks and how relevant the feedback provided by [ChatGPT](#) is in the role of an examiner.



What are some ways educators can help their students become more apt at self-regulated and self-directed learning?

Johanna Szőke

Encouraging students to use multimodal GenAI tools to understand learning materials and to search for information can help them tailor the learning process to their own needs, thus making them more independent.



Click/Scan

To use digital technologies (e.g. ePortfolios, learners' blogs) to allow learners to record and showcase their work, as well as to enable learners to reflect on and self-assess their learning process.

Traditionally, a portfolio is a collection of a student's work that contains documents and products selected by the creator on the basis of a set of criteria, proves the student's progress and efforts, and is supplemented with analytical, interpretive reflection (Frey, 2014, p. 165, see also *Chapter 1.3*). A digital solution to this can also take the form of a *blog* or *e-portfolio*. Some *learning management systems* (e.g. [Canvas](#)) have their own *e-portfolio* service, but we can also use an external application developed

for this purpose, such as [Mahara](#). If we choose a blog, students' work can be collected in a suitable interface (e.g. [blogger.com](#), [wordpress.com](#)) or on an online bulletin board (e.g. [Padlet](#), [Lino](#), see *Chapter 3.3*). On these interfaces, collections can be expanded with textual, visual, multimedia and interactive content, i.e. all the mentioned outputs can be combined on them. Another advantage is that, compared to their paper-based equivalents, they can be easily shared with the whole group (or even published more widely), so that students can learn from each other's work and feedback.

If the task requires the creation of a product that can be used directly in students' later activities (e.g. in the case of a teacher training course, a worksheet or a video-based lesson), then we can encourage them to start working as a real professional community, saving each other's work, using it and adopting it to their own context.



Portfolios are not, however, simple folders or content sharing interfaces – they only adequately fulfil their function if they also include students' reflections. In these reflections, students assess their own work, evaluating the progress they have made and planning the next steps, thereby becoming more conscious of the various stages in their own development. Ideally, portfolios also act as a learning diary (see *Chapter 4.1*), meaning that students may also continuously reflect on the causes of difficulties, the learning strategies they implemented, how they cope with time management, etc. In a nutshell, a portfolio is not simply a tool for *self-regulated learning*, but it can also play a role in its development.

If all this is done in written form, the result is typically more thoughtful and structured, but some students may require the opportunity to record their thoughts in another media format, such as an audio file (see *Chapter 5.1* on inclusion). Since the goal is authentic reflection and not the parroting of supposedly expected terminology – aka the “evaluation game” (Stocks & Trevitt, 2008) – this solution is well worth considering as well.



To conclude the chapter, János Ollé shares his thoughts on the future of higher education practice in relation to the use of digital tools.



How do you see the future of higher education practice?

János Ollé:

Innumerable elements of higher education could be almost entirely feasible in an online environment. Why don't we create a marketplace for higher education learning materials instead of parallel training? Different institutions could bring their own existing theoretical training, such as their lectures, into this online curriculum market, developing an e-learning course. Students – or even instructors – could decide quite clearly which of these was the best. In this way, part of the training could be transformed in a way that would ensure excellent quality, and rather than leading to the elimination of in-attendance universities, the pedagogical culture within those universities would be transformed.



References

- Anderson, L. W., & Kratwohl, D. R. (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives*. Wesley Longman.
- Bandura, A. (1977). [Self-efficacy: Toward a unifying theory of behavioral change](#). *Psychological Review*, 84(2), 191–215.
- Bekiaridis, G., & Attwell, G. (2024). Supplement to the DigCompEdu framework: Outlining the skills and competences of educators related to AI in education. University of Bremen: Institut Technik und Bildung (ITB). <https://doi.org/10.26092/elib/2708>
- Bergmann, J., & Sams, A. (2012). *Flip your classroom: Reach every student in every class every day*. ISTE.
- Buzan, T., & Buzan, B. (2009). *The mind map book*. BBC Active.
- Cazzaniga, M., Jaumotte, F., Li, L., Melina, G., Panton, A. J., Pizzinelli, C., Rockall, E., & Tavares, M. M. (2024). [Gen-AI: Artificial intelligence and the future of work](#). Washington, DC: International Monetary Fund.
- Chan, C. K. Y. (2023). A comprehensive AI policy education framework for university teaching and learning. *International Journal of Educational Technology in Higher Education*, 20(38), 1–25.
- Digital Education Council Global AI Student Survey (2024).
- Downes, S. (2008). An introduction to connective knowledge. In T. Hug (Ed.), [Media, knowledge & education: Exploring new spaces, relations and dynamics in digital media ecologies](#) (pp. 77–102). Innsbruck University Press.
- European Commission (2019). [Key competences for lifelong learning](#)
- Frey, B. B. (2014). *Modern classroom assessment*. Sage Publications.
- Honebein, P. C. (1996). Seven goals for the design of constructivist learning environments. In B. Wilson (Ed.), *Constructivist learning environments* (pp. 11–24). Educational Technology Publications.
- Hunt, G. H., Wiseman, D. G., & Touzel, T. J. (2009). *Effective teaching: Preparation and implementation* (4th ed.). Charles C Thomas.
- [ISTE Standards for Educators](#) (2017).
- [ISTE Standards for Students](#) (2024).
- Johnson, L., Adams Becker, S., Cummins, M., Estrada, V., Freeman, A., Hall, C. (2016). [NMC Horizon Report: 2016 Higher Education Edition](#). The New Media Consortium.
- Kop, R., & Hill, A. (2008). Connectivism: Learning theory of the future or vestige of the past? *International Review of Research in Open and Distance Learning*, 9(3), 1–13.
- Larmer, J., Mergendoller, J., & Boss, S. (2015). *Setting the standard for project-based learning*. ASCD.
- Long, D., & Magerko, B. (2020). What is AI literacy? Competencies and design considerations. *CHI '20: Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*. 1–16.
- Miao, F., & Shiohira, K. (2024). [AI competency framework for students](#). Párizs: UNESCO.
- Mishra, P., Warr, M., & Islam, R. (2023). TPack in the age of ChatGPT and Generative AI. *Journal of Digital Learning in Teacher Education*, 39(4), 1–17.
- Nahalka, I. (2002). *Hogyan alakul ki a tudás a gyerekekben: Konstruktivizmus és pedagógia*. Nemzeti Tankönyvkiadó.
- Ollé, J., Ruszkai, N., & Hülber, L. (2017). A túlközött osztályterem módszertana és tanulásszervezése. In Hülber, L. (Ed.), *A digitális oktatási kultúra módszertana* (pp. 127–143). Eger: Eszterházy Károly Egyetem.
- Pintrich, P. R. (2004). A conceptual framework for assessing motivation and self-regulated learning in college students. *Educational Psychology Review*, 16(4), 385–407.
- Pritchard, A., & Woollard, J. (2010). *Psychology for the classroom: Constructivism and social learning*. Routledge.
- Ravšelj D, Keržič D, Tomažević N, Umek L, Brezovar N, et al. (2025). Higher education students' perceptions of ChatGPT: A global study of early reactions. *PLOS ONE*, 20(2). <https://doi.org/10.1371/journal.pone.0315011>
- Redecker, C. (2017). *European framework for the digital competence of educators: DigCompEdu*. Joint Research Centre.
- Smith Budhai, S., & Brown Skipwith, K. (2017). *Best practices in engaging online learners through active and experiential learning strategies*. Routledge.
- Stocks, C., & Trevitt, C. (2008). [Signifying authenticity: How valid is a portfolio approach to assessment?](#)
- Szabó, F., & Szoke, J. (2024). How does generative AI promote autonomy and inclusivity in language teaching? *ELT Journal*, 78(4), 478–488.
- Touretzky, D., Gardner-McCune, C., Martin, F., & Seehorn, D. (2019). Envisioning AI for K-12: What should every child know about AI? *Proceedings of the AAAI Conference on Artificial Intelligence*, 33(1), 9795–9799.
- Walter, Y. (2024). Embracing the future of Artificial Intelligence in the classroom: the relevance of AI literacy, prompt engineering, and critical thinking in modern education. *International Journal of Educational Technology in Higher Education*, 21(15), 1–29.
- Zimmerman, B. J. (2002). [Becoming a self-regulated learner: An overview](#). *Theory into Practice*, 41(2), 64–70.

4. ASSESSMENT

László Hülber

Introduction

Assessment is a distinct and organic part of the pedagogical process which is simply indispensable. Being an activity which digital tools can efficiently support, the European framework for the *digital competence* for educators appropriately dedicated a separate area for it. The results of the Hungarian DigComEdu survey (Horváth et al., 2020) – in line with international research findings (Viberg et al., 2024; Fink et al., 2023) – indicate that educators face significant challenges in the area of technology-supported assessment. Based on this, the modernisation of assessment practices can be identified as one of the priority areas for educator competence development.

Assessment determines the entire educational process, and delivers information that measures the goals, content, the teaching and learning process, and the accomplishments of the learner, while also contributing to a more efficient organisation of teaching and learning from the perspectives of both instructors and students alike (Astin, 2012, p. 2). The accomplishment of our goals can only be confirmed through appropriate assessment procedures. For each piece of content and each learning or educational process, an assessment strategy must be developed. It should be used in practice for support, development and evaluation, and at the end of the

process feedback should be provided to all the stakeholders. One of those stakeholders is the instructor, who can correct the planning and implementation of the pedagogical process depending on the achievement of the designated goals.

Instructor feedback plays a key role in students' educational life and in the development of their personality. It shapes students' attitudes towards each subject, the instructor, the institution, and the whole process of study itself. Together with learning motivation, how they are assessed and the significance they attribute to this can be fundamental factors in students' development of learning strategies and their thinking about learning. Assessment provides a norm and a benchmark against which to evaluate their environment, including their peers and themselves, and therefore it is also considered a method of education (Secolsky & Denison, 2017).

The pedagogical views of educators – and thus their assessment strategies – are determined by their personal experiences of studying and the educational culture in which they were socialised. This has unfortunate negative consequences in various areas. For example, assessment may become a means of disciplinary action or the exclusive way to motivate students. This leads to the common and legitimate criticism that grades become the sole purpose of learning, i.e. students do not study for knowledge itself and they develop a learning strategy that focuses on performance at the points of measurement. The underlying reason for this often lies in the dominance among established forms of evaluation of *summative* assessments. A typical example from higher education is that the assessment of students is carried out in the form of one or end-of-module tests or exams, disregarding continuous *assessment* and diagnostic and *formative* possibilities. Such a scenario provides no information for the students about their own development before the given test. In addition,

learners may well become overanxious about their performance on those one or two appraisals because there are limited options for correction. If during the learning process they have no insight into their performance, students can easily develop misconceptions about their own learning progress. Instead of being motivated to acquire the knowledge that interests them, they are encouraged to concentrate on the specific content and the specific manner required by the given examination. Following this logic, it is easy to see how preparation for assessment supplants learning as the focal point of the pedagogical process. If instructors themselves studied in a similar type of assessment system or received the same inheritance, they can repeat the same patterns without being aware of the necessity of and the possibility for change – and its potential pedagogical benefits.

A revaluation of pedagogical assessment calls for the development of new strategies with clear goals – and planning and the subsequent choice of tools should be subordinated to these goals. In this process, as with all integration of digital devices into learning and teaching, this is the appropriate order of importance. Of course, this requires familiarity with the solutions provided by technology. Once we are aware of our options, we can select the suitable tools for our goals. Having said this, however, we do not need to dispense with traditional non-technological solutions if they are more efficient.

We interviewed the experts Gyöngyvér Molnár (University of Szeged), and Tibor Prievara (Eötvös Loránd University Apáczai Csere János Practice School and Dormitory, Budapest) about the topics in this chapter.



How can digital technologies improve the efficiency of existing assessment strategies?

Gyöngyvér Molnár:

Technology provides opportunities for assessment that we could not even imagine before.



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Tibor Prievara:

If we expect technological tools to improve or change assessment, we are probably looking in the wrong direction.



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Technology can support assessment in many ways – its significance is well illustrated by the fact that the European Commission has been promoting the use of computer-based data collection in testing for more than 15 years (Bjerkestrand, 2009). Large international assessments, such as PISA, have now switched to digital testing formats. This trend can also be observed at the national level: following the lead of countries such as the United States and Luxembourg in Europe, computer-based testing is now used instead of paper-based in Hungary.

Csapó, Ainley, Bennett, Latour, & Law (2012) collect the advantages of the application of technology in measurement and assessment and systematically organise them into a hierarchy, highlighting the following aspects:

- The administration of measurement and assessment is simplified: it is easier to create, edit and distribute tasks, and the storage, analysis and visualisation of the results is also greatly facilitated by technology.

- The use of automated assessment techniques is time- and cost-efficient, potentially leading to more measurement and assessment, and more feedback on the learning process.
- Computer-based evaluation delivers more accurate results, and if tasks requiring manual correction are not used, the results are available immediately after the survey. This may increase the efficiency of feedback on learning.
- Exploiting multimedia, interactive elements and adaptive techniques, twenty-first century skills can be measured and assessed in twenty-first century ways.



The emergence of generative AI has triggered a transformation on a similar scale and scope to that brought about by the spread of digital technologies, but the new tools are able to leverage these advantages even more dynamically and effectively. Bekiaridis & Attwell (2024, p. 35) summarise this with regard to assessment as follows:



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AI competencies in assessment include the use of AI tools for effective and efficient student assessment. This may include automated assessment systems, AI-driven analytics for assessing student progress, and the use of AI to provide personalized feedback and support.

Accordingly, it is now even easier and more effective to generate tests and test items with the help of artificial intelligence. Automated assessment is entering a new dimension: the technology-based assessment of not only

long text responses, but also multimodal student work has become feasible (Gao et al., 2024). Objective assessment can be further enhanced and time spent providing on feedback reduced. The concept of adaptivity is truly coming into its own, as personalised, meaningful, and relevant machine feedback is now possible. Furthermore, based on learner results, AI systems can immediately generate adaptive learning paths and teaching materials, thus supporting the corrective mechanisms of learning (Naseer et al., 2024). Based on learner analytics, patterns can be easily identified without in-depth data mining knowledge and complex calculations, thus allowing relevant conclusions to be drawn for the pedagogical process (Sembey et al., 2024).

At the same time, the integration of AI-like any revolutionary change—also creates a number of ethical, pedagogical, and data protection challenges. One of the main questions is to what extent the use of AI should be permitted in the preparation of student assignments and theses. How can and should this be monitored? Algorithmic bias and lack of transparency in AI-based systems also pose significant ethical challenges, as these systems often operate as ‘black boxes’ and the reasons behind their decisions are not always clear to users. The introduction of Generative AI into education is changing the role of teachers, who must adapt to new technologies. However, many educators do not have the appropriate training to use AI tools effectively (Global AI Student Survey 2024). Overuse of AI can reduce students’ autonomy and critical thinking, and also raises several data protection issues. These problems necessitate the formulation of rules and frameworks for the use of AI in higher education that ensure its ethical, transparent, and effective introduction into educational processes (Foltynek et al., 2023).

DigCompEdu breaks down the field of assessment into three components, and this chapter is structured according to this logic.

These three components also follow the timeline of the assessment process: first, *Chapter 4.1., Assessment strategies*, followed by *Chapter 4.2., Analysis of facts and evidence*, and then *Chapter 4.3., Feedback and planning*. The subchapters vary significantly in scope, as the first one describes the tools needed to develop an assessment strategy for each type of assessment, as well as the available technological solutions. In comparison, the other two subchapters cover fewer activities and therefore contain less information.

Since the intended readership may not necessarily have a background in pedagogy, the basic conceptual framework of the topic is briefly outlined in the presentation of the DigCompEdu assessment sub-areas. Related to this are innovative assessment solutions and best practices, with a particular focus on the use of technology, including AI.

4.1. Assessment Strategies

To use digital tools for formative and summative assessment. To enhance the diversity and suitability of assessment formats and approaches, and employ them in a personalised way.

Educational innovation can be effective if, along with the development of goals, content and methods, assessment practice also improves. Before developing a toolkit for this, it is important that instructors examine their own concepts of assessment, and the possible consequences of any changes they might make. These concepts exert an influence on the range of values students are encouraged to acquire and also affect the steps taken to achieve them. For learners, assessment tends to be associated with their grades and their advancement in academic life; later it will surface in job interviews and

promotions, and in their private lives when, for example, applying for a bank loan. Unfortunately, no emphasis is put on the aim of assessment, which is to support the learning process through analysis, affirmation, motivation, and the identification of gaps. In developing a modern assessment strategy, the following guidelines should be considered:

1. We should use assessment mechanisms that prevent students from focusing their learning strategies on merely obtaining satisfactory grades.
2. We should perform diagnostic analyses to identify the heterogeneous cognitive and affective factors of students. We should use the results of the analysis to plan and organise the learning process together.
3. We should provide continuous and varied assessment opportunities so that students may reflect on their learning processes more frequently and meaningfully and have the chance to make any necessary changes.
4. We should provide alternatives to the manner in which a course is completed – and elective activities accounting for graded assessment – and allow students to change their strategies during the course and to retry certain activities.
5. We should store, publish and analyse data from assessments and from other sources of information systematically, and draw conclusions about the correction and planning of the teaching-learning process for all stakeholders (*chapters 4.2 and 4.3*).
6. We should use technology and seek innovative ways to use AI in the implementation of the aforementioned guidelines, but always subordinate it to the pedagogical goals so that the effectiveness, reliability and validity of the assessment increases and reaches an appropriate level by ensuring that no students are adversely affected.



4.1.1. Defining the Goal of Assessment

Guideline 1 above is related to the clarification of the assessment's function. When students in higher education clearly have fixed learning strategies, and the most important element of this is probably a focus on performance, it may sound idealistic to try to prevent the purpose of learning being grade-oriented. It would be naive to think that the majority of students would not tend towards “the path of least resistance” in an era when the validity of education is questioned at all levels and in all types of institution.

In the course of assessment, we always compare the results of learning to the goals, so defining our goals is a step closely related to assessment. The effectiveness of assessment is fundamentally determined by the quality and method of the definition of our goals. A coherent system of goals is needed – one which provides the means to record the changes in personality, behaviour and performance that are effected by learning (Astin, 2012).

In the definition of goals, we regard the *learning outcomes* approach as the example to be followed. This is an action competence description defined in the context of knowledge + skills + attitude + autonomy and responsibility, in line with the European Qualifications Framework. It defines what students know, what they understand, and what they can do independently after completing a learning process, regardless of when, where and how these competences were acquired (European Union, 2011). To date, Bloom's hierarchical taxonomy system (remembering, understanding, applying, analysing, evaluating and creating) is the starting point for the definition of the competency organisation levels of *learning results*. Furthermore, in order to differentiate between dimensions of knowledge, it is worth using the system to distinguish between the dimensions of thinking, application (social), and disciplinary knowledge as described by Csapó and Szendrei (2011).

Instructors are not completely free in the definition of goals, so it is a misconception that students can be fully involved in this process. All the same, if students are involved in the definition of sophisticated individual learning goals (sub-goals within the main goals), they will feel that such goals are their own. One of the development proposals of reform pedagogy is to involve students in the definition of goals, methods, forms of attainment and their assessment. If students are appropriately involved in these processes, their attitude and motivation will be completely different during the whole learning process.

One potential example of the above is the so-called *learning contract*, which significantly relies on *self-regulated learning* and individual responsibility. With its help, each student agrees with their instructor on the learning path they wish to follow, the goals they wish to set, the means to achieve them, and the assessment tools they wish to choose.



There is hardly any part of education nowadays which does not have dedicated AI-based applications available. The development of learning outcomes is no exception. However, it is worth noting that some of these applications pay special attention to ensuring that these outcomes are measurable. For example, the AI-based learning outcome generator module in LearnWorlds LMS allows users to enter a brief description of a given topic or course and then use artificial intelligence to formulate learning objectives that meet SMART requirements (Specific, Measurable, Achievable, Relevant, and Time-bound).

In order to meet the condition of measurability, the objectives generated by the platform clearly define the 'what' (e.g., 'understands', 'applies', 'analyses') and the 'how' (e.g., 'through practical tasks', 'in the form of tests').



The system avoids the use of vague, generic, or difficult-to-interpret terms (such as 'becomes familiar with') and instead suggests verbs that express measurable, active actions (such as 'categorises', 'plans', 'calculates').

The platform also has a built-in 'measurability check' function, which can be used to verify that the objectives set actually meet the SMART criteria. In addition, the system suggests specific assessment methods tailored to the type of learning material, such as quizzes, practical tasks, or self-assessment sheets. Similar applications can be found integrated into other LMS systems: [iSpring](#), [EdApp](#); and in the form of dedicated applications: [MagicSchool](#), [Auto Classmate AI Lesson Plan Generator](#), and [Easygenerator](#).

4.1.2. The role of diagnostic assessments and technology-based assessment tools

A recommended first step in entering the learning process is the (2) diagnostic evaluation of learners.

The purpose of this type of assessment is to ensure that the teacher and the institution are familiar with students' prior knowledge and attitudes, and to collect information on the conditions under which they are starting the given stage of education. In an ideal case, *diagnostic evaluation* can play a key role in determining the content, the methods, and the modes of assessment (Csapó & Szendrei, 2011). *Diagnostic evaluation* is particularly important in *constructivist pedagogy*, because it always determines the structure of new constructions in relation to previously formed constructions.

Based on the results of the *diagnostic survey*, a *differentiation strategy* can be developed, and in the case of pair work and group work, homogeneous or heterogeneous student groups can be established according to the various

criteria assessed. When performed before the actual start of the learning process, this information allows us to identify students who do not have the cognitive or affective parameters appropriate to the entry level. Personalised individual sessions can be started immediately with them, and the same applies to those who have performed outstandingly. Diagnostic assessments can be carried out not only at the start of a course, but also, if necessary, before beginning each topic. These assessments may not be closely related to each other, and, for example, there may be a considerable divergence between the preliminary knowledge of individual students, or they may be influenced by other affective factors related to the given subject. The use of such *diagnostic assessments* is also justified by the peculiarity of higher education in that students and instructors are generally connected for only one semester. As a result of this, educators have little insight into students' abilities and their previously acquired knowledge (Secolsky & Denison, 2017).

Diagnostic assessment can be effectively carried out using digital tools, for which learning management systems (LMSs) offer excellent opportunities. Some higher education institutions provide access to these systems (e.g., [Canvas](#), [Moodle](#), [CooSpace \(CourseGarden\)](#)), while in other cases, educators use their own preferred systems (e.g., [Google Classroom](#), [Blackboard Learn](#), [Cypher Learning](#)). Since the basic function of learning management systems is that we can make tests, it is fairly obvious to carry out *diagnostic* measurements through these interfaces. As these tests do not have any impact on the completion of the course, or there will be no good or bad answers when exploring affective factors such as attitudes or learning styles. (Therefore, they do not even belong to the category of tests as a pedagogical concept, but in the software we access these services under this label. The tools, however, can be used not only for grading, but also for *diagnostic* or *formative purposes*.)

This assessment does not require actual attendance; students can also do it at home (we can circulate it through our LMS). In this way we can prepare for our first class with the submitted information in mind.



If we do not employ a learning management system, we can use a variety of software for test-based data collection, including measurement for *diagnostic* purposes. For example, the Hungary-developed, Redmenta app (available in many languages) is increasingly popular. This multiple Bett Award-winning app offers more than 160 AI-based educational services. It has evolved from a test and assignment creation system into a full-fledged AI-based teaching assistant. A wide range of test and questionnaire editors are also available, from which it is always recommended to look for the right one based on our individual needs and opportunities. (e.g. [Classmarker](#), [E-assessment](#), [QuizStar](#), [EasyTestMaker](#) or the [German Eas.lit](#)). If we use a questionnaire editing service (e.g. [Google Forms](#)), we have to take into account the fact that the answers will not be evaluated as in a traditional test – there is no feedback on for students regarding questions that have correct or incorrect answers. In actual fact, all we will see is which response options are marked by what percentage of the students.

In the last five years, there has been a marked increase in the popularity of interactive response systems (e.g. [Socrative](#), [Kahoot!](#), [Formative](#), [Verso](#), [Quizizz](#), [Quizalize](#)). We can use these solutions to assess students on their own ICT devices. The most important advantage of this is that instead of relying on the infrastructure of the higher education institution, we only need Wi-Fi and the students' devices. [Mentimeter](#), [Slido](#) or [Nearpod](#), for example, are actually presentation applications that allow the audience to be involved in various interactive activities, including questions (see

Chapter 3.1). Interactive response systems can also be used for all three types of assessment, including *diagnostic*.

If our diagnostic assessment focuses on affective factors and concerns sensitive topics, in the interests of obtaining more reliable results. Data collection can be set to “anonymous”.



In practice, *diagnostic evaluation* is often carried out only in the form of oral questions, but that does not allow us to perform comprehensive data collection among all the students. This is why technology-based solutions offer a wider range of possibilities.

Artificial intelligence-supported measurement and assessment systems typically cover a larger area than diagnostic assessment alone. These applications are not only used to assess students' current knowledge, but also offer personalised learning paths, course content, and complex tutoring solutions to support learning after immediate evaluation of the results.

If we focus solely on the possibilities offered by AI in diagnostic assessment, the major innovation is that adaptive testing has become available. In this process, the system automatically generates questions and dynamically modifies their difficulty level and subject matter based on the student's answers. This allows it to accurately map the student's existing knowledge and gaps.

An even higher level of application is the AI-supported use of the Knowledge Space Theory (KST). This is a mathematical and pedagogical framework suitable for the structured modelling of students' knowledge. The theory focuses on examining how knowledge elements (such as concepts and skills) build on each other. Based on the resulting graph, artificial intelligence can determine which specific knowledge elements



the learner has acquired and which are missing. We can then create a knowledge map that visually represents the learner's gaps. The system not only indicates that the learner has given an incorrect answer, but also why: which prerequisites are missing for understanding. The system then recommends tasks that help the learner acquire the missing prerequisites. The goal is not to follow a linear learning path, but to develop the missing 'nodes' (Ayele et al., 2022; Doble et al., 2019; see: ALEKS, Squirrel AI).

AI technology also makes it possible to predict students' future performance based on their previous learning and demographic data, without the need for diagnostic testing. Predictive algorithms—such as *random forest* or deep learning models—can effectively predict how well a student will perform in a given course or even achieve a specific learning outcome. These models are most effective when they take into account student activity, behaviour patterns, and environmental factors. This allows for the timely identification of students at increased risk of underachievement. This creates opportunities for early, targeted pedagogical intervention and the development of personalised support strategies. If these models are supplemented with diagnostic measurements, even more accurate and targeted interventions become possible, further reducing the likelihood of attrition (Wu & Liu, 2023).

4.1.3. The role of AI in assessment and evaluation processes

Artificial intelligence has created a new category of applications used in assessment and evaluation. Regardless of the purpose for which they are used (diagnostic, formative, or summative), they offer similar innovative possibilities:

1. automatic item generation,
2. evaluation of open-ended items and tasks,

3. advanced feedback: provision of corrective feedback, reports (see section 4.3).

(1) Large language models are capable of efficiently generating test items automatically (*Automatic Item Generation*, AIG). The use of AIG can significantly reduce the workload of educators, as it enables the rapid production of a large number of varied and unique test items. Studies recommend hybrid approaches that combine the advantages of human expertise and AI-based methods. Song & Zheng's (2025) literature review confirms that the use of AIG technologies not only increases testing efficiency but also contributes to the personalisation of the learning process and improves the reliability of assessment.

AI technology can be brought to life through dedicated applications, but bear in mind that many such systems work with the same prompts and language models that are already familiar to us. The difference is that they have a more impressive user interface than a simple chatbot design solution. Their starting prompts are presumably well written, and after requesting one or two pieces of data, they present the response generated by the language models in an aesthetically pleasing format.

If the end result is not satisfactory, or if we find the price of such a program too high, it is worth using custom prompts. Editing, testing, and refining prompts can lead to more conscious use, customisation options, and more effective solutions.

When using prompts for this purpose, consider providing the following parameters:

- the age of the students,
- subject you're teaching,
- topic (specific concepts, terms, facts),

- Bloom's taxonomy levels,
- teaching objectives (e.g., critical thinking, understanding connections, memorising facts),
- test structure:
 - task types (distribution/number of items),
 - difficulty level (distribution/number of items),
- scoring,
- output format.

Sample prompt:

Role: Act as an experienced university educator who uses artificial intelligence to generate test questions.

Goal: Generate 10 multiple-choice questions on the following topic: 'Cell biology – Structure and function of cell membranes.'

Learning objectives:

- Students should recognise the main components of cell membranes.
- They should understand the significance of membrane fluidity.
- They should be able to apply this knowledge to different cell types.

Bloom's taxonomy levels: Remembering, understanding, and applying.

Question type: Multiple choice, with four possible answers and one correct answer.

Format:

- Question text

- A) Possible answer
- B) Possible answer
- C) Possible answer
- D) Possible answer
- ****Correct answer**:** [A/B/C/D]

Make sure that the questions are varied and cover the specified learning objectives.

Truly valuable AI-based educational software uses finely tuned language models trained on domain-specific educational corpora (e.g., university essays, course materials, specific research results) and other language processing algorithms optimised for educational purposes. It is always worth checking for the presence or absence of these before purchasing software.

If we want applications for automatic item generation, [Assess.ai](#), [Questgen](#), and [PrepAI](#), for example, are recommended. These typically work by providing the learning content in some format (PDF, Word, video, URL, etc.), keywords, relevant knowledge, question types, and difficulty levels, and then the software generates the questions based on this information. As Bekiaridis & Attwell (2024) put it, AI technologies are used appropriately when this is done consciously. As such, the process of generating items cannot be fully automated. All generated test tasks must be checked responsibly.

(2) The use of AI in the assessment of open-ended, text-based, and multimodal student products can revolutionise the culture of educational assessment. The spread of computer-based assessments has led to the widespread use of closed-ended items. Since these types of tasks can be graded automatically, they allow for completely objective assessment, as well as being faster and more cost-effective.

Generative AI technologies offer significant advantages not only in content creation, but also in the interpretation and processing of text, audio, images, and video, which can be particularly useful in the evaluation of open-ended tasks. For example, an LLM not only grades students' essays, but also recognises logical structure, stylistic consistency, and depth of argumentation (Jauhiainen & Garagorry Guerra, 2024). According to the latest research, large language models are able to evaluate open-ended responses with particularly high accuracy when they are fine-tuned on specific educational data (Li et al., 2025).

However, despite these promising results, there are still many challenges regarding the reliability of the evaluations. The use of synthetic (artificially generated) data to train models is a promising option, but their accuracy varies when applied in real-world settings, as these data do not contain the random cases that occur in real responses (Capdehourat et al., 2025). A common problem is the 'black box' effect, where model errors cannot be traced back. Human assessment is currently irreplaceable, especially in areas where responses require creativity and critical thinking. Here, too, hybrid approaches may be the most effective, such as incorporating teacher review. According to Li et al. (2025), the way forward is for the system to request human review only when the model's reliability value falls below a predefined threshold.

If we want to perform automatic evaluation using prompts, consider defining the following parameters for open-ended tasks:

- original task description,
- evaluation criteria and associated scores,
- [examples],
- [input data format],
- output format.

Sample prompt:

You are a university professor of philosophy who has been educating students in Plato and Aristotle for several years. Your task is to evaluate the essay submitted by a student based on the criteria below.

Task description: The student was required to analyse Plato and Aristotle's concepts of truth in 800-1000 words, comparing their perspectives and reflecting on how they influenced the development of modern ethical thinking.

Evaluation criteria, with scores:

1. Topic relevance and content accuracy (25 points):

- 25 points: Comprehensive and accurate definition of the concept, the views of both philosophers are clearly presented, no essential elements are omitted.
- 15–24 points: Significant gaps in content – for example, the views of one philosopher are not sufficiently explained, but the basic points are correct.
- 0–14 points: Several errors in content or extensive omissions.

2. Structure and logical organisation (20 points):

- 20 points: Clear introduction, well-structured discussion and conclusion, coherent and smooth flow of ideas.
- 10–19 points: Some logical leaps, or the introduction/discussion/conclusion is unclear.
- 0–9 points: Confusing structure, incomprehensible logical arc.

3. References and examples (20 points):

- 20 points: Appropriate use of Plato and Aristotle texts, accurate quotations, and relevant secondary sources consulted.
- 10–19 points: Necessary quotations are present, but critical use of secondary sources is lacking or some quotations are inaccurate.
- 0–9 points: Missing or incorrect quotations, unreliable sources.

4. Critical thinking and reflection (20 points):

- 20 points: Not only presents the views of the two philosophers, but also draws their own conclusions and analyses the significance of these views from the perspective of modern ethics.
- 10–19 points: There is some reflection, but critical thinking is only superficial; conclusions are not sufficiently substantiated.
- 0–9 points: Only descriptive, with little or no critical analysis.

5. Grammar and style (15 points):

- 15 points: Complies with all spelling and grammar rules, style is academic and fluent.
- 8–14 points: Minor errors (grammar, comma usage), but they do not hinder comprehension.
- 0–7 points: Many structural errors that make comprehension difficult.

6. Summary (100 points in total)

Output format:

- Score per dimension (e.g., 'Topic relevance: 22 points')
- Brief, constructive feedback for each dimension (3–4 sentences)
- Total score (e.g., 'Total: 87 points/100')
- Brief summary (in 1 sentence), main strengths and main areas for improvement

Hungarian company Redmenta is a leader in AI-based assessment of test tasks, promoting its ability to process essays, video responses, and visual tasks. The free [MagicSchool](#) offers many other AI educational solutions, including the assessment of open-ended tasks. [Gradescope](#) can automatically evaluate handwritten content. The system automatically groups similar answers, radically reducing correction time. [Cognii](#) is also capable of analysing and evaluating short audio or video tasks, while also examining conceptual understanding and logical deficiencies. It is characterised by natural language processing and innovative applications of machine learning. Its *Virtual Learning Assistant* module initiates chatbot-style conversations with students, who answer questions in their own words and receive immediate feedback. According to their data, the system's scoring matched that of human evaluators 96% of the time for short essays.

4.1.4. Development of a Diversified Assessment System

Following the diagnostic assessment, goals can be refined, methods can be determined, and forms of attainment can be selected (together with the students). The process of learning begins in different ways. During this process we should use as many diverse assessment techniques as possible, utilising both the *formative* and the *summative* functions of assessment

(guideline 3 above). It is advisable to use the opportunities offered by digital devices as the target activity prescribed by DigCompEdu states below.

To use digital assessment tools to monitor the learning process and obtain information on learners' progress.

Recent international studies (UNESCO, 2023) show that assessment is not the area where educators use digital technology most frequently, meaning that Europe is lagging behind North American universities. In higher education practice, *summative* assessment tends to be the predominant type, although *formative* assessment can significantly contribute to the success of learning. The aim of formative assessment is to shape, control and facilitate the learning process. It should express confirmation of work well done as well as exploring any gaps in learning. It provides feedback on these things for the purpose of correction, and proposes ways of implementation. A support and development assessment is successful if we precisely define what students do and do not know, if the feedback is immediate and specific, and if the development guidance takes individual characteristics into account (Astin, 2012).

Pedagogical textbooks usually describe *formative* assessment as being verbally implemented. Despite this, the use of digital technologies is indispensable in this area. In higher education, there is insufficient time and opportunity to provide consistent verbal evaluations to all students, yet we can perform *formative* assessments through various digital platforms regardless of physical proximity. In addition, we can give drills involving diverse digital services, even with integrated automatic feedback mechanisms. *Since the advent of generative AI, this kind of feedback can now come close to the level of a real educator. Mechanisms can be built in that*

emphasise detailed explanations of mistakes, student motivation, or other pedagogical goals. Compared to previous machine-automated, generic feedback, AI-based assessments can be highly customised and even personalised. In this way, students receive continuous feedback, for which the formative assessment type is best suited.

To use digital technologies to enhance formative assessment strategies, e.g. using classroom response systems, quizzes, games.

For *formative* evaluation purposes, we can use interactive classroom response systems by, for example, projecting questions, waiting for answers to each of them, reflecting on the results, discussing the shortcomings, and clarifying knowledge. In such cases, it is pedagogically better to speak generally on the knowledge of the whole group rather than highlighting one or two students who did not know the correct answer. For this reason, when assessment is carried out before an audience, the preferred mode of data collection is anonymous. Interactive response software can be used in pairs and groups, and we can organise quizzes to create a competitive situation.



By its very nature, assessment creates a competitive environment in a number of situations. It would be hypocritical to eliminate this from pedagogical processes when competition for social goods is an integral part of our lives. Competitive situations may galvanise motivational energies which can produce actual *learning outcomes*. The appropriate methodological attitude can be to encourage and assess both intragroup competition and



cooperation in a balanced way. Students who constantly underperform in competitive situations can lose motivation and become frustrated, yet the opposite may be true of those who perform well. It is therefore important to provide everyone with a learning situation and a form of assessment through which positive and helpful feedback can be given.

There are countless task editors, worksheet generators, software suites and applications that check and develop knowledge in a playful form, and with them, students can test their knowledge and collect feedback about the effectiveness of their learning processes. In this case, we typically turn to solutions outside the learning management system because LMSs do not contain such integrated opportunities, or they are limited in their functions.

As an example, a task editor application already widely used in public education environments is [LearningApps](#) (Figure 4.1). As well as offering many types of tasks and supporting *differentiation*, the application has many other advantages: it is cross-platform and provides a link and a QR code to the completed task, while also giving an embedded html code, with which we can integrate the task into our learning management system. We can create student groups, assign tasks to them, and track their progress in a table. Another application with several playful elements is [WordWall](#), and attractive interactive tasks can be created with, for example, [Wizer](#). For higher education use, the [H5P](#) plugin that can be integrated into LMSs is more commonly used.

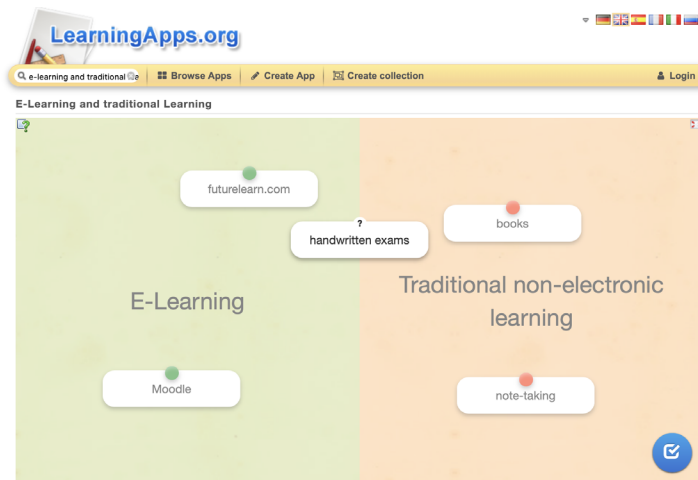


Figure 4.1. LearningApps task

[Quizlet](#) offers the digital version of printed word cards, which are most useful in language teaching, but can also be useful for mastering concepts or lexical knowledge in any discipline. The site supports the process of mastering the word cards; it facilitates learning and, through the tasks, revision as well. It skips what has already been learned, and makes users practise the word cards until even the more problematic ones are memorised. The tool generates multiple task sheets from the words that are entered. In *Quizlet live*, two or more automatically generated learning groups compete with each other and use their smartphones to answer the questions. Giving the correct solution requires active communication within the group, since only one of the options given is correct, and it is displayed on the device of only one member of the group.

In recent years, digital versions of escape rooms have become very popular. In these games, students must complete tasks embedded in a motivating narrative framework. The story progresses as the tasks are completed; when one task is solved, the player moves on to the next part. The story is always driven by some ultimate goal, such as escape or finding treasure. Practical experience shows that both students and educators enjoy this type of gamified approach. It can also be applied in higher education and is suitable for group-level tasks, thus developing cooperation skills in addition to problem-solving abilities. In terms of applications and websites, [Genially](#), primarily known as a digital content creator, also offers this service, as do [Breakout EDU](#), [Room Escape Maker](#), and [Actionbound](#), if the intention is to develop something using GEO location.

Above, we described digital task editing solutions where the software typically provides automatic forms of *formative* assessment. ICT tools can also be effectively used to process the information to be acquired by instructing students to transform the new material into a digital product (a presentation, a video, a digital poster, etc.). In order to complete this task, students must find, understand, and process the content selected for learning, and the products they create can be used not only for course completion, but for the purposes of practice as well, and we can thus associate this process with *formative* assessments.

The advocacy of this methodological technique is linked to modern pedagogical ideas, especially in higher education, as it has long been established practice in public education. On the one hand, it creates opportunities for the application of knowledge, as opposed to the recall of lexical knowledge that is measured by tests. On the other hand, if these tasks are not performed individually but are organised into projects and group work, they are also suitable for developing cooperation skills. This method, recommended by

educational experts, has become increasingly widespread in recent years. This is also because, in this way, higher education has been able to adapt to the needs of the labour market by developing desired skills, such as problem solving, creative thinking, and cooperation.

However, the emergence of generative AI has brought about a turning point: with a simple task description and a few well-targeted prompts, students can now produce results that previously required significant creative work. This raises the question of what to do: should we take a step back methodologically and the application of knowledge should again be (poorly) assessed with tests?! Or, to put it another way, should the ability to recall lexical facts measure the existence of knowledge?

With the use of AI, it is easy to get caught up in a vicious circle. The educator uses AI to generate tasks, for which the students use AI to generate their solutions, which the educator then evaluates using AI. In the end, no one is actually working, only the AI, which is extremely costly and completely ineffective. To solve this problem, best practice 4.3 is recommended, which essentially involves using AI to check whether the student has done the work themselves or not. A similar solution is to make it part of the assignment to ask the student to present the product, or, in the case of group work, to do this collectively, involving everyone. This is a desirable approach from a methodological point of view, but it is often not feasible due to time pressure. AI-based checking can help with this. We might also want to use AI detectors, but their reliability is questionable, so it is best not to rely entirely on these programs.

A related methodological question is when it is appropriate to allow the use of AI for certain tasks and when it is not. In the latter case, it is not necessarily realistic, nor is it teaching students to use AI correctly. In the former case, however, it is likely that learners will move towards the path



of least resistance and try to tick off all the performance points (with AI) with zero effort. Where should the line be drawn between assistance and plagiarism?

One solution is to define how this technology can be used. We can distinguish between three fundamental levels:

- 1. The use of AI is prohibited – Such tools cannot be used to perform any part of the task.
- 2. AI may be used in certain ways, for certain functions, or for certain tasks – students may use AI tools under predefined conditions, but not in other ways; this requires clear guidelines.
- 3. The use of AI is permitted – students are allowed and/or encouraged to use AI tools to support their learning while completing the task (e.g., brainstorming, planning, drafting, and revising).

For each assignment, students can be required to record exactly when and for which subtasks they used AI. At the same time, it should be added that the educator is also acting responsibly and fairly if, in the case of teaching content, assignments, and feedback, they themselves also specify in detail the extent to which they relied on AI technologies. This is the only way to ensure fair regulation.

It is advisable to document the different levels of AI use in a clear ‘AI use policy’ that includes examples and specific cases, and provides clear guidance to students on what is permitted and when. This will prevent the lack of regulation from leading to misunderstandings or a ‘vicious circle’.

Another technique is to require students to incorporate their personal experiences or perspectives into their creative tasks, as AI systems find this difficult to reproduce.



What are some of the most useful AI features of Wayground that can help educators create powerful and accessible assessments quickly?

Johanna Szöke
Wayground's strength lies in the fact that it can not only generate a quiz, reading comprehension activities, and interactive lessons but also host them online, store learning analytics, and adapt all these materials to meet various special needs.





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Tasks should always include the aspects of assessment, but it is even better if we provide an assessment table (or rubric) in which, in addition to the grading aspects and criteria, the achievement levels and scores (weights) are also noted.

Table 4.1 shows a detail of an assessment table for the evaluation of an essay task for a language exam. The blue header presents the criteria (in this particular case, one of four), and the following nine columns below express the expectations and properties for each achievement level, together with the points available.

Task achievement												/36	
Band 9	9 pts	Band 8	8 pts	Band 7	7 pts	Band 6	6 pts	Band 5	5 pts	Band 4	4 pts	Band 3	3 pts
Fully satisfies all the requirements of the task. Clearly presents a fully developed response.												/9	
Covers all requirements of the task sufficiently. Presents, highlights and illustrates key features/bullet points clearly and appropriately.													
Covers the requirements. Presents a clear overview of main trend differences or stages. Clearly presents key features, but could be more fully extended.													
Addresses the requirements. Presents an overview with information appropriately selected. Details may be irrelevant, inappropriate or inaccurate.													
Generally addresses the task, format may be inappropriate. Recounts detail mechanically with no clear overview; there may be no data to support the description. Presents but inadequately covers key features.													
Attempts to address the task but does not cover all key points. Parts may be unclear, irrelevant, repetitive, or inaccurate.													
presents limited information which may be largely irrelevant/repetitive													

Table 4.2. Assessment table for an essay writing task on Google Classroom (detail)

With the help of such a table, students will be able to determine the targeted achievement level in advance; they will know exactly what goals they have to set and will be able to assess their own performance during and after the process. We can also ask generative AI to help with the formulation of these rubrics.

Learning management systems are best suited for managing tasks: they provide tools to share tasks, set related deadlines, give formative and supportive textual feedback related to the task, and in some of them, evaluation tables can be included, too. Similar services are provided by individual applications such as [QuickRubric](#), [ForallRubrics](#) or [Rubistar](#).

It is important that students encounter one another's work. This can be facilitated in the LMS with a folder in a shared cloud, or with an interface for gathering and presenting student products such as [Padlet](#) or [Pinterest](#).

The learning management system can be organised so that quizzes and tasks providing automatic feedback are placed between the different units of the course material to be learned. Such an arrangement caters for embedded assessment (Redecker & Johannessen, 2013) where learning and assessment are organically linked. In addition to checking the acquisition of new information, in this way we also provide interactivity. Students are not merely passive recipients of the course materials; at certain intervals, they also perform activities which can confirm that they have properly mastered the previous course unit or provide feedback on whether their learning processes need to be adjusted, and where appropriate, they may be advised to process some additional material. When playing videos, we can use embedded assessment with [Vizia](#): at a specified moment, the application pauses playback to ask a question, and if the answer is correct, the video resumes.

To use digital technologies to enhance summative assessment in tests, e.g. through computer-based tests, implementing audio or video (e.g. in language learning), using simulations or subject-specific digital technologies as test environments.

A third type of assessment not discussed so far is *summative assessment*. *Summative* assessment is the final step in an educational phase and aims to evaluate students' knowledge in relation to the given course material. Students are put into categories based on their performance, and this is how selection can be achieved, with students failing to reach a certain level being unable to proceed. Since this is the assessment where there is the most at stake, it is important to evaluate students' knowledge in an objective, authentic and reliable way (Secolsky & Denison, 2017).

During assessment we establish a clear association between a grading scale and the characteristics tested. Assessment is carried out with an assessment instrument, the typical form of which is the test. In this case, we distribute exercises in the form of a test and assess the tested characteristics and performance based on the solutions. Strictly speaking, tests made by instructors are not real assessments but estimates because the necessary statistical tests are missing, and the requirements of measurement methodology are not observed either (Astin, 2012).

In addition to tests (which account for the majority of summative assessments), modern directives on pedagogical assessment urge the use of group projects and production-based tasks as these alternatives place more emphasis on the application of knowledge and its evaluation. Nevertheless, it may be pedagogically justified to measure students' lexical knowledge, and concepts and definitions of a subject, for which the application of tests can be considered an effective method. The application

of knowledge can also be assessed with the help of tests, but it is necessary to prepare good test tasks, something which is far from easy (see Haltyna & Rodriguez, 2013). Developing test instruments is an independent discipline where effectiveness is accurately verified by mathematical operations.



How should assessment in higher education be viewed?

Gyöngyvér Molnár:
Assessment and evaluation in higher education should be reevaluated, and we should promote the measurement of the knowledge that students will actually need after they have graduated.




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The main problem with the use of tests is that since most of them expect facts and substantive knowledge, and are typically not complemented by other forms of assessment, students associate the areas scrutinised by the tests with knowledge and erudition. All the additional components of competence and the applicability of knowledge are missing. Such a scenario is particularly dangerous because institutional education and the intellectual skills required in the job market may become separated from each other. Since performing well in these tests requires memorisation and accurate recall, students associate learning with this sequence of actions. This phenomenon has become particularly pronounced due to the trend that tests often contain only closed-ended multiple choice tasks. Using predefined response options restricts the spectrum of thinking that is measured (Foster & Schleicher, 2022; Figure 4.2). If learning success

is determined by whether or not tests are performed well, students will value what is tested and the path that leads to it.

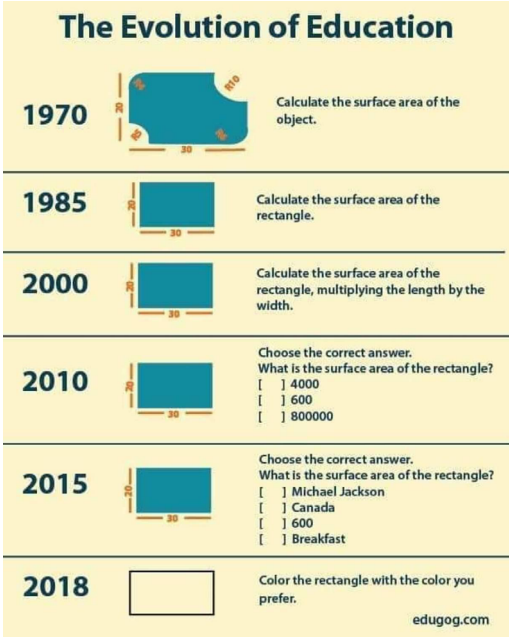


Figure 4.3. Diagram satirising the loss of the quality of knowledge required in tests (source: edugog.com)

AI can also be of great help in this challenge. In *The role of AI in assessment and evaluation processes* subchapter, when generating items, it is a good idea to write prompts that enable the measurement of knowledge application:



- ‘The purpose of the questions to be generated is not merely to measure the ability to recall lexical facts, but to enable students to apply, analyse, and evaluate the concepts they have learnt in real-life situations.
- ‘Each question should include a Bloom’s taxonomy verb, such as ‘apply,’ ‘analyze,’ ‘compare,’ ‘evaluate,’ ‘justify,’ or ‘select the most appropriate strategy.’
- ‘Set each question in a short, 2-4 sentence background context that outlines a real-life scenario. Base the question on a context like this: a problem to be solved, a decision to be made, a calculation to be performed, or an analysis to be made.’
- ‘Check that each question corresponds to the ‘apply’ or higher Bloom level, and indicate if any of them are more lexical (‘recall’) in nature and how they could be modified.’

A simple method can help us to determine whether the knowledge assessed by our tests measures applicability: if the answers to our questions can be correctly given by a simple search on Google and “copy-paste” operations, then our test is probably not assessing thinking skills.



To critically reflect on the appropriateness of digital assessment approaches and adapt strategies accordingly.

In the light of the above, it is crucial to find the appropriate place for testing in our assessment system, to use it alongside other forms of summative assessment, and to be aware of the type of knowledge measured (even if only approximately) by our tests. It should not be automatically assumed

that students who perform well in tests which explore concepts and materials actually understand and are able to apply them.

Technology-based testing (see the programs listed under diagnostic assessment) makes assessment more effective on the one hand, and changes and expands the scope of assessment on the other. Any digital media (images, videos, and interactive elements) can be placed in the items, and the desired construct can be measured based on how they are understood and solved. Moreover, thanks to the possibilities of AI, multimodal responses can now be expected. Since the processing and provision of multimedia are fundamental features of orientation and success in today’s world, the use of tests that employ such elements can be considered authentic.

If we build a test or question bank from which the test program can randomly assign exercises to students, a unique test sequence can be generated for each student. We should make sure that the exercises taken from the question bank are of equal difficulty. An alternative is to combine two partial tests of different levels, but the same intrinsic difficulty. In this way, one part of the test will contain the randomly selected easy exercises, the other the difficult ones.



To use a variety of digital and non-digital assessment formats and be aware of their benefits and drawbacks.

So far we have examined three main assessment types (*diagnostic, formative, summative*) according to the objective of assessment. In order

to further expand our tools and to employ varied forms of assessment, it is worthwhile to familiarise ourselves with additional assessment procedures.

Innovative solutions are when students compile their tests for themselves or when they are put into groups and compile tests for each other.

It is advisable to score the compilers of the questions, too: if either everyone can answer the question or no one can, no points are awarded, as the question was either too easy or too difficult. Of course, instructor control is necessary both in terms of the tasks and the scoring. By involving our students in the collective planning of performance, we can galvanise motivational forces and eliminate the anxiety associated with summative assessments, which are responsible for a number of negative consequences.



There are several ways to implement *peer assessment*, when students evaluate each other's work. This method should be used primarily for tasks where there are several correct solutions. Students may be puzzled by the assessment criteria to use, so in this case too, it is important to provide a sufficiently detailed evaluation system for the *peer assessments* and maybe even append a description of the assessment process.

From *peer assessments*, students get a better understanding of each other's work and ways of thinking, and gain perspective on their own performance. In addition to all these benefits, we increase the amount of interaction between students. We might even be helped by this assessment taking place before our own evaluation because the errors listed and the other students' comments will aid both the processing of information and the final assessment itself. Of course, the *peer assessment* procedure itself

can be rewarded and assessed. Learning management systems feature dedicated services to assist *peer assessment*. The tasks submitted can be assigned among students at random or according to the instructor's choice, and one student can assess more than one of their peers. There is a fixed rubric for assessment in which students can provide textual and score-based evaluation, if need be, anonymously.

Obviously, group assessment is applied in group work and projects, when the work of the whole group is collectively assessed.

For *summative* group assessment, we might consider giving students a total score, and entrust them with the allocation of the points to each member.



The skill of autonomous learning is one of the most important key competences. Student self-assessment is organically linked to this competence, and it can be facilitated by the use of (reflective) learning diaries. In such a document, students record their learning processes in a diary format: they cover their performance in a given activity, the things they were able to recall, the feelings they experienced, and what was or was not clear for them. The purpose of a learning diary is to enhance learning and to improve students' metacognitive skills by making them reflect on their learning experiences through documenting their experiences and drawing reflective conclusions. A modern form of the diary is blogging (see *below*). Using digital platforms, students can include photos, videos and links. By analysing students' learning diaries, teachers can understand their difficulties and the challenges they face, and make the necessary adjustments to their own educational strategies. Instructors can help students be responsible for their own

learning activities by explaining the shortcomings indicated in the diary, sharing good advice on how to achieve effective learning, and providing emotional support, such as motivation.

Self-assessment can also be performed using assessment tables in which students must mark their level and describe their performance in words. Another way to implement this is to make students create the assessment tables for themselves.



Self-assessments may also be used for summative assessments. If we treat them as partners in the assessment process, we may be surprised how clearly our students see their own performance.

To use digital technologies to guide students through the learning process with targeted, increasingly challenging tasks, and their assessment (e.g. with ePortfolios).

Digital portfolios collect and present a student's work (documents and other production) throughout a given semester.

They are both a method of learning and assessment. They help in monitoring student progress, and can even be combined with a learning diary. In addition to sharing their production, students can also record their reflections in this format. Portfolios can also support the implementation of summative assessments. There are dedicated programs for *digital portfolios* (e.g. [Mahara](#), [FolioSpaces](#)).

Just like learning diaries, portfolios can also take the form of a blog, or as a simple website created with online tools (e.g. [Weebly](#), [Wix](#), [WordPress](#)). The URL of each student's blog or website can be conveniently stored in

a cloud-based spreadsheet (e.g. using Google Sheets). By sharing this spreadsheet, students can also access their peers' content.

In this way, they discover the work of others and they can compare their own performance. They can also add comments and evaluate their peers, and this may lead to the development of an interactive sharing of knowledge and experience between the students and their instructors.



What do you think of gamification as an assessment method? How do you combine this with digital solutions?

Tibor Prievara:

Gamification is an assessment system based on clear concepts. One underlying principle is that it builds up knowledge from the bottom. Instead of measuring from above what students don't know, we focus on at what they do know. A second key element is that gamification tries to give feedback on the added value, never on the absolute value of knowledge. I'm always interested in the extent to which students have improved, not what they know now. Thirdly, the system provides an unlimited number of retry options. So if you have messed something up, you can try again, just like in a video game.



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One of the most effective ways to reform our assessment system is to gamify it. An example of gamification in higher education is to provide several options for the completion of a subject. On the one hand, several task types are offered, so that everyone can choose the form that suits them best, and on the other hand, the tasks are of various difficulty levels, so that the challenge involved can be optimised. (Of course, this should not prevent

students from proposing other forms of attainment that are acceptable to us.) Fixed scores should be associated with each alternative so as to make our entire assessment system score-based. Mandatory and optional forms of attainment could be combined as well. In such a scenario, we have to make sure that students can choose any number of optional tasks and complete each of them several times (within feasible limits). The same mechanisms apply for games: there are several ways to complete a level, and players collect scores which helps them to keep track of their performance. They know their goal, they know how many points they need to attain it, and they also know that making a mistake is not a problem, because they can always try again. This results in a fundamental psychological difference compared to traditional assessment systems and the attitude to assessment in general can finally move away from the atmosphere of anxiety. The technical background of gamification (for example, by the use of a scoring system) is an integral part of most learning management systems and it is thus not difficult to put into practice.

The workload we give should be balanced across the semester: tasks should be always available, with intermediate checkpoints (measurement points) during the semester, and we can specify how many points students must accrue before a certain date in order to move on to the next level. Such an approach might prevent our students from doing everything at the last minute, hastily and without any real involvement.

4.2. Analysing Evidence

To generate, select, critically analyse and interpret digital evidence on learner activity, performance and progress, in order to inform the learning process.

The phase of planning the assessment and collecting information about students is followed by the analysis of evidence. The substantive condition for analysing and interpreting information is that the data about our students is sufficient in both quantity and quality.

To design and implement learning activities which generate data on learner activity and performance.

Our assessment system focuses primarily on the assessment of factual knowledge and cognitive abilities in *summative* form. The collection of data on affective factors, or *soft skills*, is significantly smaller in proportion. Nonetheless, it has been long known that the labour market prefers *soft skills* to *hard skills* (Robles, 2012). As an important design principle, the values represented by higher education institutions should be in accord with those demanded by the employment market. Personal and social competences are also expected to be the subject of assessment. Personal competences include, for example, self-knowledge, control of behaviour, and motivation. Social competences help us to manage our social relationships, their major skills being related to collaboration, communication and conflict resolution. In order to collect sufficient data, we should expand the scope of assessment to the factors mentioned above, which may be important for real life but are typically absent in the assessment culture of institutional education. Of course, this requires the creation of a learning and assessment

environment where such abilities can be activated and then assessed (for example, in a passive, frontal learning environment, we never get to know the collaborative skills of our students).

To consider, combine and evaluate different sources of evidence on learner progress and performance, to compare and contrast them.

Collecting information at the institutional level can already begin during the entry assessments. It is becoming increasingly common practice in higher education to assess students with various tests at the beginning of their studies. These competency assessments can play a significant role in predicting and reducing attrition.

The process of gathering information can cover smaller or larger units of learning: one class, a series of sessions, or even a whole semester's work. As detailed in the previous section, instructors should try to employ as wide a range of assessment forms as possible so that they can gather information about the more general characteristics of students in a broader way.

In addition to the assessment of cognitive factors, *diagnostic assessments* are also suitable for the surveying of affective characteristics (such as learning habits, motivation, and attitudes to the subject matter of the given course). One of our sources of information is the observation of the students' behaviour during the course. If we develop an activity-based learning environment which provides opportunities for interactivity, then from class activity, communication, and the quantity and quality of collaboration, we will gain valuable information about various characteristics of the students and about their progress. Such activities include discussion, the Socratic method of discussion through questions, student presentations, debates,

games, drills, and the creation and presentation of projects, as well as pair and group work, such as projects, research, and *problem-solving tasks*.

To be aware that learner activity in digital environments generates data that can be used to inform teaching and learning.

We can use digital solutions to automate assessment and increase its efficiency and variety. Regardless of its purpose, a lot of information will be recorded through assessment in a digital environment, and even some (or in certain cases, most) of the traditional *formative* assessments are stored in digital format. With the use of response systems, quizzes, interactive task systems or technology-based tests, results are immediately available for tasks that do not require manual correction, while in the case of *open-ended* tasks, the software systematically stores the tasks corrected by the instructor. When tasks are shared through learning management systems, the program records the scores, the textual feedback and the assessment tables, categorised according to students and tasks.

The *logging* data generated by LMSs when student activities are recorded represents an interesting data source and opportunity for further analysis. Most LMSs perform logging of some sorts, or *plug-ins* can solve this task (e.g. IntelliBoard, see Figure 4.3). Virtually all clicks and activity within the system can be recorded by these services. We can find out when students logged in, what activities they performed, what content they clicked on, how much time they spent on these tasks, what tasks they solved, how many attempts they made, what their partial and overall results were, how actively they communicated, and what forums or services they used for this.

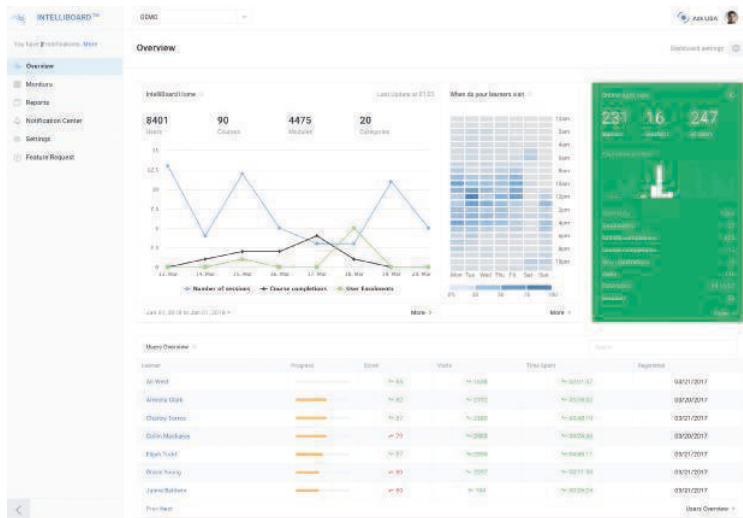


Figure 4.4. Data on the use of the LMS system and its user activity (source: intelliboard.net)



Raw log data rarely provide directly useful information; therefore, they are assigned to predictive models, clustering algorithms, and other AI-based methods that can be used to create semantic analyses and early warning systems. As an extension of these methods, solutions have also emerged that not only provide predictions but also automatically make recommendations to support learners—for example, by creating personalised learning paths or sending alerts to educators ([LearnerScript](#), [Edwiser](#)). Some platforms, such as [IntelliBoard](#), and [Civitas Learning](#), already offer the possibility of designing institutional-level intervention strategies, adding a new dimension to learning management.

There are two concepts worth mentioning in connection with the above: one is educational data mining (EDM), and the other is learning analytics. Both are based on the processing and analysis of data sets and enable the recognition of non-trivial correlations and patterns from existing information. While EDM research previously used more static data processing techniques, today deep learning and natural language processing methods are also appearing in the analysis of forum and text-based interactions. In the field of learning analytics, however, the emphasis is on real-time, AI-based predictive and prescriptive solutions: the system is not only able to predict the likelihood of dropout or failure based on student behavior, but also generates specific, pedagogically relevant recommendations—such as dynamically adjusted learning paths or motivational messages. These algorithms make it possible to explore complex relationships between variables and perform institution-wide, *Big Data*-level analyses, where input for deeper, institutional-level decision support comes not from individual courses, but from data on all students and degree programmes.

To use digital technologies to record, compare and synthesise data on learner progress.

Not all assessments generate digital data, meaning that the results of assessments carried out on different platforms cannot be automatically channelled. Individual programs and systems store their data in a unique way, for example, extracting data into an Excel spreadsheet is not always possible. Because of this, instructors often record the information they collect in unique spreadsheets formatted according to their own logic and needs and stored in the cloud.

In a more streamlined approach, data-rich spreadsheets exported from an LMS can be expanded with the information collected with other platforms or even on paper, and other kinds of administrative information (e.g. absences) can also be included. Of course, such spreadsheets should be shared with the students, and by using cell protection, our personal notes and the data that is not openly available for everyone can be stored in these documents without student access to the cells in question. In order to protect their privacy, each student should be identified by a unique code.



To critically analyse and interpret available evidence in order to inform teaching and learning.

Our assessment procedures should always be examined with a critical eye. As in the case of measurements, discussed in the previous section, the methodology for comparing performance with goals can only be regarded as scientifically sound (and more than a mere estimate) if it meets the strictest of requirements. Three basic prerequisites and quality indicators should be analysed: *objectivity*, *validity* and *reliability*.

Objectivity means that the result of the assessment can be determined solely on the basis of the properties and characteristics of the item under consideration, and that it cannot be influenced by subjective factors. Bias must be prevented during the recording, correction, evaluation and interpretation of data, and there is no room for errors caused by inattention or interpretation. No step of the assessment can depend on the persons conducting it, or on any of their characteristics. In all relevant cases, rules must be clearly and comprehensively set: the time and equipment available, the key to correction, and the individual levels for the interpretation of the

results (Secolsky & Denison, 2017). Automated correction provides a reliable means of fulfilling the criterion of *objectivity*.

Measuring *validity* is a complex problem; its existence is hard to prove and it cannot be fully verified mathematically. It is an indicator of whether we actually assess what we originally intended to. As an example, an exercise in mathematics should reflect a student's mathematical knowledge, not their level of reading comprehension. Even if their mathematical knowledge was sufficient for a given task, if it was phrased in a convoluted and lengthy way, primary school students might be unable to solve it because of their limited reading skills (Haltyna & Rodriguez, 2013). Another relevant question we have already mentioned concerns what to consider as valid knowledge for a given subject – for example, does the knowledge of definitions constitute real mathematical knowledge? In the course of our work, the best way to ensure the validity of our tasks is to collect expert opinions, that is to say, to consult with our colleagues and have them check our exercises. This is particularly justified if students perform poorly in some of our exercises for no apparent reason.

Reliability indicates whether we measure what we want to measure correctly, and the strength of the correlation between the actual value and the measured value of the features to be measured. A test with high reliability produces fewer errors in measurement. Reliability can be estimated by various mathematical methods (see Muijs, 2010) or even with the help of generative AI chatbots. However, for the latter, it is crucial to acquire the fundamentals of statistics to be able to evaluate the AI's responses.

To analyse and interpret available evidence on learner activity and progress, including the data generated by the digital technologies used.

If the majority of our students perform a task poorly, the root of the problem is not necessarily the students – the learning content might have been incomprehensible, the allocated time might have been insufficient, or the task might have been inappropriate or unclear, etc. The assessment of student performance draws attention to this issue, and problems should be clarified with the students during oral discussions (in person or online). If only some groups perform a given task poorly, an examination into the factors contributing to this uniformly poor performance is called for. As an example, in the case of a specific subtask or item, the wrong answer may have been given because the concept in question was not discussed during their years in secondary education. With the help of data tables, it is easy to identify problematic students who lag behind, do not sign in to the LMS, and do not solve tasks, who additionally fail to communicate on the interface, and whose absences are also high.

With the help of logging data, we can also identify students who perform poorly despite being active on the LMS interface both in terms of activity and communication. Their motivation is presumably strong, but they have problems with comprehension. If this symptom is recognised in time, proactive steps can be taken to prevent the student dropping out. Tasks such as the above are supported by the built-in AI-supported data analysis modules of the LMS. Students inactive in the LMS but delivering an outstanding performance in all activities should be singled out for talent management and they should be handled with a differentiated approach (see *Chapter 5.2*).

In tests, we should monitor the proportion of students answering each question correctly. In digital testing systems and software monitoring this is automated. If many students have given wrong answers to a test item, we should determine whether or not the quality requirements of assessment methodology have been met, and whether the teaching activity provided the students with the ability to answer the question correctly. It is advisable to store our data from year to year, so that we have more evidence concerning the difference between our current experience and previous patterns, the possible reasons for deviations, and the necessity of any adjustments. Analysing this data with computers, using artificial intelligence algorithms is an exciting and forward-looking opportunity.

Let's use AI to perform the analyses. This allows for deeper, automated analysis of test results: on the one hand, the measurement methodology indicators of items (e.g., difficulty, discrimination) can be calculated with a single command, and on the other hand, cluster analysis or machine learning-based grouping can be employed to identify which groups of students perform significantly differently. This allows the identification of the topics or skill components where students' performance is poorer. Natural language processing can also be used to automatically evaluate open-ended tasks and uncover any misunderstandings or semantic patterns in students' responses.



Sample prompts for test analysis:

- As an expert, analyse the following test results table item by item: calculate the difficulty and discrimination indices for each item, then rank them accordingly.
- Analyse the given test from an expert's perspective. Determine which tasks serve to assess which abilities and skills, and create

a table based on this. Identify which abilities important for learning the sciences are not measured by the test, and suggest tasks that would compensate for these shortcomings.

- Cluster the students based on the results of previous tests and show which items best distinguish between low and high performing groups.
- Prepare a tree analysis based on the test results and create a hierarchy of questions. Indicate which skills are measured by the groups identified in the hierarchy.
- Apply natural language processing to student responses to open-ended tasks: identify the most common misunderstandings and suggest feedback based on keywords.

AI can generate a chart that compares overall test scores with scores on tasks requiring higher-level thinking. A trend line on the graph indicates the average correlation between the two performances. Students who are above the trend line are generally hard-working but have more difficulty with tasks that require deeper thinking. In contrast, those below the trend line are likely to have good logical skills but have put less energy into preparation (Nádori & Prievara, 2025).

Sample prompt:

Create a two-variable scatter chart that shows the overall test results and the scores received on tasks requiring higher cognitive skills. Draw a trend line and highlight students who fall significantly above or below the trend line.

AI also supports the construction of multi-variable predictive models that show how well responses to certain items predict future academic performance (this could be end-of-semester grades, but also later exams or final state exam results). By analysing data from multiple school years, patterns and changes over time can be identified that indicate, for example, that students regularly have more difficulty understanding a particular topic at the beginning of the school year but perform better in it by the end of the year. Based on this data, the curriculum can be modified, additional practice exercises can be prepared, or targeted interventions can be made in the teaching of the more difficult parts.

4.3. Feedback and Planning

To use digital technologies to monitor learner progress and provide support when needed. To provide personal feedback and offer differentiated support to learners, and to adapt teaching practices based on the data generated by the digital technologies used. To provide the data generated by the digital technologies used to enable learners and/or parents to make informed choices.

Pedagogical assessment is a cyclical process, and after the evaluation of student performance, feedback should be provided to the stakeholders. Consequent to providing feedback, it should be considered whether the learning process needs to be adjusted or redesigned. This is carried out continuously during the learning phase itself, and at the end of that phase, the instructor and all other stakeholders can make use of their accumulated experience in the planning of a subsequent learning process.

Apart from the instructor and students, other stakeholders may be involved in the assessment, depending on the level and the topic of the evaluation. In course exams, possible other stakeholders are the examiner, the parent, the head of the department or institution, the dean, the rector, the maintainer of the institution, the compiler of the course exam, and even the wider public, but everyone is involved in a different way. In the light of this, information and feedback should be provided to different people in different forms (Secolsky & Denison, 2017).

Successful feedback has an effect on the education system and all of its stakeholders, influences its operation, and contributes to the more effective organisation of teaching and learning (Astin, 2012). To make sure that feedback achieves the desired effect, we can lay down various guidelines on the creation of quality feedback. The method, time and frequency of feedback must be determined in the phase of planning. The method of feedback should be defined by the targeted stakeholders. In what follows, we focus on the learner and their abilities as defined by DigCompEdu.

To provide personal feedback and offer differentiated support to learners based on the data generated by the digital technologies used.

In the sphere of feedback, the question of grading is an age-old dilemma. In the past, it was generally accepted that *formative* assessments should be given as much importance as summative evaluations (or even more), yet the notion of abandoning graded assessments was never considered. At the same time, it was emphasised that *summative* assessments often lead to situations where students learn for grades rather than knowledge, and that they create an anxious learning environment. If the quality indicators for assessments were strictly checked, it could be easily demonstrated that the

practice of grading does not meet the requirements for assessment – it is generally neither objective, nor valid, nor reliable.

Several pedagogical reform movements and institutions embrace and implement the elimination of grading. A form of the same intent can be identified in the exclusive use of textual assessments in the earlier stages of elementary education, but even some present-day higher education systems have eliminated grading, and only differentiate between satisfactory and non-satisfactory categories (Tannock, 2017).

The advantage of assessment by grading is that it puts students' results on a scale, making it easy to interpret and compare learners' performances in relation to each other. It provides a means of rating and selection, and it is much easier to perform than textual assessment.

The current assessment system in higher education is built around the use of grades; at the end of the semester at the latest, the performance of the learners must be expressed in the form of a quantitative grade. The disadvantage of feedback through grades is that it simply cannot provide enough information about a student's learning process. Identical grades often represent different levels of performance, feedback cannot be personalised, and differentiated.

Verbal and textual evaluation provides the opportunity to give a thorough and detailed description of the learners' performance, to indicate their strengths and weaknesses, and to give advice on their further work. A fundamental question is what factors to include in a grade, and whether, in addition to the knowledge elements of the subject, personal and social competences should also be evaluated. With verbal and textual assessments, we can easily provide feedback on these aspects and thereby ensure the possibility of development.

The use of assessments in a *gamification* type of framework should be considered here as well. Compared to a few grades during the semester, continuous assessment reflected in precise scores allows students to more closely follow their progress. A prerequisite for this is to provide numerous learner activities suitable for assessment, which, from a methodological point of view, is a goal in itself.

In addition to scores, we can give feedback with the help of badges, which also stem from the world of games (Figure 4.4). Badges should be allocated based on unique, special performances, for example: the most creative solution, quiz champion, best team player, the most inspiring communicator, etc. It is advisable to associate extra scores with the badges.



Figure 4.5. Examples of available badges

(source: garyhall.org.uk/gamification-in-education.html, website no longer available)

Many people believe that badges have no place in higher education. Those tertiary education instructors who have tried them out, however, clearly report that they have the potential to boost motivation. Badges can be easily created with, for example, [Makebadges](#), [Badge List](#) or [Open Badges](#), where they can also be collected. Most learning management systems have already started introducing this service, or we can integrate it with plug-ins. The badges can also be displayed in learners' *digital portfolios*. Of course, feedback using scores and badges cannot substitute sophisticated feedback in the form of verbal or textual assessments and so it is advisable to use both methods in tandem.

Prievara Tibor provides an innovative example of using digital technologies for data collection, and suggests ways of providing feedback to our students:



How can learner performance be analysed and what kind of conclusions do such analyses provide?

Prievara Tibor:

I am most interested in solutions which can give feedback, evaluate, represent and analyse the process of learning itself.



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To assist learners in identifying areas for improvement and jointly develop learning plans to address these areas.

Assessment for assistance and development purposes fulfils its positive role if it is comprehensible, linguistically differentiated, and personalised for the student, and if positive and negative phenomena are pointed out by the evaluator with the clear intent of support (Astin, 2012). Appropriate feedback helps students to improve their self-assessment skills and to develop, strengthen and adjust their existing learning strategies based on the information they receive about the following aspects:

- the errors in learning and thinking that have been made;
- whether their learning method was appropriate for the subject;
- their performance during the semester;
- the skills and factual knowledge they need to work on;
- [...] their position within the matrix of achieved results and requirements based on their performance in the examined period.

The goals are to provide positive reinforcement, to evaluate the effort with the original skill levels of the student taken into account, to highlight strengths, to motivate, and to offer help, counselling and constructive criticism. In the spirit of corrigibility, deficiencies must also be clearly identified and strategies to address and correct these should be developed (e.g. better time management, new learning methods). Where appropriate, a common *learning plan* should be developed based on the available evidence.

To enable learners to evaluate and interpret the results of formative, summative, self- and peer-assessments.

Accepting and interpreting feedback is another important question. That is, we should monitor students' opinions about the suitability of the assessment method used, the fairness of the assessment, the relevance and helpfulness of the feedback, and their comprehension of the content and purpose of the information provided in the feedback. If these conditions are met, students can draw profitable conclusions from the assessment, which may facilitate self-correction.

Hopefully, the degree of comprehension will be sufficient if the aforementioned guidelines for oral or textual *formative* assessments are followed. However, there will always be some students who will appreciate feedback in a different manner, form, style or quantity. In addition to *summative* assessments (i.e. grades), we can also give textual feedback, and technology makes it much easier to record and display these.

There are two common types of textual assessment: in one case we evaluate on the basis of fixed criteria (see evaluation tables) and in the other case we use our own words. Both forms have their own benefits and drawbacks, so we should choose according to the subject, goals and the desired effect of the assessment. Evaluation tables clearly and specifically indicate the aspects of the assessment, but without added explanations, students will only know which criteria they managed to satisfy, expressed in terms of points. The reasons for their success or failure will not be revealed. In the second case, this universal standard of measurement is missing, and unless precise wording is used, students may not be able to discover the areas where they should have done better. Therefore, in most cases it is best to combine the two modes.

Feedback can come not only from the instructor but from other students, or through self-reflection. *Peer assessment* is supported by several pedagogical principles: it develops a dynamic learning environment, improves pupils' social skills, and provides a foundation for self-assessment skills (OECD, 2005). However, in order to carry out effective *peer assessment*, students need to be prepared, and typically they do not have the background needed for this, as they have not necessarily experienced this method in public education. They need to understand their role, and they should neither overestimate, nor underestimate the significance of the assessment. In *peer assessment* students should follow the same criteria of evaluation that was previously listed in connection with the instructor's assessments, and they must provide constructive criticism with helpful intentions.

As a first step in students' involvement in grading they determine the grade they want to achieve. They then assess their own progress, and the instructor gives grades only after the students have graded themselves. If there is a large difference between the two assessments, a discussion must follow.



The key to the success of self-assessment is for us to provide students with varied and sufficient prior feedback on their performance (OECD, 2005).

To use digital technologies to monitor learner progress and provide support when needed.

The automatic feedback provided by technology has the advantage of being instantaneous, and it thus enables immediate reflection and intervention. In the field of psychology, it is widely known that the effectiveness

of feedback significantly increases if it is provided as soon as possible after the activity in question has been completed (Astin, 2012). Regardless of the application of technology, this fact should be borne in mind in every assessment situation, and we should try to deliver the assessment as promptly as we are able.

The progress of learners should also be represented using visual tools, as they provide feedback in an easy-to-digest form, thereby accelerating the steps needed to address the problem.

Gyöngyvér Molnár also draws our attention to the power of the visualisation of data:



How can learner performance be analysed and what kind of conclusions do such analyses provide?

Gyöngyvér Molnár:

Technology offers the greatest assistance in visualisation. Students do not need specialised training to interpret the numbers in the tables, since they can be easily displayed using relevant graphs and good visualisation.



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Learning management systems display performance per task and overall performance as well, and most of them also offer a striking visual representation of the degree of progress (Figure 4.5).

Competencies		The world in spatial terms	Places	Physical and spatial organ.	US physical and political	What is Geography	Physical systems	Shapes of the Earth	US surface	Weather and climate	Meteorology
Students	Code	1	1.1	1.2	1.3	1.4	2	2.1	2.2	3	3.1
	Average	62%	52%	73%	69%	70%	65%	64%	65%	49%	37%
Aaron, Billy	77%	88%	82%	100%	100%	100%	71%	82%	82%	64%	64%
Benett, Tudor	48%	76%	85%	85%	85%	91%	38%	32%	61%	28%	15%
Boato, Box	37%	60%	8%	90%	82%	96%	50%	50%	80%	33%	21%
Cass, Travis	76%	75%	50%	75%	88%	88%	88%	100%	75%	61%	40%
Feoster, George	52%	85%	50%	100%	95%	95%	57%	50%	62%	22%	0%
Frei, Peter	2%	8%	0%	35%	0%	0%	8%	0%	17%	4%	18%
Henderson, Row	76%	88%	50%	100%	100%	100%	75%	50%	100%	34%	0%
Johnson, Katie	89%	85%	82%	100%	95%	95%	94%	82%	95%	72%	63%
Johnson, Sally	70%	84%	50%	100%	93%	93%	97%	73%	91%	52%	36%
Jones, Ann	17%	25%	0%	80%	0%	80%	30%	100%	0%	0%	0%
Kwan, Alan	80%	84%	50%	96%	95%	95%	86%	83%	89%	72%	75%
Lim, Adrian	69%	79%	64%	89%	89%	96%	74%	70%	78%	51%	27%

Figure 4.6. Table representing learners' performance in the NEO LMS (source: neolms.com)

content in real time. They not only generate corrective, 'right/wrong' feedback, but also identify the causes of errors, recognizing, for example, where the appropriate context is missing, what technical terms should be used, and what sources and examples are missing to provide adequate support.



How can educators integrate AI-generated essay feedback meaningfully into their assessment and feedback practices?

Johanna Szöke

Make sure to choose a website that not only uses AI to generate feedback but that's also built on robust standards and quality assurance. This can minimise the chances for inconsistent scoring and feedback.





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To provide personal feedback and offer differentiated support to learners based on the data generated by the digital technologies used.



(Detailed explanation of point 3 in section 4.1.3:) Assessment and feedback based on results are clearly separate processes. With the help of technology, so far we have been able to record predefined responses to closed-ended questions, in which generic motivational content or explanatory texts suitable for correcting knowledge have been included. Similarly, when evaluating a task or essay, different feedback texts have been provided for different point ranges in relation to the total score. While this automates evaluation and offers significantly more than a mere score, it cannot be considered personalised or personal.

Thanks to AI, new opportunities have opened up in this area as well. Generative AI-based systems go beyond previous template-based feedback and are capable of performing an in-depth analysis of student-generated

Multi-agent architectures further reduce generator errors. One agent generates feedback, while another validates and refines it, thus eliminating excessive praise or overzealous assumptions (Guo et al., 2024). As a result, students receive feedback that is educationally authentic and supported by pedagogical reasoning, similar to the comments written by human educators. Multimodal processing allows students to learn not only whether their answer was correct, but also how their visual presentation or, for example, their speaking style contributed to the overall picture, and in which areas they should improve.

Through the *Personalised Feedback Framework*, feedback is directly aligned with the student's individual development profile. Kuzminykh et al. (2024) developed a procedure that uses embedding techniques to take into account not only the student's response, but also their academic context,

previous performance, and known deficiencies, so that feedback is tailored to the areas most in need of improvement and is even more personalised.

In the field of assessment and feedback pedagogy, the concept of ‘*feedforward*’ means that the system not only reflects on past performance (*feedback*), but also provides specific recommendations for the next steps (*feedforward*) before the learner continues the learning process. This approach has proven particularly effective in higher education, where learners need to quickly identify their own mistakes and receive well-founded suggestions for the next steps in their development (Fernández Cuevas, 2025).

Once the system has identified inaccurate or incomplete sections, a predictive error analysis module determines the learner’s most likely deficiencies. Based on this, the AI searches for nodes requiring correction on a predefined knowledge map. Based on the initial error and its typical prerequisites, the AI identifies which teaching materials, exercises, or video explanations are needed (Capdehourat et al., 2025). The latest *feedforward*-oriented frameworks (Khameel, 2025) are designed to generate teaching materials, exercises, and even virtual teachers who explain the necessary parts, tailored to the student’s needs, immediately after the error is identified.

The research-based development of the *Personalised Feedback Framework* and *feedforward* solutions is currently underway. However, there are already applications available that can be tried and tested. [Gradescope](#) automatically suggests changes to scoring criteria based on student responses. It compiles statistics on which concepts caused difficulty. [Cognii](#) uses multidimensional scoring metrics (content completeness, argument structure, linguistic accuracy, etc.). It can infer student motivation from the style of their answers (e.g., uncertain linguistic structures). It generates *feedback* supplemented with pedagogical explanations (e.g., ‘The introduction

clearly introduces the topic, but the third paragraph lacks a deeper critical analysis based on sources.’) After the student receives the score, the system recommends specific further learning paths (e.g., videos, articles, and interactive modules) that focus directly on the areas where the student scored poorly. In the case of the [Class Companion](#) system, the instructor uploads their own detailed assessment criteria and points, and the program automatically scores based on this and generates *feedforward* suggestions for each category, such as, ‘You repeat the same argument in three places; use new sources to support your argument.’ If the student disagrees with the score, they can request a review: the teacher then provides a clear, detailed explanation of the AI’s suggestions or modifies the evaluation.

If we want to use our own prompts to provide meaningful feedback that goes beyond scores, try supplementing the prompt for automatic evaluation as follows:

Sample prompt:

For each evaluation criterion, include:

- **Strengths:** What did the student do well?
- **Areas for improvement:** What is missing or needs improvement?
- **Specific, actionable suggestions (feedforward):** What steps can the student take when writing their next essay/assignment? What resources, videos, or exercises would be recommended?

If the student’s answer is incomplete, it should be mentioned separately: ‘The answer did not include an adequate environmental analysis; this must be added.’

Breakdown of the score: Show in detail how the scores are distributed according to each criterion. Explain why they received this number of points for this section.

Style and tone: Provide objective, clear, yet supportive and constructive feedback. If referring to specific quotes or concepts, include the exact location, too (e.g., 'paragraph 3, sentence 4').

Despite all the advantages listed above, the feedback from automatic digital services may lack personalisation – yet we have some options here, too.

As an example, when giving tests, in the case of *closed-ended items* we can provide feedback for each response option. In this way we can explain why a given answer is wrong, and the correct answers can also be commented on. More advanced test platforms provide solutions for this. With such feedback, we can create the opportunity to learn from the test itself, which is a welcome combination of assessment and learning. 

The need for the manual correction of *open-ended items* is inescapable and in such cases we should provide personalised textual feedback with the purpose of learning support. Technology facilitates and streamlines the administration of the assessment.

Although a learning and assessment program using playful (gamified) elements cannot provide personalised, *formative* feedback, it can still be motivating because of the integration of collecting points, levels to complete, and reward mechanisms.

Digital tools can also be used to expand the communication space. Focusing on *formative* assessment, if we do not have the opportunity (or time) for a verbal supportive and formative evaluation, or if we do not wish to do it before the whole group, we can do it with our ICT tools.

Most learning management systems provide a chat function, but it may be better to initiate an online voice or video call, the scheduling of which should be negotiated with the student by email. Another innovative way to use technology in our textual evaluations is to record them using a microphone instead of typing them. This saves time, meaning that our assessment can be more detailed and that we can also provide a more nuanced assessment. 

To adapt teaching and assessment practices, based on the data generated by the digital technologies used.

Assessment, quality, and quality assurance are closely interrelated concepts in the practice of higher education. The constituent elements are students' personal satisfaction, self-assessment of educational activities, and the documentation of the work they have performed. The use of technological tools for this may be more effective not only for students, but also for instructors, too.

The satisfaction of our students must be an important factor in assessing our own teaching activities. Considering our work in education as a service, in which our students are our partners who receive the service, is a constructive and progressive approach.

In addition to compulsory student satisfaction surveys, we can also create individual questionnaires asking for information that is relevant to us. We can use response systems for this purpose, creating a digital version of exit cards. With the help of these, even after the end of each session, we can ask how students felt, what they did or did not understand, what suggestions they had, etc. Responses may be provided anonymously.



Based on the assessment techniques we utilise and other relevant information we collect, we should regularly supervise the efficiency of our different teaching strategies with different types of learners, and we should both adapt our approach accordingly and develop innovative new strategies. If we wish to be really successful in this area, we should engage in critical discussions with colleagues and supervisors, and study the relevant literature and the resources available on the Internet, as well as the methodological forums related to higher education. **This is particularly true in a field as new as AI, where conditions are still immature in terms of methodology, regulations, and ethical issues, and everything is changing rapidly.** The development of pedagogical approaches, strategies and tools related to assessment is a never-ending process, and we should constantly focus on the opportunities for further improvements.

References

- Astin, A. W. (2012). *Assessment for excellence: The philosophy and practice of assessment and evaluation in higher education*. Rowman & Littlefield Publishers.
- Ayele, A. D., Carson, Z., & Tameze, C. (2022). An Efficacy Study of ALEKS-Based Placement in Entry-Level College Math Courses. *PRIMUS*, 33(4), 414–430.
- Bekiaridis, G., & Attwell, G. (2024). *Supplement to the DigCompEDU framework: Outlining the skills and competences of educators related to AI in education*. University of Bremen: Institut Technik und Bildung (ITB). <https://doi.org/10.26092/elib/2708>
- Bishop, J. (Eds.). (2014). *Gamification for Human Factors Integration: Social, Education, and Psychological Issues: Social, Education, and Psychological Issues*. IGI Global.
- Capdehourat, G., Amigo, I., Lorenzo, B., & Trigo, J. (2025). On the effectiveness of LLMs for automatic grading of open-ended questions in Spanish. *arXiv preprint arXiv:2503.18072*.
- Csapó, B., Ainley, J., Bennett, R. E., Latour, T., & Law, N. (2012). Technological issues for computer-based assessment. In Care, E., Griffin, P., & McGaw, B. (2012). *Assessment and teaching of twenty-first century skills*. Springer.
- Csapó, B., & Szendrei, M. (Eds.). (2011). *Framework for diagnostic assessment of mathematics*. Nemzeti Tankönyvkiadó.
- Digital Education Council (2024) Global AI Student Survey 2024.
- Doble, C., Matayoshi, J., Cosyn, E., Uzun, H., & Karami, A. (2019). A data-based simulation study of reliability for an adaptive assessment based on knowledge space theory. *International Journal of Artificial Intelligence in Education*, 29(2), 258–282.
- Drivas, I. C., Giannakopoulos, G. A., & Sakas, D. P. (2020). Learning analytics in big data era. Exploration, validation and predictive models development. In Kumar V., Troussas C. (Eds.) *Intelligent Tutoring Systems. ITS 2020. Lecture Notes in Computer Science*, vol 12149. Springer.
- European Union (2011): Using Learning Outcomes. European Qualifications Framework. Series: Note 4. Publications Office of the European Union. https://www.cedefop.europa.eu/files/Using_learning_outcomes.pdf
- Fernández Cuevas, H. (2024). Personalized feedback in formative assessment: A case study in Mexican higher education in the era of AI. *Journal of Educational Technology*, 5(2), 1–15.
- Fink, A., Spoden, C. & Frey, A. (2023). Determinants of higher education teachers' intention to use technology-based exams. *Education and Information Technologies* 28(6), 6485–6513.

- Foltynek, T., Bjelobaba, S., Glendinning, I., Khan, Z. R., Santos, R., Pavletic, P., & Kravjar, J. (2023). ENAI Recommendations on the ethical use of Artificial Intelligence in Education. *International Journal for Educational Integrity*, 19(1), 1-4.
- Foster, N., & Schleicher, A. (2022). Assessing creative skills. *Creative Education*, 13, 1-29.
- Haladyna, T. M., & Rodriguez, M. C. (2013). *Developing and validating test items*. Routledge.
- Jauhiainen, J. S., & Garagorry Guerra, A. (2024). Generative AI in education: ChatGPT-4 in evaluating students' written responses. *Innovations in Education and Teaching International*, 1-18.
- Khameel B. M. (2025). From Feedback to Feedforward: Using AI-Powered Assessment Flywheel to Drive Student Competency. <https://www.facultyfocus.com/articles/teaching-with-technology-articles/from-feedback-to-feedforward-using-ai-powered-assessment-flywheel-to-drive-student-competency/> (utolsó letöltés: 2025.05.24)
- Kuzminykh, I., Nawaz, T., Shenzhang, S., Ghita, B., Raphael, J., & Xiao, H. (2024). Personalised feedback framework for online education programmes using generative AI. *arXiv Preprint arXiv:2410.11904*.
- Li, H., Chu, Y., Yang, K., Copur-Gencturk, Y., & Tang, J. (2025). LLM-based Automated Grading with Human-in-the-Loop. *arXiv preprint arXiv:2504.05239*.
- Muijs, D. (2010). *Doing quantitative research in education with SPSS*. Sage.
- Nádori, G. & Prievára, T. (2025). *AI receptkönyv*. Kézirat.
- Naseer, F., Khan, M. N., Tahir, M., Addas, A., & Aejaz, S. H. (2024). Integrating deep learning techniques for personalized learning pathways in higher education. *Heliyon*, 10(11).
- OECD CERI (2005). *Formative Assessment: Improving Learning in Secondary Classrooms*. OECD.
- Redecker, C., & Johannessen, Ø. (2013). Changing assessment—Towards a new assessment paradigm using ICT. *European Journal of Education*, 48(1), 79–96.
- Robles, M. M. (2012). Executive perceptions of the top 10 soft skills needed in today's workplace. *Business communication quarterly*, 75(4), 453–465.
- Romero, C. & Ventura, S. (2010). Educational data mining: A review of the state of the art. *IEEE transactions on systems, man and cybernetics. Part C, Applications and reviews*, 40(6), 601–618.
- Secolsky, C., & Denison, D. B. (Eds.). (2017). *Handbook on measurement, assessment, and evaluation in higher education*. Routledge.
- Sembey, R., Hoda, R., & Grundy, J. (2024). Emerging technologies in higher education assessment and feedback practices: A systematic literature review. *Journal of Systems and Software*, 211, 111988.
- Song, Y., Du, J., & Zheng, Q. (2025). Automatic item generation for educational assessments: A systematic literature review. *Interactive Learning Environments*.
- Tannock, S. (2017). No grades in higher education now! Revisiting the place of graded assessment in the reimagination of the public university, *Studies in Higher Education*, 42(8), 1345–1357.
- Viberg, O., Mutimukwe, C., Hrastinski, S., Cerratto Pargman, T., Liliesköld, J (2024). Exploring teachers' (future) digital assessment practices in higher education: instrument and model development. *British Journal Educational Technology*. 55(6), 2597-2616
- Wu, D., Chen, X., & Liu, Y. (2023). Integration of artificial intelligence performance prediction and learning analytics to improve student learning in online engineering course. *International Journal of Educational Technology in Higher Education*, 20(4).

5. SUPPORTING THE STUDENTS

Judit Dombi

Introduction

The field of pedagogy is increasingly open towards constructive learning theories, which regard effective learning as a constructive, *self-regulating*, situational process, served by teaching (Golnhofer, 2002; Nahalka, 2002; Richardson, 2003). In recent decades, the need to understand learning as a cognitive process has increased, while helping and supporting learning has gained an equally important role in different approaches to teaching. However, the achievement of these goals is hindered by a number of obstacles, as the received and still widespread practice is largely based on learning conceived as the reproduction of knowledge. This is especially true in higher education. The system of higher education basically operates with a structure that is not conducive to learner- and learning-centred education because it measures and judges the excellence of institutions and the success of students mainly through their performance in different subjects. At this point, it is important to mention a legitimate dilemma of many instructors in higher education: their need to become learner- and learning-centred in their methods is a growing expectation, but the training and outcome requirements of higher education still demand extensive academic knowledge from students. By presenting examples of the use of ubiquitous twenty-first century ICT tools for *learning support*, the present

chapter aims to provide an introduction to more recent concepts related to learning and the ensuing methodological innovations.

The fifth competence area of the DigCompEdu model is crucial, and as it details how to implement and assess the teaching-learning process by focusing on students and supporting them, it is interconnected with several other competence areas, in particular *learning-teaching* (see *Chapter 3*) and *measurement-assessment* (see *Chapter 4*). Another key requirement of *learning support* is the continuous self-reflection of the instructor (see *Chapter 1.3*), in which we must consider the way we think about learning, teaching, our own position within these processes, and our practice, while evaluating how flexible we are in adapting to altered student needs.

In order to transform higher education in line with the needs of our knowledge-based economy and society, it is essential to create an environment conducive to learning, in which the primary goal of educators is to develop the complex, general and professional skills of students. This chapter focuses on certain elements of this process that can be efficiently supported by digital tools and also aims to show how AI can help colleagues achieve these goals. *5.1. Ensuring access and inclusion* revolves around the topic of inclusion, making suggestions on how to ensure that all students have access to learning activities, tools and content that support learning, while no one is inadvertently excluded. Chapter *5.2. Differentiation and personalisation* is designed to help in choosing the best response to students' needs: personalisation and *self-regulation* play a vital role in the learning process; accordingly, this section provides support on the integration of digital technologies into the learning process with the aim of adequately responding to students' diverse learning needs. Chapter *5.3. Student Engagement and Motivation* discusses how to motivate students in the extended cycles of the higher education process, which tend to provide feedback only months later,

during the exam period, and also examines how digital technologies that are very close to the age group in question and the corresponding lifestyle can become a continuous source of motivation. ICT as a means of *supporting learning* is not only a motivating force, but it also closely involves learners in forms of work requiring their active role, and encourages them to actively participate in the process. The whole chapter relies heavily on generational research, with a particular focus on sociological and psychological research concerning Generation Z (e.g. Howe & Strauss, 2000; Pais, 2013; Tari, 2011), as it sheds light on the defining characteristics of today's students.

We interviewed the experts Dr. Éva Bodnár (University of Pannonia, Veszprem) and Dr. Helga Dörner (Eotvos Lorand University, Budapest) about the topics in this chapter. AI competencies related to the area, based on the supplementary document (Bekiaridis & Attwell, 2024, p. 36):



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The relevant AI competencies are aimed at enabling educators to use artificial intelligence to support learners with different learning needs and styles, and to promote pedagogical inclusion and accessibility. Educators should be able to use artificial intelligence to support special learning needs, promote self-regulated learning, and encourage learners to think critically about AI and its implications.

Artificial intelligence can help educators support learning in a number of ways, particularly in recognising students' individual needs, tailoring the educational process, and ensuring inclusion (Walter, 2024). AI-based tools, such as intelligent question generators or chatbots, can save educators time, allowing them to focus on content and pedagogical design. AI can also

support curriculum development, for example by suggesting differentiated tasks or multimodal learning materials. When used appropriately, AI does not replace but rather complements the work of educators, providing an opportunity to offer each student a learning experience that is tailored to their individual needs. However, it is important that educators use these tools consciously and critically—this chapter aims to assist them in doing so.

5.1. Accessibility and Inclusion

To ensure accessibility to learning resources and activities, for all learners, including those with special needs. To consider and respond to learners' (digital) expectations, abilities, uses and misconceptions, as well as contextual, physical or cognitive constraints to their use of digital technologies (e.g. as concerns font, size, colours, language, layout, structure).

To use AI tools that provide a personalised learning experience for learners with different abilities, including text-to-speech, language translation, and visual aids.

At all levels of education, it is becoming increasingly clear that inequalities arising from social or cultural differences need to be addressed as a matter of urgency, as no real teaching or learning success can be achieved without taking into account the diversity of learners. This would require the pursuit of a form of educational organisation that ensures both *equal access* to learning activities and tools supporting learning, as well as an *inclusive approach* based on compensating for differences. *Pedagogical inclusion* can be defined as a process of achieving equal opportunities, in which the goal is to create an *inclusive environment*. However, an inclusive approach should appear not only at the level of educational organisation, it should also be represented in

the content of education: in inclusive pedagogy, true access must also appear in terms of content. This pedagogical process begins with the recognition of individual social, cultural, and cognitive differences between students; with a complex examination of these activities, taking them as a starting point and building on them, we must construct an inclusive environment where learning can take place. A rapid and effective response to uniqueness and changing personal needs is the essence of inclusive pedagogy (Kalocsainé & Varga, 2005). Co-learning and individual learning need to be coordinated, and the targeted, conscious use of *ICT tools in learning support* can help educators in this. Used properly (see *Chapter 3.1*), such tools contribute to the equal participation of students in the teaching and learning process.

In what follows, the theoretical background will be complemented with practical advice, but these brief examples only serve to demonstrate practices of *supporting learning* which can be implemented along each guideline.



How can digitally-assisted learning support in higher education be interpreted?

Helga Dörner:

If digital technologies support inclusivity and inclusive pedagogy, they can be powerful tools and they should by all means be used. Inclusivity in this context means accepting that the students and the faculty we work with are diverse. And this does not necessarily mean a disadvantage. Rather, we need to figure out the dimensions in which we differ, where these dimensions may intersect, and what development opportunities we can use to support each other in a learning community. If we follow this approach and ask whether digital devices can support us from that vantage point, we are on the right track.



Éva Bodnár:

Supporting learning through digital tools can be interpreted as “capturing” individual learning differences. For example, it can offer tremendous help in the transition between BA and MA courses. Students from different higher education institutions possess completely different background knowledge. There is huge potential in making a variety of preparation materials that will bring them all to the point which we regard as the entry requirement.



An inclusive educator aiming to develop students with the support of digital tools is characterised by competence in the following activities:

To provide equitable access to appropriate digital technologies and resources. To provide equal access to appropriate digital technologies and resources for learners.

Instructors must bear in mind that instead of deepening existing inequalities, the use of digital tools should compensate for them. Whenever we use any kind of digital technology, we need to ensure that all of our students have access to the technology in question.

It is not enough to just ask if everyone has the necessary device, if they possess the necessary data quota, and if a particular application is available to them as some students will not openly report any problems. It is highly recommended to test the feasibility of the process during the planning phase: let us check the availability of devices, as well as the ability of participants to use the planned application, and if they have a working Internet



connection. In an ideal world, institutional devices (tablets, laptops) would be available for such purposes, but at the time of writing, this is rarely the case in higher education.

If the instructor has more than one device of their own, they can be taken to the classroom in case students do not have a device or it is not working properly. A micro USB charger is not an expensive device, but we should always have one to hand, as probably the most common problem is running low on battery. If there are not enough devices, it can also be helpful to plan the process in a way that enables students to share their devices (for example, in pair or group work).

To select and employ digital pedagogical strategies which respond to learners' digital context.

Students are diverse in many respects. This includes their use of devices, and this fact should always be taken into account during the planning of the use of ICT tools, as the compulsory transition to digital education during the Covid-19 pandemic evidenced. In that unexpected situation, instructors had to realise that students often have access to smart devices only, so for example, assigning a file for a task that cannot be opened with an Android or iOS device is ill-advised (see *Chapter 2.2* for file conversion options). Although the use of smart devices is extremely common, it cannot be called universal – there may be students who do not own a smartphone or other mobile device. We must not take it for granted that all of our students are able or willing to use such devices, so it is a mistake to organise learning processes that build on their exclusive use. Students may also differ in the range of familiar and popular applications within their *personal learning*

environment (PLE, see *Chapter 6.5*). This is something which should be mapped at the beginning of the semester with an online questionnaire (e.g. in [Google Forms](#) or [MS Forms](#), see *Chapter 4.1*) asking which their favourite applications for learning are and which ones they would prefer to avoid (Figure 5.1). As this is a dynamically changing environment, the survey should be conducted at the beginning of each semester.

Personal learning environment survey

Dear students! I would appreciate it if you could help my work with by filling out this short form. It takes max 2 minutes.

Hi, Johanna. When you submit this form, the owner will see your name and email address.

1. What sort of apps do you use when you study at home (e.g., Quizlet, Google Notebook LM)? 

Enter your answer

2. Which apps would you NOT use for studying? 

Enter your answer

Figure 5.1. A personal learning environment survey using MS Forms on a mobile phone. The Office Immersive Reader icon appears for each question and reads the text aloud if necessary.

Other issues that should be taken into account are the different *digital competences* of the students and their attitudes to and possible misconceptions about the devices. It is difficult, but not impossible, to strike the right balance between individual and co-learning that can compensate for any differences that may arise from digital device use.

As a methodological framework, the cooperative approach may prove a useful tool, which, besides many other advantages, can also help in the democratic solution of the above problems. If we prefer group and pair work, we reduce the possibility that the individual is left out of a learning process due to an obstacle related to a digital device (for more information on applications that support digital collaboration, see *Chapter 3.3*).



To employ digital technologies and strategies designed for learners in need of special support.

As with other levels of education, teachers in higher education need to be prepared to provide *learning support* for students in need of special attention. Identifying such students and surveying their needs is also extremely important for the educators, as preliminary diagnosis facilitates the later planning of the teaching-learning process.

This can be carried out, for example, through an online questionnaire or form (e.g. [Google Forms](#), [MS Forms](#)) where students can also formulate specific needs in *open-ended items* (Figure 5.3).

The screenshot shows a Google Forms questionnaire titled "Learning support survey" for the academic year 2025-26. It includes a red asterisk icon indicating a required question. The first question is "Do you experience any of the following problems? *", with five radio button options: "Mobility, sensory, or cognitive impairment", "Autism spectrum disorder", "Learning disorder, Attention deficit disorder, Conduct disorder", "I don't know about such problems", and "I don't wish to respond". The second question is "If you suffer from any of the problems mentioned above, what is it exactly, * 1 point and according to your experience, what helps you in studying?". Below this question is a text input field labeled "Your answer".

Figure 5.2. A questionnaire made in Google Forms to survey needs related to supporting learning

A student with special educational needs is a person with musculoskeletal, sensory or speech impairments, autism spectrum disorder, or learning, attention or behavioural disorders. Artificial intelligence can support inclusivity in higher education in several ways, particularly by helping to overcome barriers to accessibility. There are numerous assistive technologies (Menich, 2021) available, and a significant proportion of these are now augmented with artificial intelligence. AI technologies improve inclusive education by providing tailored assistance and support solutions to meet



the diverse needs of learners. In the following, we present the tools that can help students with special educational needs to learn more effectively.

Artificial intelligence-driven **text-to-speech** (TTS) tools (e.g., [Natural Reader](#)) enable students with visual impairments or reading difficulties to listen to written content, making textbooks, notes, and digital materials more accessible. Students with dyslexia can use TTS tools to convert text to speech, reducing the cognitive load of reading and allowing more time to absorb the content. Perhaps even more versatile is [Microsoft Immersive Reader](#), a free tool designed to improve text comprehension and accessibility for all users. In addition to reading text aloud, Immersive Reader can also adjust font size, font type, line spacing, and background theme to improve readability in applications such as MS OneNote, Word, Teams, or Edge, making it useful as a screen reader. Students who struggle with concentration or have attention disorders can benefit from text-to-speech tools. These programs (such as the previously mentioned [Natural Reader](#)) not only read the content aloud, but can also use artificial intelligence to create summaries and outlines, helping students review and understand key concepts. The artificial intelligence-based service [Be My Eyes Be My AI](#) was developed specifically for visually impaired students. It allows users to take photos with their smartphones and receive descriptive feedback on the content of the image, thus not only helping them to read text, but also making any visual content accessible to them.

Educators can also support visually impaired students by using alternative text (alt text) generators. Alternative text serves multiple purposes. Screen readers read this text instead of images, helping visually impaired users understand the content and function of images. In the case of a slow internet connection, if an image cannot be loaded or the user has disabled images, the browser will display the alternative text in place of the

image. Several LMS systems, such as Moodle and Canvas, also provide the option to enter alternative text when uploading images. We can save time by using artificial intelligence, such as [ChatGPT](#), to generate alternative text for images, diagrams, or graphs – of course, it is extremely important to check the generated text before use.

Artificial intelligence-based **speech-to-text** (STT) technologies (e.g., [Google Voice Typing on Android](#), [Google Docs](#), and [Microsoft Dictate](#)) convert spoken language into text, helping students who have difficulty typing or writing. Students who find writing difficult or slow, or who may have dysgraphia, can use these tools for note-taking and essay writing, but these technologies also help students with hearing impairments: they allow them to read a lecture or any live speech in writing almost immediately. Similarly popular among hearing-impaired students is the freemium tool [Speechnotes](#), which is capable of recording even long lectures, making it an ‘online notebook’ specifically tailored to university needs, and it also has a Chrome extension. Previously recorded audio files, such as lectures, can also be converted to text by hearing-impaired students using Microsoft Dictate, but it is a great help to dyslexic and dysgraphic students if they can digitally record the lecture in accordance with the user rights framework (see section 2.3). This helps them later when studying at home, as they can listen to the recording several times to better understand what was said. In terms of assignments, alternatives again can be provided: instead of written papers, podcasts can be requested, as students may be better at expressing themselves verbally than in writing. Voice-to-text applications, which convert speech into text, are also very useful for dysgraphic students, as they can help them with both note-taking and writing papers. **Predictive text input** features use artificial intelligence to suggest words or phrases to students as they type, which can be a great help to those who struggle with

writing. Predictive typing in [Grammarly](#), [MS Word](#), or [Gboard](#) minimises the number of keystrokes, thereby reducing cognitive load, and produces error-free text, which also aids in later learning.

Artificial intelligence can automatically generate captions and transcripts for video lectures and teaching materials, making the content accessible to hearing-impaired students. Real-time captioning in [Zoom](#) or [YouTube](#) lectures not only helps students with special needs, but also compensates for disadvantages arising from different language levels in foreign language teaching. Recorded university lectures with automatic captions increase accessibility for students with different needs or linguistic backgrounds. Real-time, automatic captions are also available for [PowerPoint presentations](#), which can be helpful for students. Closely related to subtitling is real-time, AI-supported translation: the subtitling options described above are available in several languages, supporting not only the hearing impaired but also compensating for other linguistic disadvantages. AI-based translation tools ([DeepL](#), [Microsoft Translator](#)) can help people with different native languages understand the course material and participate more actively in class.

AI can help students **simplify complex texts** by converting them into plain language, which is beneficial for students with weaker foreign language skills. These tools can also break down complex concepts and processes into smaller, more manageable steps, making learning more accessible to everyone. Many AI applications can generate shorter summaries of detailed scientific articles, helping students understand key concepts. For example, [ChatPDF](#) or [Google Notebook LM](#) allow users to ‘chat’ with PDF files as easily as they would with ChatGPT—these programs answer questions based on the uploaded PDF file, making even complex texts easy and quick to understand.



In what ways can AI tools support both students and researchers in improving the accessibility of documents and digital content?

Johanna Szőke

Text-to-speech tools can assist dyslexic learners as well as learners with visual impairments. Text summaries can help those who have issues with discerning crucial information. The voice mode in chatbots can help those who have difficulties typing.



Click/Scan

Sample prompt (only necessary with generic chatbots)

Summarise the following text [e.g., uploaded document or copied text] in a simplified way so that it can be understood with B2 English language skills. If a technical term cannot be simplified, add its definition in brackets.

Tools that summarise lecture notes, highlight key concepts, and provide learning suggestions and guidance save time and support learning, thus enabling students to keep up with the course, thereby allowing them to focus better on their studies and overcome obstacles that do not pose a problem for their peers. Students with special needs are generally aware of these ‘barrier-free’ technologies and use them in their studies, so, in many cases, the educator’s only task is to remain open to these possibilities and to provide digital assistive technologies as an alternative, disadvantage-compensating option for students with special needs in the pedagogical process that is designed using traditional tools.

To consider and respond to potential accessibility issues when selecting, modifying or creating digital resources.

Fortunately, the access of individual students (e.g. those with visual or hearing impairments) to digital resources can easily be bridged with digital aids. In some cases, all we need to do is publish the text we want to discuss in an extension that matches the software of the students in question. However, it is not enough to make sure that the extension is the right one: screen reading software can only use files that been processed with optical character recognition (OCR). With this technology, images, scanned or photographed documents and PDF files can be converted into editable and searchable formats. The function is available on most scanners, but it is not necessarily the default setting. People with reduced mobility can also find it helpful to choose a source that is accessible online, so they do not have to go to the library (see *Chapter 2.1* for a list of usable digital libraries and archives). Some resources or databases might be subscription-based services that are only available free of charge from the network of university campuses – we should always check this and consult with students so that they are not disadvantaged as a result.

To employ design principles for increasing accessibility for the resources and digital environments used in teaching.

It is also very important to pay attention to equal access in the case of teaching materials, especially regarding their appearance, visibility and comprehensibility. As a result of the internationalisation of higher education, there are more and more foreign students socialised in writing systems other than Latin characters (e.g. Chinese and Arabic-speaking students).

These students need more time to read texts in an unfamiliar typeface, so it is more appropriate to *choose a standard font* (e.g. *Arial* or *Times New Roman*). As well as the right typeface and font size, the colour combination and the layout that appears on a projected slide can contribute to better visibility and easier reception; it is also important to pay attention to the use of light-dark contrast (Figure 5.3), which is specifically helpful for reading (see *Chapter 2.2* on further practical issues of presentation techniques and the tools that can be used).

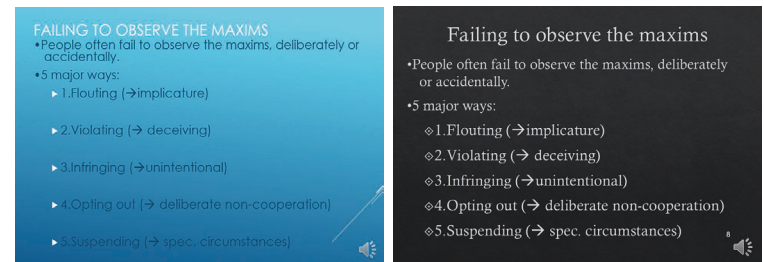
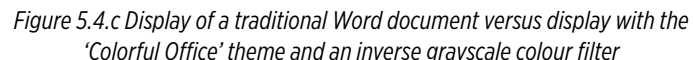
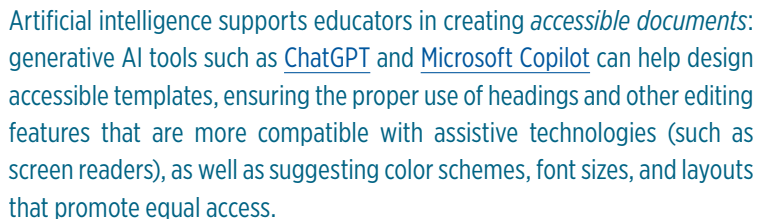


Figure 5.3. Contrast difference between two ppt slides

By using ICT tools and software with the appropriate settings, we can ensure equal access. Several applications allow us to customise the colours, font size, brightness and contrast (Figures 5.4. a-b-c). If we are projecting a document, we may wish to make use of these options because getting these details right is a great help for students with visual impairments and, over time, all participants may find the optimised settings more relaxing to the eye.





Specialised accessibility services are also available, such as the [Google Text-to-Speech](#) app, which allows other applications on our device to read aloud the text on the screen.

If we send the slides of the lecture or the *handout* to those students with visual impairment or dyslexia, they can easily convert the text to speech with MS Office's built-in Reading feature.

To continuously monitor and reflect on the suitability of the measures implemented to improve accessibility.

Asking for continuous feedback is essential in all teaching-learning processes, and digital technology renders this more efficient through functions like anonymous polling and response systems (e.g. [Google Forms](#), [MS Forms](#), [Mentimeter](#); see *Chapter 4.1* for more details). Such services allow us to monitor and analyse student access. Feedback not only helps students to acquire the ability to reflect on their own learning processes, but can also help instructors in the subsequent fine-tuning of their pedagogical strategies. Continuous feedback helps us to assess the adequacy of the tools and content, as well as students' access to them, and we can make changes in the event of any issues. This, of course, also requires some flexibility on the part of the instructor. We have to accept that inclusiveness – the truly inclusive environment in which learning can take place – can only be ensured by bearing individual characteristics in mind, constantly monitoring needs and quickly responding to them.



Although AI does not solve all problems, it has significant potential to support more inclusive educational practices. As with any digital tool, the key lies in pedagogical intent: AI should not be used because it is innovative, trendy, and novel, but because it can provide effective solutions to real student problems.

Educators and policymakers must work together to ensure that these tools are used fairly, transparently, and ethically. AI-based tools and

technologies can also exacerbate educational inequalities if some students have less access to this technology than others. Ensuring equal access to AI tools and technologies is essential, especially for students from underfunded communities or with special educational needs. It is worth paying close attention to feedback, and if it is felt that using AI has not succeeded in reducing the digital divide as originally planned, but rather that the divide is widening, then intervention is necessary to help students facing this problem. It is therefore important to emphasise that while AI-driven technologies offer greater opportunities than ever before in terms of accessibility, the active presence and awareness of educators is essential to ensure that real solutions are found rather than additional barriers.

5.2. Differentiation and Personalisation

To use digital technologies and artificial intelligence to address learners' diverse learning needs. To allow learners to advance at different levels and speeds, and to follow individual learning pathways and objectives.

Inclusion is achieved when we genuinely respond to the needs deriving from uniqueness – ICT and AI tools play a role in this, too, and they can facilitate *differentiation* and the development of *personalised learning pathways*.

Although *differentiation* is not a new concept in pedagogy (cf. Falus, 1998; Glaser, 1977), the provision of personalised learning pathways is less common in higher education. Related literature (e.g. Kereszty & Lányi, 2017) discusses several means of *differentiation*, of which the following may be relevant in a higher education context.

- **Differentiation according to prior knowledge:** within the heterogeneous groups of students typical of higher education, the level of

students' prior knowledge can vary greatly. Some students do not have sufficient prior knowledge to progress in the teaching-learning process; a number may have no prior knowledge concerning the given topic at all, others may have a varying degree of deficiencies regarding the required knowledge. There are examples of the opposite case as well: sometimes the content to be processed is already known to the student. Students' prior knowledge should be surveyed through *diagnostic assessment* (see *Chapter 4.1.2*), based on which we can form groups and plan different activities and materials for students with different knowledge.

- **Differentiation according to the basic skills:** basic skills are the skills that are necessary to carry out different activities. We distinguish between basic communicative, cognitive and psychomotor skills. As in the previous point, we typically form groups of students from those with similar abilities and try to adapt the teaching-learning process to the needs of the individual groups.
- **Differentiation according to the pace of learning:** different students need a different amount of time to complete the activities. Although student groups can be formed here as well, this kind of differentiation can be solved relatively easily in a more individualised way. Digital technologies can be particularly useful here, making it easier to manage the process (assigning a different volume of tasks, providing additional activities for faster users, even on their own mobile devices).
- **Differentiation by area of interest:** this can be extremely effective in higher education as at this stage in their lives, students already have well defined areas of interest. Building on these interests and accordingly personalising the learning process can be not only motivating (see *Chapter 5.3*) but also extremely useful.

For example, if we use an online questionnaire (e.g. Google Forms, MS Forms) to assess students' interests in advance of a lecture, we can introduce examples of phenomena from those fields that correspond to students' interests.



- **Differentiation according to the level of individual work:** this takes into account how much support a student needs while carrying out individual work. Some students are more independent, some are less so and thus require more assistance; the latter group might, for example, need more help from the instructor or their peers in interpreting or completing a task.

If classroom activities are designed so that students better skilled in individual work can progress at their own pace, while students who require some degree of support receive continuous assistance, then advance planning ensures that all students learn in the way that works best for them. In order to facilitate this, it is advisable to produce a task or a class activity in a "package" which includes a task description and a clear output goal definition for more independent students, possibly with external references and links that make individual work easier. In addition, opportunities for pair and group work (possibly directed), and constant feedback should also be provided.



- **Differentiation by intelligence types:** Howard Gardner (1983, 1999) distinguished between eight comprehensive types of intelligence: (1) linguistic intelligence, (2) logical-mathematical intelligence, (3) spatial intelligence, (4) bodily-kinaesthetic intelligence, (5) musical intelligence,

(6) naturalistic intelligence, (7) interpersonal intelligence, (8) intra-personal intelligence.

As well as trying the tests available online, after familiarising ourselves with the theory, we can quickly get an idea about the intelligence types of our students with individual questions, even during an introductory lesson. If we take into account the different types of intelligence, we can design a teaching-learning process in which everyone can learn in the appropriate way (for example, by interpreting graphs, tables, understanding coherent text, reproducing its content, or understanding relationships within a system).

- **Differentiation according to learning requirements:** the subject-specific requirements for students do not apply to everyone in general, but are tailored to the individual.

This can be achieved in several ways: students must meet the same requirements (tests, essays), but the criteria for assessment are different, depending on the students' prior knowledge or basic abilities. Another approach is to let students choose task types that they are more comfortable with (see Good Practice 5.1: *Alternative Student Products*), so that, for example, someone who is able to deliver better results in another media should not be required to give an oral presentation. Different student products pose a challenge, as we have to develop different assessment criteria, but the extra effort pays off, as the established criteria can be applied again and again.



Of course, there are varying degrees of *differentiation* (cf. Glaser, 1977): *differentiation* according to ability, interests or pace of learning is more

fundamental and easier to implement than methodological or content *differentiation*, which requires continuous *diagnostic* monitoring, or the differentiation of learning requirements that were previously the same for all.

One of the key benefits of differentiated learning organisation is that it allows for process design which takes into account the different entry levels of heterogeneous groups, including the adjustment to the level of both those with special learning needs and those performing better than average. This type of differentiation is called *quantitative differentiation*.

Another aspect of *differentiation* is *qualitative*: it builds on the previously mentioned angle, but also extends it. Its purpose is to correspond to differences arising from individual abilities, orientations, and interests. The key to such a personalisation of the learning process lies in the diversity of the tasks in terms of content and operational level, and this can be effectively applied to groups of students with different levels of knowledge and skills (Hortobágyi, 1985).

In higher education, both of the above aspects of *differentiation* have their role. The biggest challenge for supporting learning in higher education is the implementation of quality education tailored to the individual, although relevant research (e.g.: McQuarrie, McRae, & Stack-Cutler, 2008; Rock et al., 2008) proves that supporting the learning process delivers the most added value in the case of students with weaker abilities. As drop-out is a serious problem in most higher education institutions, it is important to look for individualised learning pathways that effectively help those students most likely to drop out.

Digital technologies are particularly suitable for identifying and monitoring these students (e.g. tracking absences, monitoring activities in the LMS, monitoring feedback; see *Chapter 4.2*).





How can individual learning pathways be provided to students?

Éva Bodnár:

We mapped the courses which students often enrol on for the second or third time, causing delays in the study process. In these subjects, we want to introduce a feedback system where colleagues mark such nodes in Moodle. The system notifies students that a deadline is approaching or reminds them that a task is imminent. We do this to try and prevent them from deferring tasks and interrupting the learning process. So we are developing conscious support for the teaching-learning process with the help of the LMS system.



In the same way as it is essential in responding to different learning needs, the incorporation of digital technologies into the learning process is a realistic solution to the question of compensating for differences. The use of such technologies (e.g. *digital portfolios*; see Good Practice 4.1: *Blog-Based Digital Portfolio* in Chapter 4), learning management systems (see chapters 3 and 4.2), and *collaborative interfaces* (see Chapter 3.3) not only allows students to proceed at different speeds, but also helps them to follow an individual, personalised learning pathway. Besides the inclusive pedagogical approach described earlier, personalisation is also important as a generational expectation and demand from the students, which is driven by the increasing prevalence of personalised services in other areas of life.

As a general guideline, DigCompEdu defines instructors who differentiate with digital tools as having competence in the following activities:

To use digital technologies to address the special needs of individual learners.

As discussed in the previous section, our students differ in several respects. However, creating an inclusive learning environment is only the first step in successful *learning support*. Equally important is the continuous consideration of differences – in the planning and implementation of the pedagogical process, in the organisation of learning to make it personalised, effective and supportive of individual learning paths, and in the continuous, differentiated assessment that complements it. Various digital technologies can help in these steps.

Students who require increased support can use their mobile devices to, for example, process a text in a foreign language (using translation or dictionary applications), while students with dyslexia can watch an online video (e.g. [TED](#)) that complements the literature read by others, so that they will acquire versatile knowledge deriving from several sources in the course of group work.

Artificial intelligence-based applications such as [Grammarly](#) and [Turnitin's Revision Assistant](#) support writing in English, so they can be helpful for multilingual or international students. Language support tools should be promoted in all academic fields, as students use them to participate more confidently in academic work.



To allow for different learning pathways, levels and speeds when designing, selecting and implementing digital learning activities.

In everyday life, students progress at different levels and speeds. If the instructor plans the teaching-learning process according to the time

required by the fastest learner, others lagging behind is inevitable. On the other hand, if we wait for the slowest student, the majority will quickly get bored. Ideally, our planning should reckon on an average time, however in this case, the fastest will still be bored. Digital devices appear here as a potential source of danger – practically the whole world is hidden in the pockets of inattentive students: news, entertainment options, even their friends. Only a similarly personalised learning process can compete with this highly personalised online microcosm.

For students who complete tasks sooner than the others, we can plan an extra task that they can work on together in a *collaborative interface* (e.g. [Google Docs](#), [MS OneNote](#)) while those working at an average speed catch up. In planning this process, *diagnostic* assessment (see *Chapter 4.1.2*) is given a prominent role: if we are aware of our students' abilities, we can assign tasks of a quantity and difficulty that allow us to progress together. Our students may also have different interests: if we give them tasks related to areas closer to their own future profession, they will become more open to more abstract concepts as well.

The practice of the *flipped classroom* may be also interesting as it allows students to proceed at an individual pace in the extracurricular phase, thus helping them to explore a variety of learning paths (see *Chapter 3.1* and *Good Practice 3.1: Interactive video-based presentation in a flipped classroom*).

To devise individual learning plans and use digital technologies to support these.

Accepting that our students are different and that we therefore need to plan differentiated teaching-learning processes, we should consider creating development plans (Perjés & Hájja-Nagy, 2015) and learning plans in

line with individual development goals (Szivák, 2014) (see *Chapter 1.3* on professional development plans for educators). Individual learning plans are personalised set plans that include the individual learning program, the needs, tasks, available learning paths and goals for each student. The plan also includes the expectations of the course – in light of the prior knowledge, opportunities and abilities of the particular student. ICT tools can be useful in both the planning and implementation phase of the finished plan.

A learning plan template can be created as a [Google document](#), which may include the duration of the learning process, goals, and assessment considerations. We can then share the document with our students, and they can modify it and add to it. The instructor should also respond to and reflect on the changes, resulting in the final version of the plan. If we lack adequate background information about the students, an online questionnaire (Google Forms, MS Forms) can be used to map students' previous learning paths, their existing knowledge and their potential special needs. The implementation of the learning plan can also be supported with digital tools: students can be encouraged to create a [Trello card](#), which makes the management of the plan transparent, but a shared [Google calendar](#) is also perfect for storing deadlines.

The optimal individual learning plan affects not only learning happening in the classroom but any extracurricular independent learning as well. If students know what to expect during the semester – what requirements they must meet, what to realistically expect from the instructor and their peers, and how to reach their goals – they will be responsible for their own learning processes, making them more motivated and probably ending the semester with a better performance. Such a plan is also important for the instructor: it provides carefully considered and systematic *learning support* for students.

ICT tools can also support the differentiated implementation of individual learning plans. The easiest way to provide multiple approaches to the same content is to use diversified tasks (Moran, Kornhaber, & Gardner, 2006). With the help of digital technologies, we can provide students with activities that best suit their interests, competences and learning needs.

As an example, if we use a polling application at the beginning of the class to assess which group would like to deal with which topic, and students can choose the topics they want to study and the kind of student product they will undertake, we strongly support personalised learning.



In addition, the regular use of online polls also delivers meaningful information for the educator about the students' preferred learning paths, even allowing certain trends to emerge over time.



If we create a digital collection of thematic course materials with annotated tasks of different types and difficulties (a “task bank”), and share it with students online (via, for example, [Dropbox](#), [Google Drive](#), or [OneDrive](#)), or through a university-specific system on the institution's own server, and ask students to complete three to five individually selected tasks from the ones stored there, everyone can choose individually from the tasks according to their preferences. [AI-based tools, especially chatbots \(e.g., ChatGPT, Google Gemini, Microsoft Copilot, Mistral AI, Claude, Perplexity AI, and Pi AI\)](#) are also excellent for creating a variety of tasks that promote differentiation on the same topic, see 5.5 *Creating differentiated tasks with AI best practice*.

Such thematic task banks can also be created as a result of instructor collaboration: each instructor does not have to create a large number of

tasks at once, but within a few semesters, a common resource can be developed from the shared tasks.



How can GenAI chatbots and generators assist educators with the speedy creation of differentiated materials?

Johanna Szőke

This is where GenAI can really shine. It can adapt activities and learning materials to individual student needs. You can also vary the difficulty of the activities by generating more challenging or scaffolded versions.



Click/Scan

Resources for the assignments can also be different: we can share texts for reading in a PDF file, but also podcast audio files or links to various related videos, thus providing our students with a wide variety of opportunities to follow the learning paths that best suit their needs.

If we are open to other student products in addition to the traditional essays and presentations, we further increase the chances that everyone will find the learning path appropriate for themselves (see Good Practice 5.1: *Alternative Student Products*). Examples of such products include videos, animations or infographics (*Chapter 2.2* discusses in detail the tools for the production of digital learning materials, which can also be used to create student products), task planning and digital storytelling (see *Chapter 6.3*), creating a picture gallery or collage, or possibly producing marketing material, a website or a podcast.



By encouraging students to make the produced content available to their peers, they can reflect on each other's products, and we also support mutual responsibility for learning.

According to research, differentiated educational organisation also increases student motivation (Lestyán & Szabóné, 2017), which is the topic of the next section.

5.3. Actively Engaging Learners

To use digital technologies to foster learners' active and creative engagement with the subject matter. To use digital technologies within pedagogic strategies fostering learners' transversal skills, deep thinking and creative expression. To open up learning to new, real-life contexts which involve the learners themselves in hands-on activities, scientific investigation or complex problem solving, or in other ways increase learners' active involvement in complex content.



To share examples and case studies where artificial intelligence has had a positive impact on learning, both inside and outside the classroom. To encourage students to share their experiences and insights regarding the use of artificial intelligence for learning purposes.

Learning motivation is an attitude that determines a student's active relationship to learning – a force that enables them to participate in the teaching-learning process with sustained activity. It is important to boost students' desire to achieve success, which should be a stronger motive than the fear of failure. Students with a low motivation to achieve success are typically either failure-tolerant or failure-avoiders (Covington, 1992). A failure-tolerant student is indifferent to performance situations, opting out of such tasks and viewing them from the outside. This may be due to

a lack of interest. Failure-avoiders try to avoid challenging tasks: if they are not put into a situation requiring real performance, they escape the risk of receiving negative feedback, which would be detrimental to their self-esteem.

In addition to stimulating the desire to succeed, it is also crucial to support students' performance motivation, for example by providing them with an individual path of progress (on individual learning plans see *Chapter 5.2*) and enabling them to achieve various individual development goals (Héjja-Nagy, 2015).

Based on these observations, we should reconsider our pedagogical methods and implement diverse forms of *learning support* which greatly assist heterogeneous learning communities. Digital devices and multimedia content, considered simply indispensable by Generation Z, can offer invaluable help in this. The traditional organisation of education that is typical of higher education is by no means motivating for students who are accustomed to something completely different in their daily life where they avail themselves of content options, immediate feedback and active, meaningful participation.



How can digital solutions motivate students to learn?

Éva Bodnár:

We are constantly holding frontal classes while seeing that this generation cannot cope with it and cannot even tolerate it. It is important to be up to date. A present-day student cannot accept that I am holding a lesson from slides made five years ago. This completely challenges the instructor's authority regarding knowledge.



Helga Dorner:

Assessment of student work and continuous feedback is an important part of learning support. Digital devices are now indispensable in this area.



Digital technologies are fascinating tools for motivating pedagogical activities. These technologies form an important part of modern students' daily lives and their use in education thus makes the learning process more authentic and familiar for young learners.

If students are involved in decisions concerning the syllabus – for example, if they can choose from certain areas, set texts, or assignments – and if their interests are taken into account when the syllabus is designed, they are more likely to immerse themselves in it. Anonymous polling applications are excellent for surveying opinions (see Figure 5.7).



The joint definition of learning objectives and assessment criteria is also a major motivating force, and *collaboratively* edited documents (e.g. [Google Docs](#), [OneNote](#)) are a viable platform for making suggestions, even anonymously.



Can you imagine involving students in defining the goals and performance requirements of a course?

Helga Dorner:

We can motivate our students by involving them in the planning and even the implementation of the learning process. Obviously, an important question is the result we want to achieve by this.

**Éva Bodnár:**

Making an agreement with the students at the beginning of the semester is a psychological contract that can prove exceptionally useful. It adds a completely new element of motivation, making students more committed, since we have jointly agreed about what to do and what their path is.



In higher education, the motivating role of educators is changing: their most important task is to *motivate self-regulated learning*, and the ultimate goal is to make the need for continuous learning a part of a student's make-up (Perjés & Héjja-Nagy, 2015).

The instructor who effectively motivates through the use of digital technology is characterised by competence in the following activities:

To use digital technologies to visualise and explain new concepts in a motivating and engaging way.

One of the crucial benefits of current technology is the wide-ranging use of multimedia. Videos and animations are popular among students: the present generation is extremely visual. Their favourite applications are photo and video sharing interfaces, but their digital communication is also characterised by the use of animated *emoticons* and GIFs. If we compare traditional education – a lecture supported by a “normal” slide show – to such dynamic interfaces, the former may appear dull, lacking in stimuli, and by no means motivating for students. Fortunately, applications for creating visualisation (video editors, image editors, animation and infographics software), such as [Canva](#), [Piktochart](#) and other tools and applications presented in *Chapter 2.2* are now available to instructors and they do not

require any special expertise (see Good Practice 5.3: *Feedback through infographics*). Quiz games created with different online quiz makers are also remarkably motivating, as they illustrate and synthesise material in an unconventional way, see, for example, the video below for an unusual summary lesson.



The built-in AI features of Canva and Piktochart mentioned above not only make it easier to create visually appealing content, but also help educators plan, illustrate, and engage students, while saving time. The [Canva Magic Design](#) feature automatically suggests designs for presentations, posters, and even infographics after we enter a few keywords. The ‘Text to Presentation’ feature automatically creates a slideshow based on the entered text, complete with images, layout, and titles. This allows educators to create more up-to-date presentations that are better suited to, and probably more appealing to, their audience. What is more, less time is spent editing, leaving more time for content and the audience.

With [Piktochart AI](#), text or tabular data can be automatically converted into diagrams, as the AI recognises which type of diagram (pie chart, bar chart, or flowchart) is most suitable for illustrating the information in question. This is extremely helpful when teaching abstract or numerical content, making the material more accessible, especially for visual learners.

Sample prompts:

- Generate a pie chart in MS Word based on the uploaded table
- Generate a four-part flowchart in MS Word based on the four main points in the notes below

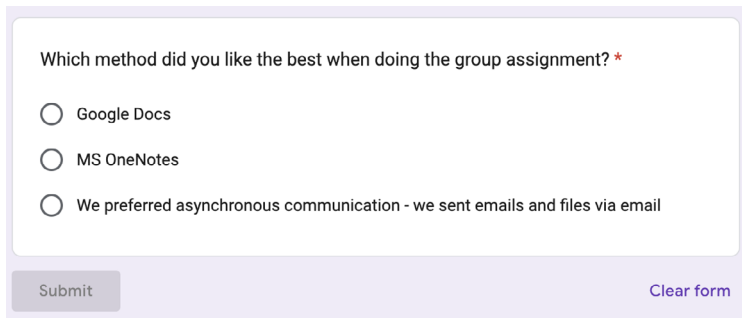
AI-supported features can suggest images, icons, and colour palettes based on keywords, which helps with creating content that is both aesthetically pleasing and pedagogically sound. Different learning preferences can also be addressed with different templates, such as visual notes, flowcharts, and infographics, which can help multiple students at the same time. With these AI features, educators can create personalised teaching materials that are sensitive to individual needs—this is especially important when teaching a heterogeneous or multicultural audience. Although artificial intelligence can provide personalised learning paths and experiences, it cannot replace the human interaction, mentoring, and emotional support provided by the university environment, peers, and educators. Integrating technological advances and finding the right balance between real, in-person teaching is key to preparing students holistically.

Quizzes created using various quiz editor websites also have a particularly motivating effect, as they illustrate and synthesise information in an alternative way. For example, the following video demonstrates such an unconventional revision lesson.



It is equally motivating to provide ongoing, personalised feedback on the learning process, which can also be carried out through media popular among students (see *Figure 5.5*, and Good Practice 5.2: *Summary collage*).





Which method did you like the best when doing the group assignment? *

☐ Google Docs

☐ MS OneNotes

☐ We preferred asynchronous communication - we sent emails and files via email

Submit Clear form

Figure 5.5. Personalised feedback for student group presentations.

By incorporating various concept-mapping applications (e.g. [mindmeister](#), [Ayoa](#), [mindmap](#), [Mindomo](#), [Coggle](#); see *Chapter 2.2*. for specific practical suggestions, and similar applications), students can be encouraged to become active in lessons, and brainstorming, note taking and project planning can be revolutionised. Furthermore, such applications can be used not only individually but also in a *collaborative* way (see *Chapter 3.3* and *Good Practice 3.3: Word cloud and mind map bank*).

To employ digital learning environments or activities which are motivating and engaging, e.g. games, quizzes.

The experience gained during the introduction of compulsory digital education due to the Covid-19 pandemic reinforced the belief of many instructors that learning management systems (e.g. [Moodle](#), [Canvas](#), [Google Classroom](#), [MS Teams](#)) cannot be a real alternative to traditional learning environments, and certainly not a replacement for them. At the same time, however, it also became clear that such interfaces can efficiently

complement the traditional learning environment, as their use expands the range of tools available to educators. These tools provide communication channels for joint learning and learning support and establish a centralised location for all information and content, and thus the processing, modification and sharing of such material is now extremely simple. The aforementioned platforms integrate functions that are important to students (e.g. storage, sharing, *tagging*, *likes* and other reactions, polls) and they reflect students' needs in other areas of life, thereby encouraging their active participation.

To put learners' active use of digital technologies at the centre of the instructional process.

Students' use of ICT is a given: it is their everyday reality. All the information they require (e.g. the meaning of a foreign word, a bus timetable, opening hours, etc.) is accessed through their mobile phones, and it would be completely unrealistic not to build on their digital literacy when planning the teaching-learning process. These days, this digital competence is increasingly complemented by the use of artificial intelligence-supported applications: students often rely on AI-based tools, such as translation software, text correction, or idea generation tools (such as [ChatGPT](#) and [Grammarly](#)) in their studies. In many cases, this competence is more advanced than that of educators, but this is not a cause for concern, as this difference can be easily bridged through collaboration and learning from each other. In fact, it creates an opportunity for educators to learn from students while guiding them toward the conscious and ethical use of AI. It can be interesting and instructive, for example, to ask students to reflect on how they use AI in their own learning process. The following questions can be helpful starting points:



- Have you ever used any artificial intelligence-based tools in your studies (e.g., ChatGPT, Grammarly, Duolingo, or chatbots)?
- How did it help you learn or stay motivated?
- What risks or disadvantages do you see in using them?
- What future AI tools can you think of that would further support your studies in higher education?

It is therefore important that educators should not be afraid to use various digital tools and technologies, or even AI, as with the right level of awareness and reflection, these can be important aids in the learning and teaching process.



How can an instructor use digital tools to effectively support students' learning processes?

Éva Bodnár:

There is no need to be afraid of the use of devices. There is no need to fear that the student will know more about digital things. Because it is a fact: they do know more about them. If something doesn't work, ask for help. You don't have to think that you must know everything about this technology. What you need to know is how it affects the educational process when you use it.



Active use of ICT also provides an opportunity to achieve *differentiation* and personalisation (see *Chapter 5.2*). In terms of motivation, it is important to differentiate in tasks: tasks that are too easy or too difficult are not motivating for an individual.

To select appropriate digital technologies for fostering active learning in a given learning context or for a specific learning objective.

Digital technologies provide an opportunity for students to actively immerse themselves in the learning material. As a result of the personalised functions of these tools, they can learn about a problem or topic from several angles, so that in-depth learning can be realised through active participation. If, during classes, students see how tools and technologies used in everyday life can serve learning, they will receive a pattern that they can use outside the sphere of education as well (about useful digital resources and their storage, see *Chapter 2.1*, on creating our own digital learning materials see *Chapter 2.2*).

As an example, if students learn how to create a mind map of a complex topic on their phones, they can share their products, storing them in a specific location accessible to others. When the learners subsequently work together, asking questions and making joint decisions, they acquire patterns of active learning (see, for example, *Good Practice 6.1: Collaboratively edited lesson notes*, or the video about a course jointly developed with students).



This process can also help students become *self-regulating* learners: they can acquire skills that will enable them to manage their own learning, and will be able to formulate their own learning goals, contribute to maintaining their own motivation, consciously and independently choose learning content, resources and methods, and reflect on these processes (see *Chapter 3.4*).

To reflect on how suitable the different digital technologies used are in increasing learners' active learning, and to adapt strategies and choices accordingly.

The constant monitoring of and reflection on the pedagogical process we have planned and implemented is crucial (it may also turn out that the planned digital technologies are not suitable for the intended purposes). Reflecting on our past decisions (for more on individual and social reflection see *Chapter 1.3*) and possibly changing our strategy in the light of experience will go a long way in maintaining motivation. Students must be involved in this process: it is important to discover what was useful or ineffective for them (see Figures 5.10 and 5.11).

How can students be motivated to learn? How can digital solutions help?

Helga Dörner:

The main principle is probably to plan continuous reflection on the course, encouraging students to think about what they have learned, what they have noted, what causes them difficulties, and where they need help. This is supporting learning. Online questionnaires or polling systems are ideal for this. Being in possession of the information is a gain for me and I am constantly changing the process of teaching-learning. This makes students much more involved in the process.



Éva Bodnár:

Today's generation is hungry for constant feedback, and the online environment is ideal for that. A carefully designed Moodle curriculum, where students receive constant items of feedback on what they did well and what went wrong, showing that the teacher really follows the process and gives feedback, is a very positive and motivating thing.



The above-mentioned student reflections can be aided by the examples shown in Figures 5.12 and 5.13.

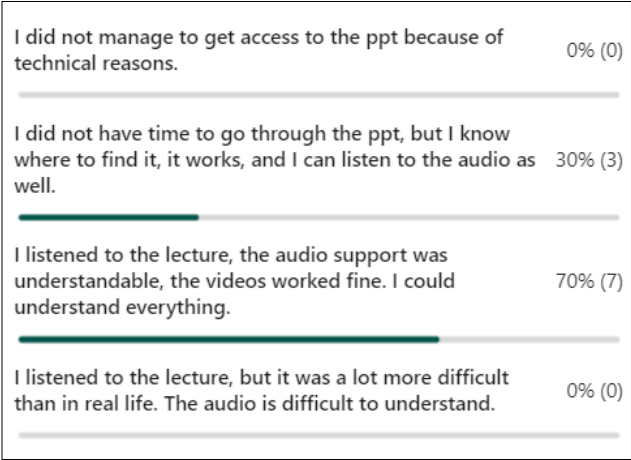


Figure 5.6. Feedback request about student preferences created in MS Teams

What do you think of the virtual learning environment (Canvas, Classroom) as the main means of communication and material sharing throughout the course?

14 responses

I like them, but I like the ones that doesn't require a student account. It can be very overwhelming for my students. Especially for my adult students.

I eill ptobably use them as a teacher (I prefer classdojo tho)

During online learning yes, but mostly with high shool and university students (and with us as correspondence students). I teach in a primary school, and during online learning-teaching we were forced to use Teams and Kréta, and I didn't want to add one more site to my students to-check list as most of them don't even have a private e-mail address.

-

I did not really like it, there erre some information I did not get

Language learning is preparing for human communication. I am convinced that the main means of human communication should stay in the areas of personal interaction. However, we should take the advantages of the virtual learning environment and ICT tools as well.

Figure 5.7. Collecting student reflections with digital tools (Google Forms)

References

- Covington, M. V. (1992). *Making the grade: A self-worth perspective on motivation and school reform*. Cambridge: Cambridge University Press.
- Falus I. (1998). *Didaktika*. Budapest: Nemzeti Tankönyvkiadó.
- Gardner, H. (1983). *Frames of mind: The theory of multiple intelligences*. New York: Basic Books.
- Gardner, H. (1999). *Intelligence Reframed*. New York: Basic Books.
- Glaser, R. (1977). *Adaptive education: Individual diversity and learning*. New York: Holt, Rinehart and Winston.
- Golnhofer, E. (2002). *Az iskola belső világa*. Budapest: OKI.
- Héjja-Nagy, K. (2015). Tanulási stratégiák és a tanulói aktivitást befolyásoló egyéni feltételek online környezetben. In: Lévai, D., & Papp-Danka, A. (Eds.), *Interaktív oktatásinformatika* (pp. 33–49). Eger: ELTE Eötvös Kiadó.
- Hortobágyi, K. (1985). *Elméleti és gyakorlati szempontok a differenciált oktatás tervezéséhez és szervezéséhez. Belső műhelytanulmányok 16*. Budapest: OPI IKFK.
- Howe, N., & Strauss, W. (2000). *Millennials rising: the next great generation /by Neil Howe and Bill Strauss ; cartoons by R.J. Matson*. New York: Vintage Books.
- Kalocsainé Sántha, H. & Varga, A. (2005). Az inklúzió mint társadalmi és oktatási idea. *Educatio*, 2005(1), 204–208.
- Kereszty, Zs. & Lányi, M. (2017). *Könyv a differenciálásról*. Budapest: Műszaki Könyvkiadó.
- Lestyán, E. & Szabóné Balogh, Á. (2017). A motiváció fejlesztése 10–14 éves korban differenciált foglalkoztatási programban résztvevő tanulóknál, *Különleges bánásmód*. 3(3), 67–78.
- McQuarrie, L., McRae, P., & Stack-Cutler, H. (2008). *Differentiated instruction provincial research review*. Edmonton: Alberta Initiative for School Improvement.
- Moran, S., Kornhaber, M., & Gardner, H. (2006). Orchestrating Multiple Intelligence. *Educational Leadership*. 64(1), 22–27.
- Nahalka, I. (2002). Korreferátum a PISA-felmérések eredményeinek értékeléséről. *Új Pedagógiai Szemle*. 52(4), 48–51.
- Pais, E. R. (2013). [Alapvetések a Z generáció tudomány-kommunikációjához](#).
- Perjés, I. & Héjja-Nagy, K. (2015). [Tanulás-támogatás a felsőoktatásban. Online mentorálási kézikönyv](#). Eger: Eszterházy Károly Egyetem.
- Richardson, V. (2008). Constructivist pedagogy. *Teachers College Record*, 105(9); 1623–1640. <https://doi.org/10.1046/j.1467-9620.2003.00303.x>
- Rock, M., Gregg, M., Ellis, M., & Gable, R. A. (2008). REACH: A framework for differentiating classroom instruction. *Preventing School Failure*. 52(2), 31–47.

- Szivák, J. (2014). [Reflektív elméletek, reflektív gyakorlatok](#). Budapest: ELTE Eötvös Kiadó.
- Tari, A. (2011). *Z generáció: Klinikai pszichológiai jelenségek és társadalom-lélektani szempontok az információs korban*. Budapest: Tericum.
- Walter, Y. (2024). Embracing the future of Artificial Intelligence in the classroom: the relevance of AI literacy, prompt engineering, and critical thinking in modern education. *International Journal of Educational Technology in Higher Education*. 21(15), 1-29.

Useful links

Google's "Generative AI for Educators" - [Link](#)

Microsoft's "AI for Educators" Course - [Link](#)

ChatGPT Foundations for K-12 Educators - [Link](#)

AI in Education: Leveraging ChatGPT for Teaching - [Link](#)

6. FOSTERING THE ACQUISITION OF DIGITAL COMPETENCES

Adrienn Papp-Danka

Introduction

Fostering the acquisition of *digital competences* has been on the agenda since the early 2000s, when the European Council called on Member States to develop “a new European reference framework of basic skills” to be acquired in lifelong learning. The European task force formed specifically for this purpose set up a reference framework which covered eight key areas of competence in the spring of 2002. One of these areas is *digital competence*. “*Digital competence* involves the confident and critical use of Information Society Technology (IST) for work, leisure and communication. It is underpinned by basic skills in ICT: the use of computers to retrieve, assess, store, produce, present and exchange information, and to communicate and participate in collaborative networks via the Internet.” (2006/962/EC)

Since 2006, key competences have been a core of all national curricula in the European Union. Simultaneously with the inclusion of digital competences in national curricula, ICT-centred courses have emerged in university education as well, as it is crucial that students, especially those in teacher training programmes acquire the new competences necessary to work and teach effectively in the digital world (Smith, 2017; *ISTE Standards*

for Educators, 2024). However, one of the central issues in the present chapter is how to organise courses for students to develop digital competence: by organising dedicated ICT courses with corresponding content, or by treating *digital competence* as a key competence, preferably integrated into all courses of the programme. In our opinion, development should be carried out on multiple levels: in part it would be useful to apply the so-called *add-onto* model, in which, independently from disciplinary training, it is possible to acquire *digital competence* mainly in the framework of IT-focused ICT courses. At the same time, subject-integrated education is also needed, where students encounter the practical advantages and challenges of using digital educational technology in connection with the teaching of their chosen subject. No research data is available about the manner and efficiency of the implementation of these two approaches in different university courses. What's more, due to the decentralisation of higher education, uniform solutions are also lacking. At the same time, it is more or less clear that in the practice and operation of universities, there is no one person in charge of the development of students' digital competences. The task (especially in the transversal model) is a responsibility shared by everyone, and every instructor must strive to make *digital competence* appear in as many courses and syllabuses as possible, both in the *definition of learning outcomes* and, of course, in implementation as well. In addition, it should be the responsibility of a university's administration to regularly review the contribution of each course to the development of students' *digital competence*. With the ubiquitous presence of generative artificial intelligence, this question has become more pressing again, also in relation to AI literacy. After all, the situation is very similar: is it the task of every university educator to develop their students' AI literacy, and how many educators feel that this is their task and responsibility? Some universities have responded quickly to the situation



by offering AI courses and AI majors for credit, while others are looking for a place for AI within their own subject courses, teaching students a little about its proper use. However, examples have also been observed at several universities where the Student Council has announced AI training courses for the development of students in this area.

Whether we support the acquisition of *digital competences* in a separate ICT course or in a transversal way, the five branches of DigCompEdu's sixth main area should be taken into account, and the present chapter is organised according to the same branches. Chapter 6.1. *Information and media literacy* discusses the management of digital resources from the students' perspective –from the articulation of information needs, through the organisation of information, to critical evaluation. Chapter 6.2. *Digital communication and collaboration* focuses on how, as instructors, we can inspire meaningful student communication and collaboration through learning organisation – for the key to the development of students' competence in digital communication and collaboration is the intentional and systematic encouragement of relevant student activities by the instructor. Chapter 6.3. *Digital content creation* primarily focuses on digital student products, with special regard to the legal and ethical issues in publishing and sharing them (copyright, licenses). Chapter 6.4. *Responsible Use* deals with the responsible and safe use of digital devices, covering the main risk factors that students should be warned about. Chapter 6.5. *Digital Problem Solving* discusses the interesting relationship between *digital competence* and problem solving.

We interviewed the experts Dr. Gyöngyi Bujdosó, (University of Debrecen) and Dr. Attila László Főző (Centre for Digital Pedagogy and Methodology, Budapest) about the topics in this chapter.



What types of ICT course would you recommend in higher education?

Gyöngyi Bujdosó:

In my view, the ideal scenario is to have some kind of IT class with IT instructors in every semester, and to also have a class in which students learn how to integrate IT into their own disciplinary subject. If students could acquire the skills to use digital tools with complete confidence in the courses held by IT instructors, disciplinary instructors would have less to do – relying on the students' previously acquired knowledge, they could focus on the use of technology and its methodological implications in their own courses.



Click/Scan

Attila László Főző:

If we look at students' digital competence and the opportunities for its development in higher education, I think it is necessary to provide some kind of ICT-type training, but it is also essential to introduce digital technology as a transversal opportunity in all other courses. Not to do so would be unimaginable for me.



Click/Scan

The topics covered in this chapter are permeated by the subject of artificial intelligence, as the use of AI is now an integral part of developing students' digital competence. As educators, the appropriate course of action is to equip students with the ability to write effective prompts, as this currently appears to be the most sustainable solution in light of the rapid development of AI technology.



At the same time, based on the supplementary document used in the volume (Bekiaridis & Attwell, 2024, p. 36), emphasis is placed not only on prompting skills, but also on the following considerations:



Educators' AI competence is key to supporting students in developing their own digital competence. This includes teaching students the basic concepts of artificial intelligence, guidelines for ethical use, data analysis skills, and the societal role of artificial intelligence. Educators should help students to critically evaluate information generated by artificial intelligence and to understand its limitations and biases.

6.1. Information and Media Literacy Skills

To incorporate learning activities, assignments and assessments which require learners to articulate information needs; to find information and resources in digital environments; to organise, process, analyse and interpret information; and to compare and critically evaluate the credibility and reliability of information and its sources.

Chapter 2 of our handbook offers a detailed introduction for instructors concerning ways to search for, organise, and store information, and it also discusses the verification of the reliability of data. The present chapter is closely related to the above activities of the instructor, but goes further in the exploration of how all this knowledge, ability, and expertise can and should be transferred to the students. Students with information and media literacy skills can be characterised as possessing the following abilities:

To articulate information needs, to search for various data, information, and content in the digital environment, find them, and successfully navigate among them.

In many cases, students need considerable help in finding data and information in the digital environment. We must constantly make them aware of the proliferation of pseudo-scientific sources, fake news and unreliable information on the Internet. As a first step, this can be easily demonstrated to them at the right moment in the course by showing them easy-to-use, openly accessible fake news generating pages such as The Fake News Generator or [The breaking news generator](#). We can also do this by ourselves, creating our own fake news article related to one of the topics in the course and start the next lesson by presenting it as if it was true. In this way, students can be tested to see how many of them are able to recognise fake news, and we can determine what giveaways they identify.

A similar goal can be achieved with the [Factitious](#) website, where the user must choose whether short articles are *fake* or real in a gamified environment. The advantage of the site is that it also gives a brief explanation as to why the article is fake or genuine. The difficulty level of the game can be freely set.

It is widely known that artificial intelligence can often hallucinate, meaning that its responses to our questions may contain false or misleading information. Hallucination provides an excellent opportunity to develop students' critical thinking skills, as this appears to be one of the most important areas for development in education in the age of AI in order to use large language models responsibly and ethically. AI solutions facilitate the production of realistic, believable deepfake content, bringing attention to the fight against fake news and the task of filtering out false information

(Horváth, 2023). The simplest example to illustrate hallucination, which is already a priority area for students, is the use of references and citations. If an LLM (Large Language Model) is prompted to recommend 6-8 references on a given topic, including journal articles and books, we can be almost certain that the response will contain references that do not exist, i.e., a fake link or title will be received. To find this out, the sources provided by the LLM must be checked one by one by visiting the links provided or searching for the titles of the sources in Google. After a few clicks, we can determine whether the sources provided by the AI exist or not.

Especially at the beginning of their university studies, students are not always able to decide if an article found on the Internet is considered a proper scientific text or not. It is crucial to thoroughly discuss with them why we should not refer to an article published in, for example, an online women's magazine in a dissertation, and why a blog post that does not include the author's name cannot be considered a scholarly publication. Everything that has been described in more detail in *Chapter 2.1* also applies to the development of students' competences:

- learning and practicing keyword search strategies;
- locating (authentic, educational) digital resources;
- searching per copyright conditions.

In addition to developing the students' critical approach to information and equipping them with the necessary search methods through targeted exercises and tasks, the instructor may opt for a methodology where students are provided with a learning environment featuring authentic resources related to the course curriculum. This is the case, for example, in a *flipped classroom* environment (for more information, see Good Practice 3.1: *Interactive video-based lecture in a flipped classroom*). In such a learning

environment, students do not necessarily have to use their information searching knowledge and skills, but rather efficiently and successfully navigate within a collection of information.

To create and update personal search strategies. To adapt search strategies based on the quality of information found.

Online library databases are considered to be among the most reliable sources of information in the digital environment. However, since the amount of data they contain is huge, it is essential to develop an effective search strategy within such sites themselves. If students are unfamiliar with this technique, some courses provide an opportunity to introduce effective keyword search strategies, either as part of a library lesson or through a demonstration by the instructor (see Good Practice 2.1: *Searching for digital content with keywords and titles*).

To analyse, compare and critically evaluate the credibility and reliability of sources of data, information and digital content.

The authenticity of digital content can be verified in different ways. Students are often unaware that a specific piece of information may not be authentic just because of its aesthetically pleasing web design, or because it contains information echoing their own experience.

In certain disciplines where such a method is warranted (e.g. economics, science, psychology), instructors often ask students to bring up-to-date news related to the given subject to each lesson. The material can come from almost anywhere: a news site, a scholarly article, or even a video sharing portal. 5-10 minutes of the lesson is devoted to discussing the

news brought by the student. Identifying the source of the news offers an excellent opportunity to develop students' critical attitudes and thinking about the credibility of sources. (For more information on this topic, see *Chapter 2.1* and the relevant [Google for Education digital lesson](#).)

To organise, store and retrieve data, information and content in digital environments. To organise and process information in a structured environment.

In an online world of unlimited information where the individual must take responsibility for their own information management activities, task-facilitating content organisation is essential (Attwell, 2007). Students cannot be expected to be familiar with methods of consciously organising information, data or digital content, applying labelling, using bookmarks, or organising data into thematic folders. In addition to the information they search for and find, this also applies to the efficient organisation and sharing of content produced by the students themselves. Accurate and structured classification is the key to easy retrieval (Vuorikari, Punie, Carretero Gomez, & Van den Brande, 2016). It is important to raise students' interest and, if possible, to achieve openness towards content management, i.e. to make students willing to improve in this area and to acquire new knowledge and methods.

Nowadays, most people are already familiar with the two main types of data storage: the use of physical or cloud-based storage. The former means the systematic storage of data on a server, the hard drive of a PC or laptop, or a flash drive or other form of external storage. The latter means that we use the cloud storage of a service provider. Suitable solutions include, for example, Google Drive, Dropbox, OneDrive and iCloud. The disadvantage of using a physical device for data storage is that if the physical device is

damaged for any reason, the files and data stored on it may be lost. The advantage, however, is that the files are self-owned and inaccessible by external service providers. Compared to this, cloud-based storage is just the opposite: files are less vulnerable to loss, but our knowledge about the security of our files and access to them by third parties is limited to the contents of the privacy policy of the third-party service provider. It is definitely recommended to store important data in several places, and to create backups on a regular basis.

Storing files in folder systems is a relatively simple and widespread method, whether on physical storage or in the cloud. However, it is often necessary to store links and URLs as well. One way to do this is to use bookmarks stored in the browser of one particular device, where URLs can be saved (and organised into folders) and assigned to the digital device in question. The downside to this is that if we are not using our own computer, we will not be able to access the bookmarks stored in its browser. It is therefore convenient and advisable to store bookmarks in the cloud on a social bookmarking solution (e.g. [Diigo](#), [Pearltrees](#), [Symbaloo](#), [delicio.us](#), [Pinterest](#) – see also Chapter 1.4).

These apps and sites share the following common features:

- users can add keywords and sometimes a short description of the content to the bookmarks;
- based on the keyword tags, the service classifies the content, and makes it searchable;
- bookmarks can be supplemented with personal or public comments;
- additional information is associated with the bookmarked pages (how many users have saved it and in which collections, how many are using it);
- some services may only be available as a paid feature (this may affect how much information we can add or what information we can access).

In [Pearltrees](#), we can store bookmarks on an online interface in subject-specific folder systems, where folders can be structured, for example, according to courses (see Figure 6.1). The link collection can be freely named, and the added links can be tagged. We simply share the link collection of the given folder (course) with the students in the form of a single URL, and they can reach the complete link collection and its subfolders, as compiled by the instructor. Collaboratively creating a collection of *links about a given topic* can be a student assignment on its own, as this is also feasible using the interface.

Because it is a social link collection service, the collections we create are public. This even means that the number of views for a given link collection is also displayed.

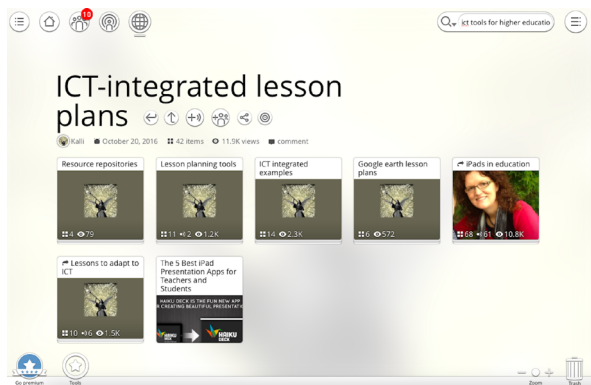


Figure 6.1. A collection of links on the subject of integrating ICT tools in lesson plans, created in Pearltrees

If we want to create a personal collection of links, [Diigo](#) might be a good choice – here we can decide whether to share the bookmark with a group, a specified individual, or leave it entirely private.

6.2. Digital Communication and Collaboration

To incorporate learning activities, assignments and assessments which require learners to effectively and responsibly use digital technologies for communication, collaboration and civic participation.

Familiarity with the various digital communication channels and methods is one of the most important areas of competence for all digital citizens. It is essential, among other things, when we cultivate friendships, or keep in touch with clients and colleagues at work, but it is also crucial in managing administrative matters and pursuing scholarly activities. At the same time, awareness of the written and unwritten rules of digital communication and satisfactory competence in this area can never be taken for granted. We may run into fundamental communication errors on a daily basis, such as using the wrong channel for the purpose of our communication, redundant sharing on various social networking sites, or choosing the wrong recipients for our email.

All this shows that education plays a key role in the development of the competence of digital communication. Literacy alone does not guarantee the success of mediated communication. In the mazes of multiplied communication interfaces and modes, education should help students, while digital communication also plays an increasingly important role in organised education. This is especially true in situations such as the Covid-19 pandemic, where attendance-based training was replaced by digital distance learning. Artificial intelligence-powered chatbots (e.g., ChatGPT, Copilot) as communication partners can easily and quickly replace human interactions, bringing with them the advantage of reducing the number of lonely students as a result of conversations with them. However, we as teachers must emphasise to students in discussions about digital



communication that AI should not be used to replace human interaction, but rather to complement it (Bognár, 2023).

Students skilled in digital communication and collaboration can be characterised as possessing the following abilities:

To keep in touch with each other using a variety of digital technologies.

We cannot influence the way students communicate with each other in every respect, but there are a number of tools and methods which enable us to steer their digital communication in the right direction.

One of these is to encourage communication within the *learning management system*. The framework of university education basically allows for two types of communication: one is to send a personal message that can only be seen by the sender and the recipient. Using this is practical because the educational work in the system is concentrated in one place, and not even email is necessary to communicate with each other or with the instructor.

However, the second option is perhaps even more important: tools that support group communication, typically in an asynchronous fashion (e.g. blogs, wikis, forums). Forums are particularly useful for the discussion of questions that can be answered by not only the instructor, but other students, too. Such questions can be divided into two main groups: on the one hand, they can be related to course administration (attainment/performance, tasks, schedules, lesson and exam organisation, etc.), and on the other hand, they can be related to the course content and the curriculum. Unfortunately, however, it is true for both types of question that until the instructor intentionally induces communication in the forum, students rarely take the opportunity to do it for themselves.

Despite the above, with appropriate methods, the forum can be incorporated into assessment. In this case, the instructor can give an extra point if a student gives a meaningful answer to another student's question, and can deduct a point if someone posts a question that has already been asked and/or answered. Furthermore, an excellent constructive discussion platform on the content of the course can be created with the help of the forum. All we need is a provocative post by the instructor, in response to which students can start to debate by listing arguments both for and against the statement.



It must be emphasised that communication in the forum available on the course interface does not start automatically, and it is necessary for the instructor to manage it in a planned and consistent way until students get used to it. Furthermore, it must be accepted that students will always create a communication interface for themselves from which the instructor is left out. If, however we manage to create a well-functioning forum that answers the questions that arise, then students will be less likely to regularly visit a parallel communication channel.

On digital interfaces, it is useful to give tasks that encourage collaboration and communication – probably the most popular tool for this is a *cloud-based* file sharing service (e.g. [Google Drive](#), [OneDrive](#)).

Joint document editing, whether in a document or a presentation, is one of the most suitable tasks to develop students' communicative and collaborative skills alike. In addition, there are a number of *web-based applications* that also facilitate collaborative editing (e.g. online mind maps – see chapters 2.2 and 3.3, or [prezi.com](#), [canva.com](#), [padlet.com](#), etc.). As an example, Padlet can be used to jointly summarise a topic if students are

instructed to use the interface in a shelf-type layout, where the main topics are noted, followed by a sketch of an idea or information in the form of text or multimedia (links, videos or images). Comments can be made to the content posted by others, so that both the students and the instructor can reflect on each other's thoughts.

*To understand appropriate digital communication means for a given context.
To adapt communication strategies to the specific audience and to be aware of cultural and generational diversity in digital environments.*

According to the traditional division of methods of digital communication, the following categories are distinguished:

- predominantly textual information (e.g. email, forums, [Messenger](#)),
- pictorial information (e.g. [Instagram](#), [Pinterest](#));
- voice-based information (e.g. [Messenger](#), [Viber](#));
- video-based information (e.g. [TikTok](#), [YouTube](#)).

There are several mixed-genre services among these, which are able to transmit textual, pictorial, audio, and video information alike (e.g. [Messenger](#), [Viber](#), [Zoom](#), [Google Meet](#)).

The competence of digital communication is more than simply knowing what tools are available to us – it also includes the ability to choose the most appropriate tool for a given communication goal. In student-instructor communication, we often encounter students choosing the wrong communication channel, for instance expecting an instructor's immediate reply to an instant message, when the answer is more suited to email, a more appropriate tool for asynchronous communication. Different tools require specific styles of communication, for example, the rules of email

and Messenger are quite different. Students should be made aware of this fact, as digital communication as a competence is an area to be developed regardless of the course and training. If they need help with this because they are unsure, for example, about the appropriate style for writing an email to an instructor, the AI tools mentioned in Chapter 1 that primarily provide linguistic and grammatical assistance (e.g., [Grammarly](#), [Quillbot](#)) are recommended. If the roles of the sender and recipient of the email are specified in the prompt, and the instruction to convert the text to a formal style is added, it will do so with no problem.



Sample prompt:

I am a university student. Help me write an email to my professor.
The letter should be formal but polite. I'll give you the details:

- **The professor's name:**
- **The purpose/subject of the email:** (e.g., requesting a consultation, reporting an absence, asking a question about an assignment, requesting information about a submission, etc.)
- **Specific questions or details:**
- **The name and code of the course:**
- **The student's name and Neptun code:**

A further difficulty is that the given physical device can also hinder the success of communication. While students are proficient at using smartphones, emails and their attachments may cause them serious problems.

One of the best opportunities for practicing digital communication is when two different groups of students come together during their training to achieve a common goal or the completion of a common course.

In public education, this is known as [eTwinning](#); in higher education, it is termed [Virtual Exchange](#) (VE). The latter is supported by the European organisation [EVOLVE](#) (*Evidence-Validated Online Learning through Virtual Exchange*) with the aim of strengthening an innovative form of *collaborative* international learning. Support is provided through [training for instructors](#), and it also offers [organised partner search services on its website](#) for the negotiation of international cooperation between schools. The *Virtual Exchange* is therefore an excellent opportunity for students to practice a foreign language, but of course cooperation between student groups can be carried out not only in an organised, international arena, but also within one country. If one student group is connected to another in a different institution, *some of the lessons should be organised in the form of a videoconference*, while in other sessions a shared digital classroom could be used for the sharing of information and content, with the utilisation of other communication tools as necessary. The only limit to the organisation of joint courses and the connection of student groups is our imagination.

To share data, information and digital content with others through appropriate digital technologies. To use digital technologies for collaborative processes, and for the co-construction and co-creation of resources and knowledge.

The sharing of information and data has already been mentioned (forums, *learning management systems*, communication tools), therefore here we will focus on the sharing of digital content. By digital content we now primarily mean material that is related to the subject matter of courses and curricula.

The primary sharing interface for digital content in a university environment is the *learning management system*. If we use a dedicated LMS tool for assigning tasks, *students might not be able to see each*

other's assignments in the system, so neither knowledge sharing nor peer assessment can be implemented.

The problem might be addressed through the use of digital portfolios, which provide students with insight into each other's work, and also encourage an element of reflection. The *use of digital portfolios* can be facilitated in various ways. The Canvas *learning management system* contains an integrated portfolio subsystem which is user-friendly and meets all the requirements of a portfolio. If Canvas is not our system of choice, then one of the most reliable applications is [Mahara](#). Whilst Mahara must be installed and may be complicated to use, [Padlet](#) is a *web 2.0 application* requiring no installation. Although the latter is not specifically a *digital portfolio* application, it does provide students with their own “digital wall” where they can place their products thematically or according to some other order (see Figure 6.2). Padlet digital walls can be shared with anyone, or optionally with only certain users, and they provide a simple means for reflection, feedback, and *peer assessment*. (For more on *digital portfolios*, see chapters 3.4 and 4.7.)

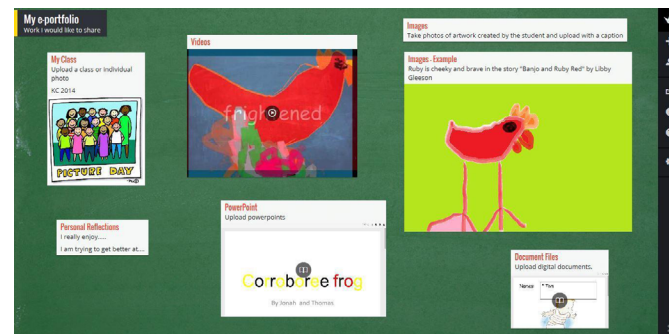


Figure 6.2. An example of using Padlet as a portfolio

A relatively new innovation in digital content sharing is the [MaxWhere](#) virtual space (see Figure 6.3). It is a *virtual reality (VR)* operating system that provides users with convenient three-dimensional spaces (including buildings, gardens, lakes, etc.) where they can create their own workspaces. There are browser windows within this space where users can specify the content to be displayed. Documents opened and displayed in a browser window can be edited and shared, and users can handle them in the same way as in a shared document editor outside MaxWhere. In this virtual space, people can work together on traditional shared documents, yet here they do so in an aesthetically more pleasing customised virtual environment (Bujdosó, Novac, & Szimkovics, 2017).



Figure 6.3. The virtual learning space of the University of Dunaújváros, created in MaxWhere (source: youtu.be/wTSiZIF3zMM)

To seek opportunities for self-empowerment and for participatory citizenship through appropriate digital technologies.

The self-empowerment section of DigComp 2.1 – the Digital Competence Framework for Citizens (Carretero Gomez, Vuorikari, & Punie, 2017) discusses self-empowerment in the sense that the individual should be able to recognise the gaps in their digital competence and conduct self-empowerment accordingly. With regard to students' *digital competence* and their self-development in the area, they should be introduced to the concept of present-day digital citizenship, and the kind of knowledge, skills and attitudes this entails. Self-reflection on this topic can be carried out with the DigComp 2.1 framework mentioned above, which, if shared with students, will give them the opportunity to assess their own levels in the five competence areas on a self-reported, self-assessment basis.

Students are encouraged to assess their own level of digital competence. There are two ways to do this:

1. DigCompSat assessment tool: a validated self-assessment tool for the DigComp digital competence framework for citizens, which assesses all 21 sub-competences at four proficiency levels (basic, intermediate, advanced, and master). The test consists of 82 self-assessment questions, which include a mix of statements relating to knowledge, skills, and attitudes. It can be found on the [MyDigiSkills](#) website.
2. [Digital Skills and Jobs](#) online platform: here, an adaptive test can be taken, at the end of which the level of DigComp competence in the five major areas of competence can be

determined. The test questions are tailored to the individual's answers, so if someone answers a difficult question correctly, another difficult question will follow. The questions are diverse, so you will never encounter the same questions twice. In addition, the platform offers development suggestions and learning opportunities.

When students identify gaps in their *digital competence*, they may need resources that provide an opportunity for self-development. As a primary source, we should recommend massive open online course (MOOC) sites (e.g. [Coursera](#), [EdX](#)) where one among the countless open courses will certainly develop digital competence or one of its relevant areas (see Chapter 1.4). If our students want to develop their skills in the field of AI, whether as students or employees, we recommend browsing the [OpenAI Academy](#) website. OpenAI Academy primarily offers practical learning paths covering topics such as effective prompting, using AI for academic success (research and learning tasks), and career counselling.



What pathways are available for educators' continued professional development in AI, and how can they support their students' AI literacy?

Johanna Szőke

While the companies behind most chat-bots offer their own AI courses, in order to develop our students' and our own AI literacy, I recommend the courses listed on the EU AI Act website or the resources available on TeachAI.org.



Click/Scan

Another excellent means of self-development is for the individual to be an active and productive member of the appropriate professional communities, where they can benefit from the information, resources and solutions that are useful for them. This is called a personal learning network (PLN), and it focuses on the target of information: the human being. Through our personal learning network, we also become a part of the network of others, because the essence of community knowledge construction is to share the knowledge elements we know with the community so that they can acquire them as well. If the learner is integrated into an appropriate network e.g. an online community during the learning process), they can significantly improve the effectiveness of their learning by harnessing the benefits of the community. Knowledge creation can thus become a cycle where personal knowledge is organised into a network, and aggregate knowledge again becomes an individual source of knowledge /// (the “cycle of knowledge development”).

As instructors, we can recommend appropriate communities for students. Some of the following are likely to be available at every university:



- mentoring student communities for first-year students;
- student groups in a given discipline on social media;
- students' scholarly workshops, groups on campus;
- university alumni communities;
- university or religious communities providing spiritual counselling and support.

If these or similar university communities do not work effectively or do not exist, we should encourage students to ensure their community participation both offline and online, highlighting the importance and benefits of the personal learning network discussed above.

To be aware of behavioural norms and knowhow while using digital technologies and interacting in digital environments.

The etiquette, habits, and behaviour forms related to Internet communication are called network etiquette, or *netiquette*. In the field of education, there is relatively little emphasis on propriety and the dos and don'ts of digital communication. Despite this, situations in which a knowledge of *netiquette* could provide students with appropriate points of reference are quite frequent: from the salutations used in emails, through trolling on course interfaces, to the reckless forwarding of *spam*.

Browsing the websites of universities, it is clear that they typically define *netiquette* guidelines for distance learning and online learning (e.g. [Oxford University](#), [Rasmussen College](#)). An example of good practice is offered by the [Lincoln University](#), where we see a list compiled by students.

The instructor should begin the semester's work with the students by laying down the rules adopted by the group for personal and online conduct.

Universities which have not yet done so should consider thoroughly reviewing good examples, and defining their own netiquette policy.

Another cardinal point concerning interaction in the digital environment is the “quality” of email addresses. In our teaching work, we often encounter students using a foolish, embarrassing email address in a formal context (e.g. *cutey@...*, *andythedandy@...*). Students using similar email addresses should be warned about the underlying connotations that may result in a less than ideal representation of the owner of the email address. Therefore,

each student should have a clear official address, preferably created from their own first and last names.

To create and manage one or multiple digital identities.

“We are what we show on the Net. Everything else is mere illusion. We are what search engines reveal about us, no matter what the reality is.”¹ Perhaps this quote is an exaggeration, but its strong words aim to draw students' attention to the existence and importance of *digital identity*. *Digital identity* is the set of data available online that makes people identifiable based on their *digital footprints*. Nowadays, thanks to various social networks where we tend to display an online representation of our offline lives, mixed offline-online identities are becoming increasingly natural. It is this mixed identity that can cause problems when someone is not sharing content in the right place or at the right time. For this reason, students should know about private and official online identities and they ought to be advised that employers routinely research job applicants' *digital identities*. If their digital identity reveals information that is not considered favourable by the employer, the applicant may not even be invited for a job interview. It follows that students should be introduced to the following two practices regarding the management of *digital identities*.

If someone maintains a profile on only one social networking site, they need to be very careful about what they share and who they share it with. Content that may not be wholly acceptable to everyone should by no means be publicly shared, but even privately shared images and other content can be easily saved by anyone, so we need to exercise caution even

¹ digitalisidentitas.blog.hu

in this case. Another viable solution is maintaining a private *digital identity* on Facebook, but simultaneously managing an official identity on another profile page. The latter is used to share only professional content, and in certain cases, it can assist in the building a personal brand. LinkedIn, the dedicated professional community service, is the probably most suitable place for this.

Digital identity has become a major issue recently. It requires constant self-reflection and regularly puts the individual in decision-making situations. Therefore, it has become an important part of the *development of digital competence*, even if it is not easily linked to course content, and the example of the instructor and well-managed profile pages can help students greatly (see *Chapter 1.1*).

6.3 Digital Content Creation

To incorporate learning activities, assignments and assessments which require learners to express themselves through digital means, and to modify and create digital content in different formats. To teach learners how copyright and licenses apply to digital content, how to reference sources and attribute licenses.

The creation of digital content from the perspective of instructors has already been discussed (see *Chapter 2.2*). This section focuses on the student's perspective, but covers only those aspects which have not been so far discussed. Students skilled in digital content creation can be characterised as possessing the following abilities:

To create and edit digital content in different formats. To modify, refine, improve and integrate information and content into an existing body of knowledge. To create new, original and relevant content and knowledge.

Students can only take advantage of the opportunity to create and edit digital content in various formats during the learning process if the instructor creates an appropriate, activity-oriented learning environment.

Activity-based education can be implemented in several ways, which are, of course, not mutually exclusive but complement each other. Here are some ideas.

- **Students do not receive ready-made educational material, but produce it on their own**

If we approach the subject from the perspective of pedagogical theory, *constructivist pedagogy* comes to mind. From a practical point of view, it should be imagined as a learning process where students are given guidance on accessing sources for quality and authentic learning materials, and then further guidance is provided in the learning environment organised by the instructor about the type of product or collection of products that should be created while processing the study material.

Examples of student products include blog posts, reflective diaries, short films, digital stories (see Good Practice 6.2: *Digital storytelling*), comic strips, podcasts, glossaries, mind maps (see *Chapter 2.2* and *Good Practice 3.3: Word cloud and mind map bank*), websites, Facebook pages, online tests (see *Chapter 4.3*), and collages (see *Good Practice 5.2: Summary collage*). Whatever type or genre of study material is produ-



ced as a student product (see *Good Practice 5.1: Alternative student products*), instructor control involving the monitoring and assessment of the quality of the work, is essential. Only high-quality learning materials that also serve the learning of others can be later shared with the student community.

- **A course based on problem solving or a case study describing a real-life situation**

A course can be much more than a simple and linear list of educational content. It can also be organised around problem-based learning (Hmelo-Silver, 2004), in which students must resolve a particular issue (see also *Good Practice 6.3: Problem-based learning*), or around processing a specific real-life situation as a case study.

- **Community organisation and knowledge sharing**

As technical tools and an editable web have become accessible to everyone, we can now build our educational process on community knowledge sharing, information flow and community productivity. The goal for a group of students may not only be the planned facilitation of communication (see *Chapter 6.2*) – the instructor should also promote conscious community building and information sharing. This often means shaping student attitudes as well. Many may think that information is power and, as a result, are not open to sharing it. The aforementioned way of learning organisation, where students create diverse products based on different sources of study materials, can be particularly well combined with community knowledge sharing. Students should be motivated to create quality products as these will serve as a basis for the performance and accountability for the whole group.

- **Digital storytelling**

Digital storytelling (DST) as a form of learning management helps to ensure students' active and creative participation in the teaching-learning process. The resulting product is a digital story in a 2-5 minute video made up of still images and narration, a linear self-narrative that can become a virtual (social) message when shared on the web. The technical conditions and pedagogical benefits of the method are summarised in figure 6.4.



Figure 6.4. Robin's Convergence Model: Digital Storytelling in Education (Robin, 2009)

Robin's study offers a number of good practices and additional resources. The [Educational Uses of Digital Storytelling website at the University of Houston](#) is also highly recommended. Featuring a collection of digital history grouped by disciplines and supplemented with additional resources that can be used in education (e.g. lesson plans, evaluation sheets, etc.), the website is a good starting point for those who are new to DST, because the films available there not only make instructors consider their courses in a new light but also encourage the adaptation of this material into higher education syllabuses. The good practices at the end of this chapter (see Chapter 6.6) include more detailed examples of good practices related to DST.



- **Game-based design** (gamification)

This method is described in detail in *Chapter 4.1*.

- **Flipped classroom**

This method is described in detail in *Chapter 3.1*.

It is true of all types of activity-based learning organisation concerned with the creation of the kinds of digital content listed above that their use results in numerous pedagogical benefits: they lend interactivity to the learning-teaching process and boost student engagement and motivation (see *Chapter 5.3*), resulting in more productive instruction.

With the advancement of artificial intelligence, task-based teaching and the use of creative student assignments may become even more important (see 5.1. best practice titled *Alternative student assignments*). Liu and Baucham (2023) distinguish between three ways of integrating AI into

education: (1) active, (2) passive, and (3) interactive. The active approach is particularly relevant here, as in this case, the instructor develops their assessment method based on their knowledge of the educational functions of AI technology and encourages students to be more creative, critical, and original than AI itself (Liu & Baucham, 2023). This approach is considered feasible with the tasks listed above: videos, posters, memes, podcasts, and comics. Of course, it is almost impossible to avoid using AI when creating digital content, but it can be motivating for students if the assignment specifies that they should strive to come up with ideas that are more original than those generated by AI. If, due to the nature of the subject or course, creative assignments cannot be given to students, the passive approach described by Liu & Baucham can be employed, which is best suited to courses based on problem solving or case studies describing real-life situations. In this case, we ask students to use AI to gather information/possible solutions, then analyse them, and finally present arguments in favour of their preferred solutions. When presenting their solutions, students should also discuss the advantages and limitations of using AI. This approach not only develops their problem-solving skills, but also their critical thinking and communication skills.

To understand how copyright and licenses apply to data, information and digital content.

It is a relatively common misconception that whatever is on the Internet belongs to everyone, and that it can consequently be used freely. Instructors often see that students do not appropriately refer to the intellectual products of others (if they do so at all); typical examples being the reuse of text, images, or even blog posts. As an organic part of *digital competence*



the individual should be aware of the various copyright licenses available, be able to conduct a search according to copyright status, and be able to refer accurately to the information they find and plan to use.

The most commonly used copyright license is [Creative Commons \(CC\)](#), which is widely recognised around the world. The idea behind *Creative Commons* is the establishment of a simple, flexible, standardised set of rights (“some rights reserved”) on a wide scale ranging from full legal protection (“all rights reserved”) to “public domain” (public property). CC licences provide a means for authors to simultaneously reserve their rights and allow the use and distribution of their work. Specific CC licenses are basically made up of different combinations of the following four restrictions: *Attribution*, *No Derivative Works*, *Share Alike* and *Non-Commercial* (see *Chapter 2.1*).



Copyright issues also arise when using artificial intelligence, and students must be informed about them. One issue relates to who the author of AI-generated content is. The current legal position in Hungary is that ‘since only humans can be authors, AI-generated works cannot be considered works of authorship and therefore cannot benefit from copyright protection’. (Pribelszki, 2024) This is an important point because we often expect students to ‘reference’ AI-generated content in their work, even though AI cannot be named as the author. Therefore, it is useful to specify the format of referencing in a student assignment, for example, by asking the student to indicate which parts of the product were created with AI, which AI application was used, and what the prompt was.

The other copyright issue relates to the fact that AI generates its own output by processing a huge amount of data, which may very well include works protected by copyright. However, since it is not entirely clear what it works with and what it used to generate the output response, it is not

possible to determine exactly whether copyright infringement is occurring. (Pribelszki, 2024) It is worth noting, however, that this risk exists, although it seems unlikely that it will be discovered in every case.

Students should be introduced to copyright issues (not only because of the attribution of others’ work, but also because of the protection of their own products), but it is also advisable to formulate clear expectations regarding the correct use of different reference styles. We also recommend image search sites where the images can be freely used or where the copyright information is clearly indicated (see *Chapter 2.1*). Let us also not forget to clearly communicate how AI is to be credited in the student’s work.



Let us here mention two of the most commonly used and internationally recognised reference styles: those of the MLA ([Modern Language Association](#)) and the APA ([American Psychological Association](#)). Students are supposed to observe the rules of referencing in written submissions handed in during their training, and then in the dissertation closing the training as well. But there is no uniformity as to which of the above reference styles (or perhaps a third style) should be followed. The required reference style depends on the instructor, university, or discipline. It is worth drawing students’ attention to the applications mentioned in section 1.2, which help to produce references and bibliographies in a given style ([EndNote](#) or [Zotero](#)).

To plan and develop a sequence of understandable instructions for a computing system to solve a given problem or perform a specific task.

This DigCompEdu activity may sound alien to the reader, and the idea that programming should be taught in university courses in a horizontal manner might give cause for concern. As yet, little of this is reflected in curricula and university syllabuses, or in the definition of *learning outcomes*, but there is no denying that programming has become a skill that is becoming increasingly important among student competences (see [ISTE Standards for Students](#), Vuorikari et al, 2016), and among the expectations of the employment market as well. With the [help of the term computational thinking](#), it may be easier to understand and embrace this topic as a competence not specifically related to programming through software in the IT sense, but as a competence associated with algorithmic thinking. In many disciplines and professions alike the individual may be expected to be able to break down a problem, highlight the essential elements of a conglomerate, process the data using digital tools, and create new descriptive models. Algorithmic thinking means that the individual is able to see an activity as a set of unfolding steps, and understand that these elementary units are causally related to each other. They are able to plan the basis decisions and steps needed to implement the sequence of activities to be performed, and they can predict the consequences of the implementation of an algorithm and the probability of the successive steps of the process.

Beyond the significance of algorithmic thinking, what instructors need to gather from all is the importance of attitude – that, as instructors or students, if we see ourselves as *digital citizens*, we must be open to basic design and coding on a user level.

6.4. Responsible Use

To take measures to ensure learners' physical, psychological and social wellbeing while using digital technologies. To empower learners to manage risks and use digital technologies safely and responsibly.

Internet security is by no means a new topic. However, back when neither the concept of *digital competence* nor the concept of *digital citizenship* was defined in such great detail, for a time these phrases were synonymous with the topic of Internet security. At that time, responsible use meant nothing more than setting up a personal password of sufficient strength on various Internet sites. In contrast, nowadays the area of competence for responsible and safe use of digital devices has expanded to such an extent that it covers everything from digital health, through cyberbullying, to environmental protection. Students skilled in the responsible use of digital tools can be characterised as possessing the following abilities:

To protect devices and digital content, and to understand risks and threats in digital environments. To protect oneself and others from possible dangers in digital environments (e.g. cyberbullying).

The responsible use of digital devices, which takes into account hazards and risks, needs to be addressed on the levels of data, devices, and personal security.

Given that the two areas are inseparable, we can discuss personal data and personal devices together (without the devices, we cannot manage the data). In terms of both data and devices, the individual is expected to be familiar with security settings such as password protection, anti-virus and firewall settings, careful use of public Wi-Fi, and so on (for more information,

see [The Student's Guide to Internet Security & Safety](#)). Whereas protecting smartphones with a password and a tracking application is now a common practice, not all users pay sufficient attention to the secure storage and backup of their data.

It is advisable to draw students' attention to the above in situations when they have to store their personal or shared files related to a particular course. The pros and cons of storing data in the cloud or on a physical device can be made clear through a few simple personal examples.



The third area of responsible device use, the issue of personal security, was primarily brought to the fore by digital harassment, about which there is now a wide range of literature (e.g. Tokunaga, 2010; Dehue, 2013; Festl & Quandt, 2013). Any student can fall victim to unsolicited content, online fraud, threats or *cyberbullying*, and they should be able to protect themselves and others from digital dangers.

It may seem alien to a specific discipline, or a university course to deal with responsible digital device use, yet it is still prudent to think horizontally about this area of *digital competence*, and thus topics such as pseudoscience, *cyberbullying* or data protection can be a part of any university course.



How can students be conditioned to conduct themselves safely and responsibly in the online space?

Gyöngyi Bujdosó:

Students have to be taught about how they can protect themselves: there is a lot of talk about passwords (i.e. during university classes), firewalls, various security devices, or, for example, covering a camera, which is the only way to protect yourself against being videoed. Then we also have to know, for example, how to hide apps on our mobile phone (...) how to locate hidden software on our phone. (...) Students have to know that whatever they put on the Internet really is going to stay there forever – they have to know the implications of this, and also that there are databases that are used to buy and sell data between corporations.



Attila László Főző:

A responsible and safe presence in the online space is, of course, a very important concern for everyone, especially for students. Emphasising this is a never-ending task for the instructor, as we should always call attention to the latest phenomena. Personally speaking, an awareness of pseudoscientific topics and scientific misconceptions is very important. As such things can also be seen in pedagogy, this is a topic which is on the agenda on a daily basis or in every semester.



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To protect personal data and privacy in digital environments. To understand how to use and share personal information while being able to protect oneself and others. To understand that digital services use a “Privacy policy” on how personal data is used.

Every chapter of the present volume contains a myriad of recommended software and online applications. When a new online application is initially used, student (and instructor) attitudes are usually mixed. Some people are completely unwilling to go through yet another registration procedure because they have fears that their data will be abused or that their inbox will be bombarded with unsolicited mail. Others do not have such reservations – in fact some do not even care about what personal information they disclose or how the service provider handles it. One thing is certain, however: every online application provider must have a privacy policy that allows us to find out exactly what happens to the email address or Facebook profile used for registration, or any other information we provide. People are often unaware of these privacy policies, so it is the instructor’s responsibility to inform their students about them.



It is also possible to browse personal data recorded by service providers on the internet. Google, for example, lists in detail everything that has been done on Google-related sites and services on the [My Activity](#) page. Here, it is also possible to delete these and to set which activities the service provider can or cannot save.

In an educational situation, students may have to handle more than merely their own data as there may be tasks and situations where they collaborate on assignments in which they and others appear in either a photo or a video. This leads to the question of how the personal data of others should be treated. Of course, before any such recording (image,

audio, video) is made public, all the persons concerned must consent to its publication. If the consent of even one person is missing, the recording may not be shared with others. This rule also applies to the instructor, who may only disclose student products with the express permission of the participants. Activities within a group, for example the *peer assessment* of the students’ work, are exceptions to this rule, as communication and information sharing within the group is obviously not the same as disclosing personal information and products to netizens en masse.

Most universities have relevant policies governing which sensitive data of students and faculty are subject to what kind of data management. This is an especially prominent issue in a distance learning environment, when, for example, in the case of an online exam, students in front of a webcam may even have to show the room in which they sitting.

To avoid health risks and threats to physical and psychological well-being while using digital technologies.

Models of digital citizenship include the competency of digital health, which can be approached from two perspectives. From an ergonomic point of view, digital health means the use of devices in a physically and psychologically healthy manner, and also involves knowledge of the risks of excessive use, its symptoms, and its treatment (Ribble, 2011). The second aspect is that of health promotion, which is concerned with how digital devices can be used for the promotion of health and prevention of illnesses.

One of the key issues in the information society, the competence of time management, can also be considered to be a part of digital health. In the information overflow of the twenty-first century, the ability to make the best use of our time is essential – not only in order to get the right information at

the right time, but also to prioritise, plan and organise our activities based on a realistic assessment of the length of time required for each task.

Since this should also be conceived as a horizontal area of development, instructors should provide students with some methodological suggestions that can improve time management, as this issue is closely related to learning and learning methodology. One of the most popular methods of prioritising tasks is the use of the Eisenhower matrix (see Figure 6.5).

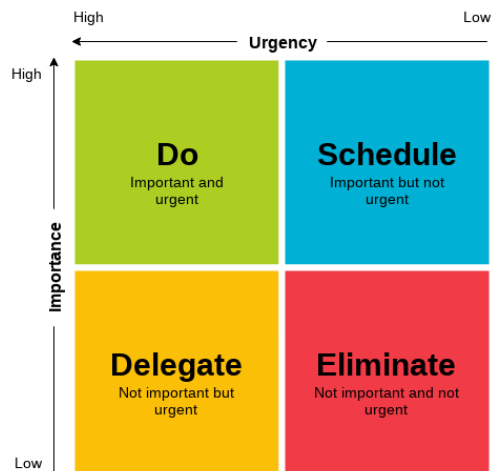


Figure 6.5. Eisenhower window, or time management matrix
(source: <https://online.visual-paradigm.com/fr/diagrams/features/eisenhower-matrix-template/>)

If we wish to assign time to tasks prioritised in this way, or measure how much time we spend on them, the [Toggle](#) application offers a simple solution. If we need to work in a focused way in front of the screen, the [Stay](#)

[Focusd plugin](#) for the Google Chrome browser might be of help. With this plug-in, certain web pages can be blocked according to our own settings. In this way, everyone can control how many minutes they spend on certain pages which tend to distract them when they are working (this can, of course, be set to zero).

Time management can also be optimised with a weekly and daily report on how much time we spend using various applications on our phones. As shown in Figure 6.6, the user often faces a shocking reality check, and it may thus be prudent to impose rules on this as well.

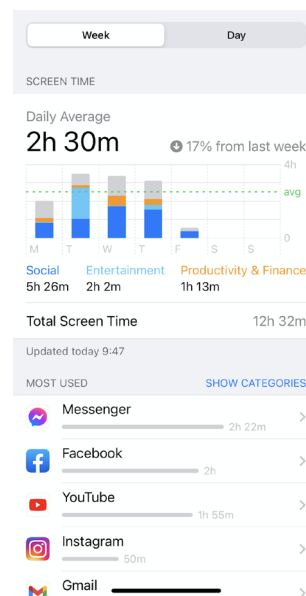


Figure 6.6. Screen time as seen on a smartphone

To be aware of the environmental impact of digital technologies and their use.

Environmentally conscious behaviour in the use of digital devices means that the individual is aware of the impact of digital devices on our environment (Vuorikari et al., 2016), and they are also familiar with the associated harmful phenomena and steps which can be taken to protect the environment (e.g. waste management options). It is important that students are aware of the detrimental effects of digital devices, and are able to enforce an environmentally-conscious standpoint and mode of conduct not only in their own microenvironment but also in communities.



With particular regard to the use of AI, as there are plenty of research data and studies available on how much energy is consumed when using AI. Rausch cites De Vries (2023) ‘calculations that while the average energy requirement of a simple chatGPT request is 3W/hour, the development and training of these language models involved enormous energy consumption.’ (Rausch, 2024:18) We also have data showing that the energy requirement for an average request was 1.28 GWh for the earlier GPT3, while for GPT4 it is many times that, approximately 50-60 GWh, which is roughly equivalent to the annual electricity consumption of 25,000 Hungarian households. (Rausch, 2024) Of course, this does not mean that the use of AI should be suspended under all circumstances, especially not at the individual level, as the relationship between AI and sustainability must be addressed through the development of global regulations. However, emphasis must always be placed on ensuring that users—in this case, students and educators—are aware of the environmental impacts of AI use.

6.5. Digital Problem Solving

To incorporate learning activities, assignments and assessments which require learners to identify and solve technical problems, or to transfer technological knowledge creatively to new situations.

Before embarking on a deeper exploration of the subject matter in this section, we should consider for a moment whether it is appropriate to treat digital problem solving as a separate activity and a subcompetence of its own. Indeed, if we peruse the present volume, it becomes clear that students may encounter problem-solving situations in several areas (they may be linked, for example, to the use of AI in general, the creation of digital content, collaboration on digital interfaces, or the responsible use of digital tools).

Students skilled in digital problem solving can be characterised as possessing the following abilities:

To identify technical problems when operating devices and using digital environments, and to solve them.

This part of digital problem solving is the most device-oriented. In ICT-supported education, students often find themselves in a situation where technical problems need to be identified and addressed (e.g. muting the microphone or turning on the camera during an online *video conference*, registering for and installing an application. These are tasks requiring a certain proficiency in the workings of digital technology and the online space. In our modern world of smartphones and applications, managing technology has become extremely simple, but perhaps that is why installing software onto a computer is more of a challenge for students. Whatever technical problems they may face, they should be encouraged to search the



Internet for the solution because they may find a plethora of *tutorial videos* and explanations concerning almost any issue they encounter.

A technical problem that may arise when using AI is that the user may be using the application without a subscription and therefore reach the token limit, which means that the number of prompt requests that can be fulfilled is limited. Tokens are character sequences, i.e., letters, syllables, and words, which AI applications use to process text. There are tools that work with a certain number of tokens (e.g., Gamma), meaning that once the user reaches the maximum number of tokens that can be used, the conversation can no longer continue; but there are also tools, such as Gemini, where even if there is a token limit, it is generally difficult to reach. There are token-counting interfaces (e.g., OpenAI tokenizer) where we can check how many tokens a single word or even the entire prompt is worth. It is a good idea to try out how many tokens the Hungarian and English equivalents of the same word, expression, or prompt are worth. (English texts typically have fewer tokens than Hungarian ones.) Breaking longer tasks and prompts down into smaller, shorter requests and feeding them to the tool in this way can lead to a more gradual use of tokens and thus to avoiding the complete exhaustion of the token set.

To adjust and customise digital environments to personal needs. To identify, evaluate, select and use digital technologies and possible technological responses to solve a given task or problem.

Closely related to the personalisation of digital environments is the concept of the *personal learning environment (PLE)*. The *personal learning environment* as an approach acknowledges that learning is a process which should be supported by dedicated tools, and web applications that students already use with proficiency are always a good starting point (see *Chapter 5.1*). If we want PLE to appear in a university environment, the instructor needs to discover each student's *personal learning environment*, and then the instructor and student have to jointly consider how the elements and applications it includes can be incorporated into the teaching-learning process. Through the use of this approach, students would acquire knowledge in a natural learning environment rather than in a compulsory and “artificial” university learning environment.



What practical strategies can users apply when encountering common limitations of AI chatbots, such as prompt refinement challenges or context window constraints?

Johanna Szőke

The main rule of thumb when prompting is to be specific. According to the Garbage In Garbage Out principle, bad input leads to bad output. For example, giving a persona to the chatbot can greatly influence the results you get.



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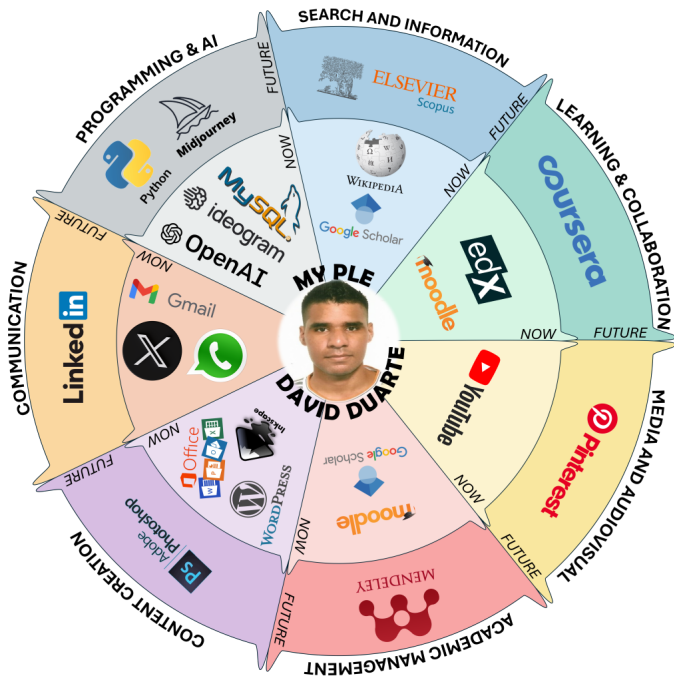


Figure 6.7. Graphical representation of a student's personal learning environment (source: <https://blogs.upm.es/t4pdc/2024/11/19/davids-ple-personal-learning-environment/>)

The university learning environment is mostly restricted to the mandatory learning management system, an undoubted advantage of which is institutional management and technological security. From a pedagogical perspective, however, we should rely more heavily on the students' personal learning environments, which may also be part of the university's

learning management system. The important question is not how many different tools make up someone's PLE, but whether the individual has the appropriate tools to deal with the various scenarios within learning situations. Even without naming specific applications, activities and functions can be defined which students will definitely have to manage in their *personal learning environment*. Examples of such functions include sharing our own products, maintaining our own digital library, communication in professional and private settings, maintaining a calendar and an activity list, and media recording and playback. (Attwell, 2007; Attwell et al., 2008; Godwin-Jones, 2009). Similar categories can be found in the outermost layer of Figure 6.7. It is worth noting that the personal learning environment includes the category 'programming and AI', which includes Midjourney and Open AI. Artificial intelligence is increasingly becoming a natural part of PLEs, as was discussed in Chapter 3.4 in relation to its function and operation as a personal assistant.



A further benefit of involving PLE in conscious, formal education is that it is one of the best places to develop a student's digital competence.

Exploring the *personal learning environment* is a difficult task conducted mainly through a survey based on self-report which takes the form of a preliminary questionnaire, especially with large samples (Chapter 5.1, Figure 5.2). But just as we usually get to meet students in person in the first lesson and ask them where they came from and whether they have a smartphone to use in class if needed, we could also ask them about the apps they use for specific (learning) purposes on their smartphone (or computer). The hardware and software requirements of the course should be clarified with the group in the very first session.



This practice is also important for ensuring equal access (*Chapter 5.7*). If we find that students are unable to provide meaningful responses concerning their *personal learning environment* because they have not actually built one yet, then we should focus on self-development.

To understand where their digital competence needs to be improved or updated. To seek opportunities for self-development and to keep up-to-date with digital evolution. To support others in their digital competence development.

It is a cliché that the *digital competence* of the Internet generation is not innately high. As mentioned by the experts in our interviews (*Chapter 6.2*), there are certain areas where students have good digital competence but that is not true of some other areas. An additional challenge is when the group of students is heterogeneous in terms of *digital competence* and there are differences between the students in their skills with digital tools. In a heterogeneous group, we should consider differentiation based on the varying levels of *digital competence* (*Chapter 5.2*). The method of organising students into pairs, a well-known organisational principle in pedagogical practice, may also prove useful because students who have a higher level of *digital competence* are usually happy to support and teach those who need help with using digital tools.

References

- Attwell, G. (2007). Personal Learning Environments – the future e-Learning? *eLearning Papers*, 2(1). <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.97.3011&rep=rep1&type=pdf>
- Attwell, G., Bimrose, J., Brown, A., & Barnes, S-A. (2008). Maturing Learning: Mashup Personal Learning Environments. <http://ceur-ws.org/Vol-388/attwell.pdf>
- Bognár, A. (2023). A generatív mesterséges intelligencia promptolása, egy új képesség fejlesztése az oktatásban. *Pannon Digitális Pedagógia*, 3 (2), 17-26.
- Bujdosó, Gy., Novac, O.C., & Szimkovics T. (2017). Developing cognitive processes for improving inventive thinking in system development using a collaborative virtual reality system. *2017th IEEE International Conference on Cognitive Infocommunications (CogInfoCom)*.
- Carretero, S., Vuorikari, R., & Punie, Y. (2018). The Digital Competence Framework for Citizens. [https://publications.jrc.ec.europa.eu/repository/bitstream/JRC106281/web-digcomp2.1pdf_\(online\).pdf](https://publications.jrc.ec.europa.eu/repository/bitstream/JRC106281/web-digcomp2.1pdf_(online).pdf)
- Dehue, F. (2013). Cyberbullying Research: New Perspectives and Alternative Methodologies. Introduction to the Special Issue. *Journal of Community & Applied Social Psychology*, 23(1), 1-6.
- Festl, R., & Quandt, T. (2013). Social Relations and Cyberbullying: The Influence of Individual and Structural Attributes on Victimization and Perpetration via the Internet. *Human Communication Research*, 39(1), 101-126.
- Godwin-Jones, R. (2009). Emerging technologies: Personal learning environments. *Language Learning & Technology*, 13(2), 3-9. https://scholarspace.manoa.hawaii.edu/bitstream/10125/44175/13_02_emerging.pdf
- Hmelo-Silver, C.E. (2004). Problem-Based Learning: What and How Do Students Learn? *Educational Psychology Review*, 16, 235-266. <https://doi.org/10.1023/B:ED-PR.0000034022.16470.f3>
- Horváth, L. (2023). Feltáró szakirodalmi áttekintés a mesterséges intelligencia oktatási használatáról. *Pannon Digitális Pedagógia*, 3(1), 5-17. DOI: 10.56665/PADI-PE.2023.1.1
- ISTE Standards for Educators (2024).
- ISTE Standards for Students (2024).
- Liu, Y. & Baucham, M. (2023). AI Technology: Key to successful assessment. In: *Handbook of Research on Redesigning Teaching, Learning, and Assessment in the Digital Era*. IGI Global. pp. 304-325. <https://doi.org/10.4018/978-1-6684-8292-6.ch016>

- Smith, R. (2017). ISTE Releases New Standards for Educators to Maximize Learning for All Students Using Technology. <https://www.iste.org/explore/Press-Releases/ISTE-Releases-New-Standards-for-Educators-to-Maximize-Learning-for-All-Students-Using-Technology>
- Papp-Danka, A. (2019). Digital lifestyle - digital citizenship - digital pedagogy. *Opus et Educatio*, 6(4), 445–457. <http://opuseteducatio.hu/index.php/opusHU/article/view/344/606>
- Pribelszki, J. (2024). AI – Szerzői jogi kérdések. <https://otpsecuritylab.inf.elte.hu/blog/ai-szerzoi-jogi-kerdesek>
- Rausch, A. (2024). Fenntartható-e a digitális oktatás a klímaváltozás árnyékában?. *Iskolakultúra*, 34(5), 15–24. <https://doi.org/10.14232/iskkult.2024.5.15>
- [Recommendation of the European Parliament and the Council of 18 December 2006 on key competences for lifelong learning \(2006/962/EC\)](#)
- Ribble, M. (2011). *Digital Citizenship in Schools*. International Society for Technology in Education.
- Robin, B.R. (2009). Digital Storytelling: A Powerful Technology Tool for the 21st Century Classroom. *Theory into Practice*, 47(3), 220–228. https://www.researchgate.net/publication/249901075_Digital_Storytelling_A_Powerful_Technology_Tool_for_the_21st_Century_Classroom
- Tokunaga, R. S. (2010). Following we home from school: A critical review and synthesis of research on cyberbullying victimization. *Computers in Human Behavior*, 26, 277–287. <https://doi.org/10.1016/j.chb.2009.11.014>
- Tóth-Mózer, Sz. & Misley, H. (2019). *Digitális eszközök integrálása az oktatásba Jó gyakorlatokkal, tantárgyi példákkal, modern eszközlistával*. Budapest: Eötvös Loránd Tudományegyetem.
- Vuorikari, R., Punie, Y., Carretero Gomez S., & Van den Brande, G. (2016). *DigComp 2.0: The Digital Competence Framework for Citizens. Update Phase: The Conceptual Reference Model*. Luxembourg Publication Office of the European Union. https://publications.jrc.ec.europa.eu/repository/bitstream/JRC101254/jrc101254_digcomp%202.0%20the%20digital%20competence%20framework%20for%20citizens.%20update%20phase%201.pdf

Authors

 Ida Dringó-Horváth, PhD	Educational developer, educational technology and language pedagogy specialist. University associate professor, Head of ICT Research Center and of Educational Technology Training Centre at the Károli Gáspár University of the Reformed Church in Hungary. She received her PhD in 2004 and habilitated in 2019 at Eötvös Loránd University's Doctoral School of Education. Her research and teaching areas are linked to learning and teaching with digital technologies (EdTech), as well as the development of digital competences within higher education. In this connection she also engages in professional community building at both the national and international levels. Linkedln; ORCID
 Judit Dombi, PhD	Associate professor of linguistics at the Department of English Linguistics, University of Pécs, Hungary. She received her PhD in 2013 in applied linguistics and completed a habilitation process in 2019. Her research focuses on various theoretical and applied aspects of pragmatics and intercultural communication. She has been involved in teacher training since 2011, her work involves digitally supported foreign language teaching. She is member of the Center for Supporting Digital Learning and Deaching at the University of Pécs. ORCID
 László Hülber, PhD	An e-learning methodology expert, he earned her doctoral degree in education from the University of Szeged, where he wrote her dissertation on technology-based assessment and evaluation. He began her career as a secondary school teacher and later worked in higher education as a lecturer, researcher, developer, and academic leader. For the past 15 years, he has been committed to supporting teachers and educators in integrating technological tools into their teaching and learning processes in a purposeful and pedagogically grounded way. He is currently working as a digital learning content developer, creating educational materials for disadvantaged groups. Linkedln

 Zsófia Menyhei, PhD	Foreign language educator, teacher trainer and senior lecturer at the Institute of English Studies, Károli Gáspár University of the Reformed Church in Hungary. She received her PhD in 2016 at the Doctoral School of Linguistics, University of Pécs. Her research interests include AI literacy development, as well as educational technology in foreign language teaching and learning. Linkedln
 Tibor M. Pintér, PhD	Linguist, university associate professor at the Department of Hungarian Linguistics of the Károli Gáspár University of the Reformed Church in Hungary. He received his PhD in 2009 in linguistics and completed a habilitation process in 2025. His research focuses on language pedagogy, translation studies, language assessment, language technology and data mining. In the field of language pedagogy he is interested in second language acquisition. ORCID
 Adrienn Papp-Danka, PhD	University lecturer, pedagogical expert and educational developer. She made her MA-degrees in Hungarian Literature and Grammar, and in Pedagogy too, at the Eötvös Loránd University. She made her PhD at Eötvös Loránd University's Doctoral School of Education in 2014. Now she is a Head of the Center for Teaching and Learning in Budapest University of Economics and Business. Her research fields are education in digital learning environments, digital competence and digital citizenship. Linkedln
 Pál Szontagh, PhD	Teacher, pedagogical expert, education leader. He obtained his doctoral degree in 2018 at the KRE ÁJK with his dissertation entitled "Quality and ethical expectations of Christian teachers and the problems of their codification." He is a college professor at the Faculty of Pedagogy at Károli University (KRE), director general of the Centre for Pedagogical Training of KRE, honorary director of the Reformed Pedagogical Institute, and editor-in-chief of the "Magyar Református Nevelés" [Hungarian Reformed Education] pedagogical journal. His main areas of research are leadership theory, organizational development, teacher ethics, and the career socialization and professional motivation of teachers. Linkedln; ORCID