Educational Technology in Higher Education – Methodological Considerations

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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, 2017[1]).

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, 2009[2]). 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, 2006[3]).

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).

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 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

[1] Redecker, C. (2017). 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. Budapest: Országos Közoktatási Intézet.

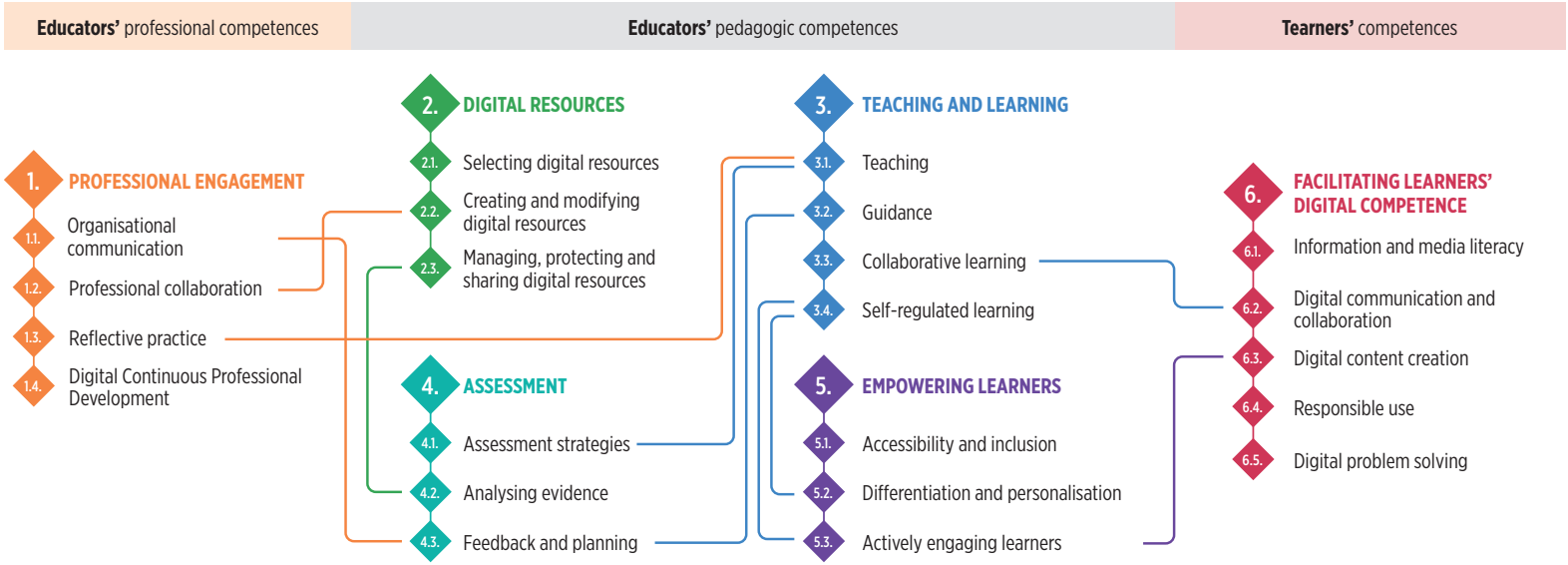


Figure 1. DigCompEdu Framework of Reference (source: Redecker, 2017)

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.

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

Click / Scan

The test can be downloaded in different languages.

Click / Scan

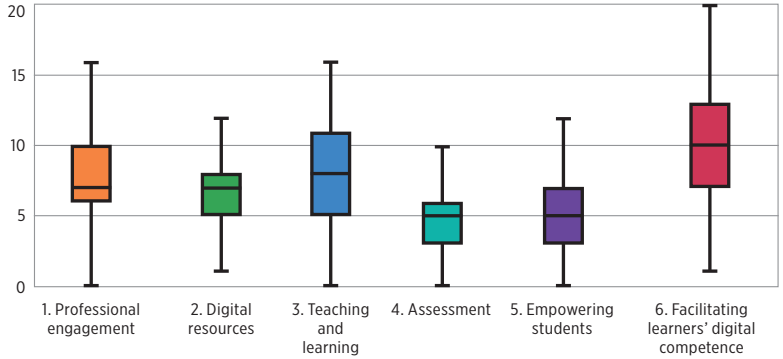


Figure 2. Results responding trainees achieved in each area through their self-assessment

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.

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.

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 Prievara:
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.

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"

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. Digital Continuous Professional Development*.

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.

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.

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 Twitter 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 employed 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 parents, e.g. rules, appointments, events, and to inform learners on an individual basis, e.g. on progress and issues of concern.

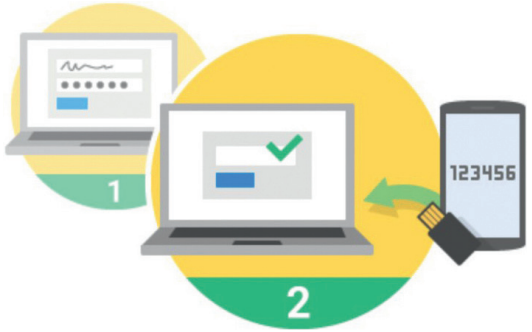
More about the diversity of digital content and the various ways it can be used can be found in Chapter 2.2, but here, it is useful to distinguish between organisational and personal space. From the point of view of organisational and institutional space, institutional web pages have a special significance, 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, researchgate.net, GoogleScholar or 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).



1 Enter your password
You'll enter your password. Whenever you sign in to Google, you'll enter your password as usual..

2 You'll be asked for something else.
Then, a code will be sent to your phone via text, voice call, or our mobile app. Or, if you have a Security Key, you can insert it into your computer's USB port.

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 their inception and development.

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 number of universities worldwide have a centre dedicated to this purpose, and it is heartening to see more and more such organisational units in institutions. It is important that the scope of the unit's activities should not be limited to IT and technical services – methodological support for teachers and students should also be given due emphasis in the digital learning space, and the appropriate methodological use of modern technology in teaching and research should be promoted.

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.

We should find out if our institution has a digital strategy. 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.

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 an 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?

Judit Szivák:

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.

Gábor Halász:

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. IdőPont.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.

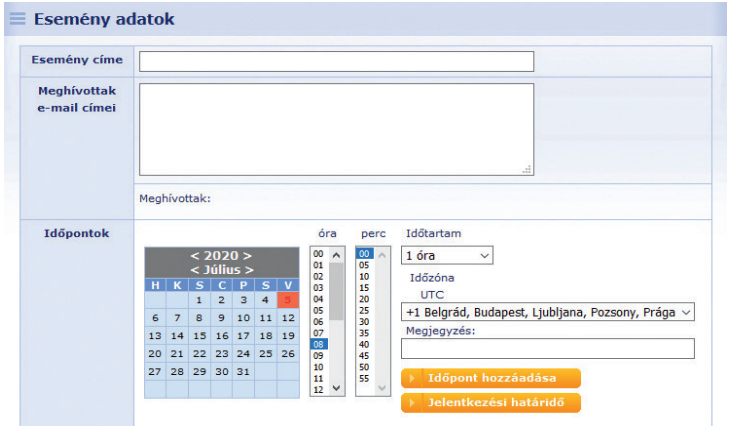


Figure 1.2. Creating a new event by időPont.net – idopont.net/newEvent.php

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.*

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 (Lengyelné 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 (Lengyelné 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.
- 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.

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).

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

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-Instituts 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 competence, and the assessment of their knowledge at the end of seminars. The main result of the project is the free DIGICOMP e-learning portal.
- The free CRISS MOOC Digital competence for teachers online course provides knowledge concerning digital competence in the classroom. Access to the MOOC course is free for all teachers in the European Union.

Our methodological development can be facilitated by an awareness of the latest ideas about learning and up-to-date professional research. A great help in this may be Learning how to learn, which is available as part of the Coursera online course collection. (For more about similar websites and courses, see Chapter 1.4).

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.

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 of 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 Research Gate 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.

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).

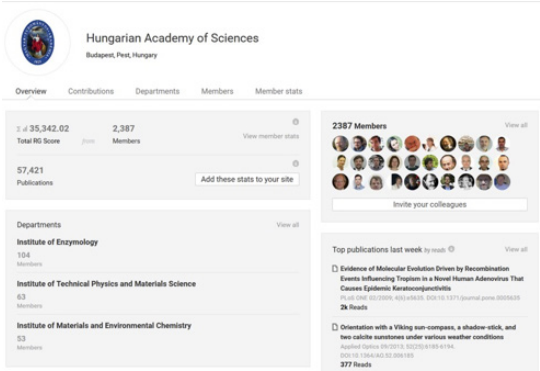


Figure 1.3. Overview of the institutional presence of the Hungarian Academy of Sciences on ResearchGate, as of January 2021.

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.

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 by searched as well (Figure 1.4).

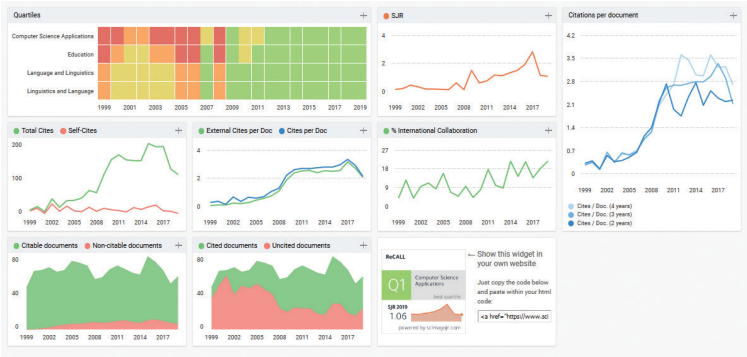


Figure 1.4. Classification and statistics for the journal ReCALL based on Scimago

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. The process is illustrated by this example.

Based on Sasvári & Urbanovics (2019), such freely available online services include:

- Elsevier Journal Finder
- Springer Journal Suggester
- Wiley Journal Finder Beta
- Edanz Journal Selector

- Jane (Journal/Author Name Estimator)
- JournalGuide
- IEEE Publication Recommender

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. In addition, predatoryjournals.com contains a register of parasitic journals, although it is difficult to keep up with their rapid growth.

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)

Considering 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 departmental meeting)

Figure 1.5. Types of reflection (authors' own editing 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 and 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.

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	Strength-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 we need to change?	• 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 some 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 regulations and recommendations are 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.

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 beneficial 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. Digital Continuous Professional Development

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, to collaborate with others;
- 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.

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.

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 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 MoocList, 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.

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, DaFWebKonf 2018, Virtual Exhibition, opening (Figure 1.7).

Figure 1.7. 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.

To use digital technologies and environments to provide training opportunities for colleagues and peers.

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). 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 or Hangout, MS Teams, Zoom, Skype, 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.

In the preparation phase, it is a good idea from a methodology viewpoint to include as many interactive elements as possible. 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.

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).

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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 & Wiltrout, 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.

Chapter 2.1. Selecting 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?

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.

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.

2.1. Selecting 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;
- 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). 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 (e.g. "digital pedagogy" provides 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 disciplinary training, courses and learning materials supplemented with digital publications
- **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 best 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 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.

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 this following playful task for the qualitative evaluation and analysis of online resources.

As instructors, we use not only content that we have created ourselves, but also content created by others. The following interview excerpt contains advice on how to use content created by others.

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.

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).

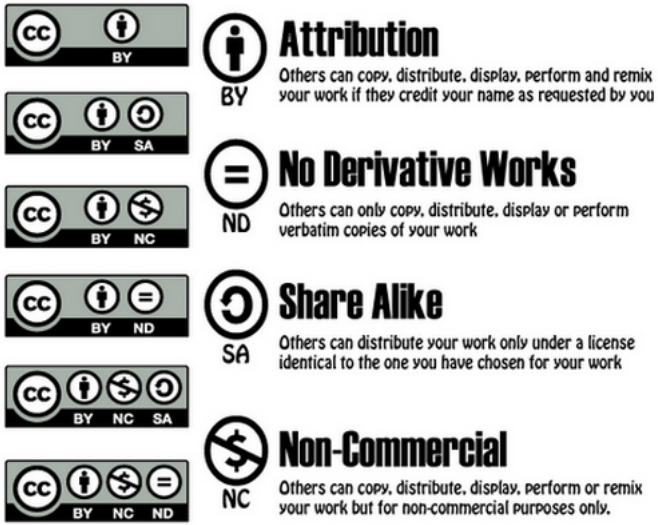


Figure 2.1. Creative Commons licenses, version 4.0 (source: http://images.huffingtonpost.com/2014-03-25-creativecommonslicenses-thumb.jpg)

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 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: jhigh 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.de 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.

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.

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.

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.

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 (such as Photoshop, GIMP, Canva, Pixlr, SumoPaint) can be used to 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 *Chapter 5.3*) and student products (see *Chapter 5.1*).

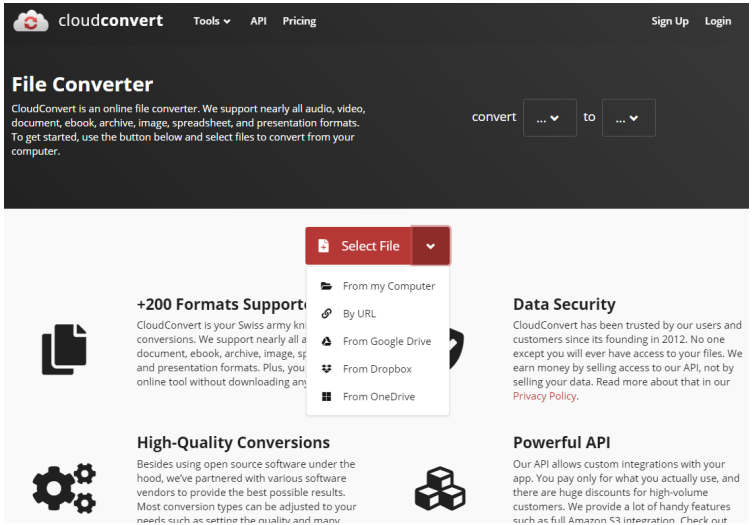
When creating images, the size and resolution should be optimised according to our requirements. Most publications require good quality images and diagrams, usually with a resolution of 300 dpi or more. However, we may need to reduce the size for online publication (e.g. on social media, image or video 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.

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.



2.2. 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.

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. 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, Animoto and Yvond, 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, textual data can be visualised in an appealing way: a given set of text 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.

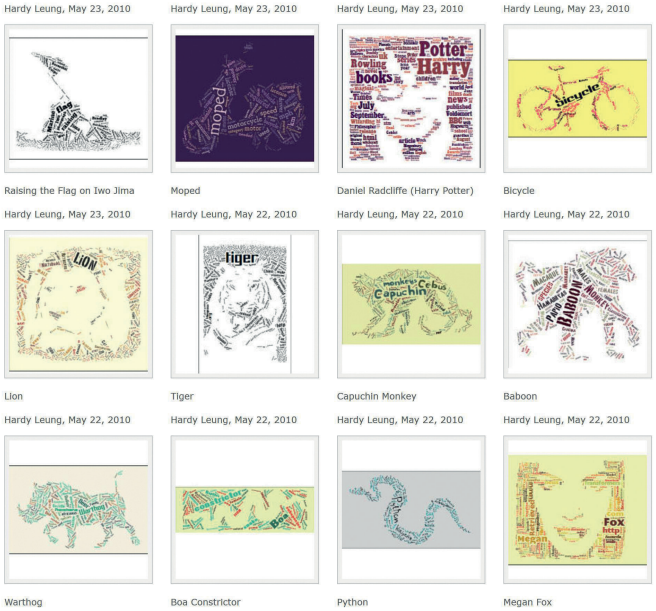


Figure 2.3. Examples from the gallery of the Tagxedo word cloud generator

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 or 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".

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 Scholar, 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 employing different images and audio, interesting effects and animations, and creative spatial layout.

One such unique, non-linear presentation software is 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.

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.

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.*

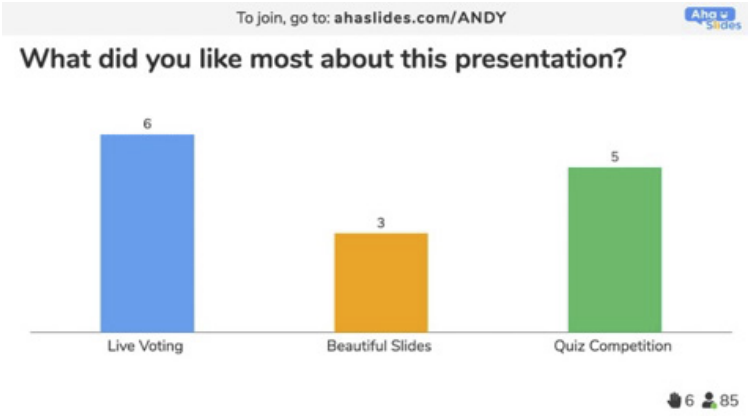


Figure 2.4. Diagrams with live voting results from a presentation (ahaslides.com)

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 (EclipseCrossword, CrosswordLabs, Crossword Puzzle), word searches (Word Search Maker) or triominos (Trimino 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, tutory.de, Übungsblätter Goethe). 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. (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).

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.

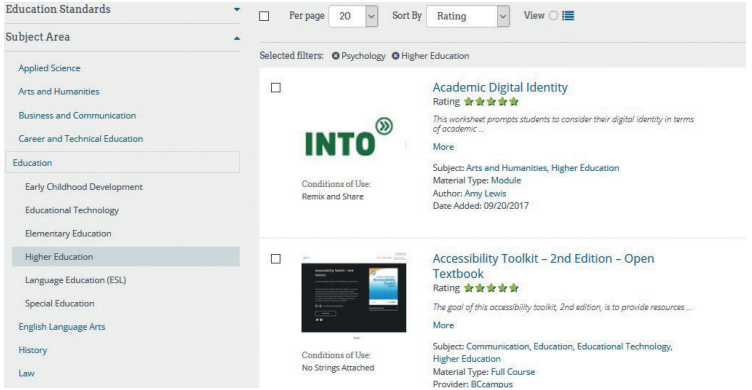


Figure 2.5. List of search results on the OER Commons educational portal

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 2.1* 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.

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, Google URL shortener, Ow.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, blogspot.com, wordpress.com, Wix and TwitterBlog. 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 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 self-made content, the conscious instructor also controls its rights of use through licenses and it is therefore very advantageous for us 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).

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.

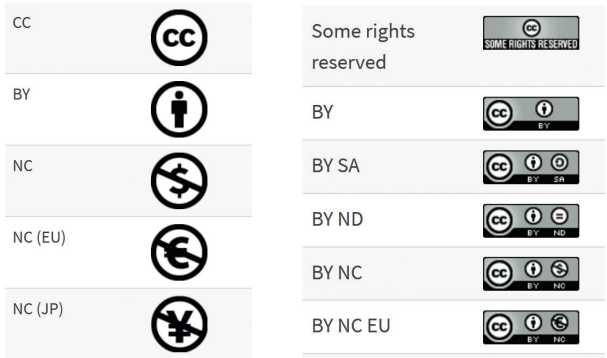


Figure 2.6. License icons and buttons

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.

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.

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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, 2016). 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-regulated learning* 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.

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?

Márta Turcsányi-Szabó:

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). This 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*).

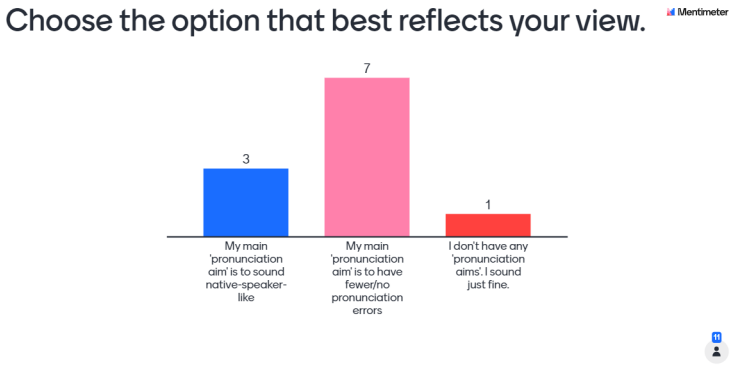

Figure 3.1. A slide type with different answer options in Mentimeter

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.

In addition, there are a number of classroom techniques that help to engage students without relying on their smart devices. 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.

Before introducing a topic, we can create a word cloud from the keywords associated with the subject matter. 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. 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".

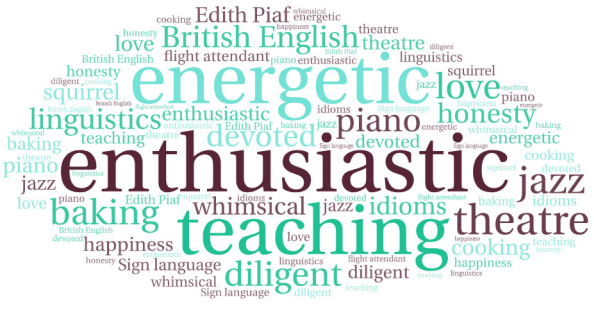

Figure 3.2. A personal word cloud for a student, created with WordArt

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 *flipped classroom* (also known as the *mirrored* 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 flipped 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 in this video). 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 *flipped 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 *flipped 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 *flipped 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 it is likely that the majority will have had no prior experience of such a model. 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.
- 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.

3.2. Guidance

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, we can upload our 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 provide solutions for administrative tasks, such as completing attendance sheets or recording grades, and they feature a calendar function, which is useful for providing students with a reminder of the deadline for the submission of their 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 conference*s, 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 which 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.

To catalyse participation on an LMS forum, 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.

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:

What can an instructor do to make students active in online communication?

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 that the workload is multiplying, we 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.

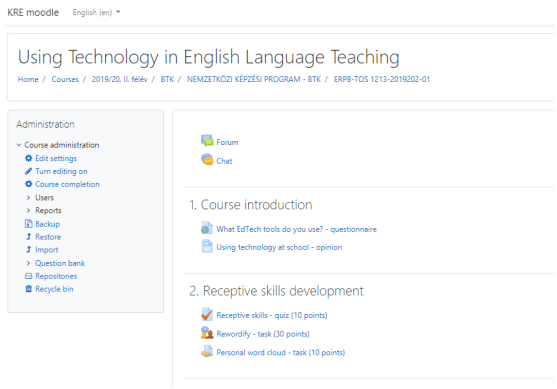

Figure 3.3. Content and activities arranged in modules on Moodle

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.

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.

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.

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

We can rely on, for instance, 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;
- trueness to life, provision of 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 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.

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.

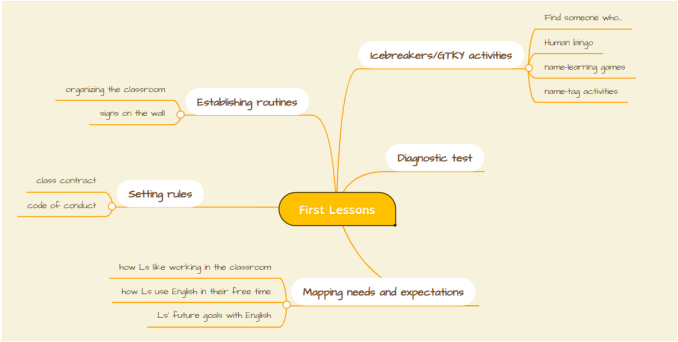

Figure 3.4. Mind map created in Mindmeister

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, 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.

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*.

As an example, a blog or an online bulletin board is an excellent way to document joint research and publish its results. 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*).

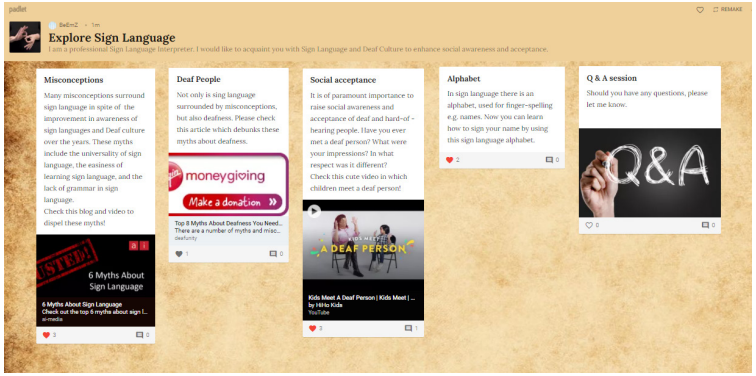

Figure 3.5. A student's bulletin board in Padlet

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).

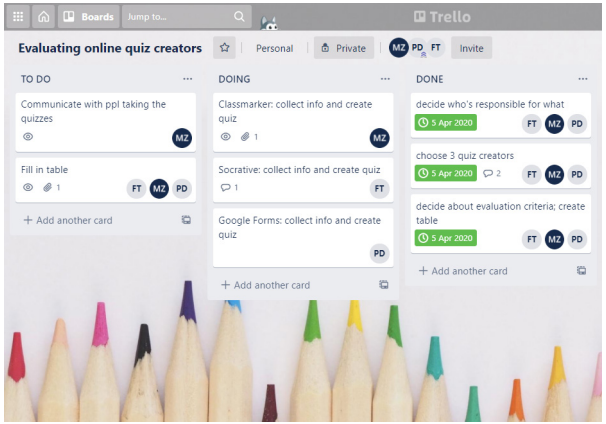

Figure 3.6. A design interface to coordinate project work created in Trello

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, 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 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. 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).

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. 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 *Chapter 6.2*).

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 adapting 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 the development of such learning.

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.

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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. Assessment determines the entire educational process and delivers information that measures its goals and 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 personalities. It shapes students' attitudes towards each subject, the instructor, the institution, and the whole process of studying 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 more 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 in those one or two appraisals because there are limited options for rectification. 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.

Tibor Prievara:
If we expect technological tools to improve or change assessment, we are probably looking in the wrong direction.

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.

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 (see *chapters 4.2 and 4.3*).
6. We should use technology 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.

4.1.2. The role of diagnostic assessments and technology-based assessment tools

Before formulating *learning contracts* or beginning the learning process, it is advisable to first perform a *diagnostic evaluation* of students (guideline 2 above). 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).

The effective implementation of diagnostic evaluation can be carried out with digital tools. Learning Management Systems (LMS) are the basic,

primary tools for learning support with digital technologies. Their use may be provided by higher education institutions (e.g. Canvas or Moodle), while in other cases instructors use them on their own initiative and according to their individual choice (e.g. NEO LMS, Google Classroom, Edmodo, Schoology). 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*. 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 in 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 is actually a presentation application that allows 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.

4.1.3. 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.

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 solutions, even with integrated automatic feedback mechanisms. 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 any shortcomings, and clarifying knowledge. In such cases, it is 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 is 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.

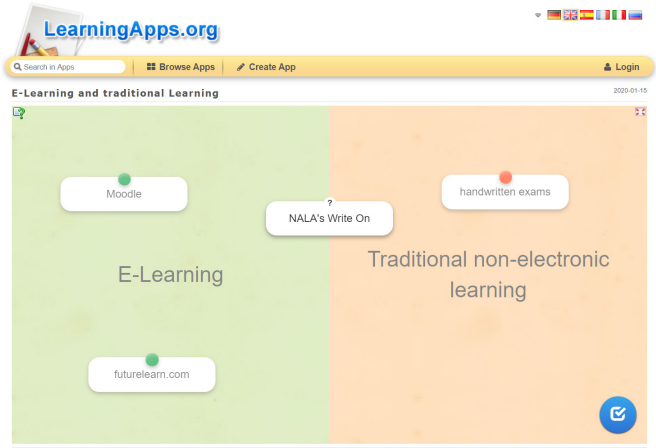

Figure 4.1. LearningApps task

Quizlet offers the digital version of printed word cards, which are most useful in language teaching, but can provide help in 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.

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.

Tasks should always include the aspects of assessment, but it is even better if we provide an assessment table 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 mind maps. The first column presents the criteria (in this particular case, one of four), and the next five columns express the expectations and properties for each achievement level, together with the points available.

Kritérium	Szintek					Pontok
információ minősége	Igazán informatív. Szintetizálja az információkat. Releváns információkat tartalmaz. Minden információ kapcsolódik a központi gondolathoz. Érthetőek az összefüggések, egymáshoz szorosan kapcsolódó fogalmakat dolgoz fel. Komplexitásra törekszik.	Sok hasznos információt közöl a témával kapcsolatban. Az információk zömében a témához kapcsolódnak. Többnyire szintetizálja az információkat.	Elvétve tartalmaz hasznos információkat a témát illetően. Nehezen érthetőek az összefüggések, a kapcsolat a központi gondolathoz. A gondolattérkép nem elég komplex, kidolgozatlan.	Nem tartalmaz hasznos információkat a témát illetően. Az információk nem kapcsolódnak a központi gondolathoz. Nem érthetőek az összefüggések.	Nem értékelhető.	
	30 pont	15 pont	8 pont	4 pont	0 pont	30 pont

Table 4.1. Assessment table for mind maps (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.

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 those students who fail 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 revaluated, and we should promote the measurement of the knowledge that students will actually need after they have graduated.

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 (Figure 4.2). If learning progress is determined by whether or not tests are performed well, what these tests measure and how their expectations can be met will be considered by students to be of the greatest importance.

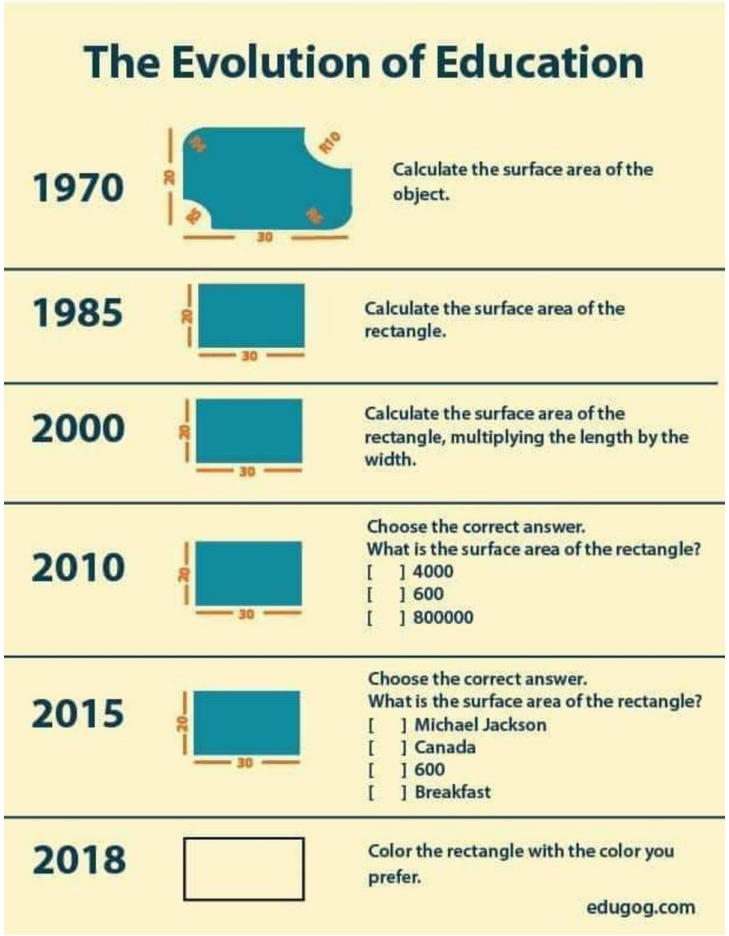

Figure 4.2. Diagram satirising the loss of the quality of knowledge required in tests (source: edugog.com)

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.

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 of 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 worth familiarising 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 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 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.

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 language 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, the key skills involved 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 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.

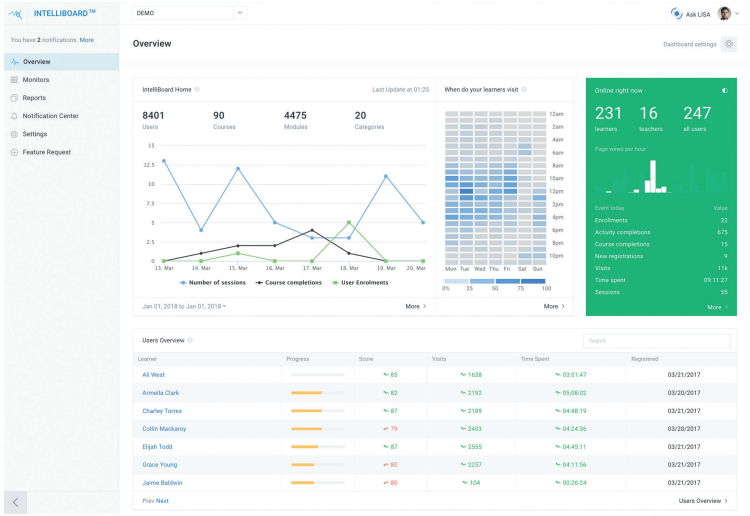

Figure 4.3. Data on the use of the LMS system and its user activity (source: intelliboard.net)

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*.

The measurement of *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 the instructions were 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).

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 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.

Two concepts are worth mentioning here: educational *data mining* (EDM) and the currently popular field of *learning analytics*. Both are used to process and analyse data sets, and they are capable of extracting new, non-trivial additional information from existing data by recognising interrelations and patterns. Data extracted from the learning environment that is submitted to analysis by complex analytical algorithms provides a deeper understanding of student achievement, and the interpretation of complex relationships between variables leads to pedagogically relevant conclusions (Romero & Ventura, 2010). A more comprehensive picture of the learning processes and the performance of the framework emerge, and the information might be used for optimisation. Analytical algorithms yield descriptive, predictive, and diagnostic information. In predictive models the system draws conclusions from a combination of parameters and events (indicators), and it is even capable of predicting an expected event (Drivas, Giannakopoulos, & Sakas, 2020). Depending on the amount of information gathered, we may also enter the sphere of big data analysis, where we examine data not only on the level of a specific course, but for the entire university, including every course and every student.

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, and 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.

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.

Figure 4.4. Examples of available badges

Tibor Prievara 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?

Tibor Prievara:
I am most interested in solutions which can give feedback, evaluate, represent and analyse the process of learning itself.

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 easily digestible 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.

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	Planets	Physical and spatial organ...	U.S physical and political...	What is Geography	Physical systems	Shapes of the Earth	US surface	Weather and climate	Meteorology
	Code	1	1.1	1.2	1.3	1.4	2	2.1	2.2	3	3.1
Students	Average	62%	35%	73%	69%	70%	65%	64%	65%	49%	37%
Aaron, Billy	77%	88%	50%	100%	100%	100%	71%	50%	93%	64%	54%
Benett, Tudor	48%	76%	45%	85%	85%	90%	56%	50%	61%	26%	15%
Besto, Bex	37%	60%	5%	90%	50%	95%	50%	50%	50%	33%	21%
Diss, Travis	76%	75%	50%	75%	88%	88%	88%	100%	76%	61%	40%
Foster, George	52%	85%	50%	100%	95%	95%	57%	50%	63%	23%	0%
Frey, Peter	5%	8%	0%	33%	0%	0%	8%	0%	17%	4%	13%
Henderson, Rox...	76%	88%	50%	100%	100%	100%	75%	50%	100%	54%	0%
Johnson, Katie	80%	85%	50%	100%	95%	95%	94%	93%	95%	72%	63%
Johnson, Sally	70%	84%	50%	100%	93%	93%	82%	73%	91%	53%	36%
Jones, Ann	17%	25%	0%	50%	0%	50%	50%	100%	0%	0%	0%
Kwan, Alan	80%	84%	50%	98%	95%	95%	86%	83%	89%	72%	73%
Lim, Adrian	69%	79%	44%	89%	89%	96%	74%	70%	78%	51%	27%

Figure 4.5. Table representing learners' performance in the NEO LMS (source: neolms.com)

To provide personal feedback and offer differentiated support to learners based on the data generated by the digital technologies used.

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. 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.

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5. EMPOWERING LEARNERS

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. *Chapter 5.1. Accessibility 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. Actively engagement learners* 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 (Corvinus University of Budapest) and Dr. Helga Dorner (Central European University, Budapest) about the topics in this chapter.

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).

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 Dorner:

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.

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 advisable to test the feasibility of the process during the planning phase: we should 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. As this is a dynamically changing environment, the survey should be conducted at the beginning of each semester.

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, a useful tool may be the cooperative approach, 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 5.1).

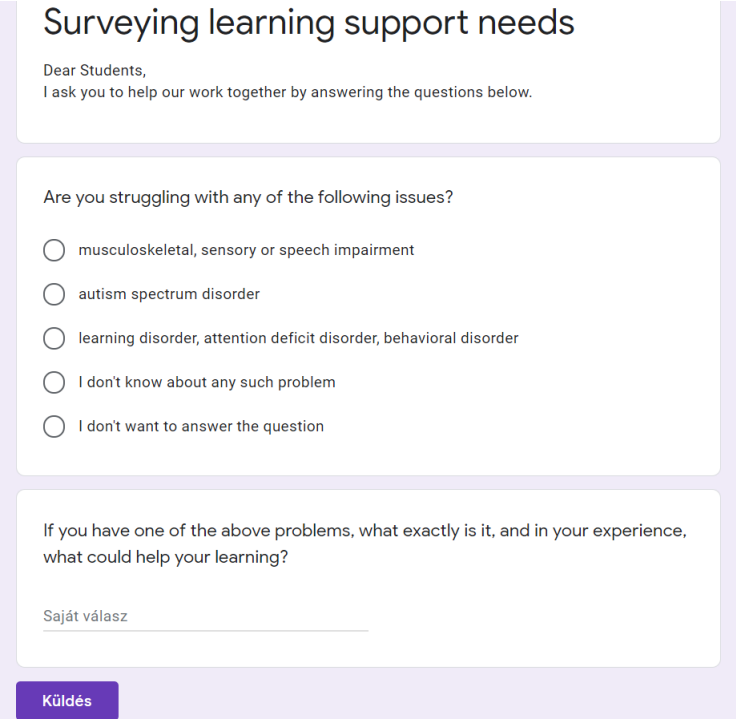

Figure 5.1. A questionnaire made in Google Forms to survey needs related to supporting learning

A student with special educational needs is a person with musculoskeletal, sensory or speech impairments, autism spectrum disorder, or learning, attention or behavioural disorders. Fortunately, a number of digital technologies are available to support the learning of these students: the visually impaired can use reading software, such as the NVDA screen reader, an open-source, freely downloadable screen reader for MS Windows; or for Android phones an app called Mobile Accessibility, which has a speech-based menu system and provides immense help in the interpretation of text on mobile devices. In addition to the many benefits of this app, it must be mentioned that it is not free, but due to its practicality, it is very popular with visually impaired students. Students using devices with an iOS operating system are assisted by an app called VoiceOver, which offers similar features. The Amazon Polly service generates life-like speech from typed text, which can be useful for students with speech impairments.

People with hearing impairments are assisted by a variety of *voice-to-text* applications that allow them to read a lecture or any live speech almost immediately in writing. An example of such an application is Dragon Anywhere, which, while not free, is extremely popular due to its powerful features and availability not only on mobile devices, but also on desktop computers. Similarly popular among hearing-impaired students is the *freemium* Speechnotes, which is capable of capturing long lectures, and is therefore specifically adapted to the needs of higher education (its disadvantage is that it is Android-exclusive). Students with special needs are usually aware of these "accessibility" technologies themselves and use them in their studies, so the task of the instructor is often simply to be open to these solution and to provide digital assistance technologies for students with special needs as an alternative, compensatory form in the pedagogical process, even if that process was originally designed with traditional tools.

As an example, NVDA can be immediately used from a flash drive or other portable storage solutions without installation. If we know (through a preliminary survey, see Figure 5.1) that there are visually impaired students in our group, we should download the program and keep it on a portable

memory device so that we can offer prompt help to students when they are not using their own devices.

For students with hearing or visual impairments, Google Assistant may be of great help. Even if it is not specifically a speech conversion application, this app has an extremely useful voice recognition function that can transform speech into text. This can be an important aid in communicating with students, but also in the teaching-learning process itself: with its help, we can efficiently assign tasks to students with hearing impairments, while visually impaired students can easily add ideas to a *collaboratively* edited document. The great advantage of Google Assistant is that it is not a specialised application; students without impairments are also usually familiar with it, and it can greatly contribute to making the teaching-learning process and collaboration as accessible as possible.

The ability to record a lesson digitally can be a great help for students with dyslexia and dysgraphia, but the participants' legal rights must be protected at all times (see *Chapter 2.3*). Recordings help such students to learn after class as they can more confidently interpret what is being said through repeated listening. In terms of the learner's performance, alternatives can be offered: instead of handing in essays, they could submit podcasts, as they can express themselves better orally than in writing. For students with dysgraphia, *voice-to-text* applications transforming live speech to written text can help them with both note-taking and essays. Free applications include Speechnotes (compatible with the Chrome desktop browser), Speechtexter (also available for Android), and dictation.io.

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 have 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, which is specifically helpful for reading (see *Chapter 2.2* on further practical issues of presentation techniques and the tools that can be used).

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. 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.

5.2. Differentiation and Personalisation

To use digital technologies 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 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) intrapersonal 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 the different types of intelligence into account, 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, 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*), 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.

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.

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 & Héjja-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 phases 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. 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.

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. 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 the research of Lestyán and Szabóné (2017), differentiated educational organisation also increases student motivation, 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.

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.

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. Quiz games created with different online quiz makers are also remarkably motivating, as they illustrate and synthesise material in an unconventional way.

It is equally motivating to provide ongoing, personalised feedback on the learning process, which can also be carried out through media popular among students.

By incorporating various concept-mapping applications (e.g. mindmeister, Ayoa, mindmup, 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*).

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, Edmodo, 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. In many cases this competence is more advanced than that of the instructor, but that should not be feared, as the problem can be easily overcome by cooperation.

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.

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 towards maintaining motivation. Students must be involved in this process: it is important to discover what was useful or ineffective for them.

How can students be motivated to learn? How can digital solutions help?

Helga Dorner:

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 5.2 and 5.3.

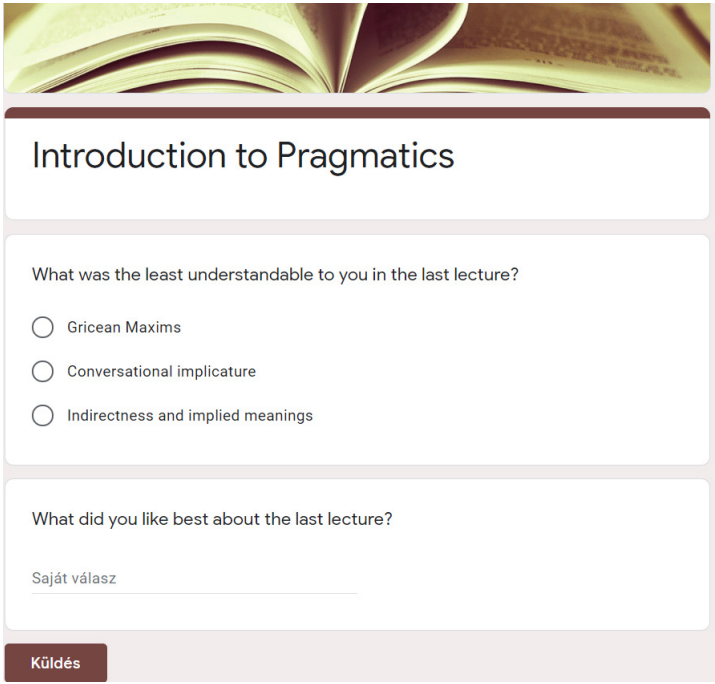

Figure 5.2. Collecting student reflections with digital tools (Google Forms)

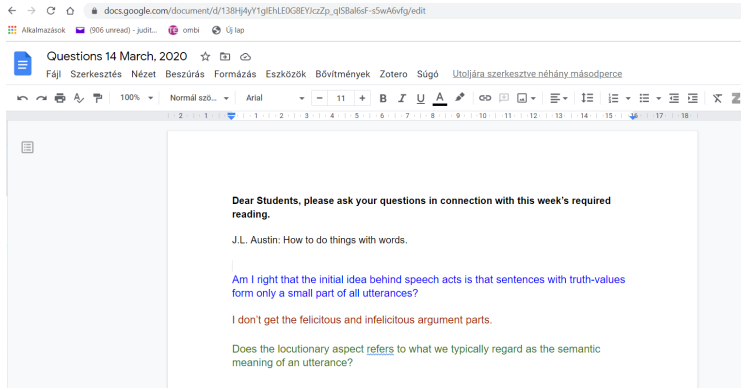

Figure 5.3. Collecting student reflections with digital tools

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6. FACILITATING LEARNERS' DIGITAL COMPETENCE

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*, 2017). 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, there is also a need for subject-integrated education, 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*.

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.

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.

6.1. Information and Media Literacy

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 this 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 Fake News Creator. We can also do this by ourselves, creating our own fake news article related to one of the topics in the course and starting 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.

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 can not 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. 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.

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, del.icio.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.

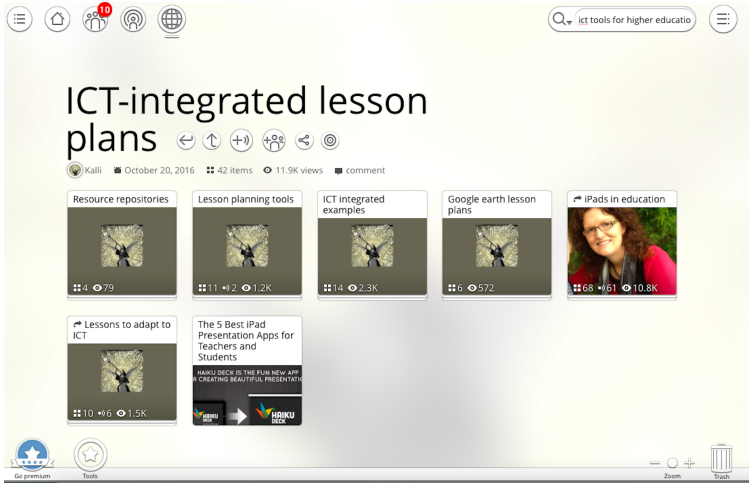

Figure 6.1. A collection of links on the subject of integrating ICT tools in lesson plans, created in Pearltrees

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.

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, Canva, Padlet, 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 added 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, podcasts).

There are several mixed-genre services among these, which are able to transmit textual, pictorial, audio, and video information alike (e.g. Messenger, Viber, Skype, 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.

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*.)

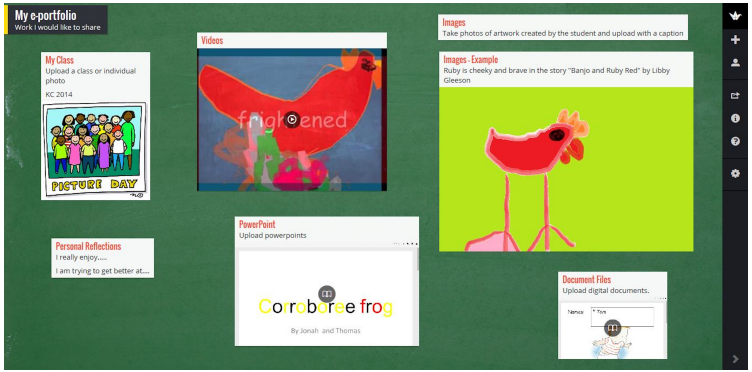

Figure 6.2. An example of using Padlet as a portfolio

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).

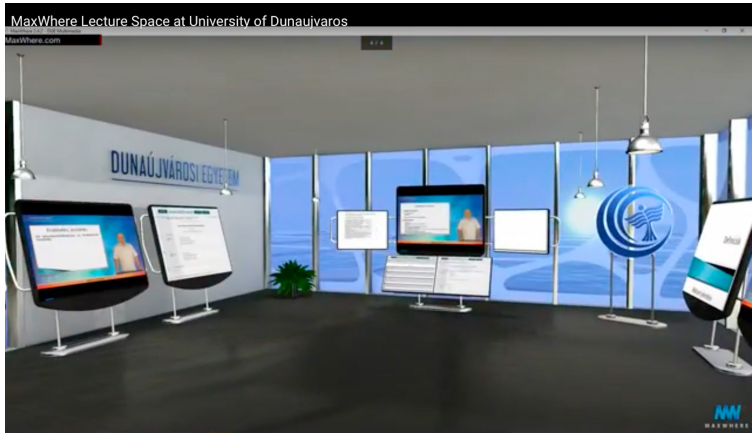

Figure 6.3. The virtual learning space of the University of Dunaújváros, created in MaxWhere (source: youtu.be/wTSiZlF3zMM)

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. 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*).

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 known as 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, Rassmussen 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." (digitalisidentitas.blog.hu) 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 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 covered. 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, comic strips, podcasts, glossaries, mind maps (see *Chapter 2.2*), websites, Facebook pages, online tests (see *Chapter 4.3*), and collages. Whatever type or genre of study material is produced as a student product, 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 should 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 in which students must resolve a particular issue (Hmelo-Silver, 2004), 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 histories 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.

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*).

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 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. Despite this 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.

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 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 this 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 or 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.

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, the attitudes of students (and instructors) 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.

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 Eisenhover matrix (see Figure 6.5).

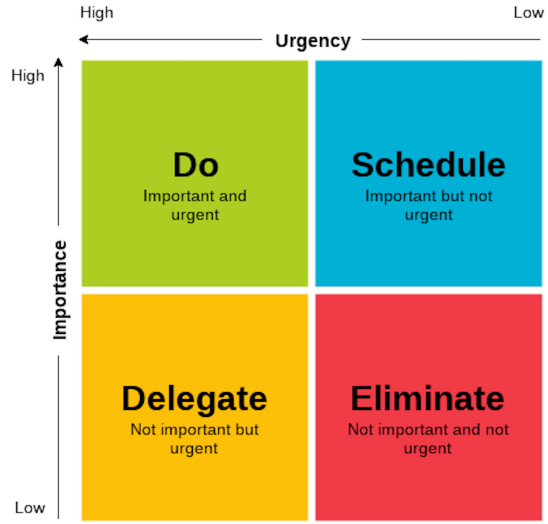

Figure 6.5. Eisenhover window, or time management matrix (source: https://online.visual-paradigm.com/fr/diagrams/features/eisenhower-matrix-template)

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 plug-in 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.

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 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.

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 acquire knowledge in a natural learning environment rather than in a compulsory and "artificial" university learning environment.

Figure 6.7. Graphical representation of a student's personal learning environment (source: dancingthroughmeganslife.home.blog)

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 (see Figure 6.7) (Attwell, 2007; Attwell et al., 2008; Godwin-Jones, 2009). 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. 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. 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.

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