
MONITORING, SUPPORTING AND ENGAGING STUDENTS BASED ON THE EVIDENCE GENERATED BY DIGITAL TECHNOLOGIES

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Abstract

This paper introduces one of the intellectual outputs that have been developed in the DIGI-PROF project. The aim of DIGI-PROF project is to support higher education teachers and higher education institutions to design and implement transparent assessments for online learning and recognition of learning outcomes by proposing methodology, guidelines, practical tools, and training material to improve and develop their digital competences. The project outcome presented in this paper is oriented toward the development of a conceptual and methodological framework, and training material to develop higher education teachers' digital competences in Assessment (Area 4, DigCompEdu Framework), focusing on the competences to generate, select, and critically analyse and interpret digital evidence on learner activity, performance, and progress, in order to inform teaching, learning, and assessment, as stated in the DigCompEdu framework. Next to this, teachers will be able to make evidence-based solutions, using learning analytics data for timely and efficient feedback and support.

Keywords:

Learners' engagement, digital evidence, data monitoring, learning analytics, assessment, learning design, online teaching

Introduction

EUA survey proved that higher education institutions in Europe are not familiar well enough with European reference Frameworks for the Digitally Competent Organization (DigCompOrg) and Digital Competence of Educators (DigCompEdu), both scientifically sound and fully applicable to higher education (further – HE). If all HE teachers were equipped with the DigCompEdu competences, HEIs' moving online would be much better facilitated and HE teachers would be ready and competent to shift to online assessment. According to Davidson (2020), the processes of switching traditional face-to-face learning to online learning, and the development of skills that meet the changing economic, educational, and social environment are seen to be an integral strategy for a global recovery in the post-Covid period. Moreover, researchers argue that there is no possibility for learning to be the same as it was before the Covid-19 pandemic. As Moore et al. (2021) claim, "for those institutions that have already invested in online and blended learning, "normal" is not an idealized past but is a continuation, a process of learning into multimodal learning ecosystems to further expand access and opportunities". Therefore, higher education institutions and teachers need to develop and improve digital skills to keep up with the changes and the potential that online learning might bring to teaching and learning.

DIGI-PROF project addresses the challenges that teachers and students have encountered during the Covid-19 pandemic, related to the lack of digital competences of teachers to engage students and prepare for the online assessment, and aims to create innovative learning and teaching practices that lead to transparent assessment for online learning. Throughout the project implementation period, HE teachers will develop digital competences in assessment (following DigCompEdu framework) in order to be able to revise online courses with transparent assessment and lead to recognition of learning outcomes with micro-credentials. HE teachers will also gain competences to monitor, support, and engage students in online learning through evidence-based solutions, using learning analytics data for timely and efficient feedback and support. Assessment strategies established in DIGI-PROF project will integrate the schemes of micro-credentialisation to strengthen the role, capabilities, and flexibility of HE, and modular learning opportunities from a lifelong learning perspective. Digitally competent professors in HE will integrate the evidence established during learning and assessment into the new form of digital and micro-credentials issued to the learners, to enable them to transfer their transparent achievements to new qualifications in the European arena and beyond through digital space.

The project outcome presented in this paper is oriented toward the development of a conceptual and methodological framework, and training material to develop higher education teachers' digital competencies in Assessment (Area 4, DigCompEdu Framework), focusing on the competencies to generate, select, and critically analyse and interpret digital evidence on learner activity, performance, and progress, in order to inform teaching,

learning, and assessment, as stated in the DigCompEdu framework. Next to this, teachers will be able to make evidence-based solutions, using learning analytics data for timely and efficient feedback and support.

The use of digital technologies in education, whether for assessment, learning, or other purposes, results in a wide range of data being available on each individual learning behavior making a huge impact on teaching, learning, and assessment quality. Analysis and interpreting of data and using it to help make decisions is becoming more and more important in assessment for online learning. As a part of digital competencies for HE teachers, this strengthens teacher preparation and exploitation of digitally supported innovations in HE. Therefore, training material for HE teachers on how to monitor, support and engage students based on the evidence generated by digital technologies is a part of overall digital assessment competence development. It will consist of the methodological framework for student monitoring, supporting, and engaging processes during online learning and teaching, as well as practical tasks, illustrations, and examples of using learning analytics to inform teaching and learning. The training material will also contain a self-check tool for HE teachers to self-reflect on how they are prepared for student monitoring, support, and engagement. The need to have this result is highly supported by ENQA and EUA surveys in 2020, and national events organised by Quality Assessment Agencies, EDEN network events in 2020, where representatives from HE institutions claim that student monitoring, engagement, and support in online learning caused significant challenges for HE teachers.

The training material will be available as reference material, and in the form of a self-check tool for HE teachers, so they will have it at hand, and this will ensure the great potential for the impact of the tool on teacher practices. This tool will also guide teachers in preparation for timely and efficient feedback using a variety of virtual learning environment tools, automatic and manual selection of solutions to monitor and support students, keep the consistency of engagement, and secure teacher workload in gradual and meaningful supervision of learners. The tool will also have a great potential to be adapted to other levels of education and sectors as well. Consortium institutions need the training material as a resource themselves, but they are also addressed by outside institutions for consultations, training, and guidance to solve these emerging issues and to prepare for qualitative student engagement and monitoring processes. The need for such results is very high among HE and other professional communities in education.

Conceptual framework of the training material

Training material is based on the theoretical framework and collection of best / good practices on student engagement techniques based on digital evidence. Next to this, the training material will be innovative because the methodological framework will be based on the latest research in the application of learning analytics as a metacognitive tool to inform teaching and learning, as well as will suggest solutions for teacher reflections and online learning assessment challenges raised during pandemic Spring, 2020. There does not exist such a tool that would be based on student monitoring, support, and engagement process phases, including learning analytics, online learning, and metacognitive theories.

To support and enable teachers to design and deliver teaching and learning that enables students' monitoring, support, engagement, and assessment based on the data generated by digital technologies, the conceptual basis is needed to provide a clear basis for the collection of best practices and development of learning material. The conceptual framework is focusing on the following key themes: (1) self-regulated learning, (2) data literacy skills, (3) digital evidence on teaching and learning, (4) learning analytics as a metacognitive tool, and (5) learning analytics dashboards (LAD) for data analysis. These themes are introduced and discussed as a basis for the training material and also support the methodological framework and collection of the best practices.

DigCompEdu framework defines self-regulated learning competence as the ability "to use digital technologies to support learners' self-regulated learning, 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" (Punie, 2017, p. 58). When talking about how self-regulated learning could be supported by learning analytics generated digital evidence, Lodge et al. (2019) suggest two ways how support could be effective: firstly, when different instruments are combined with data related to cognitive and affective processes, and, secondly, when design and learning analytics phases are integrated, allowing for a more contextualized and structured way of reading, and analysing the data.

While being aware of the possibilities that digital technologies may bring and what data they might generate, it is important for teachers to have a sufficient level of proficiency in digital literacy and know how to design the course

in a way it would generate the expected digital evidence. Therefore, it is very important to design learning in a way it encompasses metacognitive activities. As claimed by Tseng and Walsh (2016), the process and success of learning and teaching, student engagement, and academic success largely depend upon learning design solutions and collaboration established, which requires much more than just the creation of space for engagement.

Another important element of the conceptual framework that supports teachers in monitoring, supporting, and engaging students based on the evidence generated by digital technologies, is digital evidence analysis. In DigCompEdu evidence analysis competence is defined as the ability “to generate, select, critically analyse and interpret digital evidence on learner activity, performance and progress, in order to inform teaching and learning” (Punie, 2017, p.21). To be more clear on what a teacher who is competent in analysing evidence is expected to do, the DigCompEdu framework distinguishes 6 activities, presented in figure 1.

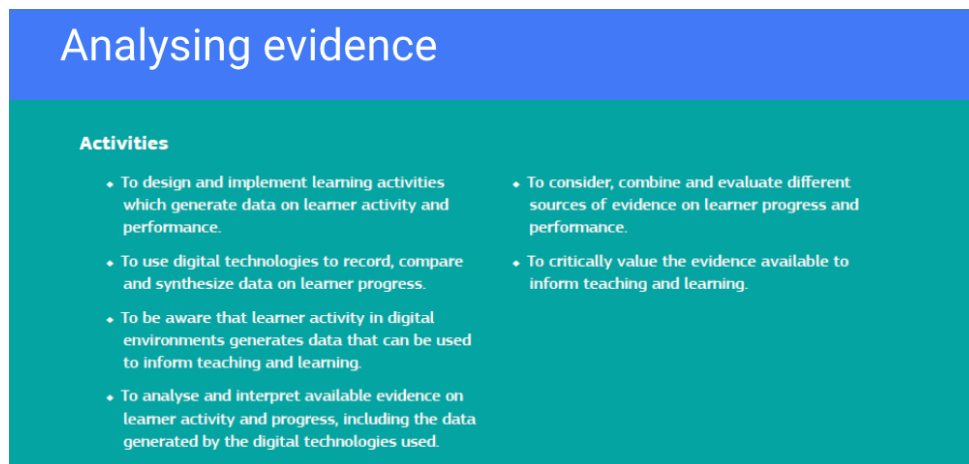


Figure 1. Activities defining 'Analysing evidence' competence (Punie, 2017, 64)

As it is discussed earlier, the use of digital technologies in education, whether for assessment, engagement, or other teaching and learning purposes, results in a wide range of data. The LA-generated data may inform both – the teacher and the student about teaching and learning processes, especially being useful for monitoring learners' behaviour, progress, and engagement with the learning material or activities. It is important to ensure that teachers have sufficient data-literacy skills and are able to analyse and interpret the data generated by learning analytics in a way so they could make evidence-based decisions and improve the teaching and learning process.

It is noted that learning analytics can provide teachers with a comprehensive understanding of the teaching and learning processes (Czerkawski, 2015) and strategies to improve them, and at the same time, raise their awareness of different educational practices (Siemens & Gasevic, 2012). Since learning analytics collect data about learners and their learning process in the online learning environment, they may be rather beneficial for teachers who are trying to improve a study course so that it corresponds to real-time learners' needs and, in this way, make their learning process more personalized. In such a way, LA fosters teachers to plan in advance what data needs to be collected so that it would serve the need to think and make decisions regarding learning design and/or teaching and learning process.

Being aware of the possibilities that digital technologies may bring and what data they might generate, teachers need to know how to design the course in a way it would generate the expected digital evidence. Therefore, it is very important to plan learning design in a way that would encompass metacognitive activities. By creating metacognitive strategies for learners, teachers will be able to measure and monitor learners' awareness of themselves as learners, their learning process, and others. By applying learning analytics, teachers can adjust and adapt the curriculum so it would respond to learners' needs and abilities, and in such a way, raise awareness of learners' cognitive skills, and a stronger sense of community (Trespacios & Perkins, 2016), and, at the same time, foster a more active learners' engagement. To achieve this, it is important for teachers to have knowledge and skills on how to make effective teaching decisions that would foster learners' metacognition. Metacognitive decision-making is about the identification, reflection, and evaluation of teaching decisions when the teacher is aware of specific teaching and learning design decisions and the reasons behind those decisions (Griffith et al., 2016). However, as research results show, while some higher education institutions have enough training and material for

digital competence development, individual respondents noted that there is a conceptual issue, meaning that digital skills training should be organised by identifying approaches that are useful, applicable, and can be integrated into a specific field of study (Gaebel, Zhang, Stoeber & Morrisroe, 2021). This idea is supported by Bates (2022) who claims that digital skills “need to be embedded within the knowledge domain in which the activity takes place” and so it has to be context specific. Therefore, 20 best practice descriptions have been collected demonstrating how digital evidence can be used to support and inform teaching and learning practices at different levels. To ensure that multiple aspects of existing practices are covered, a methodological framework has been developed.

Methodological framework for desk research and best practice collection

The methodological framework is based on Volungeviciene et al. (2021) which focuses on teachers’ metacognition and metacognitive decision making as well as the key concepts identified. It includes two phases when teachers can make evidence-based decisions and take actions to improve the course: (1) the learning design phase, and (2) the teaching and learning phase. This framework provides a taxonomy and the definition of a set of statements for the desk research that served as criteria for collecting the best practices on how teachers design and deliver teaching and learning and enable students’ monitoring, support, engagement, and assessment based on the data generated by digital technologies (see table 1).

PHASES	TOPICS OF THE FRAMEWORK
Learning design phase when strategies for data collection are planned	A - Metacognitive strategies to measure awareness of teaching and learning (e.g., Teachers plan activities for students to provide feedback on learning resources and learning design solutions; teachers adapt learning design to offer differentiation of tasks, individualisation and adaptation of learning)
	B - Metacognitive strategies to measure students’ academic success (e.g., Discussions are organised to identify successful learning factors; learning activities facilitate students’ perception of their role, self-concept and academic success)
	C - Metacognitive strategies to measure awareness of learning design (e.g., learner / course guide indicates responsibilities of learners, learners track their progress on Moodle)
	D - Learning activities which generate data on learner activity and performance (e.g., Learning design allows conscious track of learning progress using Moodle tools; assignments are linked with competence descriptions in the course)
	E - Digital tools used to record, compare and synthesise data on learner progress (e.g., regular interventions and feedback is well planned; learning progress measuring tools are enabled in the course)
Teaching and learning phase when teachers critically analyse and interpret data – based evidence on learner activity and performance	F - Awareness of the evidence available to inform teaching and learning (e.g., Evaluation criteria are described in detail; teachers ask students to provide feedback on learning resources and learning design solutions)
	G - LA generate data on student behaviour (e.g., Activities for students are created to reflect on their progress of learning and strategies used for learning)
	H - LA generate data on student – teacher, student – student and student - content interventions (e.g., Learners are asked to provide feedback periodically using self-reflection questions on how they succeeded in their learning)
	I - Assessing the process of learning and learning results (e.g., Teacher implements analysis using Moodle learning analytics to think over which activities and resources succeeded to engage learners and if learners succeeded using them)

J - Revising learning outcomes based on data generated by digital technologies
(e.g., *Teachers adapt learning design to offer differentiation of tasks, individualisation and adaptation of learning*)

K - Considering, combining and evaluating different sources of evidence on learner progress (e.g., *Teachers use data from Moodle Learning analytics to reflect on learning behaviour in comparison with learning results*)

Table 1. Taxonomy and methodological framework for desk research

Thanks to the framework, we have collected multiple best practice descriptions addressing different scenarios, activities, geographical contexts, types of sources, and types of assessment. The aim was to have as much variety as possible. Each best practice attempts to cover one or more of the topics described in table 1, and many of the concepts explained in the previous sections of this document.

Examples of the best practices for data-generating learning design decisions

20 best practice examples have been collected presenting data visualisation tools for data analysis, institutional decisions or strategies on digital evidence analysis, or different learning design decisions which are made either during the learning design phase, teaching and learning phase, or re-designing phases. All examples are focusing on how digital evidence informs teaching and learning. It is noticed that there are many teachers who are aware of the digital evidence that could be generated and know how to access, monitor, analysis this data, and use it when designing the course already. For example, as seen in figure 2, during a learning design phase, teachers might create metacognitive strategies that would help to measure awareness of learning design. To ensure that students are aware of their cognition, learning strategies, and management of their learning process, is related to a study guide, developed by the course teacher prior to the beginning of the course. In this study guide, next to other important information related to a course studying process, students are introduced to the sequence of tasks and assignments, as well as expectations of their performance. It is important to note that the study guide presents the sequence of assignments and their link with the theory and learning strategy planning. At the same time, students can see the time and place their attendance is needed.

4. Digitally competent organization.	Week 3	February 18 Adobe Connect - Lecture - Seminar 3. Application and comparison of Revive quality criteria with DigiCompOrg.	Presentation of Assignment 1. Assignment 2 (Group or individual work). Analysis of strategic integration of technologies in different sectors of education. Case study of 1 organization.
5. Application of ICT in schools. 6. Application of ICT in adult learning and vocational education and training. 7. Application of ICT in higher education.	Week 4	February 25 Adobe Connect - Lecture - Seminar 4. Selecting the sector/ organization of education and case study development.	
7. Application of ICT in higher education. 8. Virtual learning environments	Week 5	March 4 Adobe Connect - Lecture - Seminar on the use of TEL. curriculum QA	

Figure. 2. Excerpt from a study guide (Volungeviciene et al., 2021).

By knowing in advance how each theoretical presentation and topic relates to the assignments, learners are expected to become more aware of how they plan their learning to deliver assignments on time and keep up with the overall learning process in the course. As well, each assignment is described in detail in a study guide as well as in Moodle, indicating the time for submission and evaluation criteria, as well as the format expected (e.g., essay, presentation, video, mindmap).

Another example of LA-generated data that informs teaching and learning is the Activity reports. The data delivered by Activity reports allow teachers to reflect on which format of learning resources is mostly accessed by students, aiming to understand and learn about students' learning styles and preferred formats of learning resources. In this specific course, Activity reports helped to note that only a small number of students tend to rewatch class recordings, though they are keen on revising teaching slides (Fig. 3)

Open education for lifelong learning			
Adult education and training in Europe - Eurydice report	28 views by 18 users	-	Thursday, 5 May 2022, 10:25 AM (2 days 12 hours)
Lecture recording_2022 02 17	5 views by 4 users	-	Thursday, 5 May 2022, 3:24 PM (2 days 7 hours)
Lecture slides_2022 02 17	16 views by 10 users	-	Saturday, 7 May 2022, 8:13 PM (2 hours 36 mins)
Group work and discussion	32 views by 8 users	-	Tuesday, 26 April 2022, 5:31 PM (11 days 5 hours)
Video lecture_30 09 2021	7 views by 5 users	-	Friday, 11 February 2022, 6:45 PM (85 days 3 hours)
Exit ticket 3, 2, 1	17 views by 10 users	-	Wednesday, 20 April 2022, 10:43 PM (17 days)
Reflections and insights on open adult education	22 views by 7 users	-	Thursday, 24 March 2022, 5:53 PM (44 days 5 hours)
Learning scenarios	5 views by 4 users	-	Tuesday, 15 February 2022, 6:32 PM (81 days 3 hours)
Blessinger & Bliss (2016). Introduction to Open Education: Towards a Human Rights Theory	7 views by 4 users	-	Saturday, 7 May 2022, 4:34 PM (6 hours 15 mins)
Open Education 2030: planning the future of adult learning in Europe	21 views by 13 users	-	Saturday, 7 May 2022, 4:24 PM (6 hours 25 mins)
Weller, M. (2011). Openness in Education	4 views by 3 users	-	Wednesday, 23 February 2022, 2:41 PM (73 days 7 hours)
A fact sheet on Open Educational Resources	10 views by 7 users	-	Saturday, 7 May 2022, 4:24 PM (6 hours 24 mins)

Figure 3. Moodle activity report on students' behavior when accessing course content

It is important to be aware that the report shows not only the number of times when the resource or activity was accessed but also the number of unique users who accessed the resource. Meaning, that it might be some students who tend to review learning material more often than others. And this is an important indicator for teachers as well, requiring a critical approach to observe what students are more actively engaged and which might not be accessing learning material.

When designing the online course, it is important to foresee the strategies and activities which would help to collect digital evidence on how students interact with learning resources and activities, their social interactions, and overall learning progress. As a result, this evidence-based data may help teachers to improve their day-to-day teaching practice by showing what resources are not accessed by students, what activities are less engaging, and what topics or concepts remain unclear and require more discussions or hands-on practices. Next to this, it might show teachers that some students do not interact with course content at all, and it might be a signal that students might be at risk of drop-out therefore, it is important to get in touch with them and discuss the situation.

Further tasks and concluding remarks

Since the training material is meant to be created for self-regulated learning of HE teachers, at the moment, project researchers are focusing intensively on the development of the theoretical presentations, practical tasks, the introduction of best practice examples, and the self-check tools for HE teachers. To ensure the quality, the training material will be peer-reviewed and piloted by HE teachers, and afterward, translations into national languages will be made to ensure broad access to the training material.

To sum up, as it is seen from the examples presented above, it is crucial that before delivering the course the teacher reflects on and decides what data is important to be generated so that it would be important and useful for the later-on course improvement. Therefore, the training material developed in the Digi-Prof project 2nd output will empower teachers to monitor, support and engage students based on the evidence generated by digital technologies.

Acknowledgments

This research is being supported by the Erasmus+ Programme of the European Union (project "Transparent assessment for online learning by digitally competent professors", No. 2021-1-LT01-KA220-HED-000031154).

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