

eAssessment in VET

The DigCompEdu Framework area 4 (Assessment) in the context of VET

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Introduction

DigCompEdu as Research Framework

DigCompEdu is a general framework for identifying the digital skill of teachers and trainers in education in general while it is generic a more specific approach is needed for certain educational sectors, like TVET and for specific areas of the framework such as assessment.

In the context of DigCompEdu, this research report seeks to characterise and understand the digital capabilities of VET teachers and trainers within the partner countries focusing in the areas of digital assessment. The report combines a literature review, desk research and a survey (questionnaires and Interviews) in order to identify the competences and skills needed by a VET teacher or trainer for developing and using e-assessment in vocational education and training both in the classroom and in the workplace.

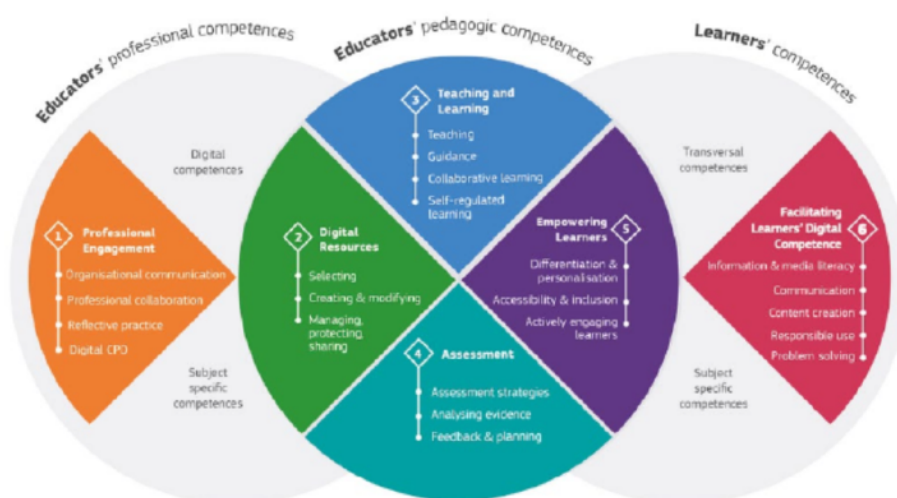
The report extends the DigCompEdu framework and focuses on the e-assessment area for which practitioners feel less confident and competent (according to a study from the TACCLE VET project) as confirmed in discussions with VET providers within the partnership.

As VET covers a broad range of sectors and professions, the report will mostly focus on two sectors which according to CEDEFOP have the largest potential for creating future employment in the partner countries: manufacturing/technology and -construction. With over 32.2 million people working in the manufacturing sector in the **European Union**, it is the largest of any industry sector in 2022. (from: [EU employment figures by sector 2022 | Statista](#))

The **impact** of this research report is significant as it can be used as reference for the design of professional development programs for VET educators and will contextualise and extend the assessment area of DigCompEdu for the VET sector. A similar approach can be used for other areas of the framework and other educational levels such higher, adult and school education.

In order to facilitate this and to allow for comparative analysis, the survey has been designed to be used beyond VET. Respondents' profiles thus include country, context of educational practice, years of teaching experience, teaching qualification and relevant ICT training.

Our research framework is based on DigCompEdu, the generic framework for digital competences of practitioners in education and training.



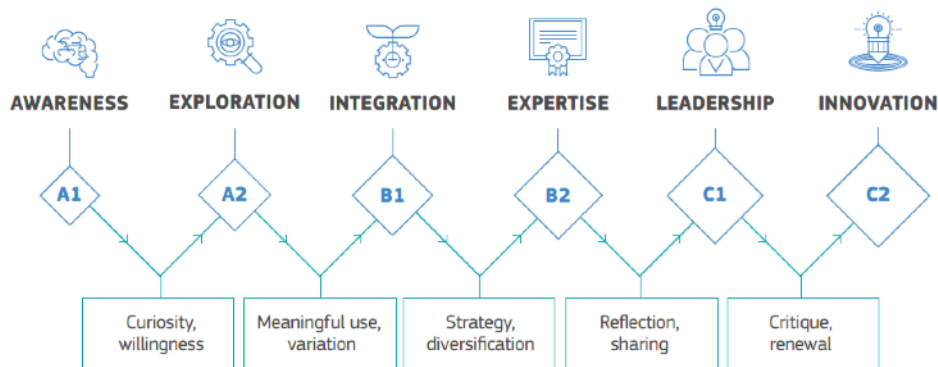
While our focus is on *area 4. Assessment*, this area does not exist in a void. Not only does DigCompEdu present a consistent whole but within the framework, elements from *area 4. Assessment* are explicitly connected to elements from *area 1. Professional engagement*, *area 2. Digital resources*, and *area 3. Teaching and learning*.



In our research, we take those linked elements into consideration as well. Our research thus includes competencies from

- 1.1 Organizational communication
- 2.3 Managing, protecting and sharing digital resources
- 4.1 Assessment strategies**
- 4.2 Analyzing evidence**
- 4.3 Feedback & planning**
- 3.1 Teaching
- 3.2 Guidance

Competencies are assessed on scale ranging from A1 (awareness) through C2 (innovation).



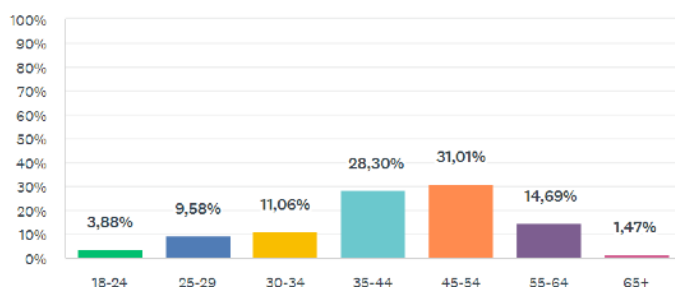
In this report, we include the proficiency statements related to each of those levels in the domains under investigation. These statements were also core in the survey we launched.

Survey

A total of 2035 participants participated in the survey. Here are the general characteristics of our participant pool.

The majority of participants were teaching in vocational education (60,1%), with the remainder of our participants being equally divided among technical education (9,5%), general education (10,6%), teacher training (9,4%) and other (10,4%). Thirty-eight percent (38%) completed ICT training in the past 2 years. Thirty-eight percent (38%) did not have formal teaching qualifications, while 62% did have formal teaching qualifications (26% at bachelor level; 12% at master level, and 24% other).

Almost half of our participants (43%) held a degree at the bachelor level, followed by 28% at the master level, 14% at the secondary level, 6% at the higher professional level, 6% at other, and 3% at the doctorate level. A little over half of the participant pool (52%) had less than 5 years of teaching experience, 15% had 5-10 years, 15% more than 20 years, 11% 11-15 years and 8% 16-20 years. The ages of our participants were well spread, with the majority between 35-55 years of age.



In the following sections we are reporting on 1114 respondents who completed the survey and belonged to the following categories:

- 1) teachers at one of the partner countries;
- 2) teaching in TVET (general and technical or vocational subjects);
- 3) with or without a teaching certification (TC);
- 4) with or without ICT training within the last 2 years.

These respondents were grouped according their ICT training and teaching certification (TC).

		ICT training		
		Yes	No	
Teaching Certification	Yes	282	287	569
	No	166	379	545
		448	666	1114 (n)

interviews

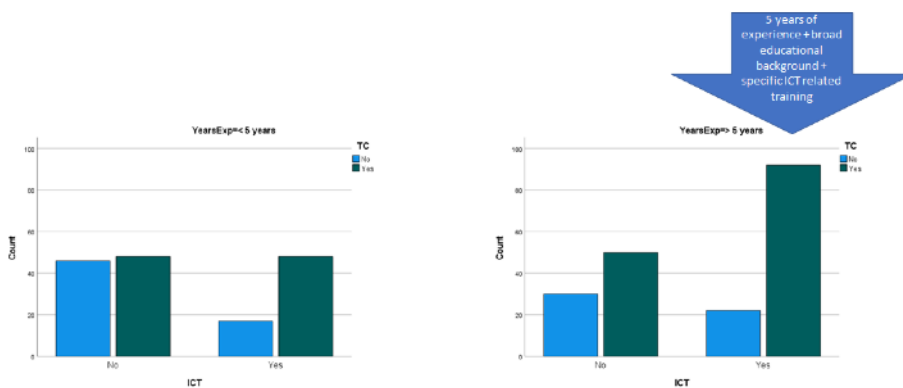
To elaborate on the finding based on the survey, we also conducted a semi-structured interview with 13 teachers after our survey was completed.

General findings

Overall, we found that a combination of three factors contributed to the success of digitalization in education

- A broad educational background (for example a teacher certification)
- A minimum of 5 years of teaching experience
- Participation in specific ICT oriented professional development

Looking, for example, at the 'C2. Innovator' profile related to using ICT for providing guidance to learners (a competence related to assessment), we find the following:



We also found that the presence of a Learning Management System (LMS) provided a certain amount of stability and continuity in the digitalization.

From our survey it appears that teachers with less than 5 years of experience generally did not complete additional ICT training, most likely because they had recently graduated from their educational program which, especially in more recent years, did already include the use of ICT. Once teachers had more than 5 years of experience, we could distinguish between those who did complete ICT training, and those who did not. In the discussion of our findings below, we distinguish between teachers with and without specific ICT training.

From the interviews we learned that mandatory ICT training at the workplace is often quite limited in scope and time. Most knowledge in ICT in the workplace was gathered through self-training based on tools and information available online and in apps.

The interviews also indicated the following:

1. Teachers mostly teach themselves how to use equipment and software via YouTube etc.
2. If ICT training is mandatory, it is often quite limited in scope and time (e.g., once a year, training on the use of a single app or LMS).
3. While LMS is often used for formative assessment, summative assessment still occurs primarily in an analogue manner.
4. Social media, if utilized by the teacher, is often used to communicate with students, but rarely do teachers inform their students on how to use it in a responsible and safe manner.
5. Quality of the equipment is country dependent. For example, in Greece, teachers find the equipment to be old; in Lithuania and the UK teachers state that their equipment is of good quality.
6. Organizational communication still primarily occurs through email.
7. Some countries (e.g., Belgium, Greece, UK) have digital repositories available to their teachers from which they can pull digital materials for their courses. Others find digital materials online, such as videos on YouTube, courses on Moodle, etc. A select few actually develop and create their own digital materials, although this is mostly done by our participants with a university degree in a computer related field such as computer science or applied data science.
8. When asked about assessment strategies, it is of interest that most of the interviewed teachers refer to analogue versions of assessment. This appears to still be the main way in which students are assessed in the classroom.
9. If ICT is used, teachers stick with the scores and stats provided within the app or digital tools they chose and they do not veer away from these analysis tools.
10. Student feedback is mostly given in person or via email.

Of all 13 teachers who participated in the semi-structured interviews, two teachers had obtained a degree involving computer science or ICT. It was quite apparent that only these teachers were more apt to using ICT in an innovative, creative and more extensive way than the other participants. All others were quite conservative in the use of ICT in the classroom, and stuck mostly to mainstream digital tools and services, such as the use of email, text, powerpoint etc. From these semi-structured interviews it is quite obvious that ICT training for teachers still has a long way to go. In fact, most teachers told us that their knowledge of ICT and digital resources was primarily self-taught and self-directed. Formal and mandatory ICT training was limited in time, scope and extent. It is not a given that every teacher will take the time for self-instruction in their free time. As one of our participants said “They don’t pay me enough to teach myself more about social media”.

It appears that schools and colleges don’t stimulate the use of alternative tools for organizational communication than emails; most teachers we interviewed told us that this was still their primary mode of digital communication between colleagues. This is important, especially in light of approaching digitation not as an object or a dataset but as a flow of information.

DigCompEdu Area4 : assessment

“Assessment can be a facilitator or bottleneck to innovation in education. When integrating digital technologies into learning and teaching, we must consider how digital technologies can enhance existing assessment strategies. At the same time, we must also consider how they can be used to create or to facilitate innovative assessment approaches. Digitally-competent educators should be able to use digital technologies within assessment with those two objectives in mind. Furthermore, the use of digital technologies in education, whether for assessment, learning, administrative or other purposes, results in a wide range of data being available on each individual learner’s learning behaviour. Analysing and interpreting this data and using it to help make decisions is becoming more and more important – complemented by the analysis of conventional evidence on learner behaviour. At the same time, digital technologies can contribute to directly monitoring learner progress, to facilitating feedback and to allowing educators to assess and adapt their teaching strategies.” (Redecker, 2017)

4.1 Assessment strategies

To use digital technologies for formative and summative assessment. To enhance the diversity and suitability of assessment formats and approaches.

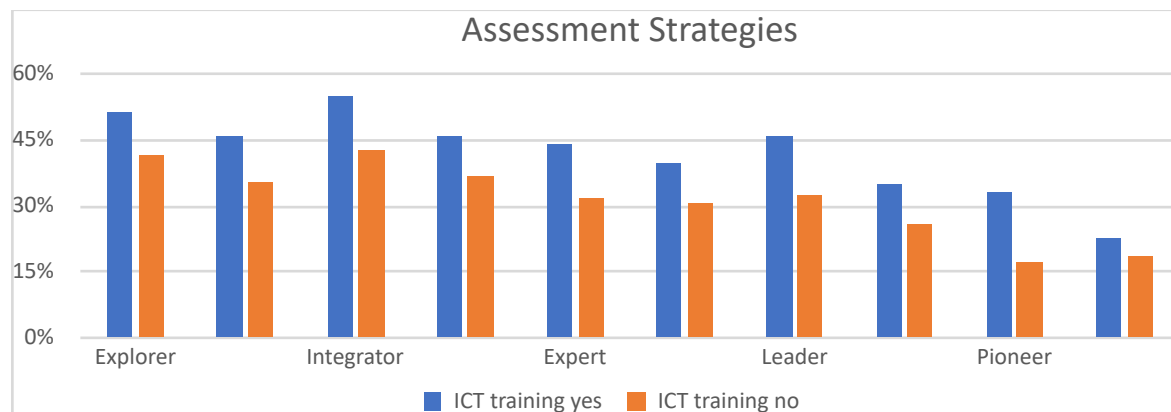
Activities

- To use digital assessment tools to monitor the learning process and obtain information on learners’ progress.
- To use digital technologies to enhance formative assessment strategies, e.g. using classroom response systems, quizzes, games.
- 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
- To use digital technologies to scaffold learners’ assignments and their assessment, e.g. through ePortfolios.
- To use of a variety of digital and non-digital assessment formats and be aware of their benefits and drawbacks.
- To critically reflect on the appropriateness digital assessment approaches and adapt strategies accordingly.

Proficiency levels

Level	Descriptor	Proficiency statements
A1. Newcomer	Making little use of digital technologies for assessment.	<ul style="list-style-type: none"> I do not or only rarely use digital assessment formats.
A2. Explorer	Integrating digital technologies into traditional assessment strategies	<ul style="list-style-type: none"> I use digital technologies to create assessment tasks which are then administered in paper-format. I plan for students' use of digital technologies in assessment tasks, e.g. in support of assignment.
B1. Integrator	Employing and modifying existing digital assessment tools and formats.	<ul style="list-style-type: none"> I use some existing digital technologies for formative or summative assessment, e.g. digital quizzes, e-portfolios, games. I adapt digital assessment tools to support my specific assessment goal, e.g. create a test using a digital test system.
B2. Expert	Strategically using a range of digital assessment formats.	<ul style="list-style-type: none"> I use a range of e-assessment software, tools and approaches, for formative assessment, both in the classroom and for learners to use after school. I select between different assessment formats the one that most adequately captures the nature of the learning outcome to be assessed. I design digital assessments which are valid and reliable.
C1. Leader	Comprehensively and critically selecting, creating and adapting digital assessment formats.	<ul style="list-style-type: none"> I use a variety of digital and non-digital assessment formats, aligned with content and technology standards, and am aware of their benefits and drawbacks. I critically reflect on my use of digital technologies for assessment and adapt my strategies
C2. Pioneer	Developing innovative assessment formats, using digital technologies	<ul style="list-style-type: none"> I develop new digital formats for assessment, which reflect innovative pedagogic approaches and allow for the assessment of transversal skills.

Findings



*TC= teaching certification

As stated before, respondents were placed in four separate groups according to whether they held a teaching certification, and whether they attended ICT training in the last 2 years. Each bar on the graph represents the percentage of teachers within each representative group who selected statements related to each proficiency level. For example, within the explorer proficiency level, the first bar reflects that 51% of respondents who held a teaching certification and completed ICT training in the last 2 years selected statements in the survey that related to the explorer proficiency level. The bar immediately to its right reflects that 42% of respondents with a teaching certification who did not complete ICT training in the last 2 years also selected these statements in the survey. The results are as follows:

1. *ICT training vs no ICT training.* A significantly higher percentage of teachers incorporated digital technologies in their assessment strategies if they had ICT training in the past 2 years, leading to an increase of 9-16% compared to the percentage of teachers without ICT training. Except for the highest level of proficiency, this was generally true irrespective of whether the teacher held a teaching certification (TC).
2. *Teaching Certification vs no Teaching Certification.* Merely holding a teaching certification is not sufficient to guarantee the incorporation of digital technologies in assessment strategies, especially when the teachers did not attend ICT training in the last 2 years.
 - a. The percentage of teachers who incorporated digital technologies in their assessment strategies did not differ much between those with or without a teaching certification if they **did not attend ICT training** (difference of 1-7%).
 - b. When teachers **did attend ICT training**, the percentage of teachers who incorporated digital technologies differed between 5-11% for teachers with vs without a teaching certification.
3. *Combination ICT training and Teaching Certification.* In general, the percentage of teachers with ICT training and a teaching certification who use digital technology for assessment is between 13 – 20% higher than teachers without training and no teaching certification.
4. *At the highest level of proficiency (pioneer level),* the percentage of teachers functioning at the pioneer level only raised substantially from 17% to 33% (i.e., 16% increase) for teachers with a teaching certification if they had ICT training in the last 2 years. If the teachers had no teaching certification, the percentage only rose by 5% if they had ICT training. This means that teachers were more likely to develop new digital formats for assessment, which reflect innovative pedagogic approaches and allow for the assessment of transversal skills, if they had substantial training in educational pedagogy as well as ICT training.

In sum, we can conclude that having ICT training increases the likelihood that teachers will adapt, critically select, and develop digital assessment tools.

More in depth analysis also showed that teachers who had ICT training as part of their degree work (i.e., those with less than 5 years of professional experience) or as a separate training (i.e., those with more than 5 years of professional experience) shared several ways in which they use digital technologies in their assessment strategies, irrespective of whether they held a teaching certification. The statements for which a teaching certification did not appear to be important are printed in unshaded areas in the list below.

A particularly revealing finding was that more teachers with a teaching certificate, as compared to those without one, are strategic and creative in their use of digital technologies. For example, they make purposeful use of digital technologies in assessment tasks, even if the assessments themselves are given in paper format; or they use a range of e-assessment approaches and tools for assessment in and outside of the classroom. Statements that were more often selected by teachers with a teaching certification who also had a form ICT training (either within their degree works, or as a separate training) are printed in the grey shaded areas.

Proficiency Level	Descriptor	Proficiency Statements
Newcomer (A1)		
Explorer: (A2)	Integrating digital technologies into traditional assessment strategies	I use digital technologies to create assessment tasks which are then administered in paper-format I plan for students' use of digital technologies in assessment tasks, e.g. in support of assignment
Integrator (B1)	Employing and modifying existing digital assessment tools and formats	I adapt digital assessment tools to support my specific assessment goal, e.g. create a test using a digital test system
Expert (B2)	Strategically using a range of digital assessment formats.	I use a range of e-assessment software, tools and approaches, for formative assessment, both in the classroom and for learners to use after school I select between different assessment formats the one that most adequately captures the nature of the learning outcome to be assessed.

Leader (C1)	Comprehensively and critically selecting, creating and adapting digital assessment formats	<p>I use a variety of digital and non-digital assessment formats, aligned with content and technology standards, and am aware of their benefits and drawbacks.</p> <p>I critically reflect on my use of digital technologies for assessment and adapt my strategies accordingly.</p>
Pioneer (C2)	Developing innovative assessment formats, using digital technologies	I develop new digital formats for assessment, which reflect innovative pedagogic approaches and allow for the assessment of transversal skills.

= statements selected by teachers with teaching certification; Unshaded area = statements selected by teachers with and without teaching certification

4.2 Analysing evidence

To generate, select, critically analyse and interpret digital evidence on learner activity, performance and progress, in order to inform teaching and learning.

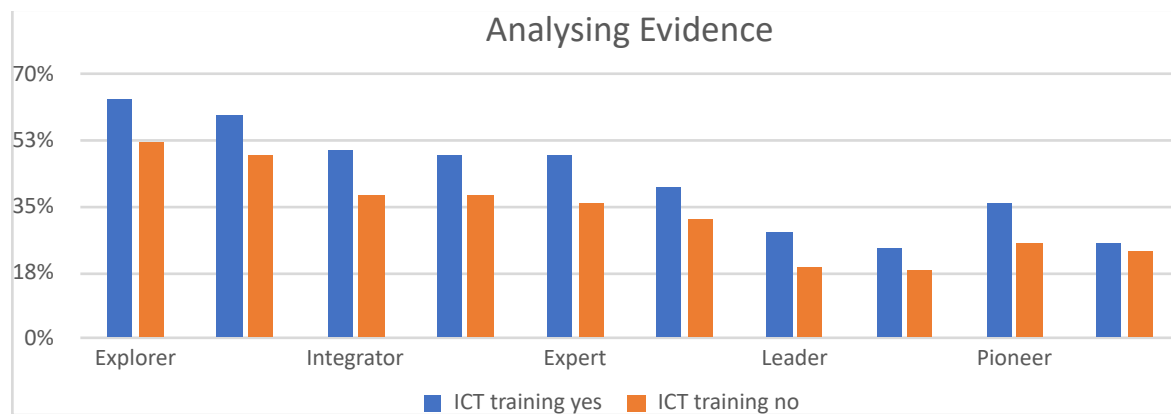
Activities

- To design and implement learning activities which generate data on learner activity and performance.
- To use digital technologies to record, compare and synthesize data on learner progress.
- To be aware that learner activity in digital environments generates data that can be used to inform teaching and learning.
- To analyse and interpret available evidence on learner activity and progress, including the data generated by the digital technologies used.
- To consider, combine and evaluate different sources of evidence on learner progress and performance.
- To critically value the evidence available to inform teaching and learning.

Proficiency levels

Level	Descriptor	Proficiency statements
A1. Newcomer	Making little use of digital data for monitoring progress.	<ul style="list-style-type: none"> I do not or only very rarely refer to digitally recorded data to understand where my students stand.
A2. Explorer	Evaluating basic data on learner activity and performance	<ul style="list-style-type: none"> I evaluate administrative data (e.g. attendance) and data on student performance (e.g. grades) for individual feedback and targeted interventions. I am aware that digital assessment tools (e.g. quizzes, voting systems) can be used within the teaching process to provide me with timely feedback on learners' progress.
B1. Integrator	Evaluating basic data on learner activity and performance	<ul style="list-style-type: none"> I evaluate the data resulting from digital assessments to inform learning and teaching. I am aware that the data on my learners' activity, as it is recorded in the digital environments which I use with them, can help me monitor their progress and provide them with timely feedback and assistance.
B2. Expert	Strategically employing digital tool for data generation.	<ul style="list-style-type: none"> I use digital technologies (e.g. quizzes, voting systems, games) within the teaching process to provide me with timely feedback on learners' progress. I use the data analysis tools provided by the digital environments I use to monitor and visualise activity. I interpret the data and evidence available in order to better understand individual learners' needs for support.
C1. Leader	Using digital data to reflect on learning patterns and teaching strategies.	<ul style="list-style-type: none"> I continuously monitor digital activity and regularly reflect on digitally recorded learner data to timely identify and react upon critical behaviour and individual problems. I evaluate and synthesize the data generated by the various digital technologies I use to reflect on the effectiveness and suitability of different teaching strategies and learning activities, in general and for certain learner groups
C2. Pioneer	Innovating data generation and evaluation.	<ul style="list-style-type: none"> I implement advanced data generation and visualisation methods into the digital activities I employ, e.g. based on learning analytics. I critically assess and discuss the value and validity of different data sources as well as the appropriateness of established methods for data analysis.

Findings



*TC= teaching certification

As stated before, respondents were placed in four separate groups according to whether they held a teaching certification, and whether they attended ICT training in the last 2 years. Each bar on the graph represents the percentage of teachers within each representative group who selected statements related to each proficiency level. For example, within the explorer proficiency level, the first bar reflects that 63% of respondents who held a teaching certification and completed ICT training in the last 2 years selected statements in the survey that related to the explorer proficiency level. The bar immediately to its right reflects that 52% of respondents with a teaching certification who did not complete ICT training in the last 2 years also selected these statements in the survey. The results are as follows:

1. *ICT training vs no ICT training.* A significantly higher percentage of teachers incorporated digital technologies when analysing evidence if they had ICT training in the past 2 years, leading to an increase of 9-13% compared to the percentage of teachers without ICT training. Except for the two highest levels of proficiency, this was generally true irrespective of whether the teacher held a teaching certification (TC).
 2. *Teaching Certification vs no Teaching Certification.* Merely holding a teaching certification is not sufficient to guarantee the incorporation of digital technologies when analysing evidence. This was particularly true when teachers did not attend ICT Training in the last 2 years.
 - a. The percentage of teachers who incorporated digital technologies in their analyses did not differ much between those with or without a teaching certification if they **did not attend ICT training** (difference of 0-4%).
 - b. When teachers **did attend ICT training**, the percentage of teachers who incorporated digital technologies in the analysis of evidence differed between 2-11% for teachers with vs without a teaching certification.
 3. *Combination ICT training and Teaching Certification.* In general, the percentage of teachers with ICT training and a teaching certification who use digital technology during the analysis of evidence is between 10 – 17% higher than teachers without training and no teaching certification.
- At the *highest levels of proficiency* (leader and pioneer level), the percentage of teachers functioning at this level raised substantially by 9-11% for teachers with a teaching certification only if they had ICT training in the last 2 years. If the teachers had no teaching certification, the percentage only rose by 2-6% for those who attended any form of ICT training. This means that teachers were more likely to develop new digital formats for evidence analysis, if they had substantial training in educational pedagogy in addition to ICT training.

In sum, having ICT training, albeit as part of their degree work (if less than 5 years of teaching experience), or as a separate training (if more than 5 years of teaching experience), increased the likelihood that teachers use digital data to inform their teaching, or to reflect on learning patterns and teaching strategies. Below are the statements that were selected by a higher percentage of teachers who underwent ICT training in the last 2 years, irrespective of whether they held a teaching certification.

Proficiency Level	Descriptor	Proficiency Statements
Newcomer (A1)		
Explorer: (A2)	Evaluating basic data on learner activity and performance	<p>I evaluate administrative data (e.g. attendance) and data on student performance (e.g. grades) for individual feedback and targeted interventions</p> <p>I am aware that digital assessment tools (e.g. quizzes, voting systems) can be used within the teaching process to provide me with timely feedback on learners' progress</p>
Integrator (B1)	Evaluating a range of digital data to inform teaching	<p>I evaluate the data resulting from digital assessments to inform learning and teaching</p> <p>I am aware that the data on my learners' activity, as it is recorded in the digital environments which I use with them, can help me monitor their progress and provide them with timely feedback and assistance</p>
Expert (B2)	Strategically employing digital tool for data generation	I use digital technologies (e.g. quizzes, voting systems, games) within the teaching process to provide me with timely feedback on learners' progress
Leader (C1)	Using digital data to reflect on learning patterns and teaching strategies	<p>I evaluate and synthesize the data generated by the various digital technologies I use to reflect on the effectiveness and suitability of different teaching strategies and learning activities, in general and for certain learner groups</p> <p>I continuously monitor digital activity and regularly reflect on digitally recorded learner data to timely identify and react upon critical behaviour and individual problems.</p>

Pioneer (C2)

Innovating data generation and evaluation

I interpret the data and evidence available in order to better understand individual learners' needs for support

I critically assess and discuss the value and validity of different data sources as well as the appropriateness of established methods for data analysis

= statements selected by teachers with teaching certification; Unshaded area = statements selected by teachers with and without teaching certification

Teachers with a teaching certification tended to engage more fully with digital technology than teachers without a teaching certification. They made more thoughtful selections of the digital environments and integrated various digital technologies to enhance their teaching experience and that of the students. They integrated data from various digital environments used with their students and were purposeful in their selection of the digital environments to inform their teaching. They made systematic use of and interpreted the digital data to monitor student progress and identify problems within learners. Below are the statements that were more often selected by teachers with ICT training in the last 2 years, comparing those who did and did not hold a teaching certification.

In sum, having ICT training as well as a teaching certificate allows teachers to feel more confident about digital technologies for analysing evidence. They have a more well-rounded experience with digital platforms and incorporate it more fully in their classroom teaching and student evaluations.

4.3 Feedback and planning

To use digital technologies to provide targeted and timely feedback to learners. To adapt teaching strategies and to provide targeted support, based on the evidence generated by the digital technologies used. To enable learners and parents to understand the evidence provided by digital technologies and use it for decision-making.

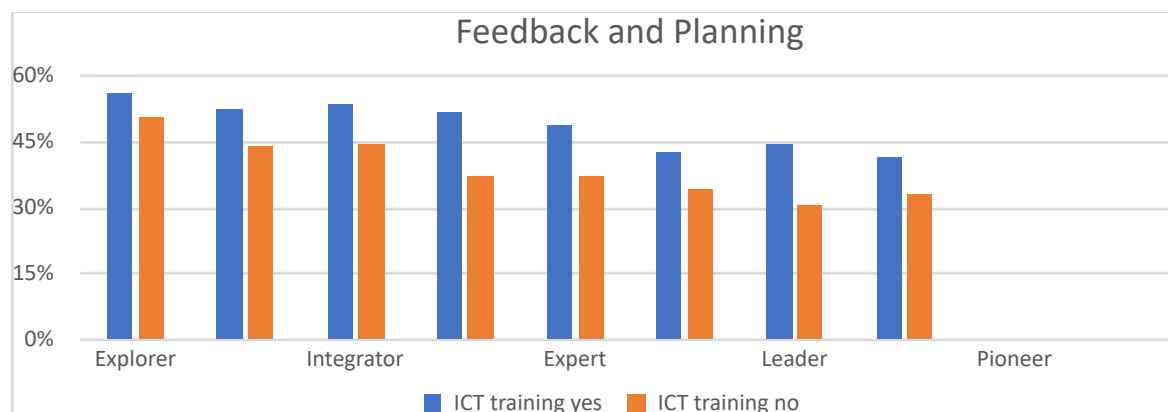
Activities

- To use digital technology to grade and give feedback on electronically submitted assignments.
- To use assessment management systems to enhance the effectiveness of feedback provision.
- To use digital technologies to monitor learner progress and provide support when needed.
- To adapt teaching and assessment practices, based on the data generated by the digital technologies used.
- To provide personal feedback and offer differentiated support to learners, based on the data generated by the digital technologies used.
- To enable learners to evaluate and interpret the results of formative, summative, self- and peer-assessments.
- To assist learners in identifying areas for improvement and jointly develop learning plans to address these areas.
- To use digital technologies to enable learners and/or parents to remain updated on progress and make informed choices on future learning priorities, optional subject or future studies.
-

Proficiency statements

Level	Descriptor	Proficiency statements
A1. Newcomer	Making little use of digital data for feedback and planning.	<ul style="list-style-type: none"> I am not aware how digital technologies can help me in providing feedback to learners or adapting my teaching strategies.
A2. Explorer	Using digital technologies to inform feedback.	<ul style="list-style-type: none"> I use digital technologies to compile an overview on learners' progress, which I use as a basis for offering feedback and advice.
B1. Integrator	Using digital technologies to provide feedback.	<ul style="list-style-type: none"> I use digital technology to grade and give feedback on electronically submitted assignments. I help students and/or parents to access information on learners' performance, using digital technologies.
B2. Expert	Using digital data to enhance the effectiveness of feedback and support.	<ul style="list-style-type: none"> I adapt my teaching and assessment practices, based on the data generated by the digital technologies I use. I provide personal feedback and offer differentiated support to learners, based on the data generated by the digital technologies used. I use digital technologies to enable learners and parents to remain updated on progress and make informed choices on future learning priorities, optional subjects or future studies.
C1. Leader	Using digital technologies to personalise feedback and support.	<ul style="list-style-type: none"> I assist learners in identifying areas for improvement and jointly develop learning plans to address these areas, based on the evidence available. I use the data generated by digital technologies to reflect on which teaching strategies work well for which kind of learners and adapt my teaching strategies accordingly.
C2. Pioneer	Using digital data to evaluate and improve teaching	<ul style="list-style-type: none"> I reflect on, discuss, re-design and innovate teaching strategies in response to the digital evidence I find, as concerns learners' preferences and needs as well as the effectiveness of different teaching interventions and learning formats

Findings



*TC= teaching certification

As stated before, respondents were placed in four separate groups according to whether they held a teaching certification, and whether they attended ICT training in the last 2 years. Each bar on the graph represents the percentage of teachers within each representative group who selected statements related to each proficiency level. For example, within the explorer proficiency level, the first bar reflects that 56% of respondents who held a teaching certification and completed ICT training in the last 2 years selected statements in the survey that related to the explorer proficiency level. The bar immediately to its right reflects that 51% of respondents with a teaching certification who did not complete ICT training in the last 2 years also selected these statements in the survey. The results are as follows:

1. *ICT training vs no ICT training.* A significantly higher percentage of teachers incorporated digital technologies during feedback and planning if they had ICT training in the past 2 years, leading to an increase of 5-15% compared to the percentage of teachers without ICT training. This was true across all levels and irrespective of whether the teacher held a teaching certification (TC).
2. *Teaching Certification vs no Teaching Certification.* Merely holding a teaching certification is not sufficient to guarantee the incorporation of digital technologies during feedback and planning. This was true for all teachers, irrespective of whether they had ICT training in the last 2 years.
 - a. The percentage of teachers who incorporated digital technologies during feedback and planning did not differ much between those with or without a teaching certification if they **did not attend ICT training** (difference of 2-8%).
 - b. When teachers **did attend ICT training**, the percentage of teachers who incorporated digital technologies during feedback and planning differed between 2-6% for teachers with vs without a teaching certification.
3. *Combination ICT training and Teaching Certification.* In general, the percentage of teachers with ICT training and a teaching certification who use digital technology during feedback and planning is between 11 – 17% higher than teachers without training and no teaching certification.
4. None of the respondents selected statements from the highest level of proficiency (pioneer) for feedback and planning.
5. This is the only digital competence under assessment for which ICT training led to improvement at all levels of proficiency, even though the highest level of proficiency (pioneer) was not obtained by any of the respondents.

Teachers who had ICT training as part of their degree work, or as a separate training, were more likely to use digital technologies to grade and provide feedback to their students and they use this information for reflection on their teaching strategies. Below are the proficiency statements selected by a greater percentage of teachers with ICT training than teachers without ICT training, irrespective of whether they held a teaching certification.

Proficiency Level	Descriptor	Proficiency Statements
Newcomer (A1)		
Explorer (A2)	Using digital technologies to inform feedback.	I use digital technologies to compile an overview on learners' progress, which I use as a basis for offering feedback and advice
Integrator (B1)	Using digital technologies to provide feedback	I use digital technology to grade and give feedback on electronically submitted assignments I help students and/or parents to access information on learners' performance, using digital technologies.
Expert (B2)	Using digital data to enhance the effectiveness of feedback and support.	I adapt my teaching and assessment practices, based on the data generated by the digital technologies I use. I provide personal feedback and offer differentiated support to learners, based on the data generated by the digital technologies used. I use digital technologies to enable learners and parents to remain updated on progress and make informed choices on future learning
Leader (C1)	Using digital technologies to personalise feedback and support.	I use the data generated by digital technologies to reflect on which teaching strategies work well for which kind of learners and adapt my teaching strategies accordingly I assist learners in identifying areas for improvement and jointly develop learning plans to address these areas, based on the evidence available
Pioneer (C2)		

= statements selected by teachers with teaching certification; Unshaded area = statements selected by teachers with and without teaching certification

Once again, having a teaching certificate in addition to some form of ICT training, allows teachers to fully engage with the digital platform and incorporate the digital data in their evaluation of students'

progress, in the feedback provided to the students and in the adaptation of new teaching practices to improve student success. Below are the statements more often selected by teachers with, as opposed to without, teaching certification who also attended some form of ICT training.

Summary findings Area 4: Assessment

It is clear from the results of our survey that ICT training is an important contributing factor in the quality and extent of teachers' confidence and expertise in the use of digital technologies for assessment purposes, which include the competences of assessment strategies, analysis of evidence, and feedback and planning. ICT training appears to be of greater importance than holding a teaching certification, even though the combination of the two factors no doubt ameliorates the outcome, especially at the highest proficiency levels (leader and pioneer).

DigCompEdu Area 1 : Professional engagement

In this area, we focus on *1.1. Organisational communication* which feeds into *4.4. Feedback & planning* in area 4.

1. Organisational communication

Organisational communication addresses the use of "digital technologies to enhance organisational communication with learners, parents and third parties" and to contributing to "collaboratively developing and improving organisational communication strategies."

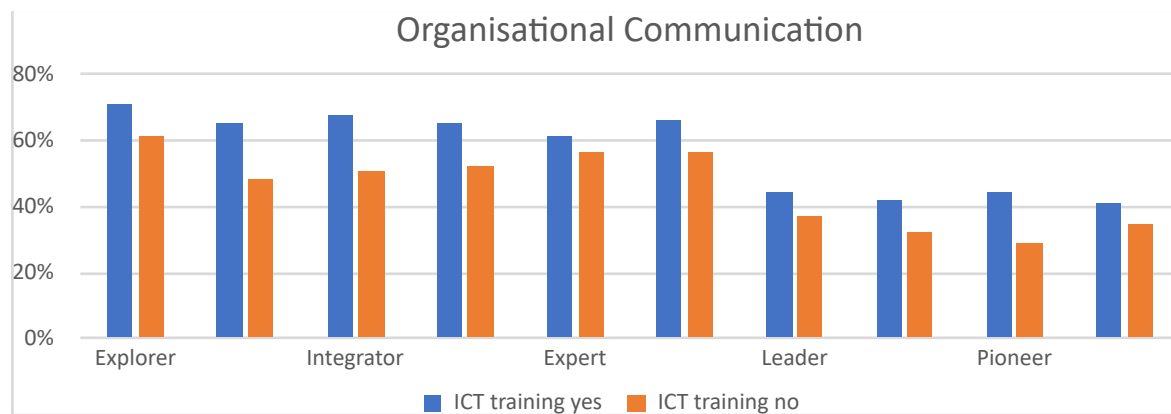
Activities

- To use digital technologies to make additional learning resources and information available to learners (and parents).
- To use digital technologies to communicate organisational procedures to learners and parents, e.g. rules, appointments, events.
- To use digital technologies to inform learners and parents on an individual basis, e.g. on progress and issues of concern.
- To use digital technologies to communicate with colleagues in the same organisation and beyond.
- To use digital technologies to communicate with third parties relevant to the educational project, e.g. experts to be invited, places to be visited.
- To communicate via the organisation's website or through corporate digital technologies, platforms or communication services contracted.
- To contribute with content to the organisation's website or virtual learning environment.
- To contribute to collaboratively developing and improving organisational communication strategies.

Proficiency statements

Level	Descriptor	Proficiency statements
A1. Newcomer	Making little use of digital technologies for communication.	<ul style="list-style-type: none"> ● I rarely use digital technologies for communication.
A2. Explorer	Being aware and making basic use of digital technologies for communication.	<ul style="list-style-type: none"> ● I make use of digital technologies for communication e.g. with learners, parents, colleagues or support staff.
B1. Integrator	Using digital technologies for communication in an effective and responsible way.	<ul style="list-style-type: none"> ● I use different digital communication channels and tools, depending on the communication purpose and context. ● I communicate responsibly and ethically with digital technologies, e.g. respecting netiquette and acceptable use policies (AUP).
B2. Expert	Using digital technologies for communication in a structured and responsive way.	<ul style="list-style-type: none"> ● I select the most appropriate channel, format and style for a given communication purpose and context. ● I adapt my communication strategies to the specific audience.
C1. Leader	Evaluating and discussing communication strategies.	<ul style="list-style-type: none"> ● I evaluate, reflect on and collaboratively discuss how digital technologies are used effectively for organisational and individual communication. ● I use digital technologies to make administrative procedures more transparent for learners and/or parents and to allow them to make informed choices on future learning priorities.
C2. Pioneer	Reflecting on and re-designing communication strategies.	<ul style="list-style-type: none"> ● I contribute to developing a coherent vision or strategy on using digital technologies effectively and responsibly for communication.

Findings



The same four groups of respondents as before are represented on the graph above. The results are as follows:

1. *ICT training vs no ICT training.* A significantly higher percentage of teachers used digital technologies for organizational communication if they had ICT training in the past 2 years, leading to an increase of 6-17% compared to the percentage of teachers without ICT training. This was true across all levels and irrespective of whether the teacher held a teaching certification (TC). The one exception is at the expert level for teachers with a TC, where a similar percentage of teachers (62% vs 57%) with and without ICT training 1) select the most appropriate channel, format and style for a given communication purpose and context; 2) adapt their communication strategies to the specific audience.
2. *Teaching vs no Teaching Certification.* Merely holding a teaching certification is not sufficient to guarantee the incorporation of digital technologies in organizational communication. This was true for all teachers, irrespective of whether they had ICT training in the last 2 years.
 - a. The percentage of teachers who incorporated digital technologies during feedback and planning did not differ much between those with or without a teaching certification if they **did not attend ICT training** (difference of 1-12%).
 - b. When teachers **did attend ICT training**, the percentage of teachers who incorporated digital technologies during feedback and planning differed between 2-5% for teachers with vs without a teaching certification.
3. *Combination ICT training and Teaching Certification.* In general, the percentage of teachers with ICT training and a teaching certification who use digital technology in organizational communication is between 6 – 22% higher than teachers without training and no teaching certification.

ICT training proves to be beneficial to teachers with and without teaching certificates in the following manners: they know 1) different digital technologies and know how and when to use them; 2) how to select the appropriate technology dependent on the target audience; 3) to reflect on the selected digital strategy and re-design it accordingly. In the unshaded areas below are statements that were chosen more often by teachers with and without teaching certification who recently completed ICT training compared to teachers without ICT training.

Even though benefits of ICT training were observed for teachers with and without teaching certification, we identified statements which were more often selected by those with teaching certification. Namely, teachers with a teaching certification who attended ICT training tend to delve more deeply into the use of the digital technology to reflect on, integrate, and enhance strategies to the benefit of their teaching as well as the learner’s experience. Statements in the shaded areas are the statements that were more often selected by teachers with teaching certification who attended ICT training in the last 2 years.

Proficiency level	Descriptor	Proficiency Statements
Newcomer (A1)		
Explorer (A2)	Being aware and making basic use of digital technologies for communication	I make use of digital technologies for communication, e.g., with learners, parents, colleagues or support staff
Integrator (B1)	Using digital technologies for communication in an effective and responsible way	I use different digital communication channels and tools, depending on the communication purpose and context I communicate responsibly and ethically with digital technologies, e.g., respecting netiquette and acceptable use policies (AUP)
Expert (B2)	Using digital technologies for communication in a structured and responsive way	I select the most appropriate channel, format and style for a given communication purpose and context
Leader (C1)	Evaluating and discussing communication strategies	I evaluate, reflect on and collaboratively discuss how digital technologies are used effectively for organisational and individual communication I use digital technologies to make administrative procedures more transparent for learners and/or parents and to allow them to make informed choices on future learning priorities
Pioneer (C2)	Reflecting on and re-designing communication strategies.	I contribute to developing a coherent vision or strategy on using digital technologies effectively and responsibly for communication

= statements selected by teachers with teaching certification; Unshaded area = statements selected by teachers with and without teaching certification

DigCompEdu Area 2: Digital resources

In this area, we focus on *2.3. Managing, protecting and sharing digital resources* which feeds into *4.3. Analysing evidence* in area 4.

2.3 Managing, protecting and sharing digital resources

This focusses on organising digital content and making it available to learners, parents and other educators, on effectively protecting digital content, on respect and correctly applying privacy and copyright rules and on understanding the use and creation of open educational resources, including their proper attribution.

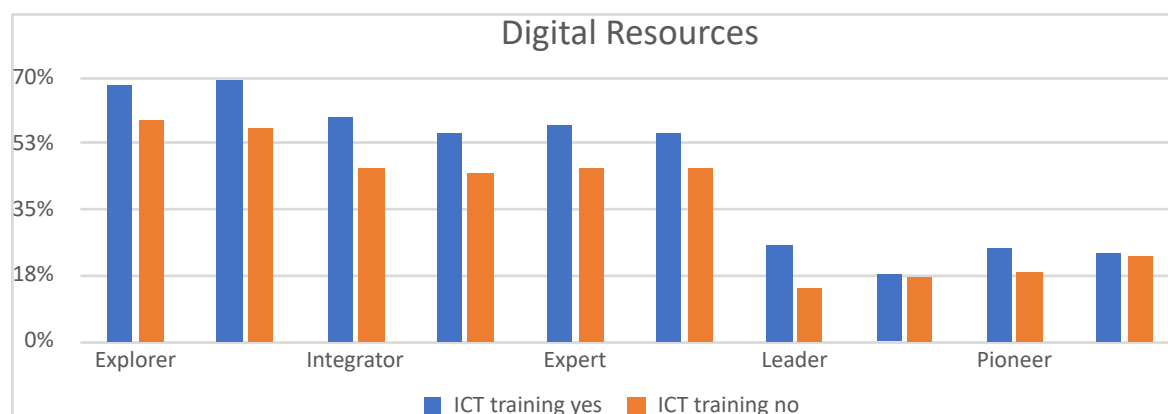
Activities

- To share resources using links or as attachments, e.g. to e-mails.
- To share resources on online platforms or personal or organisational websites/blogs.
- To share one's own repositories of resources with others, managing their access and rights as appropriate.
- To respect possible copyright restrictions to using, re-using and modifying digital resources.
- To appropriately reference sources when sharing or publishing resources subject to copyright.
- To attribute (open) licenses to self-created resources.
- To take measures to protect sensitive data and resources (e.g. students' grades, exams).
- To share administrative and student-related data with colleagues, students and parents, as appropriate.

Proficiency statements

Level	Descriptor	Proficiency statements
A1. Newcomer	Not employing strategies for sharing resources	<ul style="list-style-type: none"> I store and organise digital resources for my own future use.
A2. Explorer	Managing resources using basic strategies.	<ul style="list-style-type: none"> I share educational content via e-mail attachments or through links. I am aware that some resources distributed on the Internet are copyrighted.
B1. Integrator	Effectively sharing and protecting resources using basic strategies.	<ul style="list-style-type: none"> I share educational content on virtual learning environments or by uploading, linking or embedding it e.g. on a course website or blog. I effectively protect sensitive content, e.g. exams, students' reports. I understand the copyright rules that apply to the digital resources I use for school purposes (images, text, audio and film).
B2. Expert	Professionally sharing resources.	<ul style="list-style-type: none"> I share resources embedding them into digital environments. I effectively protect personal and sensitive data and restrict access to resources as appropriate. I correctly reference resources affected by
C1. Leader	Digitally publishing self-created resources.	<ul style="list-style-type: none"> I compile comprehensive digital content repositories and make them available to learners or other educators. I apply licenses to the resources I publish online.
C2. Pioneer	Professionally publishing self-created digital content.	<ul style="list-style-type: none"> I annotate the resources I digitally share and enable others to comment, rate, modify, re-arrange or add to them.

Findings



The same four groups of respondents as before are represented on the graph above. Results are as follows:

1. *ICT training vs no ICT training.* A significantly higher percentage of teachers used digital resources if they had ICT training in the past 2 years, leading to an increase of 6-14% compared to the percentage of teachers without ICT training. This was mostly true irrespective of whether the teacher held a teaching certification (TC), with the exception of teachers without a teaching certification at the leader and pioneer levels, where a similar percentage of teachers with and without ICT training (18 vs 16% and 23 vs 23 %): 1) compile comprehensive digital content repositories and make them available to learners or other educators, 2) apply licenses to the resources they publish online, and 3) annotate the resources digitally shared and enable others to comment, rate, modify, re-arrange or add to them.
2. *Teaching vs no Teaching Certification.* Merely holding a teaching certification is not sufficient to guarantee the incorporation of digital resources. This was true for all teachers, irrespective of whether they recently had ICT training.
 - a. The percentage of teachers who incorporated digital resources did not differ much between those with or without a teaching certification if they **did not attend ICT training** (difference of 0-5%).
 - b. When teachers **did attend ICT training**, the percentage of teachers who incorporated digital resources differed between 1-7% for teachers with vs without a teaching certification.
3. *Combination ICT training and Teaching Certification.* In general, the percentage of teachers with ICT training and a teaching certification who use digital digital resources is between 8 – 15% higher than teachers without training and no teaching certification. As an exception, at the leader and pioneer levels the combined impact of ICT training and teaching certification is minimal to non-existent.

Teachers with ICT training as part of their degree work or as a separate training often choose the following statements (in unshaded areas) more often than those without ICT training. For these statements it does not seem to matter whether the teachers hold a teaching certification.

ICT training raises teachers’ awareness about the appropriate use of digital resources, such as sharing resources effectively and correctly taking copyright laws into account. Teachers with teaching certificates have a more advanced understanding of how to share digital resources while also protecting sensitive student data. The statements chosen by a higher percentage of teachers with ICT training with as opposed to without teaching certifications are printed in the shaded areas below.

Proficiency Level	Descriptor	Proficiency Statements
Newcomer (A1)	Not employing strategies for sharing resources	I store and organise digital resources for my own future use.
Explorer (A2)	Managing resources using basic strategies	I am aware that some resources distributed on the Internet are copyrighted.
		I share educational content via e-mail attachments or through links

Integrator (B1)	Effectively sharing and protecting resources using basic strategies	I share educational content on virtual learning environments or by uploading, linking or embedding it, e.g., on a course website or blog.
		<p>I effectively protect sensitive content, e.g., exams, students' reports.</p> <p>I understand the copyright rules that apply to the digital resources I use for school purposes (images, text, audio and film)</p>
Expert (B2)	Professionally sharing resources	I share resources embedding them into digital environments
		<p>I correctly reference resources affected by copyright</p> <p>I effectively protect personal and sensitive data and restrict access to resources as appropriate</p>
Leader (C1)	Digitally publishing self-created resources	I compile comprehensive digital content repositories and make them available to learners or other educators.
		I apply licenses to the resources I publish online
Pioneer (C2)	Professionally publishing self-created digital content	I annotate the resources I digitally share and enable others to comment, rate, modify, re-arrange or add to them

= statements selected by teachers with teaching certification; Unshaded area = statements selected by teachers with and without teaching certification

DigCompEdu Area 3 : Teaching and learning

In this area, we focus on 3.1. *Teaching* which is affected by 4.1. *Assessment strategies* and on 3.2. *Guidance* which is affected by 4.3. *Feedback & planning* in area 4.

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 strategies. To experiment with and develop new formats and pedagogical methods for instruction.”

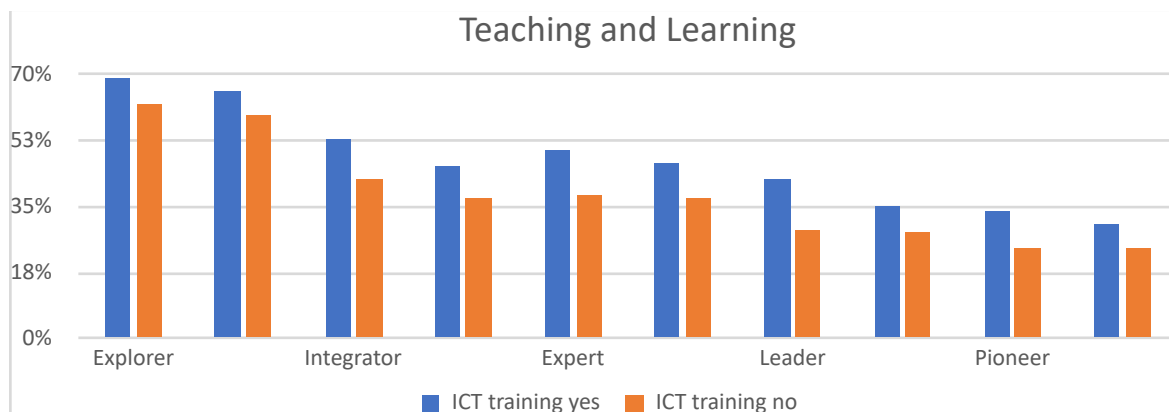
Activities

- To use classroom technologies to support instruction, e.g. electronic whiteboards, mobile devices.
- To structure the lesson so that different (teacher-led and learner-led) digital activities jointly re-inforce the learning objective.
- To set up learning sessions, activities and interactions in a digital environment.
- To structure and manage content, collaboration and interaction in a digital environment.
- To consider how educator-led digital interventions – whether face-to-face or in a digital environment - can best support the learning objective.
- To reflect on the effectiveness and appropriateness of the digital pedagogical strategies chosen and flexibly adjust methods and strategies.
- To experiment with and develop new formats and pedagogical methods for instruction (e.g. flipped classroom).

Proficiency statements

Level	Descriptor	Proficiency statements
A1. Newcomer	Making little use of digital technologies for instruction.	<ul style="list-style-type: none"> I do not or only very rarely use digital devices or digital content in my teaching
A2. Explorer	Making basic use of available digital technologies for instruction.	<ul style="list-style-type: none"> I use available classroom technologies, e.g. digital whiteboards, projectors, PCs. I choose digital technologies according to the learning objective and context.
B1. Integrator	Integrating available digital technologies meaningfully into the teaching process.	<ul style="list-style-type: none"> I organise and manage the integration of digital devices (e.g. classroom technologies, students' devices) into the teaching and learning process. I manage the integration of digital content, e.g. videos, interactive activities, into the teaching and learning process.
B2. Expert	Using digital technologies purposefully to enhance pedagogic strategies.	<ul style="list-style-type: none"> I consider appropriate social settings and interaction modes when integrating digital technologies. I use digital technologies in teaching to increase methodological variation. I set up learning sessions or other interactions in a digital environment.
C1. Leader	Orchestrating, monitoring and flexibly adapting the use of digital technologies to enhance pedagogic strategies.	<ul style="list-style-type: none"> I structure learning sessions so that different (teacher-led and learner-led) digital activities jointly re-inforce the learning objective. I structure and manage content, contributions and interaction in a digital environment. I continuously evaluate the effectiveness of digitally enhanced teaching strategies and revise my strategies accordingly.
C2. Pioneer	Using digital technologies to innovate teaching strategies.	<ul style="list-style-type: none"> I provide full courses or learning modules in a digital learning environment. I experiment with and develop new formats and pedagogical methods for instruction

Findings



The same four groups of respondents as before are reflected on the graph above. The impact of ICT training and/or teaching certification on the use of digital technologies in teaching and learning are as follows:

1. *ICT training vs no ICT training.* A significantly higher percentage of teachers used digital technologies in teaching if they had ICT training in the past 2 years, leading to an increase of 6-13% compared to the percentage of teachers without ICT training. This was true across all levels of proficiency and irrespective of whether the teacher held a teaching certification (TC).
2. *Teaching vs no Teaching Certification.* Merely holding a teaching certification is not sufficient to guarantee the incorporation of digital resources. This was true for all teachers, irrespective of whether they recently had ICT training.
 - a. The percentage of teachers who incorporated digital resources did not differ much between those with or without a teaching certification if they **did not attend ICT training** (difference of 0-5%).
 - b. When teachers **did attend ICT training**, the percentage of teachers who incorporated digital resources differed between 3-7% for teachers with vs without a teaching certification.
3. *Combination ICT training and Teaching Certification.* In general, the percentage of teachers with ICT training and a teaching certification who use digital technologies in teaching is between 10 – 15% higher than teachers without training and no teaching certification.

These results convincingly show that ICT training, as opposed to teaching certification, has the greatest impact on implementing digital technologies in teaching. Nevertheless, obtaining a teaching certificate does allow teachers to develop advanced skills in the use of digital technology in their teaching. They have a wider range of teaching techniques available to them and tend to have a better grasp of various social learning environments, and how to differentiate and incorporate teacher-led and learner-led digital activities.

Further comparative analyses on the impact of ICT training reveal that certain low-to-mid level proficiencies, such as those listed below, are commonly achieved by teachers with and without teaching certifications.

Proficiency Level	Descriptor	Proficiency Statements
Newcomer (A1)		

Explorer (A2)	Making basic use of available digital technologies for instruction	I choose digital technologies according to the learning objective and context	I use available classroom technologies, e.g., digital whiteboards, projectors, PCs
Integrator (B1)	Integrating available digital technologies meaningfully into the teaching process	I organise and manage the integration of digital devices (e.g. classroom technologies, students' devices) into the teaching and learning process	I manage the integration of digital content, e.g., videos, interactive activities, into the teaching and learning process
Expert (B2)	Using digital technologies purposefully to enhance pedagogic strategies.	I set up learning sessions or other interactions in a digital environment.	I consider appropriate social settings and interaction modes when integrating digital technologies
I use digital technologies in teaching to increase methodological variation.			
Leader (C1)	Orchestrating, monitoring and flexibly adapting the use of digital technologies to enhance pedagogic strategies.	I structure learning sessions so that different (teacher-led and learner-led) digital activities jointly re-inforce the learning objective.	I structure and manage content, contributions and interaction in a digital environment
		I continuously evaluate the effectiveness of digitally enhanced teaching strategies and revise my strategies accordingly.	

Pioneer (C2)

Using digital technologies to innovate teaching strategies

I experiment with and develop new formats and pedagogical methods for instruction.

I provide full courses or learning modules in a digital learning environment.

= statements selected by teachers with teaching certification; Unshaded area = statements selected by teachers with and without teaching certification

On the other hand, a larger number of high-level proficiencies are often selected by teachers with recent ICT training who have specific teacher training as reflected in their teaching certifications. These advanced skills show that teachers with teaching certifications truly use digital technologies to enhance their pedagogical approach and the learning experience. Teachers without teaching certifications experiment with the digital technology itself, while teachers with broad pedagogical knowledge evaluate how the digital technology can help them attain their pedagogical goals. The statements below, chosen more frequently by teachers with teaching certification who also attended ICT training, illustrate this qualitative shift in the use of digital technologies in teaching.

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.”

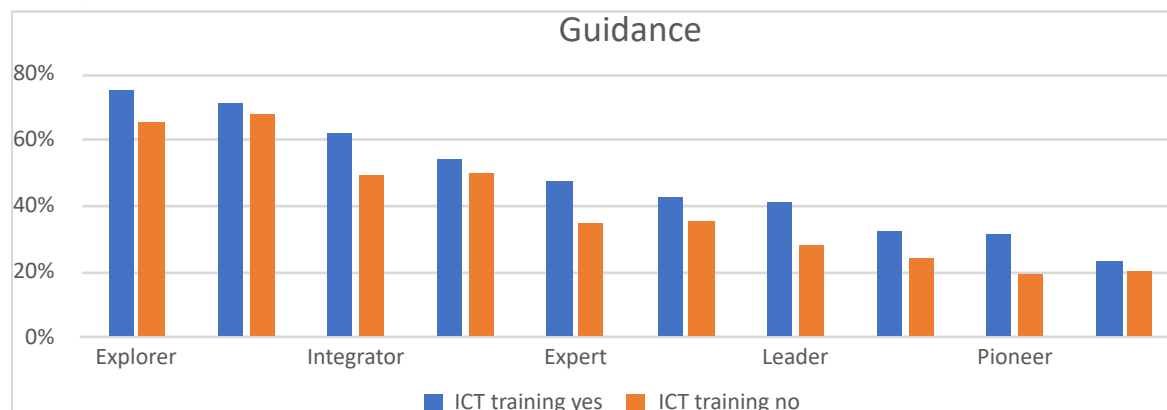
Activities

- To use digital communication tools to respond promptly to learners’ questions and doubts, e.g. on homework assignments.
- To set up learning activities in digital environments, having foreseen learners’ needs for guidance and catering for them.
- To interact with learners in collaborative digital environments.
- To digitally monitor student behaviour in class and offer guidance when needed.
- To use digital technologies to remotely monitor student progress and intervene when needed, while allowing for self-regulation.
- To experiment with and develop new forms and formats for offering guidance and support, using digital technologies

Proficiency statements

Level	Descriptor	Proficiency statements
A1. Newcomer	Making little use of digital technologies for interacting with learners.	<ul style="list-style-type: none"> I do not or only very rarely communicate with learners through digital means, e.g. e-mail.
A2. Explorer	Employing basic digital strategies to interact with learners.	<ul style="list-style-type: none"> I use digital technologies, e.g. e-mail or chat, to respond to learners' questions or doubts, e.g. on homework assignments.
B1. Integrator	Using digital technologies to enhance interaction with learners.	<ul style="list-style-type: none"> I use a common digital communication channel with my learners to respond to their questions and doubts. I am frequently in contact with learners and listen to their problems and questions.
B2. Expert	Using digital technologies to enhance monitoring and guidance.	<ul style="list-style-type: none"> I interact with learners in the collaborative digital environments I use, monitoring their behaviour and providing individual guidance and support as needed. I experiment with new forms and formats for offering guidance and support, using digital technologies.
C1. Leader	Employing digital technologies strategically and purposefully to provide guidance and support.	<ul style="list-style-type: none"> When I set up learning activities in digital environments, I foresee learners' needs for guidance and cater for them, e.g. with a help or FAQ section, or with video tutorials. When I implement digital learning activities in class, I make sure I am able to (digitally) monitor student behaviour, so that I can offer guidance when needed.
C2. Pioneer	Using digital technologies to innovate guidance provision.	<ul style="list-style-type: none"> I develop new forms and formats for offering guidance and support, using digital technologies.

Findings



The same four groups of respondents as before are reflected on the graph above. The impact of ICT training and/or teaching certification on the use of digital technologies in guidance are as follows:

1. *ICT training vs no ICT training.* A significantly higher percentage of teachers used digital technologies in guidance if they had ICT training in the past 2 years. This was true across all levels of proficiency but was more pronounced when the teacher held a teaching certification (TC). ICT training effects ranged from 9- 13% when teachers held a teaching certification, while these effects were smaller when teachers did not have a teaching certification (range between 3-8%).
2. *Teaching vs no Teaching Certification.* Merely holding a teaching certification is not sufficient to guarantee the incorporation of digital technologies in guidance. This was true for all teachers, irrespective of whether they recently completed ICT training.
 - a. The percentage of teachers who incorporated digital technologies in guidance and support of students did not differ much between those with or without a teaching certification if they **did not attend ICT training** (difference of 0-4%).
 - b. When teachers **did attend ICT training**, the percentage of teachers who incorporated digital technologies in guidance differed between 4-9% for teachers with vs without a teaching certification.
3. *Combination ICT training and Teaching Certification.* In general, the percentage of teachers with ICT training and a teaching certification who use digital technologies for guidance and support of students is between 7 – 17% higher than teachers without training and no teaching certification.

ICT training helps teachers to implement digital technologies for guidance and support of their students at an advanced level. After ICT training, teachers with and without teaching certification alike use digital technologies to monitor student activities and keep an open channel of communication via e-mail, chat or other digital sources. They foresee needs for guidance of the learners when setting up learning activities in digital environments, and they develop new forms and formats for offering guidance and support. In the unshaded areas of the list below are the statements equally selected by teachers with and without teaching certification who also completed ICT training.

However, teachers with teaching certifications often use digital technologies to a greater extent to enhance their responsiveness to, and support and guidance of their students. Once again, having a teaching certification in addition to ICT training allows teachers to take full advantage of the possibilities digital technologies offer. They evaluate digital technologies through a pedagogical lens and extend their use to benefit the learning outcomes and needs of the students. In the shaded areas of the list below are the statements more often selected by teachers with teaching certification who completed ICT training.

Proficiency Level	Descriptor	Proficiency Statements
Newcomer (A1)		
Explorer (A2)	Employing basic digital strategies to interact with learners	I use digital technologies, e.g. e-mail or chat, to respond to learners' questions or doubts, e.g. on homework assignments

Integrator (B1)	Using digital technologies to enhance interaction with learners	<p>I use a common digital communication channel with my learners to respond to their questions and doubts.</p> <p>I am frequently in contact with learners and listen to their problems and questions.</p>
Expert (B2)	Using digital technologies to enhance monitoring and guidance	<p>I interact with learners in the collaborative digital environments I use, monitoring their behaviour and providing individual guidance and support as needed.</p> <p>I experiment with new forms and formats for offering guidance and support, using digital technologies.</p>
Leader (C1)	Employing digital technologies strategically and purposefully to provide guidance and support.	<p>When I set up learning activities in digital environments, I foresee learners' needs for guidance and cater for them, e.g. with a help or FAQ section, or with video tutorials.</p> <p>When I implement digital learning activities in class, I make sure I am able to (digitally) monitor student behaviour, so that I can offer guidance when needed</p>
Pioneer (C2)	Using digital technologies to innovate guidance provision	I develop new forms and formats for offering guidance and support, using digital technologies.

= statements selected by teachers with teaching certification; Unshaded area = statements selected by teachers with and without teaching certification

General conclusions and implications

1. Digitization, including in the domain of assessment, is best served by the combination of a broad educational background (for example a teacher certification), 5 years or more of teaching experience and participation in specific ICT oriented professional development. Teachers with that profile clearly outperform other profiles. Especially in light of the shortage of teachers, education providers might be tempted to skip the requirement of having a broad educational background. While we understand the temptation of doing so, our research indicated the importance of investing in such a background.

2. Specific ICT training meets its purpose of enhancing teachers' confidence and readiness to implement digital technologies in their assessment strategies and related competencies (such as teaching and learning, organisational communication, and guidance). However, there are limitations to ICT training in its current implementation and impact.
 - a. Teachers are often unsupported and end up teaching themselves on the topics that they deem necessary. This is a big hurdle towards improving e-Assessment strategies as this assumes teachers are fully aware of what they don't know. Especially for teachers who have been in the workforce for a while and are not up to date regarding recent developments related to the use of ICT in education, this could be a real stumbling block.
 - b. When ICT training is mandated, it is often limited in scope and time. Our survey results mirror these limitations, in that ICT training tends to impact teachers with and without teaching certification at the lower levels of proficiency. The proficiency statements linked to the higher levels (such as leader and pioneer proficiency levels) have a stronger foundation in pedagogical principles and approaches than the statements of the lower levels. It is therefore not surprising that teachers without a teaching certification, who often have less academic background in educational pedagogy, use digital technologies in more apparent, prescribed ways than those with a teaching certification. This finding is of great value to the design of future ICT training modules, as it may be worthwhile to specifically consider the educational background of the audience.
 - c. Currently ICT training lacks the structure and depth to train teachers to think beyond the apparent use of the digital technologies, especially as it relates to e-assessment. Our data provides us with insight in the content ICT training should target.
3. eAssessment will greatly benefit from approaching digitization as a flow of information and not just as the production of a dataset.

Literature review

About the literature review

This literature review has been undertaken in the context of the first Project Report undertaken through the Erasmus+ eAssessment in VET project. The work is focused on the context of the DigiCompEdu, seeking to characterise and understand the digital capabilities of VET teachers and trainer within the partner countries to use digital technologies for eAssessment

The report involves a literature review, desk research and a survey (questionnaires and interviews) to identify all the competences and skills needed by a VET teacher or trainer for developing and using e-assessment in vocational education and training both in the classroom and workplace.

In 2021 and 2022, the project partners from five countries undertook a literature search, creating a shared literature base in Google Drive. To date the literature base contains links and summaries of 49 items, many academic articles but also reports and videos. While not all are referenced in this summary, we seek to identify the major themes emerging from the literature we have identified.

Assessment plays a crucial role in the education system and has a significant impact on student learning outcomes (Bethany Christian College of Teachers' Education, Undated) and well as a crucial role in the educational process as it drives improvement, shapes student behavior, and provides accountability to employers and others (Appiah and Tonder, 2018) (Durham Research online, 2007).. The use of technology in assessment, commonly referred to as e-assessment, has revolutionized the way assessment is performed. With the advancement of technology, e-assessment is increasingly becoming a popular and efficient method of evaluating student learning and performance. This short report aims to provide a concise overview of e-assessment, including its drivers, benefits, and challenges and to provide a coverview of the use of ICT in assessment, including the use of technology tools for assessment, the impact of the COVID-19 pandemic on remote assessments, and the challenges and opportunities that come with the digitization of assessment.

Drivers of E-Assessment

The primary drivers of e-assessment include increased variety of assessed tasks, the provision of instantaneous feedback, increased objectivity, and resource saving (Jordon, 2013) (Durham Research online, 2007). The development of computer-marked assessment has evolved from the early use of multiple-choice questions and machine-readable forms to sophisticated online systems that incorporate interoperability and integration with other learning management systems (Jordon, 2007).

eAssessment in the UK

A report by Durham Research Online (2007) focused on the role of assessment in education systems, identified the centrality of assessment and identified drivers of assessment and their likely impact on education systems. The report described current and planned uses of high-stakes e-assessment in the UK, current uses of ICT in assessment, the potential of new technologies for enhancing current assessment and pedagogic practices, and opportunities and suggestions for future developments. Tai, J., Boud, D., Ajjawi, R., Bearman, M. & Dawson, P., (2019) have published a further article presenting key findings on research in assessment, and links to of e-assessment, aiming to stimulate debate on the role of e-assessment in assessment, teaching, and learning.

Benefits of E-Assessment

E-assessment offers considerable benefits, including improved efficiency and accuracy in grading, enhanced assessment security, and the provision of instant feedback to students (Alruwais, Wills, Wald, 2018). The use of technology in assessment also enables teachers to evaluate student performance in real-time, allowing them to intervene and support students where necessary. In addition, e-assessment provides students with a more engaging and interactive learning experience (JISC, 2018).

Challenges and opportunities of E-Assessment

However, e-assessment also presents several challenges, including issues related to technical malfunctions, security concerns, and potential biases (Alruwais, Wills, Wald. 2018), (Callan, Johnston, Clayton, Poulsen, 2016), (Widiastuti, Mantra, Sukoco, Santosa 2021), (Santos, M., Miguéns, M., Rodrigues, A., Canelas, A., Dias, A., Gregório, C., Gonçalves, C., Faria, E., Bertinetti, F., Miguéns, M., Félix, P., Perdigão, R., Lourenço, 2021), (Caspari-Sadeghi, 2022). To overcome these challenges, it is important to ensure that e-assessment systems are

robust, reliable, and secure (Jisc, 2020) , (Pauli, 2021). In addition, the development of e-assessment should be guided by a clear understanding of its purpose, ensuring that it supports and enhances student learning outcomes (Bartolomé, Martínez, Jakobsone et al, 2018).

Digitized assessments offer both challenges and opportunities. Critics argue that the digitization of assessments has compromised integrity and opened the door to cheating and fraud (Pauli, 2021). However, comparisons suggest there has been no grade inflation (ibid). Some professional bodies remain skeptical of the robustness of complete open-book assessments, and there is a need for the protection against cheating. The shift to open-book assessments has also highlighted the importance of academic writing skills and the need for alternative assessment formats such as videos and presentations (ibid).

Jisc (2021) sets five targets for the next five years to progress assessment towards being more authentic, accessible, appropriately automated, continuous, and secure. The five targets are:

- Authentic: assessments designed to prepare students for their careers using technology they will use in their careers.
- Accessible: assessments designed with an accessibility-first principle.
- Appropriately automated: a balance found of automated and human marking to deliver maximum benefit to students.
- Continuous: assessment data used to explore opportunities for continuous assessment to improve the learning experience.
- Secure: authoring and delivery of secure assessments.

Authentic Assessment

Sutherland (2021) highlights the importance of performance-based authentic assessment and the integration of technology tools for effective student learning assessment. In looking at assessment during the Covid 19 pandemic, Hodges, C. B., & Barbour, M. K. (2021) say common assessment types used in online instruction, including written assignments, online discussions, fieldwork, tests and quizzes, presentations, and e-portfolios, with a focus on the concepts of synchronous versus asynchronous assessments and issues related to academic integrity.

A video of a Webinar discusses the impact of COVID-19 on remote assessments (McGraw Hill, 2021). The COVID-19 pandemic has posed extraordinary challenges for higher education institutions, forcing them to conduct assessments remotely. The current model of examination, which favors students with strong memory and recall skills, is being questioned, and there is a need for practice-based assessments (Santos, M., Miguéns, M., Rodrigues, A., Canelas, A., Dias, et al, 2021). The shift to digitize assessments has raised opportunities and challenges, such as digital poverty and the need for digital literacy skills. However, Neil Selwyn, Chris O'Neill, Gavin Smith, Mark Andrejevic, Xin Gu (2021) are critical that the COVID-19 pandemic has seen the rapid but sometimes controversial take-up of 'online examination proctoring' systems by universities keen to maintain their assessment schedules during times of campus closure. Through analysis of interviews, documents, news, social media and marketing materials, they examine "the 'appropriation', 'objectification', 'incorporation' and 'conversion' of proctoring technology from the perspective of commercial providers, university authorities, university staff and student groups."

Research from Australia, New Zealand and Portugal

Vocational education and training (VET) organizations and external auditors in Australia have expressed their views on the key issues in the current and future delivery of e-assessment through a comprehensive study that included 48 interviews, 10 focus groups, and 2 industry workshops (Callan, Johnston, Clayton, Poulsen, 2016). The study found that

practitioners and auditors with in-depth experience in e-assessment and audit practices emphasized the importance of e-assessment in supporting and enhancing learning. el Asame, M., Wakrim, M., & Battou, A. (2021) identified challenges in the design of e-assessment and the need for improvement to achieve the desired pedagogical objectives in e-learning environments.

A project a team of vocational educators from New Zealand (Ako Aotearoam, 2019) created a set of guidelines for the development and implementation of e-assessments for learning in VET. The guidelines were based on seven sub-projects that implemented e-assessments for learning activities using various pedagogical approaches and digital tools. These e-assessments supported feedback mechanisms to learners, providing them with accessible e-feedback through digital technologies.

A similar study conducted by the Portuguese National Board of Education (Santos, M., Miguéns, M., Rodrigues, A., Canelas, A., Dias, et al, 2021) focused on addressing the difficulties faced by schools during the Covid-19 pandemic and the strategies and solutions implemented by schools and local and central authorities to overcome these difficulties. The study aimed to identify changes that could contribute to the improvement of school organizations, pedagogical practices, and the quality of learning. The National Board of Education recommended strategies and measures to reduce the socio-educational impacts of the pandemic and promote the development and progress in learning of children and young people.

Competency-based Approach (CBA) and Objective-based Approach (OBA)

In recognition of the changes to typical patterns of working life, education institutions around the world are placing great emphasis on competence-based learning (Ilahi-Amri, M., Cheniti-Belcadhi, L., & Braham, R. 2017). However, critical issues still need to be addressed to fully realize the potential of lifelong learning in VET, universities and workplaces. This study proposes a semantic model for competence-based assessment to support the visibility of formal and informal learning competencies. The model is based on a sub-models architecture and carried out through the use of Web Services, with experimentation results supporting the research goals (ibid).

In order to achieve the desired pedagogical objectives in e-learning environments, a hybrid pedagogical framework has been proposed that includes a set of principles for competencies assessment design based on the Competency-based Approach (CBA) and Objective-based Approach (OBA (el Asame, M., Wakrim, M., & Battou, A., 2021). This framework aims to support teachers in creating assessment activities that are suited to student competency levels in a guided, controlled, and easy way. The explicit use of pedagogical approaches in e-assessment design is crucial for successful guidance and effective e-assessment design.

Student Feedback Literacy

Carless, D., Boud, D. (2018), in a paper on student feedback literacy, emphasized the importance of students having the understandings, capacities, and dispositions needed to make sense of information and use it to enhance work or learning strategies. The paper reviewed student responses to feedback and discussed several barriers to student uptake of feedback. The paper proposed a framework underpinning students' feedback literacy, consisting of four inter-related features: appreciating feedback, making judgments, managing

affect, and taking action. The paper also discussed two well-established learning activities, peer feedback and analyzing exemplars, to illustrate how the framework can be operationalized. Teachers were identified as playing an important role in promoting student feedback literacy through curriculum design, guidance, and coaching. The implications and conclusion of the paper summarized recommendations for teaching and set out an agenda for further research.

Inclusive Integrated Assessment Framework

To address the differential learning outcomes of students, a report by Zhu, X., Winstone, N., Balloo, K., Hughes, A., & Bright, C. (2019) propose an institutional approach that uses a research-informed inclusive integrated assessment framework. This framework emphasizes the importance of ongoing evaluation and the need for assessment training to be owned by the disciplines. The success of this approach also requires investment in leadership at all levels, enabling all staff and students to develop agentic assessment practices that allow them to make informed choices about the best use of time and resources.

Conclusion

To sum up the literature, assessment has a profound influence on student learning, and the digitization of assessments has both its challenges and opportunities. eAssessment can be seen a valuable tool in the education system, offering numerous benefits, including improved efficiency and accuracy, enhanced assessment security, and the provision of instant feedback. However, the development of e-assessment must be guided by a clear understanding of its purpose and must overcome the challenges posed by technology-related issues, biases, and security concerns. Investment in leadership, assessment training, and ongoing evaluation is crucial for the successful implementation of e-assessment and to ensure that it supports and enhances student learning outcomes.

With further advances in technology and pedagogic guardrails, there is optimism that the challenges can be met, and the opportunities leveraged to deliver authentic, accessible, appropriately automated, continuous, and secure assessments. Authentic assessment, online discussions, e-portfolio, video projects, and teamwork, are online learning activities that can help support these targets. While assessment remains central to the learning process, there is a need to focus on its practice and the use of technology to deliver the best possible outcomes for students.

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