

D2.2 Comparative Research & DigPlay Requirements Report



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About the DigPlay project

DigPlay is a forward-looking Erasmus+ project that reimagines how digital competences are assessed in secondary and vocational education (VET), especially for learners aged 14–19 who are underserved, disengaged or underrepresented in digital learning and future career pathways. By embedding assessment into familiar and motivating digital spaces—video games—the project transforms evaluation from a static test into an engaging, formative journey.

DigPlay maps gameplay behaviours to transversal digital skills such as collaboration, content creation, safety and problem- solving. The project introduces a robust, scalable assessment methodology that reflects how young people naturally learn and interact with technology, offering a progression model with personalised feedback and career guidance.

Through cross-sectoral cooperation, the project will develop the DigPlay assessment framework, train educators and business mentors, pilot activities in 20+ schools across five countries, and deploy a digital platform for tracking learner progress. It places strong emphasis on inclusion—particularly of girls, rural youth and learners at risk of exclusion—by lowering barriers to participation and building digital confidence through culturally relevant learning experiences.

DigPlay supports the objectives of the Digital Education Action Plan and Erasmus+ horizontal priorities by fostering innovation, equity and digital transformation in education. It contributes to policy and system-level change by producing tools, data and demonstrators that inform national strategies and support EU efforts to ensure that 80% of citizens have basic digital skills by 2030. DigPlay helps ensure that every learner’s digital skills are recognised and valued in ways that reflect how they actually use technology.

The DigPlay Consortium

The DigPlay project involves a consortium of seven partner organisations from Croatia, Ireland, Bulgaria, Slovenia, and Italy.

No	Partner	Country	Acronym
1.	PROFIL KLETT D.O.O.	Croatia	PK
2.	MATRIX INTERNET APPLICATIONS LIMITED	Ireland	MATRIX INTERNET
3.	DZHUNIAR ACHIYVMANT BALGARIYA	Bulgaria	JA BULGARIA
4.	STEP INSTITUT, ZAVOD ZA PSIHOLOGIJO DELA IN PODJETNISTVO	Slovenia	STEP INSTITUT
5.	JUNIOR ACHIEVEMENT YOUNG ENTERPRISE IRELAND	Ireland	JAI
6.	ADECCO ITALIA SPA	Italy	ADECCO
7.	OUTPLAYED GAMING SRL	Italy	OUTPLAYED

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Abbreviations

Abbreviation	Meaning
AI	Artificial Intelligence
D2.1	National Needs Analysis Reports
D2.2	Comparative Research & DigPlay Requirements Report
DigComp	European Digital Competence Framework
EU	European Union
GDPR	General Data Protection Regulation
ICT	Information and Communication Technology
UDL	Universal Design for Learning
VET	Vocational Education and Training
WCAG	Web Content Accessibility Guidelines
WP	Work Package

Executive Summary

This report presents the comparative analysis of the national needs assessments conducted in Bulgaria, Croatia, Ireland, Italy and Slovenia within Work Package 2 of the DigPlay project. It brings together national policy and desk research, consultation with 104 stakeholders, and the mapping of 33 existing digital, analogue and game-based tools and approaches. Its main purpose is to translate this evidence into practical requirements for the design, development and implementation of DigPlay.

Key cross-country findings

The five countries differ in their education systems, digital infrastructure, assessment practices and implementation capacity, but the comparative analysis identifies substantial convergence in the needs relevant to DigPlay.

Digital competence is firmly established as an educational priority, with DigComp providing a common European reference. The main challenge is no longer access to or routine use of digital technology. Across the five countries, important gaps remain in more complex competences, including critical evaluation of information, problem-solving, digital content creation, online safety and privacy, responsible digital behaviour, and transversal competences applied in digital environments. Emerging AI-related competences introduce additional needs for critical evaluation, responsible use, data protection and interpretation of AI-generated content.

Digital competence is already assessed through tests, practical assignments, projects, portfolios, self-assessment instruments and digital platforms. However, these approaches remain fragmented and are better suited to some aspects of competence than others. In particular, transversal competences and the processes through which learners make decisions, solve problems or behave in digital environments are difficult to capture through conventional knowledge tests or assessment of final outputs alone.

Stakeholders are broadly receptive to game-based assessment, but their support is conditional on its assessment value and practical usability. The main opportunity for DigPlay is therefore not the use of games in itself, but their capacity to create meaningful situations in which learners can demonstrate digital competence through relevant actions and choices. At the same time, assessment performance must not become dependent on gaming experience or other abilities unrelated to the competence being assessed.

Implementation conditions are as important as assessment design. Teacher capacity and workload, differences in school infrastructure, learner diversity, accessibility, language, previous digital and gaming experience, and data protection all influence the conditions under which DigPlay can be used. The comparative analysis therefore supports a common assessment framework combined with sufficient flexibility for different educational and national contexts.

Main conclusions

The research indicates that DigPlay can address a genuine gap between the broad conception of digital competence reflected in current European and national frameworks and the more fragmented ways in which these competences are currently assessed in practice. Its added value is likely to be greatest where game-

based and contextualised activities make competences observable that are difficult to assess through conventional approaches.

DigPlay should remain complementary to existing teaching and assessment practices rather than seek to replace national or school-level assessment mechanisms. Its credibility will depend on a transparent relationship among the competence being assessed, the activity undertaken by the learner, the evidence generated by that activity, and the resulting assessment.

Inclusion and fairness are integral to this assessment logic. Learners enter DigPlay with different abilities, educational opportunities, languages, levels of digital confidence and gaming experience. Accessibility and inclusive design therefore need to influence both the platform and assessment activities. The same applies to data protection and transparency: learners and educators should understand what is assessed, what data are collected, how results are produced and who can access them.

Finally, WP2 provides the evidence needed to define the initial requirements for DigPlay, but several assumptions can only be tested once assessment activities and platform functionality are in place. Piloting with diverse learners, teachers, schools and national contexts is therefore an essential part of validating the assessment approach.

Priority recommendations

Based on the comparative findings, the following priorities should guide the next stages of DigPlay development:

1. Maintain clear alignment with DigComp 3.0. The competences assessed through DigPlay should be explicitly defined and linked to the relevant DigComp areas and levels, while allowing the framework to respond to emerging competence areas, including AI-related developments.
2. Keep the assessment focus clear. Each activity should have a defined assessment purpose, with a transparent connection with the task, the relevant learner actions or outputs, and the assessed competence.
3. Use practical, contextualised tasks that add assessment value. Game-based scenarios are particularly relevant where they allow learners to demonstrate competences that are difficult to capture through conventional tests. Gameplay should support the assessment purpose rather than become an objective in itself.
4. Design for learners' diversity. Accessibility, language, digital confidence and previous gaming experience should be considered from the beginning. The assessment should minimise the influence of factors that are unrelated to the assessed competence.
5. Keep teacher use simple. DigPlay should require limited additional preparation and provide clear guidance and understandable results. Teacher support should focus on what is needed to use the tool correctly rather than creating unnecessary complexity.
6. Protect learner data and make the assessment transparent. Data collection should be limited to what is needed for the intended purposes, access should be appropriately controlled, and users should be informed about what is assessed, what data are collected and how results are used.
7. Allow adaptation to different educational contexts. A common assessment framework can be retained across countries, while language, scenarios, implementation arrangements and other contextual elements may require adaptation.

8. Validate before wider implementation - assumptions made during development should be tested through piloting. Assessment activities should be tested with diverse learners, teachers and school settings. Piloting should examine not only technical functionality and user experience, but also whether tasks provide the intended evidence of competence and whether irrelevant factors influence performance.



1. Introduction

1.1 Purpose of the Report

This report constitutes Deliverable D2.2, Comparative Research & DigPlay Requirements Report, of the DigPlay project – *Unlocking digital potential through gaming* (101259291). It forms part of Work Package 2 – Needs Analysis & Digital Skills Assessment Research and builds on the evidence generated through the three complementary research activities implemented within the Work Package: national needs analysis and policy reviews (T2.1), stakeholder surveys and interviews (T2.2), and the mapping of existing digital and game-based assessment tools and practices (T2.3).

The purpose of D2.2 is to move from the national-level evidence established in D2.1 towards a comparative interpretation of needs, gaps and implementation conditions across the five participating countries – Bulgaria, Croatia, Ireland, Italy and Slovenia – and to translate this evidence into concrete requirements for the future DigPlay assessment framework and platform. The report therefore has both an analytical and an applied function: it identifies where the national contexts converge and where meaningful differences remain and uses these findings to establish an evidence-based foundation for the subsequent design and development of the DigPlay ecosystem.

D2.2 is directly linked to Deliverable D2.1, National Needs Analysis Reports, which provides the principal national evidence base for the comparative analysis. D2.1 examined how digital competences are currently developed, assessed and supported in the five education systems and identified national gaps, barriers, opportunities and implications for DigPlay. It combined desk research, stakeholder consultation and structured mapping of existing digital, analogue and game-based approaches. D2.1 was intentionally organised around the individual national contexts; D2.2 takes the next analytical step by examining this evidence across countries and across research components, rather than reproducing the five national analyses.

The comparative analysis has four main objectives:

1. To identify common and country-specific needs in the development and assessment of digital competences, including the needs of learners who may face educational, socio-economic, geographical or accessibility-related disadvantages.
2. To compare existing approaches to digital competence assessment, including their coverage of DigComp and transversal competences, their strengths and limitations, and the extent to which current practices provide authentic and formative evidence of learner competence.
3. To examine the conditions affecting the adoption of innovative and game-based assessment, drawing together policy and institutional conditions, stakeholder perspectives, teacher readiness, infrastructure, inclusion and accessibility considerations, and the evidence from existing tools and practices.
4. To translate the comparative research findings into a structured set of requirements for DigPlay, covering functional, pedagogical, technical, user experience, inclusion and accessibility, data protection and ethics, and implementation requirements.

In this way, D2.2 serves as a bridge between the research phase of WP2 and the subsequent design and development activities of DigPlay. Its role is not simply to summarise what was found in the five countries, but to determine which findings have direct consequences for the assessment methodology, platform functionality, learner and teacher experience, implementation model and capacity of DigPlay to operate consistently across different national and educational contexts.

1.2 Comparative Research Methodology

The comparative analysis builds on the common research framework applied across the five participating countries and integrates evidence generated through the three research activities of WP2: national needs analysis and policy review (T2.1), stakeholder consultation (T2.2), and mapping of existing digital and game-based assessment tools and practices (T2.3). This corresponds to the WP2 research design established in the Project Management Handbook.

Analytical approach

The analysis followed a cross-country thematic approach. Evidence was compared across a common set of analytical dimensions: national policy and educational context; current approaches to digital competence assessment; digital skills gaps and learning needs; stakeholder perspectives; existing tools and innovative practices; and barriers and enabling factors.

For each dimension, the analysis examined both convergence and variation. Recurring findings across several or all participating countries were treated as evidence of shared needs or implementation conditions. At the same time, differences were retained where they reflected meaningful characteristics of national education systems, assessment practices, infrastructure, learner needs or institutional arrangements. This approach allows the report to distinguish between requirements that can form part of a common DigPlay model and aspects that may require national or local adaptation.

The comparative analysis also uses triangulation across evidence sources. Findings from policy and desk research were considered alongside stakeholder evidence and the mapping of existing tools and practices. Particular analytical weight was given to findings supported by more than one source of evidence. Stakeholder evidence was also used to identify implementation concerns and priorities that may not be fully visible from policy documents or existing assessment frameworks alone.

Data sources and evidence base

The evidence base for D2.2 is the research consolidated in D2.1, which covers Bulgaria, Croatia, Ireland, Italy and Slovenia. The national research combined desk research, stakeholder consultation and structured mapping of existing digital, analogue and game-based approaches, using a common methodological framework to support comparability across countries.

The stakeholder consultation comprised 104 respondents across the five countries: 24 in Bulgaria, 22 in Croatia, 22 in Ireland, 14 in Italy and 22 in Slovenia. Participants represented a deliberately diverse group of stakeholders with relevant knowledge or practical experience in digital education, competence development and assessment. They included representatives of schools and colleges, universities, public administration, NGOs, companies and software providers, training organisations and independent professionals.

Data were collected through a mixed-mode approach, using a standardised self-administered online questionnaire and semi-structured telephone, video call or face-to-face expert interviews. The same core research instrument was used across the participating countries, allowing the evidence to be analysed at both aggregate and national level.

An important component of the evidence base is the structured mapping of existing assessment and learning tools compiled under T2.3 and consolidated in Appendix G of D2.1. In D2.2, the mapping is used comparatively to examine the extent to which existing approaches cover DigComp areas and transversal competences, provide performance-based evidence, support formative assessment and progression tracking, and address accessibility and inclusion.

Analysis of qualitative and quantitative evidence

The qualitative findings were analysed thematically using the common analytical categories applied across the national studies. Responses were compared to identify recurring themes, areas of agreement, divergent perspectives and country-specific implementation conditions. The purpose was to understand why particular needs and barriers arise and what they imply for the design and implementation of DigPlay.

The quantitative data obtained through structured interviews with stakeholders were analysed descriptively. Frequencies and percentages are used to indicate the distribution of views across the overall sample and to provide quantitative support for major findings. Where appropriate, results are presented visually through charts and tables. Country-level comparisons are used selectively and interpreted with caution because of the small and unequal national sample sizes. The quantitative evidence is therefore used to strengthen and contextualise the qualitative findings rather than to make statistically representative estimates of national stakeholder populations.

The final stage of the analysis translates the comparative evidence into DigPlay requirements. Requirements are derived from identified research findings rather than formulated independently of the evidence. This creates a traceable link between the needs analysis and the functional, pedagogical, technical, user experience, inclusion and accessibility, data protection and ethical, and implementation requirements presented in Section 4.

Ethical considerations and data protection

The ethical and data-protection principles applied in D2.1 also apply to the comparative analysis. Participation in the stakeholder research was voluntary and based on informed consent. Respondents were informed about the purpose of the research, the voluntary nature of participation, the intended use of the information and the guarantee of anonymity.

No directly or indirectly identifying personal information was collected in the research dataset. Responses were analysed in anonymised and aggregated form, access to research data was restricted to authorised members of the research team, and data were stored in secure project repositories. The lawful basis for processing was informed consent, in accordance with the data-management procedures established for DigPlay.

Limitations

The comparative findings should be interpreted in light of the research design. The stakeholder consultation targeted a specialised expert population and was not designed to produce statistically representative national samples. The relatively small number of respondents within individual countries limits the extent to which percentage differences between countries can be interpreted as substantive national differences.

The composition of the stakeholder samples also varies between countries, reflecting differences in the relevant expert communities and in respondent availability. Consequently, apparent country differences may in some cases reflect differences in stakeholder composition as well as differences between national contexts.

The fieldwork was conducted towards the end of the academic year, when teachers and higher-education staff faced substantial examination, administrative and reporting commitments. In addition, data collection was implemented by national partner teams rather than professional fieldwork agencies. These constraints were mitigated through a common methodology and research instruments, central methodological guidance and training, mixed-mode data collection, and standardised digital data administration, as documented in D2.1.

These limitations do not prevent the identification of recurring patterns, shared priorities and meaningful contextual differences, but they require caution in interpreting small numerical differences. Accordingly, the comparative analysis gives greatest weight to patterns that are supported across multiple evidence sources or recur consistently across national contexts.

2. Comparative Needs Analysis

2.1 Policy and Educational Context

Across the five participating countries, digital competence development is supported by a strong and increasingly mature policy environment. Bulgaria, Croatia, Ireland, Italy and Slovenia have all incorporated digitalisation into national education strategies, curricular reforms or investment programmes, although the institutional arrangements and degree of implementation differ. DigComp serves either as an explicit reference framework or as an important influence on national approaches. At the same time, competence-based learning, digital citizenship, online safety, media literacy and, increasingly, artificial intelligence are common policy priorities.

The main cross-country difference is therefore not whether digital education is recognised as a policy priority, but how these ambitions are translated into educational practice and assessment. Across the five systems, implementation remains dependent, to varying degrees, on individual schools, subjects, teachers, available resources and educational pathways. This creates a recurring gap between relatively advanced strategic frameworks and the consistency with which digital competences are developed and assessed in everyday learning.

National policy environments

Bulgaria has established digital competence as part of the broader competence-based orientation of school education. The Strategic Framework for Education 2021–2030, the Digital Transformation of Bulgaria 2024–2030, the National Recovery and Resilience Plan and Programme “Education” 2021–2027 provide complementary strategic and investment mechanisms. Digital competence is recognised as a key competence in the curriculum, and current curricula show substantial correspondence with DigComp 2.2. At the same time, implementation remains uneven across schools and subjects, while DigComp 3.0 and AI-related competences are only emerging as explicit priorities.

Croatia combines a strong national policy framework with substantial previous investment in school digitalisation and institutional capacity. The e-Schools programme has been particularly important in developing infrastructure, digital resources and school-level capacity, while national approaches to school digital maturity provide an institutional perspective on digital transformation. This gives Croatia a comparatively favourable implementation environment and experience on which a new assessment approach can build.

Ireland has a highly developed digital education environment, supported by strong infrastructure, widespread digital engagement and national initiatives linking digital technologies with teaching, learning and educational inclusion. The policy environment also explicitly addresses educational disadvantage through mechanisms such as DEIS, which provides additional support to schools serving socio-economically disadvantaged communities. The Irish context therefore combines a relatively advanced digital environment with an explicit concern to ensure that digital transformation does not reinforce existing educational inequalities.

Italy has undergone substantial school digitalisation, supported by national policy initiatives and investment in connectivity, digital learning environments and digital citizenship. The policy and institutional landscape includes strong links to European competence frameworks. At the same time, DigCompEdu provides a reference for educators' digital competence, including the use of digital technologies for assessment, feedback, accessibility and learner participation. However, the national evidence also identifies persistent territorial disparities, particularly between Northern and Southern Italy, meaning that favourable national-level indicators do not imply uniform implementation conditions across the education system.

Slovenia similarly combines a strong digitalisation agenda with widespread access to digital technologies and growing integration of digital competence into education. Its context, however, illustrates particularly clearly that high levels of connectivity and technology use cannot be treated as equivalent to advanced digital competence. Despite near-universal internet use among young people, national evidence shows substantial variation in actual skill levels. Inclusion is also an important policy consideration, including the integration of learners with special educational needs into mainstream educational provision.

Taken together, these national contexts show different stages and models of digital education development rather than fundamentally different policy directions. Croatia and Ireland enter DigPlay with particularly strong institutional and infrastructural foundations; Italy combines substantial digitalisation with pronounced territorial disparities; Bulgaria has a clear strategic and curricular direction but uneven capacity for implementation; and Slovenia combines very high digital access with a continuing need to strengthen the depth of young people's digital competence. These differences are important for implementation, but they coexist with a substantial common policy foundation for DigPlay.

Digital education priorities

A notable area of convergence is the gradual broadening of what is understood by *digital competence*. National priorities are moving beyond operational use of devices and software towards a wider set of competences involving critical engagement with information, digital content creation, communication and collaboration, safety, problem solving and responsible participation in digital environments. The emergence of generative AI adds a further dimension, increasing the importance of critical evaluation, responsible use and understanding of digitally generated content.

This evolution is particularly relevant for DigPlay. A platform designed around a narrow understanding of digital skills would risk addressing needs that national education policies are already moving beyond. The common direction across the five countries instead supports an assessment model that captures transversal competence demonstrated through behaviour and decision-making in meaningful digital situations.

At the same time, the evidence shows that equally developed assessment practices do not yet match policy ambitions in these broader competence areas. This is the point at which the five national contexts converge most strongly.

Assessment policies

Assessment represents the clearest common weakness in otherwise relatively developed digital education policy environments. Across all five countries, existing approaches remain fragmented and only partially

aligned with the broader conception of digital competence promoted by DigComp. Digital skills are commonly assessed through subject-based tests, practical assignments, projects or digital products, while national and international instruments provide additional evidence in some countries. However, these approaches generally assess particular subjects or competence components, or serve system-monitoring purposes, rather than providing continuous evidence of learners' transversal digital competence.

Bulgaria, for example, has a standardised Grade 10 external assessment combining an online test with a practical task. Still, the national analysis identifies a lack of a broader, standardised, DigComp-aligned assessment mechanism and weak progression tracking. Croatia has experience with digital maturity frameworks and competence-based initiatives, but still lacks a coherent, learner-level, DigComp-aligned assessment approach. Ireland, Italy and Slovenia similarly use combinations of classroom assessment, digital platforms, national or international mechanisms and self-assessment tools, without these forming an integrated system capable of assessing the full range of transversal digital competences.

The comparative evidence therefore points to a structural mismatch: digital competence policy is increasingly transversal, while assessment remains predominantly fragmented, subject-specific or episodic. This is more consequential for DigPlay than differences between individual national policy frameworks.

2.2 Current Approaches to Digital Competence Assessment

Digital competence is assessed to some extent in all five participating countries, but there is no single dominant assessment model across the national contexts. The evidence collected in D2.1 points instead to a combination of classroom-based assessment, practical tasks and projects, digital products and portfolios, online tests and learning platforms, alongside national or international assessment instruments in particular countries. The balance between these approaches differs, as does the extent to which assessment is explicitly linked to digital competence frameworks.

A common distinction emerging from the national evidence is between assessment of subject-specific digital knowledge and skills and assessment of broader transversal digital competences. The former is more clearly established, particularly within ICT/Informatics subjects and relevant VET programmes. The latter is considerably less systematic because competences such as critical evaluation, collaboration, responsible digital behaviour, problem solving and digital identity management cut across subjects and are more difficult to capture through conventional tests or assessments of final products.

Existing assessment practices

At classroom level, the most widespread approaches are teacher-led. Teachers use combinations of written or online tests, practical exercises, project assignments, presentations, digital products, portfolios and activities delivered through learning management systems. These methods can provide evidence of learners' digital skills, but the extent and quality of that evidence depend substantially on the task, assessment criteria and teacher practice.

This pattern is particularly evident in Bulgaria, where assessment remains concentrated mainly within Computer Modelling, Information Technologies and Informatics despite digital competence being formally defined as cross-curricular. Classroom assessment combines tests with practical assignments, programming

tasks, presentations, projects and digital products. The Grade 10 National External Assessment in Information Technologies provides a more structured example, combining an online test with a practical digital task. In VET, theoretical and practical assessments can also capture the use of specialised software, digital equipment, and workplace-related problem-solving. These approaches provide useful evidence within their respective domains, but they do not lead to a common assessment of transversal digital competence across subjects and educational pathways.

In Croatia, digital competence is assessed primarily through Informatics and curriculum-based activities, including projects, practical work and digital products. The country also has experience with approaches explicitly designed around broader digital competence. The CRISS Platform, for example, used authentic learning scenarios, ePortfolios and performance-based assessment aligned with DigComp. However, it has not become part of mainstream educational practice. The Croatian evidence therefore illustrates both the availability of more comprehensive assessment models and the difficulty of embedding them sustainably in everyday educational practice.

In Ireland, assessment is strongly decentralised and predominantly teacher-led. Projects, Classroom-Based Assessments, digital portfolios and activities within learning management systems can provide authentic opportunities for learners to demonstrate competence. However, these practices are locally designed and implemented, resulting in limited consistency and comparability. Stakeholders also showed considerable uncertainty about whether digital competences are formally assessed, particularly in VET, indicating that existing practices are not always recognised as part of a coherent digital competence assessment approach.

The evidence from Italy similarly identifies projects, portfolios, digital products, coding and STEM activities and teacher-led formative assessment as important ways through which digital competence is assessed. National initiatives provide additional reference points, including DigComp-related assessment, but the overall picture remains diverse and uneven. The national analysis particularly highlights the limited availability of approaches that assess competence through authentic real-life situations and the continuing difficulty of capturing transversal competences.

In Slovenia, the evidence likewise indicates a combination of classroom assessment and broader national or international approaches rather than a single comprehensive model. As in the other countries, the practical assessment of digital competence is embedded to varying degrees in teaching activities and subject contexts, while broader evidence on learners' competence may also come from external or self-assessment instruments.

Assessment methods and tools

An important comparative finding is that the term “digital competence assessment tool” is used rather broadly in practice. Stakeholders across countries referred to dedicated competence frameworks and assessment instruments, as well as learning management systems, online survey or testing applications, certification schemes, portfolios and general teaching platforms.

Examples identified in the national studies include SELFIE, SELFIE for Teachers, ICILS, Europass digital skills self-assessment, Moodle, Google Classroom, Google Forms, Canvas, ECDL/ICDL and Microsoft Office Specialist certification, as well as national- and school-developed approaches. These tools serve

different purposes and assess different units: some focus on learners, some on educators or institutions; some are self-assessment instruments; and others provide an environment in which teachers can construct assessment activities rather than directly assessing digital competence themselves.

This distinction is important when interpreting the existing assessment landscape. The availability of digital platforms does not necessarily imply the availability of tools specifically designed to assess digital competence. For example, Moodle, Google Classroom, or similar platforms can distribute tasks, collect learners' work and provide feedback, but the validity and competence coverage of the assessment depend primarily on what teachers ask learners to do and how their performance is evaluated.

Strengths of current assessment approaches

Despite their fragmentation, current practices contain several elements relevant to the development of DigPlay. Practical assignments, projects, portfolios and applied VET tasks allow learners to demonstrate competence through activity rather than solely through knowledge recall. In occupational contexts, assessment can be directly connected to the realistic use of specialised software, equipment, or digital problem-solving. Project-based and portfolio approaches can similarly provide richer evidence than conventional tests where tasks and assessment criteria are appropriately designed.

Teacher-led assessment also provides flexibility. Activities can be adapted to curriculum content, learner level and classroom context rather than requiring all learners to complete an identical standardised task. Ireland provides a particularly clear example of the benefits and limitations of this approach: locally developed assessment can be authentic and closely integrated into learning, while also producing limited consistency across settings.

The mapped experience also demonstrates that more explicitly competence-oriented approaches are feasible. The CRISS example (developed within Horizon 2020 project and piloted in Croatian schools, as identified in the Croatian desk research) is relevant in this respect because it combined authentic scenarios, performance evidence and DigComp alignment. Its value for the present analysis is not that it provides a model that DigPlay should reproduce, but that it illustrates one existing way in which these elements have previously been brought together.

Limitations of current assessment approaches

Across the five countries, the clearest limitation is fragmentation. Assessment varies by subject, school, teacher and educational pathway, and the evidence does not identify a commonly used approach that provides broad coverage of learners' digital competences across the DigComp areas. This does not mean that digital competence is not being assessed; rather, different parts of it are assessed through different mechanisms and with varying degrees of explicitness.

A second gap concerns transversal and higher-order competences. Existing practices appear better suited to assessing knowledge, technical or procedural skills and completed digital products than to capturing how learners evaluate information, collaborate digitally, make decisions, solve problems or behave responsibly in digital environments. This difficulty appears repeatedly in both the national reviews and stakeholder evidence.

Third, self-assessment and self-perception have inherent limitations when used alone. Bulgarian stakeholders, for example, reported that learners and teachers may overestimate digital competence when assessment relies primarily on self-perception, and emphasised the value of observing what learners can actually do in digital environments. This does not make self-assessment unsuitable; it indicates that it provides a different type of evidence from demonstrated performance.

Finally, awareness and practical use of dedicated assessment tools are uneven. In Croatia, for example, only a small number of consulted stakeholders reported personally using a digital competence assessment tool, despite broader awareness of several available solutions. Irish stakeholders similarly demonstrated limited awareness of dedicated tools, often naming general-purpose platforms and learning activities instead.

2.3 Learning Needs and Digital Skills Gaps

The five national studies show that young people's frequent use of digital technologies does not necessarily mean that they have strong digital competences. The gaps identified across the countries are mainly related to the quality and complexity of digital skills, rather than to basic access or everyday use alone.

The evidence points to several recurring areas of need:

1. evaluating online information critically;
2. creating and managing digital content;
3. solving problems in digital environments;
4. online safety and responsible behaviour;
5. privacy and digital identity;
6. responsible use of emerging technologies, including AI.

The national studies also identify difficulties in transversal competences such as collaboration, communication and critical thinking when these are applied in digital environments.

Critical digital competence gaps

Information and data literacy is one of the clearest areas of concern across the countries. Young people are generally experienced users of online information, but this does not always translate into an ability to assess its reliability, quality and origin. In Bulgaria, national assessment evidence points to particular difficulties in extracting and interpreting information from texts and data, information management and information evaluation. The Irish analysis similarly identifies critical evaluation of online information among the main competence gaps. At the same time, the Slovenian findings show weaknesses in computer and information literacy despite very high levels of internet use.

Problem-solving digital skills form a second recurring area of weakness. In Croatia, ICILS evidence and stakeholder findings point particularly to computational thinking, higher-order digital problem solving and the application of digital skills in authentic contexts. Bulgarian evidence shows a similar distinction between comparatively stronger performance on familiar or procedural tasks and weaker performance where critical judgement, independent reasoning, collaboration or conceptual problem solving are required. Slovenia provides particularly clear quantitative evidence: 51% of eighth-grade students did not reach proficiency

Level 2 in computer and information literacy, while performance in computational thinking was below the ICILS average. Only 14% reached Level 3 and 2% Level 4 in computational thinking. ICILS assesses eighth-grade students, who are slightly younger than the DigPlay target group, but it provides the most robust performance-based evidence available for the national context.

A third group of gaps concerns safe and responsible digital participation. These include privacy and personal data protection, digital identity, appropriate online behaviour and the ability to recognise and respond to harmful content or interactions. These issues appear across the national studies, although with different emphasis. In Slovenia, for example, a 2024 Safe.si study found that 63% of female and 54% of male secondary-school students had experienced at least one form of online violence. Bulgarian evidence also identifies digital health and wellbeing among the areas where relatively few students demonstrate the highest level of performance, while the Irish findings place particular emphasis on digital citizenship, responsible behaviour and privacy.

Digital content creation is another area where the evidence points to uneven competence. Across the countries, young people are generally comfortable consuming and sharing digital content, but more advanced creation, adaptation and responsible use of content are less consistently developed. This includes not only producing digital material, but also understanding copyright and licences and selecting appropriate tools and formats.

Italy adds an important dimension to the comparative picture. The national evidence highlights the need to raise overall digital competence levels while also addressing differences in learning opportunities and outcomes between territories. It also gives particular prominence to media literacy and the competences required for critical and responsible engagement with AI. This reinforces a broader finding across the five countries: competence gaps cannot be understood only as deficits in individual skills, since opportunities to develop and apply those skills are also unevenly distributed.

Emerging technologies add a further layer to these needs. AI is increasingly present in young people's educational and everyday digital environments, but frequent use does not necessarily imply the ability to evaluate AI-generated information, recognise limitations or bias, protect personal data, or make responsible decisions about when and how AI should be used. This concern is particularly visible in the Italian and Croatian evidence, but is relevant across the five national contexts.

Differences between access, use and competence

One of the most consistent findings across the five countries is the need to distinguish between access to technology, frequency of use and actual competence.

This is particularly clear in Slovenia. While digital access among young people is very high, ICILS results show substantial gaps in computer and information literacy and computational thinking. Slovenian students also use ICT much more frequently outside school for non-school purposes than for schoolwork: 81% reported daily non-school use outside school, compared with 11% using ICT daily for schoolwork while at school.

The Bulgarian findings point to a similar distinction between familiarity with digital devices and more advanced competence. The national synthesis identifies gaps between young people's device use and their achievement of above-basic digital skills.

These findings are relevant because they caution against using the frequency of technology use as an indicator of competence. Learners may be confident users of smartphones, social media, or entertainment applications, yet have more limited experience with complex information tasks, content creation, solving or specialised digital tools.

Groups facing greater difficulties

Digital competence gaps are not distributed equally. Across the national reports, several groups appear more likely to have limited opportunities to develop a broad range of digital competences.

Learners from socio-economically disadvantaged backgrounds may face limitations in access to suitable devices, stable connectivity, specialist software or support at home. Access through a smartphone alone may be sufficient for many everyday activities but not for more complex educational tasks.

Learners in rural or less well-resourced areas can face similar constraints. The scale and form of this issue differ between countries. Italy, for example, reports continuing territorial differences in infrastructure and learning outcomes between Northern and Southern regions. Bulgaria and Ireland also identify inequalities related to location and socio-economic disadvantage.

Learners with disabilities and special educational needs may face additional barriers where digital resources and activities are not designed with accessibility in mind. The national studies therefore treat accessibility as part of digital inclusion rather than simply as a technical feature.

Girls and young women remain underrepresented in digital and STEM pathways, which is one of DigPlay's central inclusion priorities. The Italian evidence points to stereotypes, confidence gaps, and a lack of relatable role models, as well as targeted initiatives such as Coding Girls and Girls Code It Better. At the same time, Slovenia's Digital Education Action Plan (ANDI) explicitly aims to increase girls' participation in STEM and computer science. Gender differences are also visible in online experiences: in Slovenia, female secondary-school students reported online violence more often than male students (63% and 54% respectively).

Learners with a migrant background or a different home language, and Roma learners, may face additional barriers. The Slovenian evidence shows that ICILS results are associated with home language and migrant background, and Slovenian stakeholders drew particular attention to Roma students and to students without stable access to a computer or the internet at home.

The evidence also points to differences in the learning opportunities available to students. Teacher competence, school resources, technical support and the way digital technologies are integrated into teaching can affect the range of digital tasks that learners encounter. As a result, two learners with similar access to technology may still have very different opportunities to develop digital competence.

The evidence does not support treating these groups as uniformly “digitally excluded”. Rather, it shows that some learners face greater barriers to developing particular types of digital competence. This distinction is important for DigPlay because differences in prior experience should not automatically be interpreted as differences in learning potential.

Changing priorities within digital competence

The national studies show that the relative importance and context of digital competence needs are changing as digital technologies evolve. Within the DigComp competence areas, particular emphasis is placed on critical evaluation, privacy and data protection, digital wellbeing, responsible participation and the ability to work with increasingly complex digital information and environments.

This changing emphasis also reinforces the distinction between assessing knowledge and assessing the ability to apply digital competence in practice. Knowledge-based assessment can establish whether a learner knows, for example, how personal data should be protected or how the reliability of a source can be judged. Assessing practical competence requires evidence that the learner can apply this knowledge when faced with a digital task or situation.

This is particularly relevant to DigPlay, which is intended primarily to assess demonstrated digital skills and competences rather than factual knowledge alone. Evaluating a source, selecting relevant information, deciding how to protect personal data or choosing between alternative solutions may therefore require evidence not only of the final outcome, but also, where relevant, of the learner’s actions and choices during the task. This can make aspects of competence visible that conventional knowledge-based assessment may not capture.

AI-related competences

Artificial intelligence is an emerging theme across the national research findings. Its prominence is not uniform across all five countries, but the direction is clear: AI is becoming part of the digital environment in which young people learn, search for information and create content.

The competence needs identified in the reports include evaluating AI-generated information, recognising possible errors and bias, protecting personal data when using AI services, understanding when and how AI has contributed to an output, and using AI responsibly. The Slovenian analysis, for example, explicitly identifies the need for learners to evaluate AI-generated information, recognise errors and bias, protect personal data and document AI assistance. Italy's policy framework also places increasing emphasis on AI-related competences through DigComp 3.0. Ireland identifies responsible and ethical use of AI among its emerging competence gaps.

AI also creates a specific issue for assessment. If learners can use AI while completing a task, the assessment needs to distinguish, where relevant, between what the learner can do independently and what has been produced with AI assistance. This does not mean that AI should always be excluded from assessment. Depending on the competence being assessed, the appropriate use of AI may itself be part of the task. The important point is that the role of AI needs to be clear.

For DigPlay, this means AI-related competences should be considered in the assessment framework, and the rules for AI use in individual assessment activities should be explicit.

Cross-country similarities and differences

Across the five countries, the main digital competence gaps are found in more complex uses of digital technology rather than in basic technical skills. These gaps are most consistently identified in critical use and evaluation of information, problem solving, digital content creation, online safety and responsible participation.

The differences are mainly in scale, emphasis and context. Countries vary in infrastructure, the integration of digital technologies into teaching, teacher capacity, national assessment practices and the extent of inequalities between schools and learner groups. Some issues are also more prominent in particular countries: computational thinking is especially evident in the Slovenian evidence; territorial inequalities stand out in Italy; Bulgaria shows uneven achievement in above-basic skills and differences in school capacity; while Ireland highlights critical information use, digital citizenship, and the challenge of assessing transversal competences.

These differences matter for the way DigPlay is implemented, but the evidence does not indicate a need for five fundamentally different assessment approaches. It points instead to a shared set of competence areas, combined with differences in learners' starting points and in the educational environments in which the tool would be used.

2.4 Stakeholder Perspectives

The stakeholder consultation adds a practical perspective to the policy and desk research presented in the previous sections. It shows how professionals working in education, digital competence development, assessment, policy, research and related fields perceive the current situation and the proposed DigPlay concept.

Overall, the stakeholder evidence confirms three findings already visible in the national analyses. First, assessing digital competence is seen as difficult in practice. Second, stakeholders are generally open to game-based assessment. Third, this openness is conditional: the approach needs to be credible, easy to use, inclusive and clear about what is being assessed.

Perceived challenges in digital competence assessment

The results at aggregated country level highlight four challenges perceived as main or major by the consulted experts.

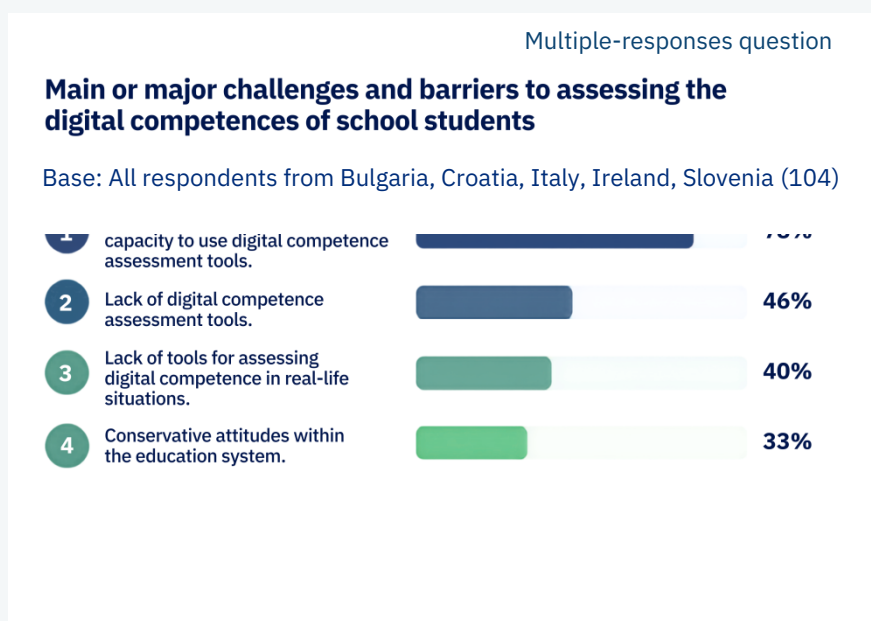


Figure 1. Main or major challenges and barriers to assessing students' digital competences, as perceived by the consulted stakeholders (n=76). Source: DigPlay WP2 stakeholder survey

Overall, 78% reported challenges or barriers to assessing students' digital competences (n=74), while 4% reported no barriers and 18% could not answer.

Familiarity with existing assessment tools is also limited. Among respondents asked about such tools 31% had used one, 23% knew of tools but had not used them, and 46% said that, as far as they knew, no such tools were available. The latter reflects stakeholder awareness rather than the objective availability of assessment tools.

Expectations towards digital assessment

Across the qualitative interviews, stakeholders repeatedly favoured assessment that shows what learners can actually do, rather than relying only on self-assessment or theoretical knowledge. Practical tasks, projects and other applied activities were commonly mentioned as useful because they allow competence to be demonstrated in context.

Stakeholders also raised the issue of competences that are difficult to observe through conventional assessment. These include collaboration, critical evaluation, problem-solving, responsible digital behaviour, and decisions related to privacy, digital identity and AI-generated content. The Italian report, for example, discusses the use of observable behaviour in structured situations as one possible reference for assessing transversal competences.

The expectation is therefore not simply for assessment to become more digital. The stakeholder evidence points to a need for tasks that are relevant to the competence being assessed and for a clear connection between the task, the learner's performance and the interpretation of the result. This is also important for teachers, who need to understand what an assessment result represents if they are expected to use it in practice.

Attitudes towards game-based assessment

Stakeholder reactions to the DigPlay concept were generally positive. Across all 104 respondents, two-thirds selected the statement that the idea was very good and that the tool could be useful for students, and half saw potential to facilitate teachers' work.

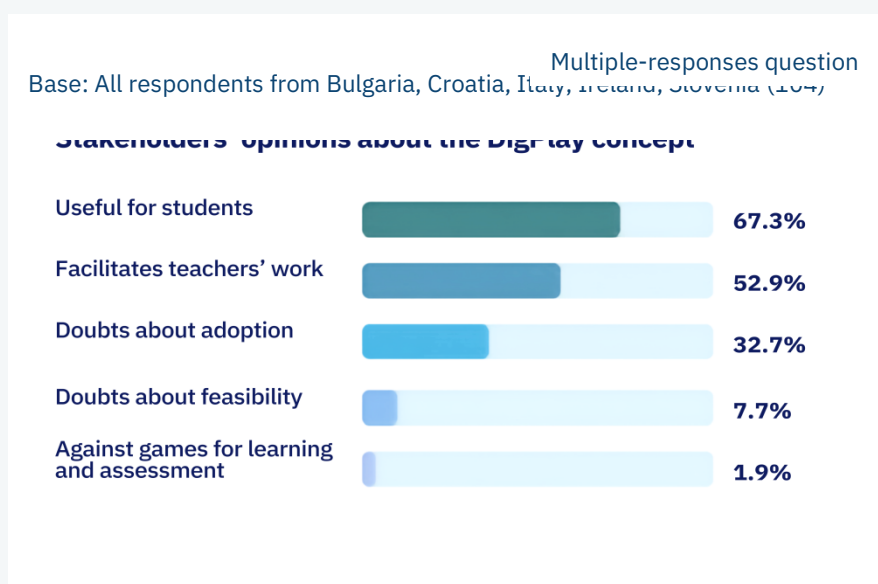


Figure 2. Stakeholders' opinions about the DigPlay concept (all respondents, n=104; multiple answers possible).

Source: DigPlay WP2 stakeholder survey

Only 2% rejected the idea of using computer games for learning and competence assessment. At the same time, positive attitudes did not mean unconditional confidence in implementation. 33% considered the idea good but doubted whether it would be appreciated and adopted in their education system, while 8% expressed doubts about whether such a tool could be successfully developed.

The country results should be treated cautiously because the national bases are small. They nevertheless suggest that concerns are more about implementation and adoption than about the principle of game-based assessment itself. For example, doubts about adoption were expressed by 11 of 22 respondents in Croatia and 11 of 22 in Slovenia, compared with 5 of 24 in Bulgaria and 3 of 22 in Ireland. These differences are indicative rather than representative, but they are useful for identifying issues to explore during piloting.

The qualitative evidence helps explain the generally positive response. Stakeholders see game-based activities as potentially engaging for learners and as a way of observing performance during practical tasks. In Bulgaria, for example, respondents associated the approach with greater student motivation and participation, as well as the possibility of complementing self-assessment with evidence from actual performance. Italian stakeholders also expressed openness to alternative and game-based approaches that focus on practical rather than only theoretical digital skills.

However, stakeholders also identified an important risk: performance in a game should not be confused with digital competence. Learners with more gaming experience may be faster or more familiar with controls and common game mechanics. This could disadvantage students with little gaming experience even when

their underlying digital competence is similar. Bulgarian respondents therefore recommended simple controls, clear instructions and onboarding, and task design that reduces the effect of previous gaming experience.

Conditions influencing adoption

The consultation suggests that adoption will depend on several practical conditions.

Teacher capacity is one of the clearest. The fact that 78% of the relevant stakeholder group identified insufficiently competent teachers or specialists as a barrier indicates that introducing a new assessment tool cannot depend on teachers acquiring extensive new technical or assessment expertise. Training and guidance may still be required, but the tool itself needs to be understandable and manageable in average educational settings.

A second condition is clarity of purpose and results. Stakeholders stressed the importance of a transparent relationship between the activity, the competence being assessed and the indicators used to interpret performance. This is particularly important for game-based assessment, where an engaging activity alone does not demonstrate that the intended competence is being measured.

A third condition is fairness and inclusion. Different levels of gaming experience, digital exposure, language proficiency, accessibility needs and access to technology may affect how learners interact with the platform. These factors need to be considered when designing and testing tasks and interfaces.

Finally, data protection and transparency are clearly important to stakeholders. More than half of all respondents (55%) reported ethical, privacy, or transparency concerns related to assessing students' digital competences through gameplay. Among those who expressed concerns (n=57), the most frequently selected issues were informed consent (83%), data protection (81%), transparency of assessment criteria (68%), access to student data (67%) and explanation or justification of results (65%). Fairness of assessment (58%) and avoiding excessive tracking (56%) were also mentioned by more than half of this group.

In general, the stakeholder evidence shows broad interest in the DigPlay concept, combined with clear expectations about how it should work. The main concerns are associated with practical realisation and real-life implementation rather than with game-based assessment itself. Stakeholders want assessment to relate to demonstrated competence, while avoiding unnecessary complexity for teachers and learners. They also expect a clear link between activities and the competences assessed, safeguards against the influence of previous gaming experience, attention to different learner needs, and transparent handling of assessment results and learner data.

Business perspectives

The consultation also provides a distinct business perspective on the digital competences expected from young people entering employment. The business-related questions were answered by 28 respondents from Bulgaria, Croatia, Ireland and Slovenia. Although the national groups are small, the combined quantitative and qualitative evidence shows several consistent findings across the four countries.

1. The clearest potential value for business is at the transition from education to employment.

Business respondents see value in making young people's practical digital competences more visible when they enter the labour market. In Bulgaria, Croatia and Ireland, the potential application of the DigPlay concept was associated primarily with assessing new recruits or job applicants. Slovenian respondents were more divided on its immediate application, although the qualitative findings indicate potential use both in recruitment and in employee development.

More importantly, respondents across all four countries were positive about the usefulness of a clear profile of the practical digital competences of young people leaving secondary or VET education. The Slovenian qualitative evidence additionally highlights its potential as a common reference point between education and the labour market, while also indicating that any assessment used in recruitment would need to remain sufficiently concise for practical use.

2. Business respondents value applied digital competences rather than narrowly technical proficiency. Across the four countries, several competence areas emerge particularly consistently as important for entry-level recruits:

- evaluating information;
- communicating and collaborating through digital technologies;
- protecting personal data and privacy;
- identifying creative solutions using digital technologies.

Technical problem solving, programming, content creation and information management are also relevant, but they are less consistently prioritised across the four national groups.

The qualitative employer evidence from Ireland reinforces this broader pattern. Employers emphasised critical judgement, digital collaboration, responsible digital behaviour and professionalism, privacy and data protection, digital identity management and creative problem solving. The overall picture therefore points towards the ability to use digital technologies critically, collaboratively and responsibly, rather than simply operate them.

3. Some of the competences considered most important are also those in which new recruits are perceived to have weaknesses.

This overlap is particularly important. Three areas stand out across the business evidence:

- information evaluation – highly valued but also frequently identified as a weakness;
- personal data and privacy protection – considered important for entry-level employees while also emerging as a competence gap;
- creative digital problem solving – valued by employers but also identified as an area in which new recruits may struggle.

Other gaps are more pronounced in particular countries. Copyright and licensing issues are especially visible in the responses from Bulgaria, Croatia and Ireland, while digital identity management emerges more strongly in Ireland. The national evidence therefore differs in emphasis, but the broader finding is consistent: the main concern is not simply whether young people can use digital technologies, but whether they can

evaluate information, make appropriate decisions and use digital tools responsibly in practical situations.

4. Future business needs reinforce the shift towards critical, adaptive and responsible digital competence.

When respondents considered which competences would become particularly important for their sectors over the next three to five years, the strongest recurring priorities were:

- evaluation of information;
- creative problem solving using digital technologies;
- digital collaboration;
- protection of personal data and privacy;
- responsible use of technology, including digital wellbeing and environmental considerations.

There are differences in emphasis between countries. Bulgarian respondents give particular weight to information skills and identifying appropriate technological responses, while also highlighting digital wellbeing. Croatian respondents strongly emphasise information evaluation and management, collaboration, privacy and responsible use. Irish respondents identify a particularly broad combination of communication, responsible-use and problem-solving competences, consistent with the qualitative employer interviews. Slovenian respondents place particular emphasis on information evaluation and creative digital problem solving, while showing greater uncertainty regarding some of the more specialised competence areas.

5. Business respondents also see potential in game-based assessment, particularly where it provides evidence of practical competence.

The qualitative findings indicate that business respondents are receptive to innovative and game-based approaches, although the evidence is strongest in Ireland and Slovenia. Slovenian participants from IT and software-related sectors saw gamification as a way of sustaining learners' attention more effectively than conventional methods, while also stressing that assessment should measure the intended digital competence rather than gaming ability. In Ireland, business respondents showed particular interest in approaches capable of providing richer evidence of practical digital competences and workplace readiness, including competences such as problem solving, collaboration, judgement and responsible digital behaviour that are difficult to capture through conventional assessment.

The business perspective therefore supports game-based assessment primarily for its potential to make applied competence observable, rather than for the motivational value of gaming alone.

Overall, the business evidence largely reinforces rather than introduces a separate set of digital competence needs. The competences valued in the transition to employment substantially overlap with those identified elsewhere in the research as important but difficult to assess through conventional approaches, particularly critical information evaluation, collaboration, responsible digital behaviour and problem solving. The business perspective therefore provides additional support for assessing what learners can demonstrate in practical situations, rather than focusing primarily on their knowledge of digital technologies.

2.5 Existing Tools, Practices and Innovation Opportunities

The mapping carried out under T2.3 identified 33 digital and analogue tools, assessment instruments and game-based approaches across the five participating countries. The mapping includes tools used directly for assessment, tools primarily designed for learning or self-assessment, and broader platforms or approaches that can support the development or observation of digital and transversal competences.

The main finding is that there is already a wide range of relevant tools and practices, but they serve different purposes and cover different parts of digital competence assessment. Some provide structured assessment against competence frameworks; others support self-reflection; some create practical or game-based learning situations; and general digital platforms provide environments in which teachers can design and assess their own activities.

For this reason, the value of the mapping for DigPlay lies in identifying useful features, existing gaps and approaches that can inform particular aspects of the future tool.

Overview of the mapped tools

The largest category consists of digital platforms (10 of the 33 mapped tools). These include widely used learning and collaboration environments such as Google Classroom, Microsoft Teams and Moodle, national or sector-specific environments such as Bulgaria's Digital Backpack and Shkolo, and more specialised platforms such as Coding Ireland and Scoilnet. These environments can support assignments, learner interaction, feedback and the collection of digital work. Their main strength is their established role in educational practice. However, most are not digital competence assessment tools in themselves: what they assess depends on the activities and criteria defined by teachers. The CRISS Platform is a notable exception. It was specifically designed to assess digital competences through authentic learning scenarios, ePortfolios and performance-based evidence aligned with DigComp, although it has not become part of mainstream educational practice.

A second substantial group consists of digital self-assessment tools (8). Examples include Europass Test Your Digital Skills, SELFIE, SELFIE for Teachers, DigCompEdu Check-In and Slovenia's Safe.si tests. These tools illustrate different forms of structured reflection and diagnostic assessment. Some are explicitly aligned with DigComp or related European competence frameworks and can provide users with an overview of perceived strengths and weaknesses. Their main limitation for DigPlay is that they predominantly assess self-perception, institutional practice or specific aspects of digital behaviour rather than demonstrated learner performance. SELFIE for Teachers, for example, is aligned with DigCompEdu and focuses on teachers' professional use of digital technology, while Safe.si concentrates specifically on online safety.

The mapping also includes digital tests (3). These include structured approaches such as ICILS and Bulgaria's Grade 10 National External Assessment in Information Technologies, which combines an automatically scored test with a practical digital task assessed against standardised criteria. Such approaches demonstrate the advantages of standardisation, scoring and comparability, and the Bulgarian example also shows how theoretical knowledge and practical performance can be combined. However, conventional test formats remain better suited to knowledge and clearly defined skills than to observing complex learner behaviour, decision-making or transversal competences.

The remaining tools and approaches include digital gamification (5), analogue gamification (4), one combined analogue/digital gamification approach and two digitally oriented initiatives. The digital examples include Kahoot!, Mentimeter, Quizizz/Wayground and Scratch, while the analogue and blended examples include Barabar, BioXcape and LEGO Education. The mapping also includes initiatives such as EU Code Week and programmes targeting specific groups, including Coding Girls/Girls Code It Better. These approaches illustrate different uses of quizzes, programming activities, scenarios, physical-digital interaction, escape-room formats and collaborative challenges. Their main relevance is that they create situations in which learners can solve problems, make decisions, collaborate or produce something, although most were developed primarily for learning and engagement rather than structured competence assessment.

Useful practices identified in the mapping

Several features of the mapped tools and practices are relevant to DigPlay, even where the tools themselves serve a different purpose.

One is the use of practical and contextualised tasks. The CRISS Platform provides the clearest mapped example of competence assessment through authentic learning scenarios and performance evidence. Other approaches demonstrate individual elements of this logic: BioXcape uses an escape-room setting requiring team interaction, decision-making and problem solving; Barabar uses scenarios and cooperative and competitive interaction to make complex behaviours observable; and LEGO Education combines physical and digital activities around practical STEM and problem-solving tasks. These examples show different ways of placing learners in situations where competence is demonstrated through action rather than assessed only through factual questions.

A second useful feature is immediate feedback. Digital quiz and gamification tools such as Kahoot!, Quizizz/Wayground and Mentimeter demonstrate how results and feedback can be provided during or immediately after an activity. This functionality is widely established and can support formative assessment, although in these tools it is generally linked to responses to predefined questions rather than interpretation of more complex learner behaviour.

A third useful feature is structured competence mapping and reporting. Europass Test Your Digital Skills demonstrates how results can be organised around DigComp competence areas to provide a recognisable competence profile, while SELFIE and SELFIE for Teachers illustrate structured reflection and automated reporting against European digital competence frameworks. The CRISS Platform goes further by linking authentic activities and performance evidence to DigComp. These approaches provide useful examples of how competence-related information can be structured and communicated, even though their assessment purposes and target groups differ from those of DigPlay.

The mapping also provides examples of collaborative and problem-based activities. Barabar, BioXcape and LEGO Education, as well as coding and project-based approaches identified in the national studies, require learners to interact, make decisions, create solutions or solve problems. They are relevant because they demonstrate practical ways of making transversal competences visible through learner activity,

although they do not necessarily provide a standardised method for converting these behaviours into assessment evidence.

No single mapped tool provides a complete model for DigPlay. Their value lies instead in demonstrating individual elements that can inform its development: authentic tasks and scenarios, immediate feedback, structured competence mapping, practical problem solving and opportunities to observe learner behaviour.

Main shortcomings of the existing tools

Only 4 of the 33 tools were rated as directly relevant to DigPlay's intended assessment logic, while most were assessed as providing partially transferable elements or contextual examples.

Several limitations can be identified across the mapping:

First, many tools assess perceived competence rather than observed performance. This is particularly true of self-assessment instruments. Second, tools that create engaging practical or game-based activities do not necessarily provide a structured way of translating learner behaviour into evidence related to specific competences. Third, DigComp alignment is uneven. Some tools are explicitly based on DigComp, while others address relevant skills without mapping them systematically to the framework. Fourth, transversal competences are covered unevenly. Existing tools may support collaboration, problem-solving or creativity as part of an activity without necessarily assessing these competences consistently.

Finally, progression tracking, accessibility and inclusion are not consistently combined with competence assessment. These features exist in parts of the mapped ecosystem, but rarely together.

Opportunities for DigPlay

The mapping does not indicate a need for DigPlay to reproduce functions that are already widely available through learning platforms, testing applications or self-assessment tools. Instead, it provides examples of features and approaches to consider during development.

In particular, the research findings explore a combination of practical tasks, clear competence mapping, observation of relevant learner actions, feedback and progression information. Game and scenario-based approaches can provide the context for such tasks, while existing competence frameworks and assessment tools provide examples of how results can be structured and communicated.

There is also an opportunity to address competences that are currently difficult to assess through conventional formats. Where appropriate, gameplay can create situations in which learners need to evaluate information, solve a problem, make a privacy-related decision or collaborate with others. The important issue for DigPlay is not the game format itself, but whether the activity provides relevant and interpretable evidence for the competence being assessed.

The mapping therefore provides a practical reference base rather than a model. Existing tools demonstrate that many of the individual components envisaged for DigPlay are already used in education. The development task is to determine which of these components are appropriate for DigPlay's specific

purpose and how to combine them without unnecessarily complicating the assessment for learners or educators.

3. Cross-Country Synthesis and Strategic Implications for DigPlay

3.1 Common Findings

Despite differences in education systems, infrastructure and assessment practices, the comparative analysis identifies several common findings that are directly relevant to DigPlay.

Digital competence gaps are more evident in complex uses of technology than in basic technical skills. Across the five countries, the main digital competence gaps are found in more complex uses of technology rather than in basic technical skills. These gaps are most consistently identified in the critical use and evaluation of information, problem-solving, digital content creation, online safety and responsible participation, as well as in transversal competences applied in digital environments. AI adds further competence needs related to critical evaluation, responsible use and data protection.

Current assessment captures only part of digital competence.

Digital competence is already assessed through different methods and tools, but coverage remains fragmented. Existing approaches are generally better suited to assessing knowledge, technical skills or final outputs than competences demonstrated through decision-making, problem-solving, collaboration, and behaviour in digital environments. This creates particular challenges for assessing transversal competences and for capturing relevant aspects of the process through which learners complete a task.

Game-based assessment is positively received, but its value depends on what it can assess. Stakeholders are broadly open to the DigPlay concept, particularly where game-based activities can create practical situations in which learners demonstrate competences that are difficult to assess through conventional methods. At the same time, gameplay needs to serve the assessment purpose, and performance should not depend substantially on previous gaming experience or other factors unrelated to the competence being assessed.

Teacher usability is a key implementation condition.

The evidence consistently points to differences in teacher capacity, available time and experience with digital competence assessment. DigPlay therefore needs to minimise additional preparation and provide clear guidance and results that teachers can understand and use without requiring specialised assessment or technical expertise.

Inclusion and accessibility need to be addressed from the beginning.

Learners differ in access to technology, educational opportunities, language, disability or special educational needs, digital confidence and previous gaming experience. These differences can affect both access to

DigPlay and assessment performance. Inclusive and accessible design is therefore necessary for both practical participation and fair assessment.

Transparency and responsible data use are integral to the assessment approach. Game-based assessment may generate information not only about task outcomes but also about learner actions and choices. The collection and use of such data needs to be proportionate and transparent, with appropriate safeguards for consent, access, privacy and data protection. Learners and educators also need to understand what is being assessed and how results are produced.

3.2 Recurring challenges

Altogether, the research findings identify a relatively clear set of challenges identified in the five countries:

1. assessing complex and transversal digital competences through meaningful tasks;
2. ensuring that the assessment reflects the intended competence rather than unrelated factors such as gaming experience;
3. making results understandable and useful to teachers and learners;
4. keeping the tool manageable for teachers and compatible with different educational settings;
5. accommodating differences in infrastructure and learners' prior digital experience;
6. ensuring accessibility and fair participation;
7. protecting learner data and explaining clearly how assessment information is generated and used.

These challenges are closely connected. For example, a more complex assessment activity may provide richer evidence of competence but may also increase technical demands, teacher workload or the influence of previous gaming experience. Similarly, collecting more detailed information about learner behaviour may support assessment but also increases the importance of data minimisation, transparency and privacy safeguards.

The development of DigPlay will therefore need to balance these considerations rather than optimise one of them in isolation.

4. DigPlay Requirements

4.1 How the requirements are presented

The requirements presented in this section translate the findings of the comparative research into priorities for the further design, development and implementation of DigPlay. They are derived from the combined evidence of the five national analyses, stakeholder consultation and mapping of existing assessment tools. The DigPlay Requirements Framework answers the following specific guiding questions:

Requirement category	Guiding question
1. Functional	What must the platform be able to do?
2. Pedagogical	What principles must the assessment follow?
3. Technical	Under what technical conditions must it operate?
4. User Experience	How easily and clearly must users be able to interact with it?
5. Inclusion & Accessibility	How do we prevent unnecessary barriers for different learners?
6. Data Protection & Ethical	How must learner data, transparency and fairness be handled?
7. Implementation	What is needed to introduce, support and test DigPlay in educational practice?

Priorities definition

Each requirement is assigned a priority level. Priority reflects both the strength and consistency of the research evidence and the expected importance of the requirement for the intended use of DigPlay. The priorities should therefore be understood as research-based development priorities rather than as final technical specifications.

Essential: Strongly and consistently supported by the research and necessary for the validity, fairness, accessibility, legal compliance or basic usability of DigPlay. Its absence could substantially compromise the intended assessment or its responsible use.

Important : Clearly supported by the research and expected to contribute substantially to the quality, usability or implementation of DigPlay, but not a prerequisite for its core assessment function.

Desirable: Supported or suggested by the research as potentially beneficial, but more context-dependent, relevant to later development, or not sufficiently strongly evidenced to be treated as a core requirement.

4.2 Functional Requirements

Code	Research finding	Functional requirement	Priority
FR-01	DigComp provides the common framework for defining the digital competences to be assessed through DigPlay.	DigPlay should provide a core DigComp-based assessment module through which learners complete practical and contextualised assessment activities.	Essential
FR-02	Existing assessment approaches often cover only selected aspects of digital competence rather than providing a comprehensive assessment across the full set of competences. At the same time, different learning situations may require different sets of competences to be assessed	DigPlay should provide a Complex Competence Assessment Module that supports assessment across the full set of DigComp competences as well as to allow separate assessment of competences and grouping them into various sets upon specific evaluation needs of the learning process.	Essential
FR-03	Teachers need concise, understandable information about learner performance and competence results.	The platform should provide a teacher reporting function that allows authorised educators to review relevant learner and/or group assessment results.	Essential
FR-04	Formative feedback can help learners understand their performance and areas for further development.	The platform should provide a learner feedback function presenting assessment results and relevant competence-based feedback in an understandable form.	Important
FR-05	For some digital competences, the learner's decisions and actions while completing a task provide important assessment evidence, not only whether the task was completed successfully.	The platform should be able to capture and store the learner's performance data during assessment activities and apply assessment indicators regarding it	Desirable
FR-06	Repeated assessment may provide useful information on competence development over time, although WP2 did not establish it as a core need.	The platform can allow comparison of results across assessment occasions.	Desirable
FR-07	Business respondents see value in a clear and concise profile of learners demonstrating digital competences, particularly to support the transition from education to employment.	The platform should allow learners to view and, where they choose, share a concise profile of their demonstrated digital competences, for example through digital badges, to support career orientation and transition to further education or employment.	Important

Based on these requirements, six functional modules can be proposed for DigPlay, covering the six core functionalities:

1. DigComp Assessment based on DigComp competences and evaluation relevant indicators
2. Competence Results (including not only the final score but integrating also the learner's performance during the assessment)

3. Teacher Reporting
4. Learner Feedback
5. Progress Monitoring
6. Learner Competence Profile

Their final configuration as modules should be determined during platform development.

4.3 Pedagogical Requirements

Code	Research finding	Requirement	Priority
PR-01	Across the five countries, digital competence is understood increasingly as the ability to apply knowledge, skills and attitudes rather than demonstrate factual knowledge.	Competence-based assessment: DigPlay assessment should focus on what learners can do with their digital competences, rather than primarily on what they know about digital technologies.	Essential
PR-02	The comparative analysis identifies a need to assess digital competence in practical and meaningful situations, particularly for problem-solving, information evaluation and responsible digital behaviour.	Real-life relevance: Assessment activities should, where appropriate, place competences in meaningful contexts that reflect situations in which they are used outside the assessment itself.	Essential
PR-03	For some digital competences, the learner's decisions, strategies and actions provide relevant evidence that cannot be captured from the final outcome alone.	Evidence-based assessment: Assessment should use evidence that is appropriate to the competence being assessed, considering both outcomes and the process of task completion where relevant.	Essential
PR-04	Stakeholders see value in assessment that helps learners understand and further develop their digital competences rather than being used only to measure performance	Assessment for learning: Assessment should help learners understand their current competence and support further development, rather than serving only as a measurement exercise.	Important
PR-05	Digital competence develops across different areas and levels, and the needs analysis points to substantial differences in learners' starting points and experience.	Progression: Assessment should allow competence to be interpreted in terms of progression, recognising different levels of development rather than treating competence simply as present or absent.	Important
PR-06	Learner performance may be affected by factors that are not part of the digital competence being assessed, including previous gaming experience.	Fair assessment: Assessment design should minimise the influence of abilities or previous experience that are not relevant to the competence being assessed.	Essential

4.4 Technical Requirements

The initial technical parameters of the new software tool are defined in the Project Management Handbook. These include an open-source approach, compliance with WCAG 2.1 AA and GDPR requirements, support for at least five languages, and encrypted hosting. WP5 further covers the technical architecture, access to external games with continuity of learner progress, open-source deployment, security audits, maintenance, and public availability for at least three years after the end of the project.

In addition to these predefined parameters, the technical requirements presented below are derived from the research findings, primarily from the views and practical experience of the experts consulted. As respondents have different levels of technical expertise, these requirements reflect their experience of the conditions and constraints in which DigPlay would need to operate rather than detailed software specifications.

Code	Research finding	Requirement	Priority
TR-01	School equipment and device capacity vary within and between countries, and some schools operate with older or lower-specification hardware.	DigPlay should run on commonly available school computers and devices without requiring advanced graphics capabilities or specialised gaming hardware.	Essential
TR-02	Schools use different devices, operating systems and digital environments, while restrictions on software installation may apply in institutional settings.	DigPlay should support commonly used web browsers and operating systems and should minimise the need for local software installation.	Essential
TR-03	Connectivity quality varies across schools and learner contexts, and connection interruptions can affect loading, authentication and the saving of assessment data.	The platform should automatically save learner progress and allow interrupted assessment sessions to be resumed without loss of assessment data.	Essential
TR-04	Schools use different account and authentication arrangements, and account creation and access can create practical implementation barriers.	The platform should support simple and flexible user authentication options appropriate to school use, including compatibility with existing school accounts where feasible.	Important
TR-05	Schools already operate within heterogeneous digital environments and use different learning and management platforms.	DigPlay should be capable of operating alongside existing school digital environments and, where required, support appropriate integration or data exchange with existing systems.	Important
TR-06	Network capacity, local storage and technical support are limited in some educational settings.	The platform should minimise large downloads, frequent high-volume updates and unnecessary demands on local storage or network capacity.	Important
TR-07	Technical problems related to accounts, access, updates, connectivity and troubleshooting can become an additional burden for teachers where dedicated support is unavailable.	DigPlay team should provide clear technical support, troubleshooting, and account recovery mechanisms for participating schools and users.	Important
TR-08	Long-term adoption depends on the continued technical availability and maintenance of the platform beyond initial implementation and piloting.	The technical model should provide for platform maintenance, updates and continued access to the platform and stored results.	Important

4.5 User Experience Requirements

Code	Research finding	Requirement	Priority
UXR-01	Stakeholders see engagement as one of the main potential advantages of game-based assessment, but emphasise that the game format should not distract from the assessment purpose.	Learner activities should provide an engaging experience while keeping the assessment task, instructions and expected actions clear throughout the activity.	Important
UXR-02	Previous gaming experience may influence learner performance independently of the digital competence being assessed. Stakeholders specifically warn against complex gaming conventions, menus and rapid-reaction requirements.	Navigation and interaction should be simple, consistent and based on controls that do not require advanced gaming experience or specialised gaming conventions.	Essential
UXR-03	Learners need to understand how to navigate the environment and what is expected of them before assessed performance begins.	DigPlay should provide concise instructions and, where needed, a non-assessed orientation or familiarisation activity before assessment starts.	Essential
UXR-04	Familiar layouts and interaction patterns can reduce the learning curve and make the platform easier for both learners and teachers to use.	Interface design should use clear and consistent interaction patterns and, where appropriate, draw on conventions familiar from digital environments already commonly used in schools.	Important
UXR-05	Teacher workload and limited time are major barriers to adoption. Teachers need assessment tools that can be used within normal classroom routines without complex administration.	The teacher interface should minimise the number and complexity of steps needed to prepare, assign, launch and review an assessment activity.	Essential
UXR-06	Teachers need assessment outputs that can be understood and used without advanced analytical expertise or substantial additional interpretation.	Teacher-facing results should be presented in a clear and intuitive format, with concise explanations and actionable information for follow-up.	Essential
UXR-07	Learner feedback needs to be understandable and appropriate to the target group's age and experience.	Learner-facing results and feedback should use clear, age-appropriate language and present information in a form that learners can understand without teacher interpretation.	Important

4.5 Inclusion and Accessibility Requirements

Code	Research finding	Requirement	Priority
IAR-01	Learners differ in ability, socio-economic circumstances, language, digital confidence and access to technology and support. Some groups have fewer opportunities to develop digital competence outside school.	DigPlay should be designed and tested with diverse learner groups, including learners from under-resourced backgrounds, rather than assuming a single learner profile.	Essential
IAR-02	Learners with disabilities and additional educational needs may face barriers in accessing instructions and content, navigating digital environments and interacting with assessment activities. The Irish research specifically highlights Universal Design for Learning (UDL), assistive technologies and adaptive approaches as ways to support inclusive participation.	DigPlay should comply with WCAG 2.1 AA and, where appropriate, support assistive technologies and adaptable ways of presenting content and interacting with assessment activities, without changing the competence being assessed.	Essential
IAR-03	Stakeholders identify fairness as an important assessment concern. Factors unrelated to the intended digital competence, such as interface complexity, previous gaming experience or other irrelevant task demands, may affect learner performance.	Assessment design should support fairness by minimising the influence of factors unrelated to the digital competence being assessed.	Important
IAR-04	Language proficiency can affect learners' understanding of instructions and scenarios independently of their digital competence.	Assessment instructions and relevant learner-facing content should be available in the languages required for implementation and written in clear, accessible language.	Essential
IAR-05	Examples, scenarios and references may not be equally understandable or appropriate across the five national and cultural contexts.	Assessment content should allow linguistic and cultural localisation without changing the underlying competence or assessment criteria.	Important
IAR-06	Complementary evidence indicates gender-related differences in average game preferences and gaming motivations, which may affect familiarity and engagement with particular types of gameplay. (See the table below)	DigPlay should provide diversity in game scenarios, themes and interaction styles to avoid systematically favouring the gaming preferences of one gender.	Important
IAR-07	The national reports emphasise the need to test DigPlay with diverse learners and educational settings before wider implementation, including to identify accessibility and	Piloting should examine whether assessment tasks or interfaces create systematic disadvantage for relevant learner groups and identify necessary adaptations.	Important

inclusion issues that cannot be fully anticipated during design.

Gender considerations in game design

Gender did not emerge as a specific concern in the WP2 stakeholder research. However, complementary evidence from international research on youth gaming experience indicates differences in average game preferences and motivations between male and female players. The data show particularly visible differences in preferences for some game genres: sports, shooter and fighting games are more frequently preferred by male players, while puzzle games, for example, are considerably more frequently preferred by female players. Differences have also been observed in gaming motivations, including competition, challenge, story, design and completion. More detailed genre data on genre preferences are presented in Annex 1.

These differences should not be interpreted as fixed preferences of individual boys and girls. They are nevertheless relevant to DigPlay because the choice of game genres, themes and interaction styles may influence learners' familiarity with and engagement in assessment activities. A platform relying predominantly on a narrow type of gameplay could therefore unintentionally favour some learners over others for reasons unrelated to their digital competence. DigPlay should consequently provide diversity in game scenarios, themes and interaction styles rather than relying predominantly on a single game genre or gaming convention. Gender differences in engagement and assessment performance should also be examined during piloting.

4.7 Data Protection and Ethical Requirements

Code	Research finding	Requirement	Priority
DER-01	Data protection is one of the main ethical and privacy concerns identified by stakeholders.	Personal and assessment data should be processed in accordance with GDPR and the project's data-management requirements.	Essential
DER-02	Informed consent is the most frequently identified ethical/privacy issue among stakeholders expressing concerns.	Users and, where applicable, parents or legal guardians should receive appropriate information and consent procedures should correspond to the intended data processing and applicable legal requirements.	Essential
DER-03	Stakeholders expect transparency about what is assessed and how results are produced.	Users should receive appropriate information about the competences assessed and the basis on which performance is interpreted.	Essential
DER-04	Access to learner data is a prominent stakeholder concern.	Access to identifiable learner and assessment data should be controlled through clearly defined roles and permissions.	Essential

DER-05	Stakeholders express concern about follow-up tracking of learner behaviour.	DigPlay should collect only the data necessary for the defined assessment, and operational purposes.	Important
DER-06	Stakeholders expect assessment results to be understandable and capable of explanation.	Assessment outputs should enable learners and educators to understand the competence basis of the result.	Important
DER-07	Fairness is a recurring concern, particularly where behaviour during gameplay contributes to assessment.	Assessment methodology and piloting should examine whether performance is influenced by factors unrelated to the intended competence.	Desirable
DER-08	Experts anticipate that DigPlay may potentially incorporate automated or AI-supported functionality.	The project should assess the applicability of the EU AI Act to the final intended functionality, including whether functionality would fall within the high-risk category for AI systems used in education and vocational training and implement any applicable obligations.	Important

4.8 Implementation Requirements

Code	Research finding	Requirement	Priority
IR-01	Insufficient teacher and specialist capacity is the most frequently reported barrier to digital competence assessment among education and NGO stakeholders.	DigPlay implementation should include concise, practical guidance and appropriate training or support for educators responsible for using the tool.	Essential
IR-02	Existing digital competence assessment practices differ between countries, schools and educational settings, and no single implementation model predominates.	DigPlay should be introduced in a way that allows it to complement existing teaching and assessment practices rather than requiring their replacement.	Essential
IR-03	National and school contexts differ in curriculum organisation, institutional arrangements and established assessment practice.	The implementation model should allow the way DigPlay is introduced and organised to be adapted to the relevant national and institutional context while retaining its common assessment principles.	Important
IR-04	Stakeholders perceive the DigPlay concept positively in general, but concerns remain about whether a game-based assessment approach will be adopted in education systems.	Implementation should clearly communicate to educators and other relevant stakeholders the purpose of DigPlay, how it is intended to be used, and the role of its results alongside existing assessment practice.	Important
IR-05	The comparative research identifies substantial differences in learner characteristics, school conditions and educational contexts that cannot be fully addressed through the needs analysis alone.	Before wider implementation, DigPlay should be piloted in sufficiently diverse educational settings to test its practical usability and identify implementation adaptations that may be required.	Essential

IR-06	WP2 identifies several factors that may affect implementation, including teacher capacity, accessibility, gaming experience and technical conditions, but cannot establish their effects before the tool is tested in practice.	Pilot implementation should use a common evaluation framework to document implementation barriers, user experience and necessary adaptations across participating contexts.	Important
IR-07	The stakeholder consultation included NGOs, training organisations and companies, while the mapped practices also include approaches relevant to non-formal learning contexts.	Implementation guidance, training and support should address youth workers and business volunteers, where relevant, and enable DigPlay to be used in non-formal learning settings as well as in formal education.	Important

Summary of priority requirements

Priority area	Consolidated requirement
1. Valid assessment of digital competence	DigPlay should assess clearly defined digital and transversal competences and minimise the influence of unrelated factors, particularly gaming experience.
2. Transparent DigComp alignment	Assessed competences, tasks, observable evidence and results should have clear and transparent connection with DigComp.
3. Real-life relevance	Where appropriate, assessment should use practical and contextualised situations in which learners demonstrate competence through relevant actions, choices and outputs.
4. Usable feedback and reporting	Results should be understandable and useful to learners and teachers without creating substantial additional assessment workload.
5. Inclusive and accessible assessment	DigPlay should address diverse learner needs and minimise barriers associated with disability, language, socio-economic conditions, digital experience and gaming familiarity.
6. Responsible and transparent data use	Learner data should be collected and processed lawfully and transparently, with appropriate consent, access control and explanation of assessment use.
7. Practical implementation in different educational contexts	DigPlay should operate under varied school conditions, require manageable teacher input and complement rather than replace existing assessment practice.
8. Validation before wider implementation	Assessment validity, fairness, accessibility and practical usability should be tested with diverse learners and educational settings before wider implementation.

5. Conclusions and Recommendations

The comparative research across Bulgaria, Croatia, Ireland, Italy and Slovenia shows considerable variation in national education systems, digital infrastructure and existing assessment practices. At the same time, the research identifies several common needs that are relevant to the development of DigPlay.

Digital competence is recognised as an important educational priority in all five countries, and DigComp provides a common European reference point. The main gaps identified by the research concern not basic access to technology, but the development and assessment of more complex digital competences. These include critical evaluation of information, problem solving, digital content creation, safe and responsible behaviour, and transversal competences applied in digital environments. AI is introducing new competence needs, particularly regarding critical evaluation, responsible use, privacy and the interpretation of AI-generated content.

The research also shows that digital competence is already assessed through a variety of methods and tools. These include tests, practical tasks, projects, portfolios, self-assessment instruments and digital learning platforms. However, these approaches cover different aspects of competence and are not equally suited to assessing transversal competences or learner performance in practical situations. The mapping of existing tools confirms this diversity: useful features and practices already exist, but they are distributed across tools designed for different purposes.

Stakeholders are generally open to game-based assessment. Their responses nevertheless make clear that the value of such an approach will depend on what is assessed and how, rather than on the use of games itself. The assessment needs to maintain a clear relationship between the task, the learner's performance and the competence being assessed. It also needs to limit the influence of factors such as previous gaming experience that are not part of the intended competence.

Implementation conditions are equally important. Teacher capacity and available time, differences in school infrastructure, accessibility, learner diversity and data protection were all identified as factors that may affect practical use. These conditions vary between and within countries and should therefore be considered during development and piloting.

Overall, the research results do not indicate opposition to DigPlay. They show that stakeholders expect learner data and the assessment process to be clearly explained and appropriately protected. These issues are therefore relevant not only to legal compliance but also to acceptance of the tool.

Critical success factors

The comparative evidence suggests that the success of DigPlay will depend on the balance between assessment quality and practical usability. A technically sophisticated platform would have limited value if teachers find it difficult to use or if learners' results are strongly influenced by familiarity with gaming. Conversely, a highly engaging game would have limited assessment value if the relationship between gameplay and digital competence is unclear.

A second critical factor is the combination of consistency and adaptability requires a sufficiently common assessment basis to retain a clear relationship with DigComp across the participating countries, while allowing practical adaptation to different languages, educational settings and learner needs.

A third factor is validation through use. WP2 provides evidence for defining the initial requirements, but it cannot establish whether the resulting assessment tasks will perform as intended. This can only be examined during development and piloting with actual users and across different contexts.

Annex 1. Complementary Evidence on Gender and Gaming Preferences Relevant to DigPlay Design

The data from the international survey conducted among over 24,000 active video game players in 21 countries indicate substantial gender differences in average preferences for several game genres. The largest contrasts are visible for puzzle games, which are more frequently preferred by female players, and sports, shooter and fighting games, which are more frequently preferred by male players. These differences do not imply that particular genres are inherently “male” or “female”, nor that individual learners will follow these patterns. They indicate, however, that relying heavily on a single genre or type of gameplay may create differences in familiarity, engagement and motivation that are unrelated to the digital competence being assessed.

Preferred game genre	Male players	Female players
Action	53%	38%
Puzzle	39%	62%
Fighting	38%	26%
Shooter	38%	23%
Sports	38%	20%
Racing / vehicle simulation	31%	24%
Simulation	24%	27%
Skill & chance	22%	31%

Source: Entertainment Software Association, *Power of Play: Global Report 2025*.

Annex 2. Quantitative Stakeholder Survey Results

S1 Are you personally involved in one or more of the following activities:

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Italy	Slovenia
	104	24	22	22	14	22
Teaching digital competences to students in secondary and VET settings	38.5%	14	8	5	6	7
Assessment /Evaluation of digital competences (DCs)	28.8%	9	10	6	2	3
Developing policies regarding digital competences	22.1%	7	6	6	0	4
Developing assessment methodologies	15.4%	7	3	5	1	0
Developing tools for teaching DCs only	17.3%	5	2	4	1	6
Developing tools for teaching & assessment of DCs	16.3%	4	5	5	1	2
Developing tools for DC assessment only	3.8%	2	2	0	0	0
Researching on digital competences	27.9%	7	9	8	2	3
Other activities related to digital competences	54.8%	10	10	14	7	16

S2 The organisation you work at is a/an:

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Italy	Slovenia
	104	24	22	22	14	22
NGO	7.7%	4	3	0	0	1
School	35.6%	8	8	6	14	1
College	1.9%	0	0	0	0	2
University	13.5%	3	3	5	0	3
Company	19.2%	5	3	4	0	8
Freelancer (IT sector)	1.9%	1	0	1	0	0
Training center	1%	0	0	1	0	0
State administration	9.6%	2	3	2	0	3
Software development company	1.9%	0	1	1	0	0
Other	3.8%	0	0	1	0	3
NGO with its own business activities	3.8%	1	1	1	0	1

A1 In your opinion, for which of the following groups is it necessary to assess digital competences (DCs):

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Italy	Slovenia
	77	18	17	15	14	13
School students	85.7%	18	16	12	8	12
University students	70.1%	15	13	12	6	8
School teachers with IT specialisation	45.5%	9	9	7	5	5
All school teachers	71.4%	17	15	4	12	7
Applicants for a job	54.5%	12	11	8	4	7
Applicants for universities /colleges	33.8%	9	7	5	1	4
Employees at the state administration	61%	11	12	8	9	7
Other groups	18.2%	2	1	5	0	6

A2 Are the digital competences of secondary school students in our country assessed in any way?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Italy	Slovenia
	77	18	17	15	14	13
Yes	54.5%	15	10	8	7	2
No	23.4%	2	1	3	6	6
Can't answer /Don` t know	22.1%	1	6	4	1	5

A3 Are the digital competences of students in VET schools assessed in any way?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Italy	Slovenia
	77	18	17	15	14	13
Yes	39%	13	8	4	3	2
No	20.8%	1	3	1	2	9
Can,t answer /Don't know	40.3%	4	6	10	9	2

A4 DigComp 3.0: Which of these competences are assessed in some way for students in secondary schools or VET settings?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Italy	Slovenia
	77	18	17	15	14	13
Browsing, searching and filtering information	44.2%	12	10	3	9	0
Evaluating information	36.4%	10	8	4	6	0

Managing information	26%	8	3	4	5	0
Can't answer	49.4%	5	6	10	4	13

A4 DigComp 3.0: Which of these competences are assessed in some way for students in secondary schools or VET settings?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Italy	Slovenia
	77	18	17	15	14	13
Interacting through and with digital technologies	35.1%	8	9	4	6	0
Sharing through digital technologies	35.1%	9	11	3	4	0
Engaging in citizenship through digital technologies	18.2%	5	5	1	3	0
Collaborating through digital technologies	28.6%	8	7	2	5	0
Digital behaviour	33.8%	6	10	2	8	0
Managing digital identity	19.5%	5	6	1	3	0
Can't answer	50.6%	7	5	11	3	13

A4 DigComp 3.0: Which of these competences are assessed in some way for students in secondary schools or VET settings?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Italy	Slovenia
	77	18	17	15	14	13
Developing digital content	45.5%	11	11	3	10	0
Integrating and re-elaborating digital content	31.2%	10	6	3	5	0
Copyright and licences	20.8%	7	8	0	1	0
Computational thinking and programming	37.7%	11	12	3	3	0
Can't answer	48.1%	6	4	11	3	13

A4 DigComp 3.0: Which of these competences are assessed in some way for students in secondary schools or VET settings?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Italy	Slovenia
	77	18	17	15	14	13
Protecting devices	26%	8	10	1	1	0
Protecting personal data and privacy	40.3%	7	13	3	7	1
Supporting wellbeing	26%	6	8	2	3	1
Environmental impacts of digital technologies	23.4%	7	8	1	2	0
Can't answer	54.5%	9	4	12	5	12

A4 DigComp 3.0: Which of these competences are assessed in some way for students in secondary schools or VET settings?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Italy	Slovenia
	77	18	17	15	14	13
Identifying and solving technical problems	32.5%	10	10	3	2	0
Identifying needs and digital technological responses	18.2%	9	4	1	0	0
Identifying creative solutions using digital technologies	31.2%	9	8	3	4	0
Identifying and addressing digital competence needs	15.6%	6	3	2	1	0
Can't answer	55.8%	6	6	11	7	13

A5 Are there any tools used to assess the digital competences of students in school or VET settings in our country - either tools you know of, have personally used, or have simply heard about?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Italy	Slovenia
	61	17	14	14	12	4
Yes, I have used such a tool/s	31.1%	12	2	4	0	1
Yes, I know there are some, but I haven't used them	23%	1	7	2	4	0
No, there are no any tools - as far as I know	45.9%	4	5	8	8	3

P1 Are there any challenges and barriers to assessing the digital competences of school students in our country?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Italy	Slovenia
	76	17	17	15	14	13
Yes	77.6%	12	9	13	12	13
No	3.9%	1	1	0	1	0
Can't says	18.4%	4	7	2	1	0

P2 Which are the challenges and barriers to assessing the digital competences of school students in our country?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Italy	Slovenia
	76	17	17	15	14	13
Not enough competent teachers/specialists to use these tools	77.6%	13	11	12	11	12
No tools for DC assessment	46.1%	7	12	7	3	6
There are no tools that assess the DC in real-life situation	39.5%	9	6	6	4	5
There are many conservative people in the educational system	32.9%	3	7	4	7	4
Other	31.6%	6	2	9	1	6

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P3 Are there groups of students whose needs related to digital competences are not being addressed, for example, those from vulnerable groups or other underserved communities?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Italy	Slovenia
	76	17	17	15	14	13
Yes	39.5%	9	4	10	2	5
No	15.8%	3	2	0	2	5
Can't says	44.7%	5	11	5	10	3

P5 Are there policies / regulations in our country that are related to DC assessment at schools?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Italy	Slovenia
	76	17	17	15	14	13
No, there are none	9.2%	2	1	1	1	2
I have heard there are some but I am not informed which are	15.8%	2	1	1	4	4
Yes, there are EU policies	36.8%	8	9	6	1	4
Yes, there are national policies	31.6%	7	7	5	2	3
Yes, there are local /institutional policies	15.8%	6	1	5	0	0
Can't answer	26.3%	1	6	4	6	3

P6 Based on your observations, are these policies and regulations applied in schools?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Italy	Slovenia
	38	12	9	9	3	5
Yes	10.5%	1	1	1	1	0
To some extent	57.9%	9	6	4	2	1
No	10.5%	1	1	1	0	1
Can't answer	21.1%	1	1	3	0	3
	38	12	9	9	3	5
Yes	21.1%	1	2	2	2	1
To some extent	47.4%	7	6	2	1	2
No	2.6%	0	0	1	0	0
Can't answer	28.9%	4	1	4	0	2
	38	12	9	9	3	5
Yes	18.4%	3	0	2	2	0
To some extent	31.6%	4	5	2	1	0
No	5.3%	0	1	1	0	0
Can't answer	44.7%	5	3	4	0	5

P7 Are there organisations, institutes or companies that are specialized in assessment of digital competences at secondary or VET schools?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Italy	Slovenia
	49	14	10	10	7	8
Yes	36.7%	6	5	4	2	1
No	22.4%	1	1	3	3	3
Can't says	40.8%	7	4	3	2	4

P10 Do you know any specialists / experts in the field of assessment of DC in our country?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Italy	Slovenia
	76	17	17	15	14	13
Yes	22.4%	6	5	3	2	1
No	77.6%	11	12	12	12	12

D1 What do you think of this CONCEPT DigPlay?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Italy	Slovenia
	104	24	22	22	14	22
1 The idea is very good as this tool will be very useful for the students	67.3%	18	13	17	8	14
2 The idea is very good as this tool will facilitate the work of the teachers	52.9%	16	11	12	6	10
3 The idea is very good but I doubt that the execution of such a tool would be possible	7.7%	1	0	0	1	6
4 The idea is very good but I doubt it would be appreciated and adopted in our educational system	32.7%	5	11	3	4	11
5 I do not like the idea computer games to be used for learning and assessment of competences	1.9%	1	0	1	0	0
Other	18.3%	2	1	10	2	4

D4 Do you see any ethical, privacy or transparency concerns related to assessing students digital competences through gameplay?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Italy	Slovenia
	104	24	22	22	14	22
Yes	54.8%	8	13	18	3	15
No	34.6%	11	6	4	9	6
Can't says	10.6%	5	3	0	2	1

D4_1 If yes, what should be addressed?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Italy	Slovenia
	57	8	13	18	3	15
Informed consent	82.5%	6	13	15	3	10
Transparency of assessment criteria	68.4%	6	10	14	3	6
Access to student data	66.7%	5	7	17	3	6
Data protection	80.7%	5	12	18	2	9
Fairness /competence of the assessment	57.9%	3	7	13	1	9
Avoiding excessive tracking	56.1%	5	9	13	2	3
Explanation/justification of the results	64.9%	6	11	12	1	7

B1 Do you think such idea would be applicable to DC assessment for the needs of business organisations?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Slovenia	
	28	7	5	7	9	
Yes for assessment of the new recruits /applicant for a job	50%	5	3	5	1	
Yes, for assessment of existing employees competences	10.7%	0	0	0	3	
Not applicable in our business	3.6%	0	0	0	1	
I can't answer	35.7%	2	2	2	4	
	18	5	3	5	5	
Very useful	72.2%	4	2	4	3	
Mostly useful	16.7%	1	1	0	1	
Partly useful	5.6%	0	0	1	0	
I cannot say /not relevant to my role	5.6%	0	0	0	1	

B3 Which of the following digital skills are most important for entry-level hires for your organization?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Slovenia	
	28	7	5	7	9	
Browsing, searching and filtering information	64.3%	6	5	4	3	
Evaluating information	64.3%	4	3	5	6	
Managing information	39.3%	2	1	4	4	
Can't answer	14.3%	1	0	1	2	

B3 Which of the following digital skills are most important for entry-level hires for your organization?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Slovenia	

		Bulgaria	Croatia	Ireland	Slovenia	
	28	7	5	7	9	
Interacting through and with digital technologies	64.3%	4	4	6	4	
Sharing through digital technologies	60.7%	2	5	6	4	
Engaging in citizenship through digital technologies	17.9%	0	2	3	0	
Collaborating through digital technologies	60.7%	3	4	6	4	
Digital behaviour	50%	2	3	6	3	
Managing digital identity	35.7%	3	2	4	1	
Can't answer	14.3%	1	0	1	2	

B3 Which of the following digital skills are most important for entry-level hires for your organization?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Slovenia	
	28	7	5	7	9	
Developing digital content	46.4%	4	3	3	3	
Integrating and re-elaborating digital content	42.9%	2	3	5	2	
Copyright and licences	35.7%	2	3	4	1	
Computational thinking and programming	35.7%	3	2	4	1	
Can't answer	28.6%	1	0	1	6	

B3 Which of the following digital skills are most important for entry-level hires for your organization?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Slovenia	
	28	7	5	7	9	
Protecting devices	46.4%	4	2	6	1	
Protecting personal data and privacy	75%	6	5	6	4	
Supporting wellbeing	35.7%	5	0	3	2	
Environmental impacts of digital technologies	25%	2	0	3	2	
Can't answer	14.3%	0	0	1	3	

B3 Which of the following digital skills are most important for entry-level hires for your organization?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Slovenia	
	28	7	5	7	9	
Identifying and solving technical problems	35.7%	3	0	5	2	

Identifying needs and digital technological responses	42.9%	5	1	4	2	
Identifying creative solutions using digital technologies	60.7%	2	3	6	6	
Identifying and addressing digital competence needs	25%	1	1	3	2	
Can't answer	14.3%	0	0	1	3	

B4 Which competences do new recruits most often lack?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Slovenia	
	28	7	5	7	9	
Browsing, searching and filtering information	28.6%	3	3	1	1	
Evaluating information	53.6%	4	4	4	3	
Managing information	35.7%	2	2	3	3	
Can't answer	21.4%	1	0	1	4	

B4 Which competences do new recruits most often lack?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Slovenia	
	28	7	5	7	9	
Interacting through and with digital technologies	21.4%	2	1	2	1	
Sharing through digital technologies	17.9%	0	3	2	0	
Engaging in citizenship through digital technologies	28.6%	6	0	2	0	
Collaborating through digital technologies	28.6%	0	3	3	2	
Digital behaviour	25%	2	2	3	0	
Managing digital identity	35.7%	3	2	4	1	
Can't answer	28.6%	1	1	1	5	

B4 Which competences do new recruits most often lack?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Slovenia	
	28	7	5	7	9	
Developing digital content	14.3%	2	1	1	0	
Integrating and re-elaborating digital content	17.9%	2	1	2	0	
Copyright and licences	50%	5	3	5	1	
Computational thinking and programming	39.3%	4	1	2	4	
Can't answer	21.4%	1	0	1	4	

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B4 Which competences do new recruits most often lack?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Slovenia	
	28	7	5	7	9	
Protecting devices	32.1%	2	2	3	2	
Protecting personal data and privacy	50%	3	3	5	3	
Supporting wellbeing	10.7%	1	1	1	0	
Environmental impacts of digital technologies	25%	3	1	2	1	
Can't answer	28.6%	2	0	2	4	

B4 Which competences do new recruits most often lack?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Slovenia	
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Identifying and addressing digital competence needs	17.9%	2	1	1	1	
Can't answer	21.4%	1	0	3	2	

B5 Which of these DCs, you think, will be of significant importance for your sector over the next 3-5 years?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Slovenia	
	28	7	5	7	9	
Browsing, searching and filtering information	32.1%	4	2	2	1	
Evaluating information	71.4%	6	5	5	4	
Managing information	53.6%	4	5	2	4	
Can't answer	14.3%	0	0	1	3	

B5 Which of these DCs, you think, will be of significant importance for your sector over the next 3-5 years?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Slovenia	
	28	7	5	7	9	

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Sharing through digital technologies	21.4%	1	2	2	1	
Engaging in citizenship through digital technologies	32.1%	5	0	4	0	
Collaborating through digital technologies	57.1%	6	3	5	2	
Digital behaviour	39.3%	3	3	5	0	
Managing digital identity	46.4%	3	2	5	3	
Can't answer	17.9%	0	0	1	4	

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	All respondents	Country				
		Bulgaria	Croatia	Ireland	Slovenia	
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Integrating and re-elaborating digital content	39.3%	3	3	3	2	
Copyright and licences	42.9%	2	4	5	1	
Computational thinking and programming	32.1%	2	2	3	2	
Can't answer	25%	2	0	1	4	

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	All respondents	Country				
		Bulgaria	Croatia	Ireland	Slovenia	
	28	7	5	7	9	
Protecting devices	25%	2	1	3	1	
Protecting personal data and privacy	57.1%	5	4	5	2	
Supporting wellbeing	50%	4	4	4	2	
Environmental impacts of digital technologies	50%	3	2	4	5	
Can't answer	17.9%	0	0	1	4	

B5 Which of these DCs, you think, will be of significant importance for your sector over the next 3-5 years?

	All respondents	Country				
		Bulgaria	Croatia	Ireland	Slovenia	
	28	7	5	7	9	
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Identifying creative solutions using digital technologies	64.3%	5	4	5	4	

Identifying and addressing digital competence needs	32.1%	3	2	1	3	
Can't answer	14.3%	1	0	1	2	

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