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## **DIGITAL COMPETENCE ASSESSMENT FRAMEWORK FOR PRIMARY AND SECONDARY SCHOOLS IN EUROPE: THE CRISS PROJECT**

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### **Summary**

This paper presents the Digital Competence Assessment Framework for primary and secondary schools in Europe developed in the H2020 CRISS project. A qualitative approach consisting of an integrative literature review and input from experts and teachers from seven European countries was used to validate the construct. The framework adopts the approach of integrative pedagogy for implementation within the school curriculum, structuring learning through competences in various syllabus specifications focusing on the digital competence. It proposes a process based on a set of assessment scenarios that use several methods for gathering learning evidence and implement rules to ensure validity and reliability. In this sense, the scalability and flexibility of the entire proposal is one of the strengths of the system and makes the solution transferable to similar contexts using a Competence-Based Education (CBE) approach.

### **Introduction**

Competence assessment is an essential component in the learning and teaching process and should promote learning as well as measure or certify outcomes (Clements & Cord, 2013). There have been significant changes in the approaches to teaching and learning in secondary schools with the advent of new technologies and the adoption of active pedagogies such as game-based learning, flipped classroom and project-based learning. Whilst ICT have promoted changes in our understanding of how curricula might be designed and delivered, there are few developments focusing on a consistent method to support competence assessment by teachers and intelligent systems (Guàrdia, Crisp, & Alsina, 2016).

To respond to this challenge, CRISS (demonstration of a scalable and cost-effective cloud-based digital learning infrastructure through the certification of digital competences in primary and secondary schools), an H2020 project funded by the European Commission, was born with the goal of developing a solution for the implementation, assessment and certification of the digital competence (DC) within European schools.

A detailed definition of DC suggested by Ferrari (2012; p.3) was adopted in our research: “Digital Competence is the set of knowledge, skills, attitudes (thus including abilities, strategies, values and awareness) that are required when using ICT and digital media to

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perform tasks; solve problems; communicate; manage information; collaborate; create and share content; and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, reflectively for work, leisure, participation, learning, socializing, consuming, and empowerment”. On the basis of this definition, CRISS proposed a Digital Competence Assessment Framework that implements a DC operational concept of five areas and 12 sub-competences with associated performance criteria and indicators.

Although the assessment system proposed by the CRISS project aims to evaluate and certify DC, the proposal can also be applied to other key competences (Guàrdia, Maina, & Julià, 2017). In this sense, its scalability and flexibility is one of the strengths of the system and makes the solution transferable to similar contexts using a Competence-Based Education (CBE) approach.

### **Competence-Based Education**

There is growing interest in Competence-Based Education (CBE), particularly in relation to the assessment of competences. Despite there being several concurrent definitions of a competence (Baartman et al., 2007; Biemans et al., 2004), one of the most comprehensive states that a competence consists of an integrated set of knowledge, skills and attitudes that can be activated in a context to solve a problem or deal with a situation. Therefore, a competence is not only reduced to cognitive elements (theories, concepts and knowledge), but also includes functional aspects (skills), interpersonal attributes (organisational and social capacities) and ethical values (Cedefop, 2008). This notion is also confirmed by a rigorous recent analysis of the best known international competence frameworks carried out by the EU working group for a Council recommendation on Key Competences for Lifelong Learning (SWD, 2018), which concludes that all the studied frameworks “define knowledge, skills and attitudes as key elements of a competence” (p.19).

The challenge of a competence-based approach in education dates back to the 1950s when “CBE was coined as a general concept, based on the ideas of mastery learning and criterion-referencing of assessment. Learning, teaching and organisation should be guided by clearly specified (minimum) competencies to be demonstrably acquired” (Lassnigg, 2015; p.10). However, European education systems have only begun focusing their efforts to introduce CBE into school curricula in recent years.

The European Recommendation on Key Competences for Lifelong Learning promoted a competence-based approach in EU member states’ education systems, based on the idea that: “As globalisation continues to confront the European Union with new challenges, each citizen will need a wider range of key competences to adapt flexibly to a rapidly changing and highly interconnected world.” (EU, 2006; p. L 394/13). Key competences are defined as “those that all people need for their fulfilment and personal development, for active citizenship, for social inclusion and for employment” (idem) and they are identified as:

*“Communicating in a mother tongue, Communicating in a foreign language, Mathematical, scientific and technological competence, Digital competence, Learning to learn, Social and civic competences, Sense of initiative and entrepreneurship, and Cultural awareness and expression.”*

The working group (SWD, 2018) also presents the main challenges and difficulties of implementing these frameworks in schools, concluding that “translating key competences into learning outcomes is a major step to overcome difficulties in implementation”. In addition, Halász and Michel (2011) state that

*“there are significant differences between countries in their way of interpreting the notion of competence and of translating it according to their national contexts. [...] Countries differ not only in the strength of the commitment of key policy actors to the idea of competence-based education, but also in their capacities to implement complex curriculum reforms aimed at altering school level pedagogical approaches” (p.303).*

## **Competence assessment and the pedagogy of integration**

In order to overcome these challenges, we developed a competence assessment methodology for the CRISS project that led us to explore how teachers can better understand the concept of CBE and how it should be implemented into the school curriculum.

Roegiers proposes the introduction of a competence approach in schools as a response to the shortcomings of the objective-based pedagogy with the idea of a “pedagogy of integration”. The pedagogy of integration focuses on learning (mastering) competences, instead of acquiring isolated skills (Roegiers & Ketele, 2000). The goal of integration is to enable students to master situations that they will have to deal with in their lives.

As Boukhentache (2016) concludes, the main contribution of the pedagogy of integration is “its effort to structure learning through competencies by framing specific guidelines for implementation and evaluation of competencies through various syllabus specifications” (p.450).

In a thorough and systematic review of 21<sup>st</sup> century skills, Lai and Viering (2012) provided a set of recommendations for competence assessment, summarised in six recommendations to provide advanced solutions for the assessment of competences:

- Assessment systems should provide multiple measures that support the triangulation of inferences.
- Assessment tasks should be of sufficient complexity and/or offer sufficient challenge.
- Assessments should include open-ended tasks.
- Assessments should use tasks that establish meaningful and/or authentic, real-world problem contexts.

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- Assessment tasks should strive to make student reasoning and thinking visible.
- Assessments should explore innovative approaches to address scalability concerns.

The CRISS project provides a way to integrate the complexity of DC and the necessary simplification and adaptation to implement it in schools. Furthermore, the Digital Competence Assessment System (DCAS) adopts and adapts the pedagogy of integration as a general approach, follows Pepper's (2013) principles and adopts Lai and Viering's (2012) recommendations for competence assessment. The foundations and methodology leading to the development of a theoretical construct and the basis for a system supporting digital competence assessment and certification are presented in Guàrdia, Maina, and Julià (2017).

The Digital Competence Assessment System (DCAS) was developed in coordination with the deployment of a Digital Competence Operational Concept (DCOC) (Guitert, Romeu, & Baztán, 2017), addressed to primary and secondary schools. The DCOC is the result of an analysis and mapping of seven European digital competence frameworks and schemes already in use with the DigCom. The DCOC consists of five areas (digital citizenship, digital communication and collaboration, searching and managing digital information, digital content creation, and digital problem solving) that group 12 sub-competences and corresponding performance criteria which translate the competences into more concrete elements of what students should be able to demonstrate. Each performance criterion (PC) is assessed according to a set of indicators. These indicators are observable characteristics of the PC.

The DCAS and the DCOC are integrated into teaching practice in the schools through a set of Competence Assessment Scenarios (CAS). Each CAS integrates one or more subjects or disciplines from the school curriculum. They are designed on the basis of advanced instructional approaches where the learner or learners are required to solve problems, develop projects or search for solutions in realistic contexts and meaningful situations.

In this paper, we present the development of a set of CAS covering the whole DCOC framework, built with the participation of primary and secondary teachers from different countries and disciplines, European policymakers and experts in digital competence.

### **Competence Assessment Scenarios (CAS)**

In order to ensure the validity, reliability and equity of the assessment process, CRISS proposes the creation of Competence Assessment Scenarios (CAS) where digital competences are developed and evaluated in context according to a set of rules described below.

The CRISS Digital Competence Assessment Strategy establishes each area, sub-competence and performance criterion considering their relevance to the school context. In this sense, CAS are integrated into the school curriculum. At the same time, integration activities are those which enable the assessment of different competences and subjects in a specific learning scenario.

A CAS develops within a temporally bounded situation where disciplinary or interdisciplinary knowledge or knowledge subjects and digital competences are integrated in line with the school curriculum. Furthermore, a CAS adopts advanced instructional approaches in which the learner or learners play the central role in solving problems, developing projects or searching for solutions in realistic contexts and meaningful situations. CAS instructional approaches are macrostrategies that “set a general direction or trajectory for the instruction and are comprised of more precise or detailed components” (Reigeluth & Keller, 2009; p.31).

A CAS proposes a set of activities and tasks that enable the assessment of one or more performance criteria. In addition, a set of rules for areas, sub-competences, performance criteria and indicators has been defined to ensure the validity, reliability and equity of competence assessment. The most important of these is the *rule of 2/3*, which gives the student three opportunities (events) to practice each performance criterion. It is considered that there is mastery of a PC when it is successful achieved on two out of three occasions.

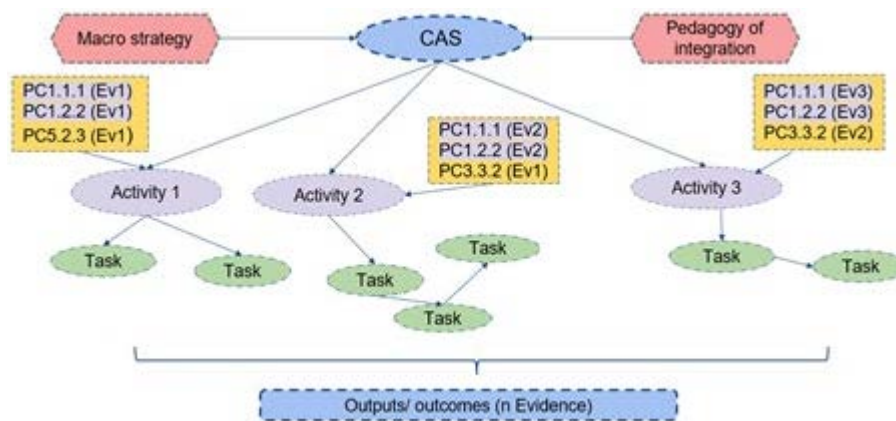


Figure 1. Principal elements of a Competence Assessment Scenario

In this example, the PC 1.1.1 (corresponding to Area 1 and sub-competence 1.1) is assessed three times (Ev1, Ev2 and Ev3) across the whole scenario. The same occurs with the PC 1.2.2 (corresponding to Area 1 and sub-competence 1.2).

### CAS design and validation

For the CRISS project, a creation process for the scenarios produced by a group of teachers has been set up. A CAS may be created from scratch or built by adapting an existing learning project, didactic unit, lesson plan or learning activity. In any case, creating a CAS requires a continuous process of review and refinement.

The methodological process behind the CAS design can be summarised in three steps: a first round of CAS creation based on a guide, a focus group to analyse the work done and a second round of CAS creation.

A guide detailing the procedure for designing a CAS was created and issued to the teachers. The guide proposes a work process and provides a template with detailed information about

how a CAS should be structured, all the elements that a CAS should contain (see Figure 1) and specific examples.

In the first round, a set of scenarios was created, and this was followed by an internal validation carried out on the basis of two checklists: one to verify whether the information was complete and in line with the CRISS methodological approach, and another to check which elements of the operational concept (areas, sub-competences and performance criteria) were covered by the scenarios. The internal validation of a single CAS depends on the ability to integrate digital competence within a disciplinary or interdisciplinary approach; the use of methodological strategies that favour active learning; the clear specification of assessment strategies, methods and instruments to collect evidence for assessment; the proper description of the learning activities and tasks, and the inclusion of all the resources/information needed to carry out the tasks.

After the first round, a focus group was carried out to gather the CAS creators' opinions about the creation process and how to improve it. The participants were nine CAS creators: eight participants with more than ten years of teaching experience, and one with more than five years. All of them have experience of teaching with digital technologies and introducing competence-based learning activities into their classes, and all except one introduced competence-based assessment activities in their classes. During the two-hour session, the creation process was analysed and several improvements were suggested.

Before sharing their opinions, the participants completed a questionnaire on the same topics they were later invited to discuss.

The questionnaire was composed of seven questions: two regarding the creation process, one about how this process could change the design of assessment activities, and four more about the future implementation of the CRISS assessment approach in schools.

The most relevant conclusions concerning the CAS creation process that resulted from the focus group and the questionnaire analysis are:

- Participants tend to agree with the statement “The CRISS assessment approach helps me to design the CAS”. (The average of an agreement scale from 1 to 4 was 3.6).
- CAS creation is easier when focused on a specific area from the DCOC framework, due to its extension.
- CAS creation is easier when based on the performance criteria.
- The CAS creation guide is rated as very useful. (The average of an agreement scale from 1 to 4 was 3.4). Some terms need to be clarified because of the different uses between countries.
- The creators find the template useful (The average of an agreement scale from 1 to 4 was 3.2), but too time-consuming due to the amount of detail it requests regarding the CAS.

Concrete suggestions for the second round of CAS design were shared with the creators (complete missing information, merge or fragment an activity, include additional PC in scenarios, improve the assessment instruments, etc.). The guide was also improved after the analysis conducted by the CAS creators.

In the second round, a second set of scenarios was created taking into account the suggestions provided and a second internal validation was carried out.

In the end, the methodological process followed ensures that:

- The CAS creation guide accomplishes the aim of helping creators to develop or adapt a CAS.
- Each CAS is complete and is in line with the CRISS methodological approach.
- The set of CAS covers all the elements of the Digital Competence Operational Concept.
- The set of CAS is in line with the Digital Competence Assessment System approach and requirements.

### **Next steps: pilots and external validation**

The next step of the CRISS project is a pilot involving more than 490 schools, including 25,400 students and 2,290 teachers across Europe. The Digital Competence Assessment System, the Digital Competence Operational Concept as well as the content and applicability of the set of CAS will be tested during the pilot process.

To carry out the external validation, two principal strategies have been developed:

- a set of semi-structured interviews with CAS creators and users regarding their experience of implementing the proposal, and
- a questionnaire addressed to teachers and students based on the 10 criteria for Competence Assessment Programmes (Baartman et al., 2007). The questionnaire includes statements to evaluate these 10 criteria: Authenticity, Cognitive complexity, Fairness, Meaningfulness, Directness, Transparency, Educational consequences, Reproducibility of decisions, Comparability, and Costs and efficiency.

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