Development of a Model for Transversal Competence Assessment in K-12: an Internal Validation Study for the Digital Competence

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Abstract. While competence-based education is gaining momentum in K-12, integration into the curriculum is still challenging. We present a Competence Assessment Model that supports creating scenarios that use several active methods for gathering learning evidence and implementing assessment rules. The study adopts a design and development research approach that spans three phases of conceptual development and model internal validation. The usability documentation method was applied to digital competence as a test case involving teachers, learning designers, and researchers across six European countries. Results confirm the model's effectiveness for supporting competence assessment design and identify key organisational issues and teacher challenges for its adoption.

Keywords: competence assessment, assessment model, active pedagogies, pedagogy of integration, transversal competence, K-12, internal validation, digital competence.

1 Introduction

The development of transversal competences has been acknowledged as part of lifelong learning, with the early stages of school education considered as the foundation of continuous development throughout the lifespan [1, 2]. The Organisation for Economic Co-operation and Development [OECD] [3], in alignment with Education 2030 [4], calls for a general and in-depth curriculum redesign where students are enabled to become reflective and proactive citizens in their environment. The European Union recognises and recommends the various key lifelong learning competences [5] that any individual should develop throughout their life to become an engaged participant in society, and international studies such as the INACOL [6] highlight the need to advance an agenda promoting K-12 competency-based education (CBE). While there is substantive conceptual development of CBE in primary and secondary education, its actual implementation has advanced at a relatively slow pace [7, 8]. Guidance on how to apply CBE and assess competencies in action is still part of a gap in educational design that is poorly and partially tooled, leaving the teacher with the responsibility to fill in the gaps [9, 10].

This article describes the development and the internal validation process of an authentic assessment model for Digital Competence (DC) within the K-12 curriculum. The internal validation [11] is understood as a type of formative evaluation, aiming at proving "the integrity of the model and its use" [12, p. 174]. The validation of the Competence Assessment Model (CAM) involves teachers-as-designers [13] of the DC assessment as proof of concept [14]. The model understands competence assessment as intrinsic to learning as well as a tool for measurement [15]

and pays special attention to the competence development process and the outcomes. It provides a consistent conceptual basis, but also practical tools to ease the process of putting it into practice, in such a way that it is sufficiently flexible to be applied in multiple contexts.

It is worth mentioning that there are very few examples [16] that show how innovation in competence-based assessment can be a key element in understanding and implementing the CBE approach. Based on these premises, this study aims at answering the following research questions:

RQ1. How does the CAM support the design and practical implementation of a consistent competence assessment approach?

RQ2. What is the impact of the CAM on the teaching and assessment practices applied in the school context?

2 Research Context

This study took place as part of the H2020 project funded by the European Commission – the CRISS project – aimed at developing a solution for the implementation, assessment, and certification of the DC within European schools. The project involved three main interrelated developments: an operational definition of DC for K-12, the CAM model that we present in this paper, and a technological solution enabling its implementation. The elaboration of an operational concept for K-12 DC [14] was based on the basis of the DigComp [17], and the analysis of seven DC schemes applied in the school context in Europe. The K–12 DC is made up of 5 areas and 12 sub-competences that are further broken down into performance criteria and indicators for each of the areas (digital citizenship, communication and collaboration, search and manage information, content creation, and problem-solving). The CAM aligns with the DC operational concept and runs within an ePortfolio platform [18] that enables tracking student progress.

3 Competence Assessment Theoretical Development

The development of the initial conceptual version of the CAM involved an integrative literature review [19] aiming at developing a grounded understanding of competence assessment and elaborating a conceptual model. The review provided insights into transversal competences [20, 21, 22], integration pedagogy [23, 24], and the interplay of integration pedagogy and CBE [25]. The synthesis [26] of the main principles in competence assessment and abductive reasoning [27] led to the CAM [10].

3.1 Pedagogy of integration and CBE

This study adheres to the pedagogy of integration [24]. It focuses on developing competences to master everyday situations as a reaction to the limitations of pedagogy by objectives. One of Roegiers' main contributions is specific guidance for the implementation and assessment of competences that structure the learning process [25]. Thus, this integrative teaching/learning model allows students to obtain and integrate the required skills to solve complex tasks in different contexts and gives a more precise definition of the expected learning outcomes.

The concept of skill integration is considered the most important stage in the learning process, and it is characterised by the *interdependence* of different elements, the *coordination* of the elements for a harmonious operation, and the *polarisation*, that is, the implementation to produce meaningful learning. According to Peyser et al. [23], students can learn to integrate and transfer skills by working on similar tasks in different situations or contexts within the classroom. Hence, the integration of knowledge and skills involves making different resources available to students, designing complex problem situations according to the student's level, and promoting student motivation so they can progress gradually in the development of competences and transfer knowledge from the school context to daily life.

Even if there are a number of other approaches (proficiency-based, standards-based, personalised learning, student-centred learning) that describe the process in which students advance after demonstrating mastery [28], the pedagogy of integration is a methodological framework for applying the CBE by operationalizing its principles [25]. As Evans et al. [8] state, the overlapping definitions make it difficult to distinguish each approach, which is reflected in the lack of uniformity that is found in research related to competence-based practices [28, 29, 30, 31, 32].

3.2 Conceptualisation of competence-based assessment

The definition of CBE in K-12 includes seven key elements that are relevant to its understanding and implementation in daily practice: student empowerment, assessment as a meaningful experience, student support, evidence of mastery, different pathways and varied pacing, equity and common expectations for learning [33, 34]. Assessment as a key feature of CBE is assumed to be "a meaningful, positive, and empowering learning experience for students that yields timely, relevant, and actionable evidence" [8, p. 3].

Competence-based assessment, therefore, is conceived as a "process of making inferences about an individual's knowledge, skill, attitudes or other constructs using information from one or more methods" [22, p. 1] and as a means of supporting changes in what is taught and how it is taught, and consequently in the learning of individuals. From this perspective, competence assessment should provide, on one side, robust support for students to progress and, on the other, multiple opportunities to demonstrate what students know and what they can do based on knowledge, experience, and skills [33].

3.3 Competence-based assessment practices

Competence assessment practices are characterised by a variety of measures designed to gain a better understanding of students' progression [21, 22]. Among them are summative and standardised testing and performance-based assessments; the latter includes digital portfolios and capstone projects that capture the work students have done throughout the school, programme, or project experience [28]. Formative assessment, as part of the learning process, provides feedback that enhances student reflection on the expected learning outcomes. Self-assessment is also relevant for promoting ownership of learning. Contrary to traditional education evaluation, a combination of assessment methods helps gather data and evidence on various aspects of competence, enabling teachers to gain a comprehensive understanding of how students' learning has developed and to adequately assess students' competences [16].

As assessment allows students to demonstrate the application and transfer of knowledge and skills, teachers should develop what Patrick and Sturgis [35] call *assessment literacy*, referring to the knowledge and skills associated with its design,

implementation, interpretation, and proper use in teaching practices to improve learning. Properly assessing competences is a critical teacher skill [36], so to facilitate this task and ensure its effectiveness, it is necessary to identify the expected behaviours for each competence at different levels [37].

Despite the relevance of evaluation within the CBE, most of the reviewed research did not explicitly mention how teachers use assessment as a meaningful experience and how they get relevant evidence of students' competence progression [8]. It may be due to the perpetuation of traditional assessment methods, normative beliefs, and assumptions that guide schools [31]. One of the barriers to CBE implementation is inertia and the established culture of schools that make the transition from traditional practices to new approaches difficult for teachers [31].

Teachers' lack of preparation to shift assessment practices to evaluate student mastery is considered a barrier to the K-12 CBE implementation. Teacher training and professional development are requirements to develop an understanding of what competencies are and how they can be assessed: "Effective competence-based education depends, in a large part, on teachers' ability to assess students' competence accurately using various types of evidence" [36, p. 3]. In that sense, teachers "need to rethink the role of assessment and work together to come to a shared understanding on how to determine proficiency and what constitutes sufficient evidence of mastery" [28, p. 3]. This challenge implies providing opportunities for teachers to receive training and professional development on CBE implementation, offering leadership support and resources, and providing time for teachers to collaborate and work together to see the long-term benefits [38, 39, 40].

Misalignment between policies and practices is an additional issue affecting CBE implementation. It could explain why some teachers do not view assessment as a primary element within CBE implementation, so they continue using established assessment methods to evaluate competences [8]. Competences are developed by aligning curriculum, instruction, and assessment [28]. It requires time to engage teachers in learning communities that think and rethink the curriculum, defining or refining the competences and aligning instruction, assessment, and grades to the competences. So, implementing a competence assessment system requires alignment among educational policies, curriculum, teachers' perceptions, and teaching practices. However, developing and implementing changes in curricula are not always reflected in assessment practices [22].

Research indicates that assessment and flexible pacing, for example, are classroom practices more difficult to implement and much less reported than those practices that do not challenge the school's traditional models and structures [31, 38, 39, 41]. Also, the distinction between competence-based and traditional models at the implementation level sometimes is not as explicit as expected [29, 33]. So, there is a need for more research on competence-based learning, for updated assessment practices that respond to the challenges that schools face every day, and for providing teachers with professional development and resources that help them to develop the skills to implement competence-based practices.

4 The Competence Assessment Model (CAM)

The pedagogy of integration [24] is the theoretical foundation of the model, where DC is embedded into different subjects. The CAM provides a solution for the development of complex activities and the assessment of DC in meaningful scenarios based on theories of learning such as constructivist learning, situated learning, and experiential learning. It adopts advanced instructional approaches such as project-based learning (PBL), competency-based learning (CBL), or game-based learning

(GBL), among others. In that sense, it entails a student-centered and active learning approach, focusing on the development of authentic situations that enable the demonstration of desired learning outcomes. The methodological approaches involved can be described as macro-strategies that "set a general direction or trajectory for the instruction and are comprised of more precise or detailed components" [42, p. 31].

As shown in Figure 1, the central element of the CAM is the Competence Assessment Scenario (CAS). The CAS incorporates one or more subjects from the curriculum and encourages learners to tackle problems, develop projects, or seek solutions individually or collaboratively within realistic and meaningful contexts. In order to assess the development of competence in a particular learning scenario, the CAS includes one or more learning activities that are linked to performance criteria, allowing students to generate evidence of their learning. A crucial aspect of CAS design is to define indicators that provide a proper interpretation of the evidence in terms of performance criteria and competence achievement. Activities, in turn, consist of tasks (specific assignments or actions) that guide learners through the process and lead to the completion of the activity. All CAS activities require tangible outputs (such as written assignments, presentations, physical or digital artefacts, reports, etc.) that serve as evidence of learning and are assessed based on the learning outcomes.

Regarding assessment methods, teacher assessment, co-assessment, and self-assessment are encouraged. The application of different methods and instruments such as checklists, questionnaires, rubrics, and observation grids enables teachers to collect multiple measures of the student's competence progression [21, 22]. In that sense, a distinctive aspect of the model is that students are presented with different competence assessment opportunities. Following Roegiers [24], the student has three different opportunities to demonstrate competence development and achievements. The competence development and assessment is technology enabled. An ePortfolio platform supports the process of CAS creation and implementation and keeps track of the student performance dynamically [18].

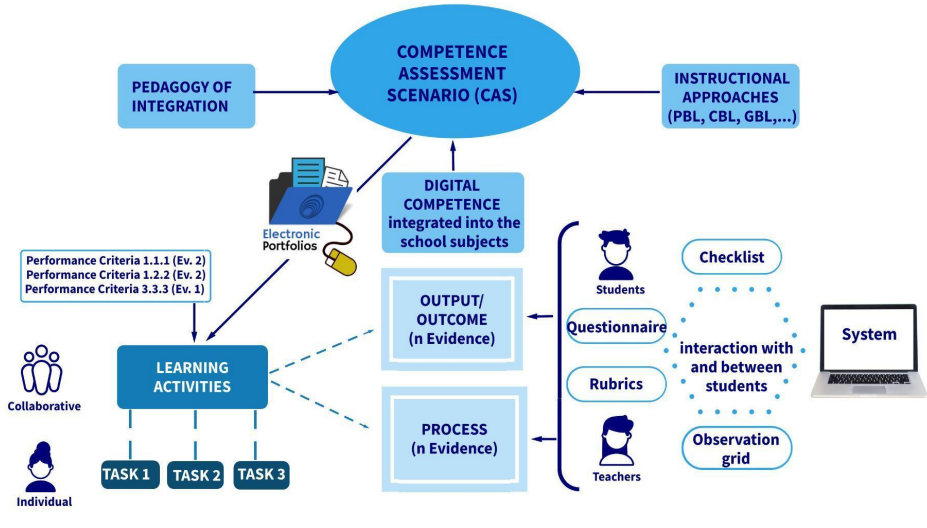

Fig.1. CAS structure and main components.

5 CAM Internal Validation

5.1 Methodological process

This study adopted a design and development research (DDR) approach, a pragmatic type of research that addresses "the validity or effectiveness of an existing or newly constructed development model, process, or technique" [43, p. 11], identifying and describing the conditions that facilitate successful design and development.

For the internal validation of the CAM, the usability documentation process proposed by Richey and Klein [12] was used to test the extent to which it was "effectively, efficiently, and satisfactorily used in the context for which it was intended" [43, p.160]. We explored the conceptual soundness of the model to support the creation of the CAS, the usability of the design support instruments (design guide, template, checklist, and design support sessions), the distance between teachers' practices and CAM-driven practices, and the potential enablers or barriers to its adoption.

These aspects were analysed through three principal lenses: design, implementation, and teaching practice. *Design lens* explored how the assessment approach facilitated the CAS design. *Implementation lens* focused on the ease with which the assessment approach can be applied. The *teaching practice lens* looked at changes in teaching practice afforded by the approach; in particular changes in assessment activities.

The internal validation process was conducted in two stages. The first stage centered on the CAS design. The second stage focused on the implementation and broader teacher adoption of the CAM through the adaptation of the CAS. The main characteristics of each stage of the CAM internal validation process are provided in Table 1.

Stage 1: CAS Design. The preparation of the internal validation began with the creation of the design instrumentalities (DI) [44]. DI are design-decision tools that teachers use to generate CAS. Among the DI are: a design guide with step-by-step procedures, an accompanying template, and a checklist to ensure the alignment of the CAS with the approach.

In this stage, teachers, supported by the model development team, used the CAM to design new learning activities or adapt existing ones to competence assessment scenarios (CAS) for their contexts [10, 45]. They first evaluated to what extent the model proved fit for purpose in terms of usefulness and usability, and, secondly, they reflected on the impact it might have on their teaching practice.

Initially, the first set of CAS was designed by 30 teachers who worked together in nine teams. The activity was informed by the design instrumentalities and included a process of continuous exchange between teachers and the learning designers. This was principally done through remote Design Support Sessions (DSS), in which experts addressed teachers' queries. The CAS drafts were shared using Google Drive to allow continuous monitoring of their progress. The teachers' feedback from this process was also used to review and adjust the DI.

Stage 2: CAS Adaptation. The second stage focused on the broader teacher adoption of the CAM, involving them in a process of adapting the CAS sketched out in Stage 1. A guide for CAS adaptation with examples was used to show how existing CAS can be adapted to the local context and specific needs. A participatory approach was implemented, involving 44 K-12 school teachers in a three-day workshop. They explored the existing CAS and discussed the implications for implementation in their contexts and in relation to their teaching practice.

The first day involved a training session on the CAM - CAS model, the design process, and the DI. On the second day, teachers were shown how the CAS integration and adaptation work within the platform. Finally, a hands-on session based on a detailed script and role-play allowed the teachers to work in pairs on the CAS adaptation.

5.2 Participants

In total, 74 K-12 school teachers from country member partners, Romania, Greece, Croatia, Italy, Spain, and Sweden, participated in the internal validation process of the CAM. It is worth mentioning that the participant countries represent different stages of digital development, according to DESI [46]. The first stage involved the participation of 30 teachers who were divided into 9 groups. In the second stage, a total of 44 teachers took part. Additionally, two learning designers were actively involved throughout the process.

Table 1. Stages in CAM internal validation.

	Stage 1: CAS Design	Stage 2: CAS Adaptation
Design instrumentalities	CAS design guide (step-by-step) CAS template CAS checklist Design Support Sessions (DSS)	CAS adaptation Platform tutorial
Dynamics	Teachers' team design Design Support Sessions with Learning Designers	Rehearsal (Try-Out) Workshops: Induction session (DC OC & CAM-CAS) Demo session Hands-on session: CAS adaptation CAS implementation in platform
Participants	9 groups: 30 teachers 6 EU countries: Croatia, Greece, Italy, Spain, Romania and Sweden.	44 teachers 6 EU countries: Croatia, Greece, Italy, Spain, Romania and Sweden.
Data Collection	- Focus group: 9 teachers (1 per group) - Interviews: 2 learning designers - Documentation analysis	- Survey: 44 responses - Group interviews: 6 (1 per country)
Output	20 new CAS	22 adapted CAS

5.3 Data collection and analysis

There were structured data collection points at each stage (Table 1). At the end of the first stage, nine representative teachers from each design team participated in a focus group and expressed their impressions regarding the CAM model and design process. A second source of information came from the interviews with learning designers, which provided a complementary view enriching the understanding of the process. Finally, an analysis of the generated CAS was carried out by the researchers following the same criteria of the DI checklist used by the learning designer, as a confirmatory action of the CAS compliance to the CAM.

At the end of the second stage, 44 new teachers answered a survey about the adaptation of the CAS and their perceptions regarding the CAM. Among the participants, 63.6% of the teachers who participated were female and 36.4% were male, with a mean age of 44.86 years old. The majority (90.9%) had more than five years of teaching experience, and 56.8% had more than 15 years' experience. The majority had an intermediate (40.9%) or advanced (36.4%) level of experience in teaching using digital technologies. The vast majority of teachers (97.7%) used competence-based learning activities in the classroom. With regard to competence-based assessment, the percentage was lower (77.3%), but still indicates that this group of teachers was generally experienced in teaching using digital technologies, and well-versed in the use of competence-based teaching and assessment practices.

They were also grouped according to their country of belonging and participated in structured group interviews. Six group interviews took place, with teams from Romania, Greece, Croatia, Italy, Spain and Sweden. The focus groups and interviews (Stage 1), and group interviews (Stage 2) were then coded thematically [47] using Atlas.ti (Table 2). A summative content analysis [48] was conducted to generate a textual corpus based on non-literal transcripts. This analysis aimed to identify the key elements and significant aspects related to each theme. Regarding the information provided in the survey, the data has been described according to the nature of its measurement using univariate descriptive statistics [49].

Table 2. Data collection methods and coding analysis structure

Stage	Methods	Primary code	Secondary code	Questions
1-2	Focus group (FG) LD interviews (LD1-2) Group Interviews (GI1-6) Survey	Design	#applicable #di_creation_guide #di_creation_template #di_checklist #dss	1. Applicability of CAM to CAS design. 2a. Elements supporting CAS design
1-2	Focus group Survey Group interviews	Impleme n-tation	#teacher_training_ competence #teacher_coordination #teacher_workload #student_experience_ competence #student_workload #classroom_ratio #Technology_ resources	4. Aspects intervening in the CAM/CAS implementation

			#institution_support	
1-2	Focus group Survey Group interviews	Teaching practice	#aligned_practice #transforming_ practice #lo_to_competence #summative_to_ formative #results_to_process #teacher_to_ student_led #isolated_to_ integrated #variation_strategies_ tools	2b. Impacts of CAM approach on teaching practice. 3. Changes in assessment practices with the CAM approach.

6 CAM Internal Validation Results

The results are organised according to the two stages and the identified lenses. They provide a first interpretation of results that are progressively discussed, providing insights from the fist to the second stage and final discussion and conclusion.

6.1 Stage 1: CAS design

This stage focuses on the activity of CAS design as a process and output. Teacher focus groups, learning designer interviews, and CAS analysis provide evidence of the model's usability.

Design Lens. The general tenor concerning design is very positive. Teachers agreed that the approach helped them to design the CAS. The following statement from the qualitative data regarding the DI reflects teachers' opinions of their usefulness: "The guide and other documents helped us to understand the details of the approach" (FG).

According to some participants, the approach is applicable to their teaching and easy to incorporate into their daily practice. However, it should be adapted to the level of the students, the subject, and the needs of the context: "Some of the scenarios are easier to take to class, such as the book, maybe not Oliver Twist, but, as history teachers, we can incorporate another book" (GI5). On the contrary, some teachers mentioned issues with the model application related to the approach integration, technological shortcomings, and the additional effort required (time, workload, cooperation among teachers and subjects).

Regarding the DI, teachers highlighted that the design guide is a helpful tool that enables them to follow the CAS creation process step-by-step. From the perspective of the learning designers, it shows all the necessary elements that should be included in the CAS: "It gives concrete indications on how to adapt already designed learning activities and on how to design a CAS from scratch" (LD1). Teachers concurred that the template is easy to use, but "it was time-consuming" (FG). Conversely, learning designers considered the template a practical instrument for organising the information required in the CAS, providing a common structure. Additionally, learning designers mentioned that the checklist is a review instrument that allows them to identify incomplete sections and make suggestions to improve the CAS.

Learning designers' reflections produced a series of insights regarding the design process, highlighting how DI helped them to make all the necessary elements of the CAS explicit from the start and provide concrete examples as well as reducing the risk of missing information and inaccuracies: "They were also a way to structure our dialogue with the teachers" (LD1).

According to learning designers, the design support sessions (DSS) were a more personalised strategy to address the difficulties that teachers had with the CAS process design and implementation: "Since we noticed that teachers had quite different doubts and gaps, as well as different level of commitment/understanding of the design process, we opted for setting up individual sessions targeted at solving all the problems encountered by each of them" (LD1). Teachers also expressed that the personal support provided by the learning designers on the development team was valuable: "They trained us in many things that we were not familiar with" (FG). The result of the design process provided 20 validated CAS as presented in Table 3. A booklet [50] presents the most representative CAS in detail.

Although teachers were chosen in the first design round for having experience in innovative learning, the challenge of transposing the theoretical framework into meaningful activities was demanding for some of them with little previous experience in CBE. They all underlined the convenience of deciding the focus of the CAS in terms of the subjects to be involved from the start and acknowledged that working with other teachers and learning designers supported finding better solutions [10].

Learning designers identified three main issues emerging from this experience. First, a third of the early CAS drafts maintained a predominantly passive role for students, showing that the assessment strategy was not fully aligned with the active pedagogies adopted in the scenarios. Second was the difficulty for teachers to integrate a non-linear approach to assessment, manifested in multiple requests for clarification on providing students with multiple assessment opportunities. Third, the development of identifying performance criteria and indicators was considered demanding.

Table 3. Competence assessment scenarios integrating the Digital Competence into multiple subjects.

Documentation (CAS) analysis: 20 CAS		
OUTPUT	AGE RANGE 11 to 17 years old	WORKLOAD 2 to 20 hours
	INSTRUCTIONAL APPROACH ● 11 project-based learning ● 2 collaborative project-based learning ● 1 case-based learning ● 2 open-source learning ● 1 gamification & problem-solving ● 3 problem-based journal	ASSESSMENT INSTRUMENTS ● 14 Rubric ● 4 Rubric + scale ● 1 Rubric + self-evaluation tool + game (Kahoot) ● 1 Rubric + self-evaluation tool

WORK DYNAMICS

- 14 collaborative + individual
- 1 pair + individual
- 3 collaborative
- 1 individual
- 1 collaborative + cooperative

ASSESSMENT FOCUS

- 6 teacher + self & peer
- 4 teacher + self
- 3 teacher + peer group
- 7 teacher

SUBJECTS & DISCIPLINES

- 6 combining 3 or more subjects
- 9 combining 2 or more subjects
- 5 only one subject

History, English language or other, Civics, Computer Science, Mathematics, Literature, Technology, Physical Education, Philosophy, Economics, Geography, Arts & Craft, Biology, Information & Communication, Social Education…

Implementation Lens. Learning designers indicated that some teachers lacked knowledge and experience in CBE. Training (e.g., advanced assessment, macro-strategies, co-design, or pedagogies integrating different disciplines) is pointed out as a key issue to be addressed. Teachers, from their side, manifested that teacher training is a significant element for implementing competence assessment in order for them to see their students' progress and adapt the process to students' needs. Also, they considered that training is important to overcome resistance to introducing new approaches into the curriculum, acknowledging that they also need DC training: "It is very important because the resistance may come from the difficulty of introducing these new things into our curriculum, which is very restricted, is very concentrated and very theoretical" (GI1). Moreover, teachers considered that explicit institutional support is required: "We are enthusiastic about this project as our principal is fully supportive" (FG).

Teachers also highlighted that the approach entails more participatory work between teachers and fully functional technology for implementing some types of assessment: "It would be very helpful to have some application for self- and co-assessment" (FG). Technology support is also seen as an enabler, making classroom ratio and student workload less relevant when thinking about the CAS implementation in their courses.

Teaching Practice Lens. Most teachers agreed that the approach was coherent with their teaching practices, albeit not in such an integrated manner. The experience of designing the CAS supported them in shifting focus from learning objectives to competence development, from isolated assessment to integrated assessment activities, and from the focus on final results to the learning process. The design experience assisted some of the teachers in reflecting and realising their actual expertise on the matter and revealed the potential of the model as a way to improve their practice: "I thought I was using competence-based education with my students, I realise now that it was only partially. I feel more confident now knowing what it is all about" (FG). However, the responses were not unanimous, and one participant saw the approach as a major transformation of their teaching practices: "I think this approach in our country will take longer" (FG).

6.2 Stage 2: CAS adaptation

In this stage, teacher surveys and group interviews provided rich information from the participating teams, especially with the implementation and teaching practice lenses.

Implementation Lens. Regarding the implementation, 75% of teachers agreed that the assessment approach was easy to put into practice. It is important to note that the positive results tended towards the somewhat easy (68.2%) as opposed to the most positive option (6.8%), which indicates some degree of reservation within a generally positive response. Both training sessions in the competence-based approach (59%) and training in the DC (54.5%) were considered key factors along with the need to coordinate with other teachers (56.8%). With a slight difference, other factors having relevance to implementation were the availability of resources (52.3%), the teacher workload (45.5%), and the interest of the institution in the competence-based approach (45.5%). Conversely, regarding student factors, these were perceived as not considerably affecting implementation in terms of student workload (22.7%), previous experience in competence-based learning (15.9%), and ratio in the classroom (15.9%).

In the group interviews, the comments were largely aligned with the results indicated by the survey; however, in the analysis of the discussions, some core themes appeared across all the group interviews.

For many participants, the most important aspect regarding the competence-based approach was: "It can transform the way we approach our subjects and the way we teach our students" (GI2). Also, another participant considered that the "CRISS project is very valuable because it's a different way of assessing" (FG). For others, already focusing on competences, it constituted a tool to facilitate existing competence-based approaches. The value of the way the approach permitted a student-centred focus on transversal competences was also remarked on. A few voices indicated more alignment with a curriculum organised by objectives, arguing that though some domains such as physical education or languages are more susceptible to a competence-based approach, this is not the case for all domains. Though these may indicate misconceptions of the approach, they were present as a common thread in the conversations. The test case of the DC, used as a 'rehearsal' of the model, was seen as promising for the implementation to other competences: "We have a project in my school of integrating the 'entrepreneurship' competence, and I see this model as useful for that" (GI4).

Collaboration and interdisciplinarity were also seen as a source of motivation for teachers, though challenging, for the open mindset required and the changes needed in school organisation and teacher roles. Some comments revealed that cooperative work between different subjects is an unusual practice. According to teachers, the most challenging aspects of cooperative work are the compatibility of schedules and the commonly adopted methodologies: "This is not the usual approach in the schools, it is very challenging, teachers usually work alone in their subjects, and they do not cooperate in the schools" (GI2). Other participants saw collaboration as complex, but not new.

Though in many cases the approach was welcomed by the institution, there was frequent mention of the need to go from non-opposition to active support by providing, for example, time and space for collaboration between teachers and recognition of the workload required by the adaptation process.

Teaching Practice Lens. Although more teachers (54.5%) considered the assessment approach coherent with their teaching activity, 45.5% (similar to stage 1) declared that it entailed a major transformation of their practices by moving the focus

from traditional assessment to a variety of different assessment strategies (45.5%); from teacher-led assessment to student-centred assessment (43.2%), and from learning objectives to competence development (40.9%), all of them being the pillars of the CAM. Other factors were perceived to have a more moderate impact on the teaching practices as they were to some extent already in use: from a focus on summative assessment to formative assessment (29%), from a focus on isolated assessment activities to assessment integrated into contextualised activities (27.3%) or from a focus on final results to the learning process (25%). It is worth mentioning that these answers were collected after the workshop on the adaptation of the CAS where, in pairs, teachers performed 22 adaptations according to their envisioned context of implementation. Main changes entailed translations to another language (17 CAS), the addition of a subject (4 CAS), the subtraction of a subject (5), the workload (11 CAS), the assessment tools (7 CAS), and the type of assessment (2 CAS with added self-assessment, 3 CAS with added co-assessment).

The group interviews provided additional consensus on the teacher practice challenges. The analysis provides more details regarding teachers' experiences and concerns. For some teachers, the approach constituted "absolutely a transformation" (GI6).

The change was also identified through the fact that teachers "are not very accustomed" (GI2) to this practice, and resistance was also mentioned. However, qualitative insights revealed that some teachers "don't want to change" as they tend to repeat "the experience that they had, that's what they lived through when they went to school" (GI6). These comments indicate that, for many teachers, the model is transformative, but it is not the case for all of them. However, there was a sense that the model does constitute a useful way of articulating the gradual integration of these practices. For many, the teaching and assessment integration, as proposed in the model, is especially valuable, making assessment part of the learning process, rather than a separate activity, more visible and transparent. Also, it was noted that the approach provides clear information to the students regarding what is expected from them, reducing the number of teacher interventions and adding motivational value for the student.

7 Discussion

The study's purpose was to describe the internal validation of an assessment model for transversal competences. It was implemented as an attempt to establish the integrity of the CAM in terms of its conceptual basis and procedure for implementation. It looked at teachers' and learning designers' impressions of the approach through different lenses (design, implementation, and teaching practices), moving beyond a simple evaluation of whether it worked to build up a complex picture of the dynamics of the approach in practice. This process is a step towards the advancement of promoting K-12 CBE. As Evans et al. [8] highlight, there is still a gap in the literature related to competence assessment, mentioning that it is important to inquire how and in what ways the assessment of what students know and what they can do varies along the continuum of competence-based implementation [51]. In addition, the competence of teachers to rethink assessment to shift to a competence-based curriculum is an issue that requires efforts in training and professional development. Understanding the nature of competences, the development of learning progressions, the design of appropriate and authentic assessment, and the interpretation of the outcomes, in fact, contribute to improving teaching practices and student learning [37].

The results show consistency with the work of Evans and DeMitchell [38] about the factors that affect CBE implementation, such as conceptual clarity about CBE, lack of knowledge and experience, misalignment between active pedagogies and assessment, and institutional support. From the design lens point of view, the validation process demonstrated that the approach permits independent development of the CAS by teachers in school contexts. Though there were challenges involved, these were reduced over time as familiarity with the tools developed. The most useful elements were the CAS creation guide and the CAS creation template, although personal support was also highly appreciated. In line with Evans et al. [8], the design lens confirms that appropriate guidance on learning process design, time for teachers to reflect on their own work, and professional development are key factors that enhance teaching practices and teacher motivation. The confirmatory analysis of the CAS to ensure alignment with the CAM produced positive outcomes, with a total of 44 new and modified CAS that were found to be in compliance with the CAM requirements. The purpose of this analysis was to validate and verify that the CAS aligns with the intended goals and principles of the CAM. By applying the DI checklist, the researchers aimed to ensure that the CAS effectively integrates competences into the curriculum and adheres to the student-centered approach, active pedagogies, authentic situations, and evidence-based assessment encouraged by the CAM.

Through the implementation lens, the two stages confirmed that the approach is perceived as having great potential to be put into practice. While student-related issues such as workload, class size, or even previous experience are not perceived as inhibitors, others are objects of concern and should be addressed. These are mainly training teachers in the competence-based approach, providing an environment that facilitates effective collaboration among teachers from different subjects or disciplines, and the availability and accessibility of technology. Authors such as Evans and DeMitchell [38] and Pane et al. [41] agree that the lack of resources such as training, planning time, logistical issues with devices or lack of technology and data are restraining forces that can affect CBE implementation. As Scheopner Torres et al. [28] state, developing competences and aligning curriculum, instruction, assessment, and grading practices require changes in professional culture in which teachers can set aside time to collaborate, discuss and share practices and expectations.

The teaching practice lens involved more diversity of outlooks in the sense that for some teachers the approach was a new departure while for others it aligned with their current practice. There was a broad consensus on (a) the positive change in teaching and assessment practice that the approach involves, (b) the focus on competence development, (c) promoting a more student-centred activity, and (d) a move away from traditional assessment practices to formative assessment integrated into teaching practice. Part of the cultural change in schools begins when teachers become aware of their beliefs and habits in the classroom and learn new teaching and assessment methods. The process also indicates that the nature of the approach can boost these changes in diverse school contexts.

Overall, the approach was shown to be valid and also seen as pedagogically attainable. Though a series of logistical challenges were identified, these were not considered to affect its internal validity.

8 Conclusions

The internal validation process described in this article demonstrates the effectiveness of the transversal CAM, using the case of DC to explore its applicability and

practicability. The model combines work with specific and transversal competences, integrating them into the curriculum and promoting the use of active methodologies, collaboration between teachers, and continuous assessment. The model's potential for creating meaningful learning experiences also indicates that it could be extended to other transversal competences. Moreover, other essential, but not strictly pedagogical aspects for its implementation, were identified during the process. These include teacher training needs, institutional commitment to the articulation of teacher collaboration, and planning and management of teacher workload, each of which can greatly contribute to realising the potential of the model.

It is important to note, however, that in contexts where teachers have previous experience in competence-based approaches, the adoption of the model is more likely to proceed smoothly, while in others, greater efforts will be required, albeit with a potential for more marked transformations. Implementation plans need to ensure appropriate adaptation to the needs of each situation.

Finally, we illustrated the usefulness of a DDR approach to the iterative development and validation of the model. The actual implementation of CAS with students in school settings as part of an external validation should provide further evidence of the potential for widespread adoption of the model.

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