Connecting digital and social competences in a flexible and adaptive framework for VET teachers

Conectando competencias digitales y sociales en un marco flexible y adaptativo para docentes de Formación Profesional

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ABSTRACT

Vocational Education and Training (VET) demands specialized and workplace-applied skills, which require teachers to be trained in a variety of competences that are up to date with digital changes. Based on the comparative analysis of general and specific VET digital competence frameworks for teachers, a new framework combining digital and social competences is proposed in the context of a need-based research from a European project. Based on the framework a flexible and adaptive training course involving 171 VET teachers from Spain is generated. The pre and post levels of knowledge and application of the 8 competences areas (5 digital and 3 socio-professional competences for digitality) are analyzed, together with the evaluation of the usefulness and time spent on the course. The results indicate that in social competences, knowledge increased (Collaborative intelligence and Creativity) and the greatest application was linked to Digital assessment, Digital teaching and Working with hidden talents. The perception of usefulness was high in all competences, with gaps depending on the age of the participating teachers. The discussion in line with other studies leads to emphasize flexibility and scalability in digital literacy competency frameworks. The conclusion is that there is a need to integrate social and digital competences and to create more flexible frameworks that allow for training adapted to the diverse socio-professional needs of this level of education.

Keywords: vocational educational training; competences framework; digital competences; social competences; teacher training.

RESUMEN

La Formación Profesional (FP) demanda conocimientos especializados y aplicados al puesto de trabajo, que requieren que sus docentes estén formados en competencias diversas y actualizadas a los cambios digitales. A partir del análisis comparado de los marcos de competencias digitales docentes, generales y específicas de FP, se propone un nuevo marco combinando las competencias digitales y sociales, en el contexto de una investigación fundamentada en un proyecto europeo. Con base en dicho marco se genera un curso de formación flexible y adaptativo en el que participan 171 docentes de FP de España. Se analizan los niveles pre y post de conocimiento y aplicación de las 8 áreas de competencias (5 digitales y 3 socioprofesionales para la digitalidad), junto a la valoración de la utilidad y tiempo empleado en el curso. Los resultados indican que en las competencias sociales se incrementaron los conocimientos (Inteligencia colaborativa y Creatividad) y la mayor aplicación se vinculó a competencias de Evaluación digital, Enseñanza Digital y Trabajo con talentos ocultos. La percepción de utilidad fue elevada en todas las competencias, con brechas en función de la edad de los docentes participantes. La discusión en línea con otros trabajos lleva a enfatizar la flexibilidad y la escalabilidad en marcos de competencias de alfabetización digital. Se concluye con la necesidad de integrar las competencias sociales con las digitales y generar marcos más flexibles que permitan una formación adaptada a las necesidades socioprofesionales diversas de esta etapa.

Palabras clave: formación profesional; marco de competencias; competencias digitales; competencias sociales; formación docente.

INTRODUCTION

This study is part of an Erasmus+ project grounded in the existing knowledge of the specific demands, challenges, and competency needs of Vocational Education and Training (VET) learners and teachers in Spain. It also draws on a comparative analysis of previous teacher competency frameworks to propose a flexible and adaptive competency framework that integrates socio-professional skills with digital competencies. The need to propose new frameworks for this educational level is driven by labour market demands to integrate technological dissemination alongside other competencies with high social engagement. This is especially important in an educational setting characterised by a wide range of learners and professional specialisations, where the minimum competencies required are constantly evolving.

VET plays an essential role in preparing learners for a rapidly changing labour market, enabling them to respond swiftly to socio-economic challenges (Zaga, 2023). To achieve this, VET is characterised by its development in more flexible training environments, which can be tailored to students with different profiles, abilities, or knowledge, whether they are beginning or retraining in a profession. This type of training is specific and geared towards the acquisition of skills and experiences relevant to a particular occupation, where proficiency in technology is essential to facilitate connectivity between educational institutions and workplace learning environments (Lahn & Berntsen, 2023). Furthermore, the integration of emerging technologies is more fluid in this context (Cattaneo et al., 2022), requiring both a basic command and continuous digital upskilling (UNESCO-UNEVOC, 2023).

This professional specialisation is a determining factor because it demands highly specific knowledge that is directly applicable to the workplace, requiring a broad range of diverse and interdisciplinary competencies. In other words, it calls not only for digital skills but also for other competencies needed to tackle global challenges. In this context, the major global challenges outlined in the 2030 Agenda have highlighted the need to integrate training that combines digital competencies with social, soft, and specialised skills aimed at fostering inclusion and advancing toward a fairer and more sustainable society (Helin, 2021; McGrath & Ramsarup, 2024).

Since the Osnabrück Declaration (2020), there has been a growing call for VET systems to integrate digital challenges with those arising from climate change and the consequences of COVID-19, in order to establish a more cross-cutting and diverse competency framework. This call has led to both contradictions and new demands for VET, as well as some disagreements, which have not been without resistance (Kärner et al., 2021; Maué et al., 2024).

On one hand, competency-based training should inherently address this diversity of challenges, understanding competencies as the "proven ability to use knowledge, know-how, experience, and skills (related to work, personal, social, or methodological domains) in employment or study environments and in professional and personal development" (CEDEFOP, 2024). In other words, competencies involve a combination of "cognitive elements (which include the use of theories, concepts, or tacit knowledge); they also encompass functional aspects—such as technical skills—as well as interpersonal attributes (e.g., social or organisational skills) and ethical values" (CEDEFOP, 2024).

On the other hand, the call for this competency-based multiliteracy has contributed to the establishment of a political model for implementing competency frameworks to address educational demands. This model results in the constant

revision of curricula, methodologies, and resources, which is accompanied by a culture of measurement and comparison—an approach that has faced significant criticism (Standish, 2018; Petersen, 2022). In this context, learners must demonstrate whether they have acquired each type of competency and to what extent.

Moreover, these ongoing revisions have created a problematic disconnect between political imperatives and the needs of governments and industry. This includes debates over whether to provide a minimal or broad foundation of competencies to keep pace with rapid changes, or to combine competencies for professional development with those for personal and social growth. In the case of VET, these constant revisions within the context of a specific profession often result in more demands. This is because VET's compensatory role may prioritise general competencies established by global policies—such as emphasising basic digital skills—while relegating those specific to a profession. Additionally, top-down frameworks may be implemented without considering the needs or baseline competencies of learners and teachers, who start from highly varied levels in this type of training. Structural factors such as digital resources (Heine et al., 2023) or connectivity also play a critical role, despite improvements in equipment and infrastructure following the COVID-19 pandemic (Gudmundsdottir & Hathaway, 2020). Consequently, although progress has been made in teacher digital literacy, significant deficits remain (Villarroel & Stuardo, 2022; Martínez-Izaguirre et al., 2021; Lahn & Berntsen, 2023), necessitating that VET teachers ensure they master the competencies they will need to impart to their students.

This study addresses the adaptability required in the professionalising context of VET while also aiming to resolve some of the discrepancies regarding the need for multiliteracy in competencies. The following sections present a comparative study and define the FLEXI-COMP framework, detailing its structure and the innovative teaching and assessment model, which is based on a methodology supported by gamification and micro-learning. Finally, the results from the pre- and post-test validation process of the model's application to a sample of middle- and upper-level VET teachers in Spain are presented, providing significant insights into the integrated combination of digital and social competencies.

Comparative Review of Digital Competency Frameworks for VET Teachers

Teacher competency frameworks serve as a key reference for updating professional profiles, enabling educators to enhance their teaching practices and thereby empower their students to face challenges. According to Becerra and Lau (2020), the most relevant competency frameworks are developed by global bodies such as UNESCO or the European Commission. At a more specialised level concerning digital challenges, there are frameworks that have been adopted by numerous educational systems, such as the UNESCO ICT Competency Framework for Teachers (ICT CFT, Version 3, 2018) and the DigCompEdu framework (Redecker & Punie, 2017), which are the most widely recognized references (Bilbao et al., 2021). However, many other frameworks are in place across different countries, as highlighted by the UNESCO-UNEVOC compilation for Technical and Vocational Education and Training (2023).

In addition to these global frameworks, there are also specific frameworks for VET that aim to address its unique characteristics as a diverse, specialised, and enabling system. These frameworks are designed to meet the evolving demands of the labour

market with a high degree of applicability. Among them are the Digital Teaching Professional Framework (DTFP, 2018) and the Vocational Education and Training Teachers Embracing Digital Disruption (VET-TEDD, 2019). Alongside these frameworks, research-based proposals and initiatives have been developed through international projects, such as Mentoring Technology-Enhanced Pedagogy (MENTEP, 2017), Vocational Education and Training Teachers Embracing the Digital Disruption (VET-TEDD, 2019), and the Technical and Vocational Education and Training Teacher's Digital Competence Model (TVET-TDCM, 2022).

Table 1 provides a comparative summary of these VET frameworks in relation to the general frameworks of DigCompEdu and UNESCO, as well as VET-specific frameworks. This comparison allows for an examination of whether similar competencies have been included and whether the combined digital and social competencies demanded by the current agenda have been addressed. The final column presents the FLEXI-COMP framework (2023), which was developed following the analysis of the initial version of this comparative matrix and fieldwork conducted with teachers and learners across five countries. This framework integrates both digital and social competencies, along with the professional competencies specific to VET frameworks.

Table 1
Comparative Analysis of Competency Frameworks and the FLEXI-COMP Proposal

General Frameworks		Specific VET Frameworks		Digital Competency Projects for VET			Proposal
DigcompEdu (2017)	ICT CFT (2018)	DLGF (2018)	DTPF (2019)	MENTEP (2017)	VET-TEDD (2019)	TVET-TDCM (2022)	FLEXI-COMP (2024)
Professional Commitment	Professional Learning		Self-Development	Communication and Digital Collaboration			**1. Professional Development**
Digital Resources	Organisation/ Administration	Literacy: Information and Data. Creation of Digital Content		Use and Production of Digital Content	Enriched Multimedia Content	Use of Technology	**2. Resources**
Evaluation	Curricula and Evaluation		Evaluation				**3. Evaluation**
Teaching and Learning	Understanding ICT in Education. Pedagogy, Application of Digital Competencies	Devices and Software Operations.	Lesson Planning. Pedagogical Approaches	Digital Pedagogy	Digital Education Methodologies. Digital Education Models. Alternative and Simulated Environments	Technical Skills: Planning, Development, and Teaching Evaluation	**4. Teaching**
Empowering Students		Security. Problem Solving	Accessibility and Inclusion		Digital Identity; Security and Data Handling		**5. Empowerment and Digital Skills Training for Students**
Facilitate Students' Digital Competencies				Digital Citizenship			

Hernández-Serrano, M. J., Morales Romo, N., Gago Rivas, V., & García-Gutiérrez, C. (2025). Connecting digital and social competences in a flexible and adaptive framework for VET teachers. [Conectando competencias digitales y sociales en un marco flexible y adaptativo para docentes de Formación Profesional]. *RIED-Revista Iberoamericana de Educación a Distancia, 28*(1). https://doi.org/10.5944/ried.28.1.41470

General Frameworks		Specific VET Frameworks		Digital Competency Projects for VET			Proposal
DigcompEdu (2017)	ICT CFT (2018)	DLGF (2018)	DTPF (2019)	MENTEP (2017)	VET-TEDD (2019)	TVET-TDCM (2022)	FLEXI-COMP (2024)
		Career-Related	Subject- and Sector-Specific Teaching			Industry Needs	**7. Employment**
			Help Students Develop Employability Skills			Interpersonal Skills	**6. Collaborative Intelligence** **8. Creativity**

Table 1 presents an analysis organised by rows or competency domains, with the first six rows referring to digital domains and the last two to socio-professional domains. The general frameworks do not address specific competencies related to job preparation or the development of soft skills. Only the DigCompEdu framework places special emphasis on empowering and facilitating the development of student competencies. In contrast, VET-specific frameworks include competencies from the latter two dimensions, relating to career development and sector-specific teaching, as well as competencies aimed at helping students develop employment-related attitudes. Among the projects, only the TVET-TDCM has explored industry needs and considered interpersonal skills. This cross-framework analysis reveals that none of the frameworks or projects have integrated digital competencies with social competencies and job preparation. Furthermore, as noted by other studies (Bravo et al., 2021; Mattar, Santos & Cuque, 2022), there is minimal development of soft skills in these frameworks, which were addressed in earlier frameworks such as DigCompOrg (Kampylis et al., 2015) and are being revisited in current VET framework projects (DIGCOMP4VET, 2024).

The cross-competency analysis by rows reveals that the most developed competencies are those related to digital skills applied to the teaching and learning process, including the use of software, applications, or environments, along with pedagogical aspects such as planning or teaching development. Regarding evaluation, some frameworks address specific competencies, while others include them within broader teaching competencies. The second most addressed competency pertains to digital resources, including their organisation, creation, production, and use. Professional development, which encourages lifelong learning among educators, is only covered by one specific framework and one of the analysed projects. Student empowerment, which involves addressing diversity and/or vulnerability, is also commonly found in VET-specific frameworks due to the diverse profile of VET learners, whereas only one framework considers digital citizenship. Professional competencies in the last two dimensions are only addressed by the two specific VET frameworks and one project. Lastly, regarding interpersonal skills related to soft skills, only one framework addresses employment-related aptitudes, and one project includes an interpersonal skills dimension.

This analysis led to the development of a new framework, FLEXI-COMP, presented in the final column. This framework integrates digital and social competencies (including interpersonal skills, collaborative intelligence, creativity, and

entrepreneurship), and complements existing frameworks by incorporating employment-related skills.

Connecting Digital and Social Competencies in a Flexible and Adaptive Framework

FLEXI-COMP is a digital and social competency framework developed through research conducted across five countries (United Kingdom, Germany, Sweden, Italy, and Spain) between 2022 and 2023. The research involved focus groups and interviews with VET teachers and students, with a particular focus on those who are most vulnerable, at risk of exclusion, or affected by digital divides. The findings highlighted the need to incorporate social skills for digital contexts, given the existing challenges in providing adequate tutoring, mentorship, entrepreneurship guidance, and hands-on experience in both natural and virtual professional environments. The study also underscored the necessity of creating frameworks specifically tailored to VET, rather than applying general frameworks designed for other educational levels. These specialised frameworks should include competencies that prepare students for professional settings and ensure digital integration in professional subjects (Lahn & Berntsen, 2023). Additionally, in line with other reports (UNESCO-UNEVOC, 2021), the research emphasised the importance of considering the diversity and vulnerability of disadvantaged students. It called for specific competencies to support their inclusion, which few existing frameworks have adequately addressed (Atherton et al., 2019).

Based on this needs analysis of both teachers and students, the FLEXI-COMP competency framework was designed as part of the project (see Table 2). FLEXI-COMP integrates digital and social competencies and includes a dimension focused on both knowledge and professional application. It is conceived as a flexible framework, aiming to address the rigidity of general frameworks, which tend to be standardised and progress linearly. This design seeks to maximise applicability, offering theoretical-practical examples tailored to different educational contexts, thus providing more comprehensive and resilient solutions. Another significant contribution of FLEXI-COMP is its emphasis on empowering teachers digitally, which directly benefits their students.

Table 2
FLEXI-COMP Competency Framework

AREAS	COMPETENCIES	
1.PROFESSIONAL DEVELOPMENT AND COMMITMENT	1.	Organisational Communication
	2.	Professional Collaboration
	3.	Reflective Practice
	4.	Digital Personal Development
2. USE OF RESOURCES AND CONTENT	5.	Select Digital Resources
	6.	Create and Modify Digital Resources
	7.	Manage, Protect, and Share Digital Resources
3. EVALUATION	8.	Evaluation Strategies and Tools
	9.	Use Evaluation Results for Feedback and Reflection

4. TEACHING AND LEARNING	10.	Design and Learning Plan
	11.	Interactive Digital Teaching: Select and Integrate Digital Tools
	12.	Offer Guidance and Support to Students
5. EMPOWERING STUDENTS	13.	Accessibility and Inclusion
	14.	Actively Engage Students
	15.	Media and Information Literacy
	16.	Understand and Guide Online Student Practice
	17.	Digital Content Creation for Empowerment
	18.	Responsible Use of Technology
	19.	Digital Problem Solving
6. COLLABORATIVE INTELLIGENCE	20.	Communication and Understanding
	21.	Understand and Manage Conflicts
	22.	Promote Resilience
7. UNLOCKING POTENTIAL EMPLOYMENT	23.	Beyond Training
	24.	Teaching in Context: How to Make Our Teaching Industry-Specific
8. PROMOTING CREATIVITY	25.	Work with Hidden Talents
	26.	Foster Creativity and Innovative Thinking

Source: FLEXI-COMP project

To the first five competency areas, drawn from the DigCompEdu framework, three socio-professional competency areas were added: Collaborative Intelligence (interpersonal skills), Unlocking Potential (employment skills), and Promoting Creativity (entrepreneurship and innovation).

While several studies emphasise the importance of soft skills for teachers' training activities (Osuna-Acedo et al., 2018; Fuentes et al., 2021; Lozano et al., 2022), areas 6 and 8, respectively titled "Collaborative Intelligence" and "Promoting Creativity", represent a significant innovation within this framework due to their limited presence in the examined frameworks. Although recent studies in primary education (Jara et al., 2024) and higher education (Bucheli et al., 2023) mention creativity and collaboration as necessary competencies, they remain notably absent in discussions about digital competencies within the VET context (Borden-Lanza et al., 2023). International fieldwork involving interviews with VET teachers and students (Morales et al., 2024) revealed the importance both groups attributed to these areas, identifying them as key demands to be included in training activities. The inclusion of area 7, titled "Unlocking Potential", which is focused on the labour market, provided a practical, realistic, and coherent perspective aligned with current market demands, while also emphasising entrepreneurial spirit and initiative.

More specifically, area 6 facilitates the application of elements such as empathy, responsibility, and the management of interpersonal relationships in teaching. This includes skills for understanding and preventing conflicts in the classroom through active listening and intercultural awareness, helping vulnerable students overcome various barriers. Area 7 takes a forward-looking approach beyond the training period, utilising digital tools to support students' employability and entrepreneurial spirit. It highlights the contextualisation of various professional fields by teaching digital tools

to identify and capitalise on employment opportunities. Finally, in area 8, "Promoting Creativity", digital tools serve as a resource for working with students' hidden talents, particularly valuing those of the most disadvantaged. This area fosters creativity and innovative thinking through activities and design proposals that enable students to respond to challenges in an inventive and functional manner.

In summary, FLEXI-COMP is innovative primarily due to its combination of areas and competencies. Building on existing frameworks that did not fully address the diverse needs of students and VET teachers, FLEXI-COMP was developed as a broader framework aimed at acquiring digital skills and knowledge, while also encouraging the development of soft skills. This dual focus empowers educators and helps to bridge gaps, particularly for the most vulnerable students.

In the next phase of the project, each of the eight areas and 26 proposed competencies were further developed into theoretical and applied knowledge, accompanied by resources and activities that formed a comprehensive training course. A mixed-methods approach was adopted, featuring a self-directed online format that combined theoretical-practical learning with collaborative work using co-creation tools within the virtual platform. Scaffolding was chosen as the structuring strategy due to its flexibility in accommodating different learning rhythms and progression levels, allowing participants to delve deeper into and seamlessly connect the various areas and competencies based on their interests or needs. Additionally, learning resources were provided in various microlearning formats, including educational modules, podcasts, downloadable materials, and infographics. These were complemented by a video game that enabled participants to apply the content to everyday situations in VET classrooms, using gamification mechanics and personalised badges as rewards (Morales et al., 2023). This approach ensured flexible access to content and respected individual learning rhythms, offering adaptable time management that catered to the diverse schedules and situations of educators, such as those engaged in dual education systems, as noted in previous studies (Dillenborough et al., 2022).

The course incorporated the principles of Universal Design for Learning (UDL) (Rose & Meyer, 2002) to ensure that all teachers could equally participate in the various activities related not only to techno-pedagogical content but also to practical cases and problem-solving. A review of educational strategies supported by microlearning conducted by Betancur and García-Valcárcel (2023) highlighted the lack of peer interaction strategies. This weakness was addressed in the training by emphasising experiential exchange among teachers, collaborative work, and the processes of creation, analysis, and reflection. This was achieved through a "collaborative corner" where teachers developed activities and proposals contextualised to their areas of expertise.

The course was publicised in the five countries involved, and in Spain, it benefited from the collaboration of a teacher training centre to ensure its dissemination across different levels of VET. The course was conducted online via the Moodle platform from January to May 2023. During its implementation, data were collected to verify the validity and utility of the course and the FLEXI-COMP framework, using various instruments designed to answer the following Research Questions (RQ):

- Self-perception of competency development: (RQ 1) Which competencies were most developed by VET teachers by the end of the course (pre-post comparison)?

- Degree of applicability of the areas and competencies: (RQ 2) Does the course reduce the gap between knowledge and the ability to apply these competencies?
- Assessment of the course's utility and complexity: (RQ 3) Which content (competencies) were the most challenging to acquire or required the most learning time? (RQ 4) Which competencies were rated as most useful? (RQ 5) Were there differences in the assessments based on sociodemographic variables?

METHODOLOGY

Measurements

To statistically test the research questions, various primary data collected during the online course implementation were analysed. Firstly, a questionnaire was designed based on existing self-perception instruments for teachers (Cattaneo et al., 2022; Mattar, Ramos & Lucas, 2022; Párraga et al., 2022) to measure the level of competency development before and after the course, in relation to both knowledge and application in the classroom. A Likert scale ranging from 1 to 5 was used, with 5 representing the highest score for self-perceived knowledge and application for each of the 26 competencies in the FLEXI-COMP framework. Administered before and after the course, this questionnaire enabled the assessment of causality, determining how the course influenced improvement in each competency, based on self-perception levels (RQ 1). It also allowed for the evaluation of whether the course reduced the gap between teachers' claimed knowledge and their ability to apply competencies in the classroom (RQ 2). The validity of this questionnaire was tested using a confirmatory factor analysis, demonstrating that the 52 pre-post questions fit well with the theoretical model of the eight FLEXI-COMP competencies (CFI > 0.9; TLI > 0.9; RMSEA < 0.08; SRMR < 0.06). Reliability was assessed through several indicators: Cronbach's alpha was 0.97 for the pre-test and 0.98 for the post-test, indicating high internal consistency. The Pearson correlation between the pre- and post-test was 0.84, and the Intraclass Correlation Coefficient (ICC) was 0.61. These results show that the measurements are internally consistent and stable over time, providing a solid basis for evaluating the course's impact.

Secondly, an anonymous evaluation questionnaire was completed by course participants, including demographic data and a 0-10 rating of the utility of the eight FLEXI-COMP competency areas, as well as an estimate of the hours spent on the training course. Additionally, post-course assessment tests by competency areas were conducted to evaluate the acquired knowledge (10 questions per topic, four response options, one correct). These two instruments, the evaluation questionnaire and the tests, address Research Questions 3, 4, and 5.

Participants

The sample of VET teachers was selected for convenience from those interested in the course, although national reach was ensured during its dissemination. After excluding cases of participants who dropped out (n=28), the final sample consisted of 171 VET teachers from various professional fields, covering both intermediate and higher levels, as well as dual training. Regarding sociodemographic characteristics, 34% of the participants were male and 66% were female. In terms of age distribution: 6.4% were under 25 years old, 12.2% were between 26 and 35 years old, 34.5% were

between 36 and 45 years old, 35% were between 46 and 55 years old, and 11.6% were over 56 years old. This sample, with a female overrepresentation, is representative of the sociodemographic profile of VET teachers, according to data from the National Statistics Institute (2021), which indicates that slightly over 60% of this educational level's total workforce is female.

Statistical Procedure

The evaluation of the improvement in each area was conducted by grouping the competencies and using T-tests to compare means for paired samples, given the normal distribution of most of the variables analyzed. This allowed us to determine whether there were significant differences between the means of the results obtained before and after the course and how self-perception had changed by analysing the difference in knowledge and application capacity. It highlighted not only if there was an increase, but also which competencies experienced the greatest improvements. The aim was to ascertain whether the course improved both the knowledge of each competency and its application capacity for teachers, and whether it reduced the gap between theory and practice. The methodological procedure involved calculating the mean distance and its difference with the T-test for the knowledge and application items, measured in absolute terms, before and after the course.

To identify which competencies presented the greatest learning difficulties, the differences in the means of the assessment tests conducted after the course implementation were calculated. ANOVA, followed by Tukey's test was used for this analysis. Finally, statistics regarding teachers' satisfaction with the usefulness of what was learned in relation to each competency and the time invested in the course were calculated, also examining potential differences based on sociodemographic variables such as gender and age. For gender differences, a T-test was used, while age differences were analysed using ANOVA and Tukey's test. This allowed for the determination of overall satisfaction and satisfaction within each sociodemographic subgroup for each of the eight areas, as well as differences in the time invested.
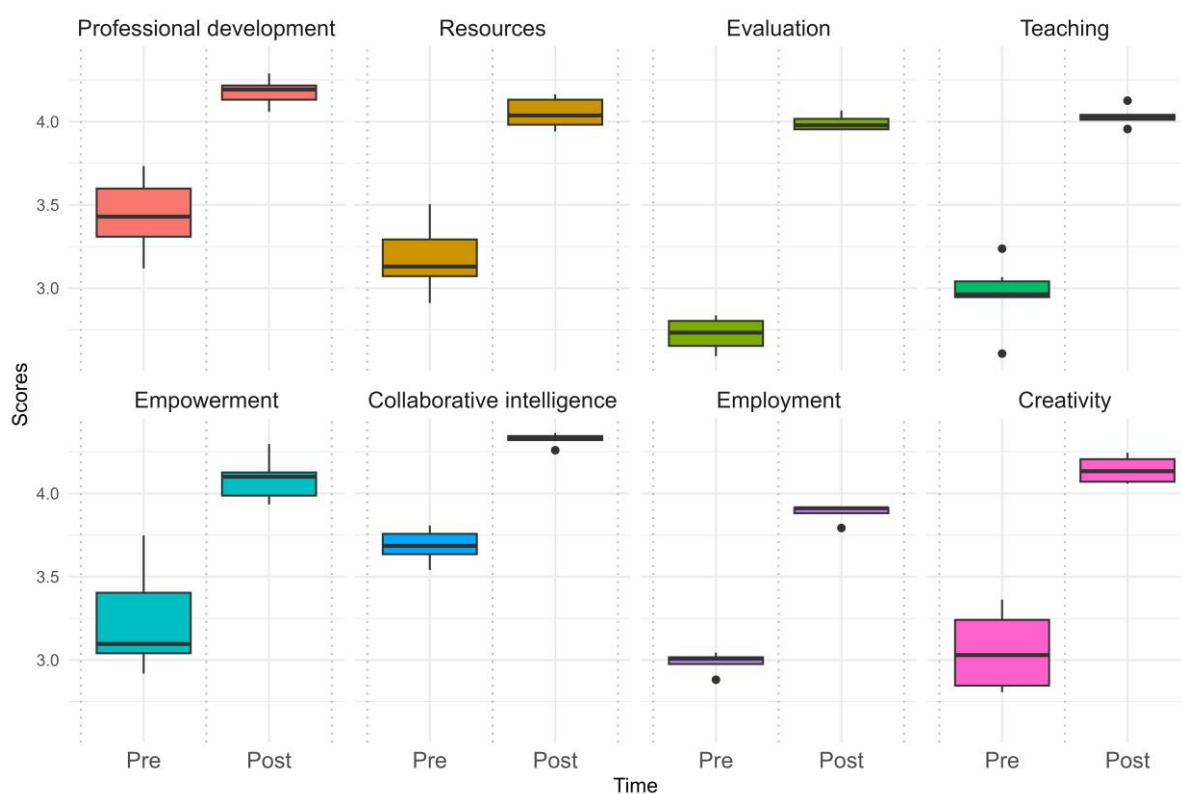
The statistical demonstrations, effect size calculations, and metrics of validity and reliability for the tests are available in the following file: https://figshare.com/s/73ec7cb79ce193b89866

RESULTS

Research Question 1, which examines the degree of competency development after the course and identifies which competencies improved the most, reveals a statistically significant increase (p<0.05) across all eight evaluated competency areas (see Figure 1). Initially, teachers reported higher development in areas such as *Professional Development* (Mean=3.4), *Empowerment* (3.1), and *Collaborative Intelligence* (3.6), with the latter showing the highest post-test mean score (4.6 out of 5). The areas showing the greatest differences before and after the course were *Evaluation* (T=14.942, df=134, Difference=1.269), *Teaching* (T=14.128, df=134, Difference=1.068), and *Creativity* (T=12.679, df=134, Difference=1.085). These areas initially had lower development scores, suggesting potential training deficiencies for both digital and social competencies among the teachers. Competency groupings showed greater mean differences in digital competencies (pre-test mean=0.22, post-test mean=0.18) compared to socio-professional competencies (pre-test mean=0.20,

post-test mean=0.15). The dispersion of mean scores was higher in the pre-test, whereas post-course responses were much more homogeneous. This suggests that the course's flexibility and adaptability effectively catered to teachers with varying levels of competency.
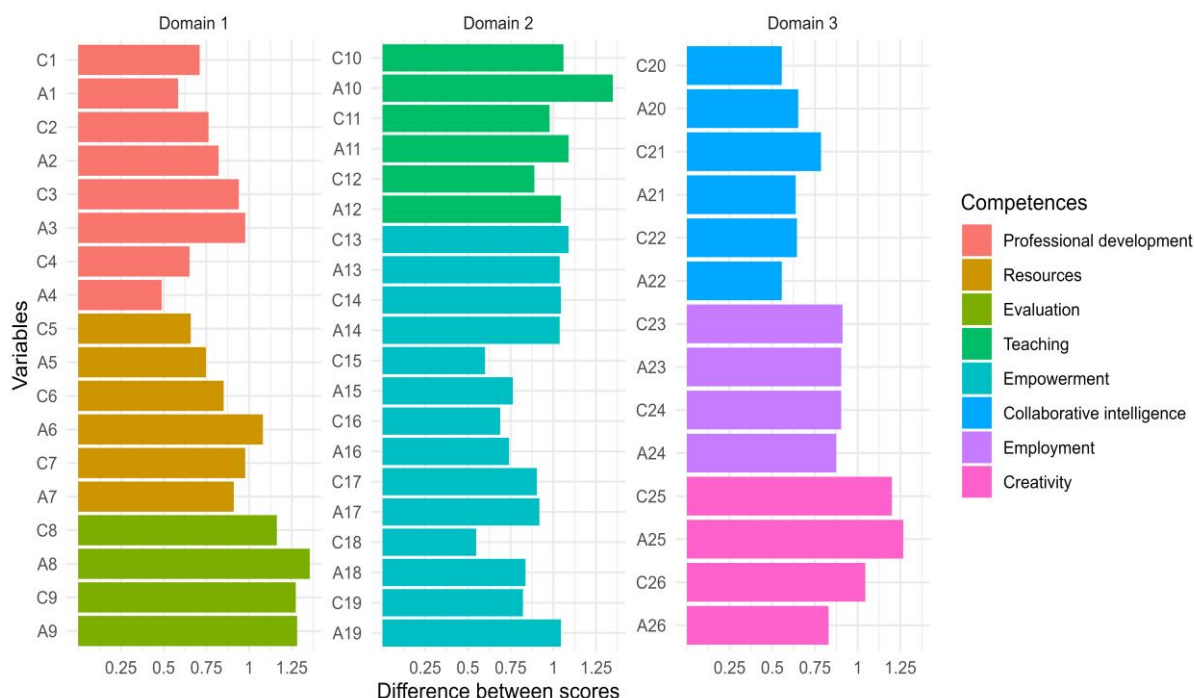
Figure 1
Mean values and their dispersion by areas between pre-test and post-test

Regarding Research Question 2, the mean scores for knowledge and application in each competency were disaggregated. Figure 2 shows the average increase for each of the 23 competencies, calculated using the T-test, in relation to the teachers' self-perception before and after the course. The competencies are divided into two categories: knowledge (prefix C) and application (prefix A). The colours in the chart indicate the area to which each competency belongs, with the first two columns representing digital competencies and the last one representing socio-professional competencies. The results indicate that, for all competencies, both in knowledge and application, there was a statistically significant increase ($p < 0.05$) after completing the course, suggesting improvements in the ability to apply the knowledge in the classroom by VET teachers. According to the mean values, the competencies with the greatest applicability were: *8 Evaluation Strategies and Tools* (Dif=1.356), *10 Design and Learning Plan* (Dif=1.356), *9 Use Evaluation Results for Feedback and Reflection* (Dif=1.281), and *25 Work with Hidden Talents* (Dif=1.267).

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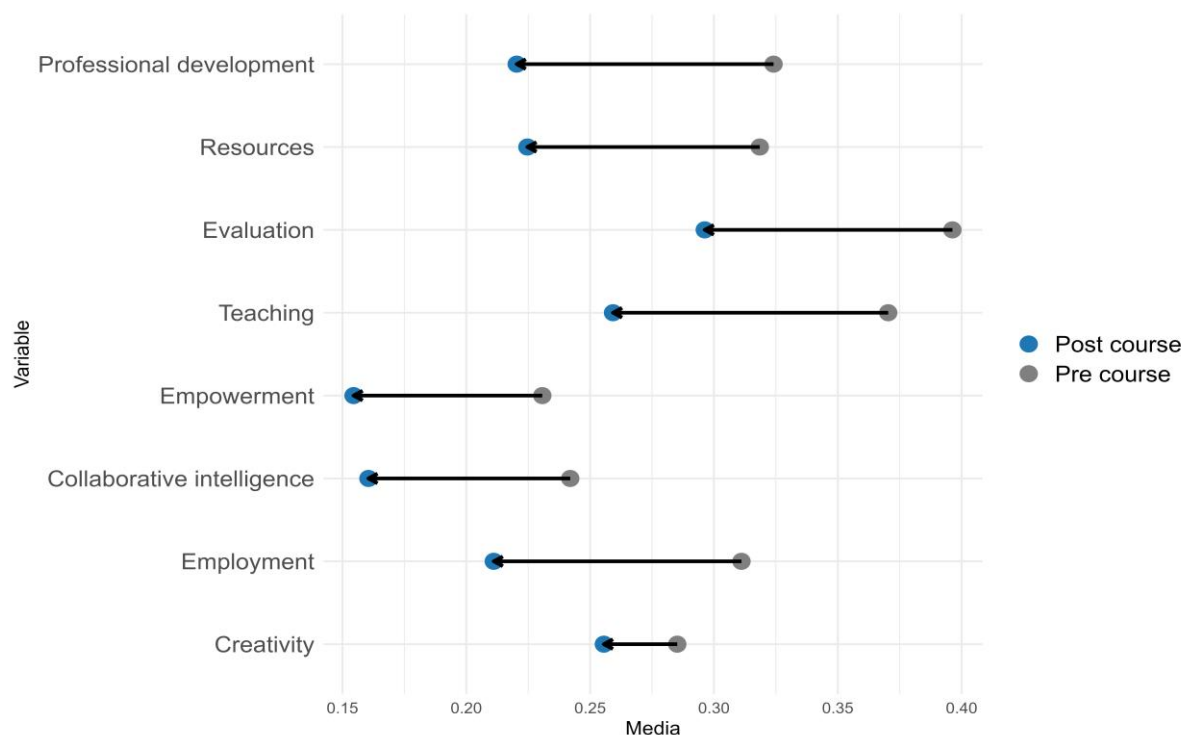
Figure 2
Average increase in knowledge and application scores by competency

To address RQ 2, regarding the effect of the course on reducing the differences between teachers' knowledge of each competency and their ability to apply it, a comparison of the mean differences between knowledge and application before and after the course was carried out (see Figure 3). The results show a significant reduction in this difference across all evaluated areas ($p < 0.05$), except for that of *Creativity*, where the reduction was not statistically significant ($p=0.49$) due to the small effect size (Dif=0.03). In conclusion, before the course, teachers did not perceive a clear correspondence between their level of knowledge and their application ability in the teaching context. However, after the course, there was a greater alignment between these aspects, reducing the perceived difference between knowledge and application.
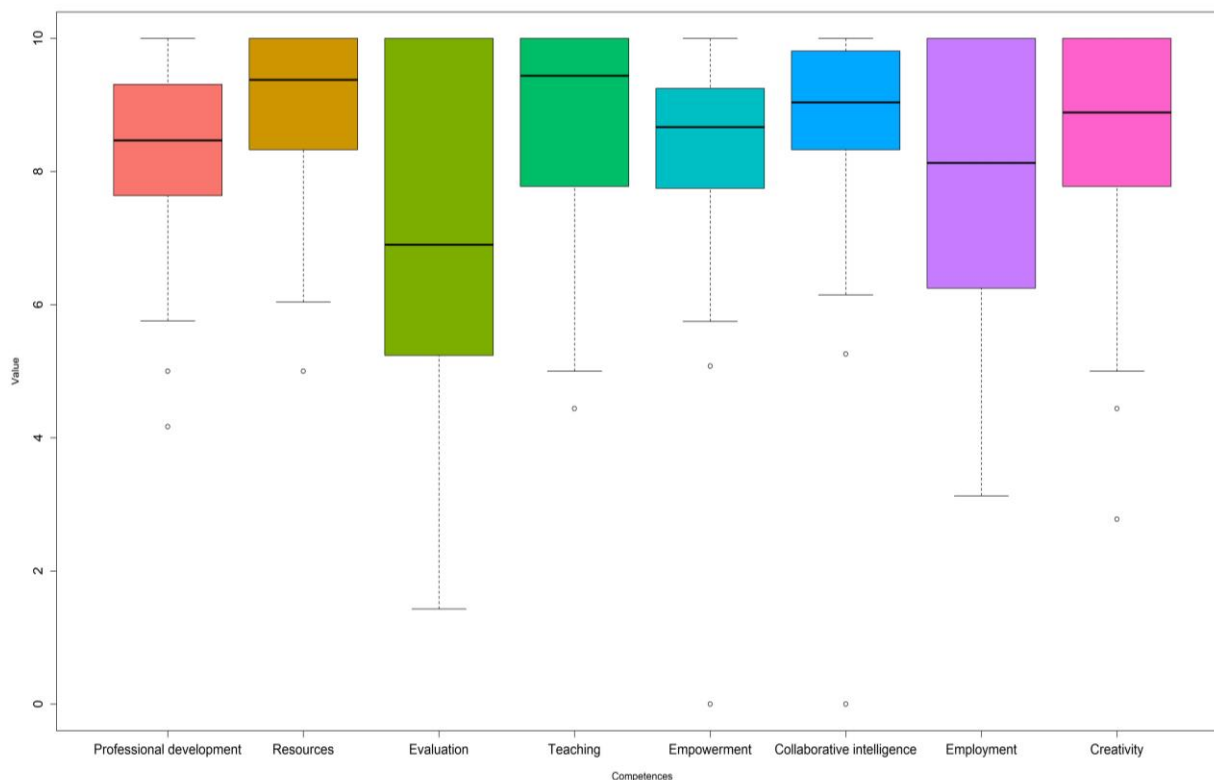
Figure 3
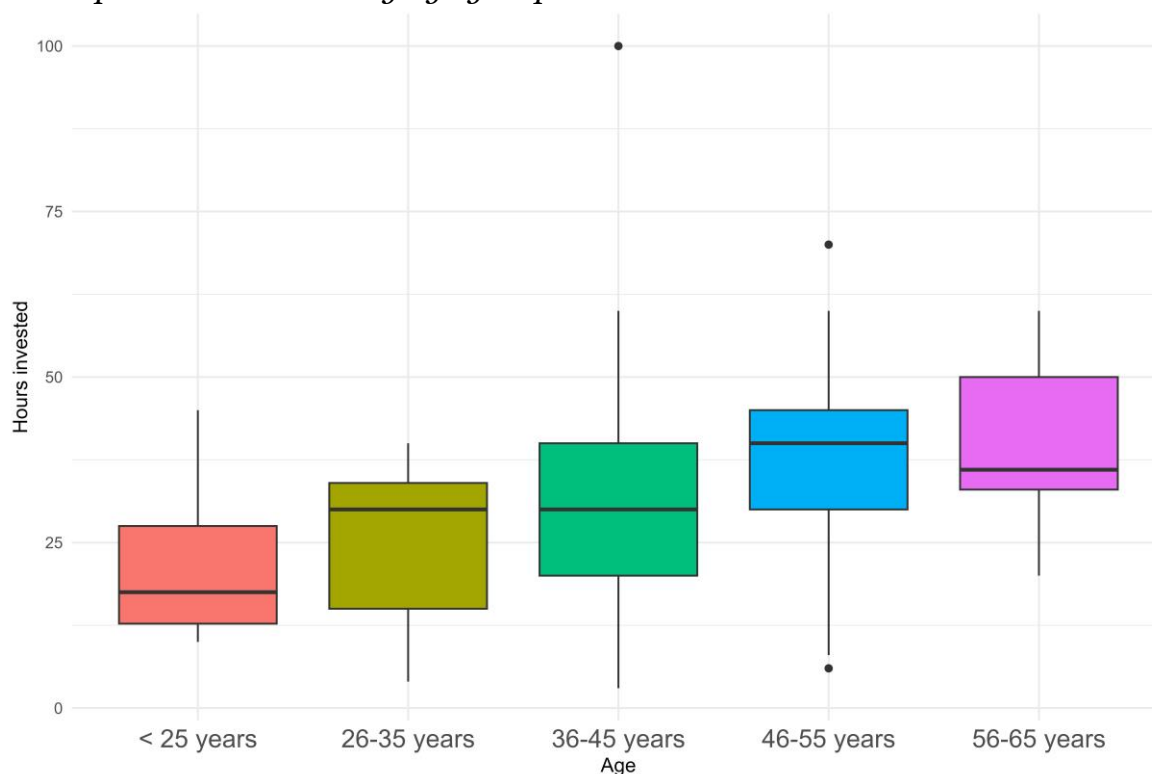*Difference in mean scores between knowledge and application by areas*

To determine in which competency areas teachers experienced the greatest difficulty (RQ 3), the scores from each evaluation test by competency area, conducted after the implementation of the course, were analysed. The ANOVA test was performed, yielding significant results ($p<0.05$), followed by the Tukey test. As shown in the box plot (see Figure 4), competency areas related to *Evaluation* and *Employment* had the greatest dispersion, with more varied scores and means significantly lower than the other competencies. This indicates a higher number of errors and, consequently, a greater level of difficulty in acquiring these areas.

Figure 4
Scores obtained by competency areas

In relation to the analysis of the utility of the course learnings (RQ 4), a Likert scale from 0 to 5 was used in the questionnaire, with 5 representing "Very Satisfied". The data show mean satisfaction scores for the competencies ranging from 4.12 to 4.24, indicating a high level of satisfaction with no statistically significant differences between competencies. The standard deviations ranged from 0.73 to 0.83 points, suggesting that satisfaction levels were not only high but also homogeneous, implying a general agreement on the utility of the course and the generated learnings. Statistical tests found no significant differences by age or gender regarding the valuation of the course's utility. The only significant differences found ($p < 0.05$) were related to age, divided into five cohorts, and the variable "time spent on the course", which showed a differential increase (see Figure 5). The Tukey test revealed that older participants spent more hours on learning teaching competencies, with differences between those under 25 and those over 45 years old. These results are likely related to the technological skills possessed by different groups, highlighting the need for continued training in competencies, particularly for older educators.

Figure 5
Hours spent on the course by age groups

DISCUSSION AND CONCLUSIONS

This study has presented the FLEXI-COMP framework, designed to integrate social and digital competencies, and validated it through the results of a training course. This integration, often referred to as multi-literacy, has not been explicitly addressed in previous competency frameworks. It is highly relevant to the emerging demands for teaching competencies that include interpersonal skills to tackle global challenges (UNESCO-UNEVOC, 2023). Training teachers in intra- and interpersonal skills for digital contexts could ensure that both face-to-face and virtual training processes are comprehensive and resilient, especially when working with diverse or vulnerable students affected by digital literacy gaps, as is often the case in VET.

In addition to being integrative, the FLEXI-COMP project highlighted the need for frameworks and teacher training to be flexible, adaptive, and preferably applied, given the high perceptions of applicability reported by participating teachers. Emphasising flexibility and scalability has been a strategy considered by other digital literacy frameworks (Castañeda et al., 2024), which is even more relevant in the VET system due to the multiple learning environments between educational centres and workplaces, as well as the ever-changing nature of job roles (Lahn & Berntsen, 2023).

The FLEXI-COMP areas and competencies can be used to build new professional development programmes for VET, as the results revealed both gaps and gains in digital and socio-professional competencies.

Regarding the most significant contributions of the study, it was observed that the most developed competencies by VET teachers at the end of the course were related to *Teaching* and *Digital Evaluation*. This aligns with other studies showing low levels of development in tech-pedagogical competencies (Lahn & Berntsen, 2023; Burns &

Hernández-Serrano, M. J., Morales Romo, N., Gago Rivas, V., & García-Gutiérrez, C. (2025). Connecting digital and social competences in a flexible and adaptive framework for VET teachers. [Conectando competencias digitales y sociales en un marco flexible y adaptativo para docentes de Formación Profesional]. *RIED-Revista Iberoamericana de Educación a Distancia, 28*(1). https://doi.org/10.5944/ried.28.1.41470

Kanninen, 2023) and that VET teachers have lower levels of acquisition compared to teachers from other educational levels (Cattaneo et al., 2022; Betancur & García-Valcárcel, 2023). An increase in social competencies was also noted, particularly in the area of *Collaborative Intelligence*. Additionally, the low variability found in teachers' self-perception allows us to assert that, despite differences among VET teachers, this group generally assimilates training positively.

Regarding the applicability of the competencies acquired during the course, the results were highly revealing. The differential score between pre- and post-test was higher for the application level in 10 of the 19 digital competencies evaluated, indicating VET teachers' readiness to apply the developed digital competencies. Focusing efforts on competencies with practical applicability is essential in VET, as the gap between theoretical and applied knowledge is narrower and more focused on job demands.

In addition to the applicability of digital competencies, teachers perceived applicability in socio-professional competencies, though to a lesser extent, except for the subcompetencies *Understand and Manage Conflicts*, *Foster Creativity* and *Innovative Thinking*. In these areas, VET teachers might have found greater applicability in their classroom context, while in others, such as working with hidden talents, they developed both knowledge and application. Burns and Kanninen (2023) also found that VET teachers need more opportunities for competency development, requiring applied examples that can be transferred to their classrooms.

Finally, regarding the evaluation of the course's usefulness and format, high satisfaction scores were obtained. The course allowed VET teachers to acquire content in multiple formats with practical examples, which improved their perception of the ease of applying the competencies in the classroom. Using specific examples for VET advances beyond the limitations of previous studies that used instruments created or validated for other educational levels (Cattaneo et al., 2022; Lahn & Berntsen, 2023).

A limitation that our study shares with others is the challenge of evaluating competencies due to the use of vague concepts or those lacking widely accepted definitions, such as "competency", "skills", and "qualifications" (Cattaneo et al., 2022). In the context of VET, these terms take on additional connotations. Additionally, the tools used to assess competency acquisition, while widely employed in other studies (Mattar, Ramos & Lucas, 2022; Párraga et al., 2022), only measure self-perception and do not assess the actual competency performance of teachers. However, it has been shown that self-perception tools help teachers become aware of their deficiencies and training needs (Cliffort et al., 2020), with a clear effect on their willingness to acquire new competencies (Antonietti et al., 2022). Thus, while advancing the evaluation with different methods and tools is necessary, current methods provide valuable information, as demonstrated by this study, about the gaps that training proposals for VET teachers should address. This is especially important for older teachers, who may be affected by gaps in access to and effective use of digital resources. Our study revealed that age is a determining factor in the acquisition of both digital and social competencies, with older teachers investing more time, consistent with the findings of Burns and Kanninen (2023).

The study concludes that new competency frameworks for VET teachers should include socio-laboral competencies for digitality, such as those found in the FLEXI-COMP framework. This includes specific skills for developing collaborative intelligence, employment skills, and promoting creativity, entrepreneurship, and innovation.

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