Promoting competency-based teaching and learning in higher education through AI-generated self-assessment questionnaires

Promoviendo la enseñanza-aprendizaje competencial en educación superior mediante cuestionarios de autoevaluación generados con inteligencia artificial

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ABSTRACT

Educational models used in competence-based university education should align with the learning outcomes students are expected to achieve. Artificial Intelligence (AI) has emerged as a resource with significant potential to support curricular redesign, orient teaching towards learning outcomes, and generate assessment instruments tailored to specific competences in each subject. However, a persistent lack of instruments to promote student metacognitive reflection within the assessment process often results in a disconnect between competence-based models and actual teaching practices. The aim of this study was to explore the impact of self-assessment questionnaires as an AI-mediated educational innovation for analysing students' self-perceived competence levels and guiding teaching in postgraduate studies. A sequential mixed design (QUAN–QUAL) was employed, involving 1,324 students and 93 lecturers from a Spanish private online university. The students completed ad hoc competence self-assessment questionnaires, and the lecturers evaluated the utility of the AI-mediated self-assessment model through a separate questionnaire. Interviews were conducted with academic coordinators, and three class sessions for each subject were observed. The results showed that the competence self-assessment questionnaires strengthened students' metacognitive reflection and served as a diagnostic instrument for lecturers. Observational analysis, however, revealed a gap between the theoretical acceptance of this instrument and its practical application. The findings highlight the potential of AI to guide the competence-based design of subjects and improve the development of assessment instruments mapped to learning outcomes.

Keywords: educational innovation; higher education; artificial intelligence; questionnaire; competencies.

RESUMEN

La formación competencial en la universidad requiere alinear los modelos educativos con los resultados de aprendizaje que el alumnado debe alcanzar. La Inteligencia Artificial (IA) se presenta como un recurso con alto potencial para apoyar el rediseño curricular, orientar la docencia hacia dichos resultados y generar instrumentos coherentes con las competencias de cada asignatura. Sin embargo, persiste la falta de herramientas que favorezcan la reflexión metacognitiva del alumnado como parte del proceso evaluativo, lo que genera desajustes entre los modelos competenciales y las prácticas docentes. El objetivo de este estudio fue explorar el impacto de los cuestionarios de autoevaluación como innovación didáctica mediada por la IA para el análisis de los niveles de competencia autopercibida por el alumnado y la orientación de la enseñanza en estudios de posgrado. Se empleó un diseño mixto secuencial (CUAN–CUAL), con 1324 estudiantes y 93 docentes de una universidad privada online española. Los estudiantes completaron los cuestionarios ad hoc de autoevaluación competencial. Los docentes analizaron la utilidad del modelo mediante otro cuestionario. Se realizaron entrevistas a los coordinadores académicos y se observaron tres sesiones de clase de cada asignatura. Los resultados mostraron que los cuestionarios fortalecen la reflexión metacognitiva del alumnado y actúan como instrumento diagnóstico para el profesorado. El análisis observacional reveló una brecha entre su aceptación teórica y su aplicación práctica. Los hallazgos subrayan el potencial de la IA para orientar el diseño competencial de las asignaturas y mejorar la elaboración de instrumentos evaluativos alineados con los resultados de aprendizaje.

Palabras clave: innovación educativa; universidad; inteligencia artificial; cuestionario; competencias.

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INTRODUCTION

A fundamental purpose of universities is the provision of a holistic education, enabling students to consolidate their academic progression and flourish both professionally and as active members of civil society. Consequently, since the turn of the century, an educational model has been promoted that prioritises the development of key competences, to equip students to navigate the social and professional challenges they will face as graduates (Molina-García et al., 2025).

Competences are defined as a combination of knowledge, skills, abilities and attitudes that enable individuals to act in real-world settings (social, academic, professional, etc.) in an appropriate, effective manner, while demonstrating a commitment to ethical standards and democratic values (Gil-Galván et al., 2021; Tobón, 2013). Following the framework of the Tuning Project (González & Wagenaar, 2003), competences are classified into generic or basic competences, which are transversal and independent of any single subject area, and specific competences, which are particular to a field of study or profession and involve a high degree of specialisation. The implementation of modern competence-based learning aims to ensure that students develop flexibility to adapt to the changing dynamics of their professional careers (Garcés & Bastías, 2025; Molina-García et al., 2025).

Addressing the paucity of scholarly literature within the Spanish context, this study examines specific competences associated with several postgraduate (Master's) programmes and their constituent subjects. Existing research has predominantly focused on generic or transversal competences (Cebrián Cifuentes & Guerrero Valverde, 2024; Lattek et al., 2024; Regueiro et al., 2021). Nevertheless, assessing specific competences remains fundamental to students' academic and professional progression. Prioritising specific competences enables a tailoring of pedagogical models and more accurate assessment of competences that constitute distinct degree programmes (Santiago Gómez et al., 2018).

Learning outcomes in higher education

To guide the instruction and assessment of competences, learning outcomes (LOs) have been established as essential benchmarks of achievement. Furthermore, in Spain, following the enactment of Spanish Royal Decree 822/2021 (2021), governing the organisation and quality assurance of university education, LOs have assumed a central role in the design of higher education curricula, as prescribed by the National Agency for Quality Assessment and Accreditation (Agencia Nacional de Evaluación de la Calidad y Acreditación [ANECA], 2022). ANECA defines LOs as "statements of what a student is expected to know, understand and/or be able to do at the end of a training or learning process" (ANECA, 2022, p. 12), and their specification involves an educational innovation in two respects: firstly, in placing assessment at the centre of the teaching-learning process; and, secondly, in ensuring comprehensive alignment between LOs and the broader pedagogical framework, including instructional delivery, as well as assessment means and instruments. The latter respect is what in pedagogical jargon is known as constructive alignment in outcomes-based teaching and learning (OBTL) educational philosophy (Biggs et al., 2022).

Despite the reforms implemented in higher education, the concept of LOs has gained only limited traction in institutional practice, where they are frequently conflated with competences (Astigarraga Echeverría et al., 2020). This state of affairs

is clearly illustrated by the formulation of LOs in accreditation reports, a subject examined in a recent study of 83 Master's degree programmes at Spanish universities (Rodríguez-Gómez et al., 2025). The study found that only 20.2% of LOs were accurately defined, only 22.7% were verifiable, that is, measurable and observable, and only 33.6% were context-aligned, that is, action-oriented and relevant to a professional context.

Regardless of the specific formulation of LOs, pedagogical processes aimed at their achievement necessitate a coherent definition of assessment means of student performances and production, such as activities and problem-solving, and of assessment instruments, such as exams and rubrics, so that they facilitate a concise, clear and objective evaluation of attained outcomes (Ibarra-Sáiz et al., 2023). Regarding assessment means and instruments (AMIs), a primary issue involves the conceptual confusion between the two terms. Indeed, a study by Rodríguez-Gómez et al. (2025) found that while assignments, tests, participation, and activities were the most frequent designations, only 47.3% of AMIs were accurately defined, and a mere 22.4% were context-aligned. However, despite these discrepancies, a growing trend towards the integration of student-centred AMIs is nonetheless evident (Ibarra-Saiz et al., 2023).

Furthermore, from a conceptual perspective, Astigarraga Echeverría et al. (2020) defined three interrelated approaches to assessment in higher education. First, assessment of learning is primarily concerned with the certification of attainment and is summative in nature. Second, assessment for learning serves a diagnostic and formative function, providing ongoing information to enhance pedagogical processes. Finally, assessment as learning incorporates a metacognitive dimension by placing the student at the centre of critical reflection on their own progress and achievement. Accordingly, within the framework of self-regulated learning, students employ cognitive and motivational strategies to plan, monitor and evaluate their progress, drawing upon metacognitive skills such as reflection and self-assessment (Simón Medina et al., 2023). In this regard, assessment as learning extends beyond a diagnostic function to act as a scaffold for fostering competence awareness, responsibility, and self-regulation of academic development (Villalonga-Gómez et al., 2023). Nevertheless, while the scholarly literature acknowledges the potential of assessment as learning, the preponderance of research and practice remains focused on the aforementioned summative and formative dimensions. Consequently, assessment as learning remains a relatively under-explored and under-utilised domain in higher education (Rutherford et al., 2025).

Finally, among their primary conclusions, recent review studies have identified in AI an opportunity to enhance assessment frameworks (Jiménez-García et al., 2025; Xia et al., 2024). Specifically, these studies, firstly, contend that the emergence of AI necessitates a re-evaluation of LOs and AMIs to reflect professional and academic environments increasingly characterised by use of this technology. Secondly, they argue that AI enables more effective assessment for learning, as students have access to immediate feedback tools that promote self-regulated learning. The present study therefore addresses the need for scholarly contributions focusing on assessment as learning by proposing an AI-mediated metacognitive assessment mechanism.

Questionnaires as instruments for competence self-assessment in higher education

Competence-based education is associated with effective actions oriented to problem-solving and the improvement of reference social contexts. In this framework, acquired knowledge is to be applied by making efficient and ethical use of resources (Asún et al., 2020). The assessment of competence, therefore, must take into account the executive component of learning (Crespí & García-Ramos, 2021; Organisation for Economic Co-operation and Development [OECD], 2019). This approach, however, is insufficient when assessment is understood as a learning process in itself, as argued in the previous section.

Similarly, in initial university education, it is inappropriate to apply evaluative criteria that are specific to or equivalent to those of professional practice. It is essential that students do not merely solve problems or perform in accordance with professional standards, but also reflect on their own competence development through self-assessment processes (Zabalza & Lodeiro Enjo, 2019). Consequently, the integration of student self-assessment with teaching staff's perceptions of competence-based teaching-learning models constitutes a useful element in the evaluation of the educational process. Furthermore, the integration of performance assessments with the perspectives of key educational stakeholders, including students and teaching staff, has been proposed as the most effective means of optimising higher education curricula (Shivoro et al., 2018).

One of the most widely used instruments for the self-assessment of competences in the university context is the ad hoc questionnaire (Lattek et al., 2024). This type of self-report is easy to administer, demands little time, is low-cost, and allows information to be captured from the perspective of the person completing it (Farrés-Tarafa et al., 2020; López-Núñez et al., 2022). Throughout the last decade, in the Spanish context, there has been a proliferation of questionnaires that allow the assessment of competences via analysis of LOs by students themselves. Notable research in this field includes studies incorporating self-assessment questionnaires for generic or transversal competences (Cebrián Cifuentes & Guerrero Valverde, 2024; Crespí & García-Ramos, 2021; Pérez Navío et al., 2019; Regueiro et al., 2021). Furthermore, specific instruments have been developed to evaluate domains such as digital competence (Saltos-Rivas et al., 2021), entrepreneurial competence (López-Núñez et al., 2022), or those tailored to the requirements of individual academic programmes (Asún et al., 2020).

Notwithstanding the significance of these questionnaires for the self-assessment of generic or specific competences, research such as that by Santiago Gómez et al. (2018) has identified a lack of alignment with the LOs underpinning various university degree programmes, thereby hindering assessment and attainment of more objective and conclusive results. Similarly, there is a conspicuous lack of targeted research and instruments regarding the promotion of student reflection as a metacognitive mechanism for assessing specific competences inherent in individual subjects and degree programmes. The development of ad hoc questionnaires aligned with the LOs of specific subjects within university curricula would thus facilitate more accurate and meaningful self-assessments. In this regard, and considering distance education contexts, where student autonomy takes on a central role, the incorporation of structured instruments that specify LOs can favour the activation of metacognitive

strategies and a more strategic regulation of study (Ortega-Ruipérez, 2022). Reflecting on outcomes achieved and those still in the process of development enables learners and teaching staff to formulate proposals for orienting assessment and pedagogical models towards a genuinely competence-based perspective. This approach is grounded in both the educational process and the LOs that define foundational university education (Pérez Navío et al., 2019).

This manuscript presents an educational innovation along with accompanying research, addressing several of the aforementioned challenges regarding LOs: 1) it promotes greater knowledge, awareness and the correct application of LOs among university lecturers; 2) it evaluates the potential of artificial intelligence in formulating subject-specific LOs; 3) it proposes a novel metacognitive assessment instrument that simultaneously encourages lecturers to align their teaching with LOs and enables students to self-assess their level of proficiency. Building on these considerations, the primary objective of this study was to evaluate the impact of self-assessment questionnaires as an AI-mediated educational innovation, specifically in relation to an analysis of students' self-perceived competence levels and the pedagogical orientation of postgraduate education. This primary objective is further specified in the following specific objectives:

- To describe the effectiveness of self-assessment questionnaires as a mechanism of metacognitive reflection through the perceptions of university students.
- To determine the utility of self-assessment questionnaires for the application and development of competence-based teaching-learning models from the perspective of teaching staff.
- To analyse variations in the levels of competence self-perceived by students.
- To identify changes in the orientation of teaching by university staff, resulting from the implementation of competence self-assessment questionnaires.

METHOD

This study adopted a sequential and descriptive QUAN-QUAL mixed-methods research design (Creswell & Creswell, 2018). The research commenced with a preliminary exploration, using ad hoc questionnaires to survey lecturers and students, followed by an analysis of interviews conducted with academic programme coordinators and of data obtained through virtual observations.

Participants

The initial sample consisted of 1,665 students and 93 lecturers from a Spanish private online university, selected through incidental non-probabilistic sampling, based on criteria of accessibility and willingness to be involved in the study. Of these, 79.5% of students and 65.6% of lecturers completed the questionnaires. Thus, the final sample was formed by 1,324 students (68% women) and 61 lecturers (58% women) from twelve postgraduate degree programmes (University Master's [UM]), representing the six faculties of the reference university (Education and Humanities, Arts and Social Sciences, Law, Higher School of Engineering and Technology, Economics and Business, and Health Sciences).

Procedure

This study was supported by an Applied Teaching Innovation Project (PIDA) grant awarded by the host university. The initiative involved the development of competence self-assessment questionnaires, designed to be administered at the start and conclusion of the academic year for every subject module within the participating degree programmes.

To facilitate this task for the academic coordinators and participating teaching staff, a specific prompt was developed to automatically generate between 6 and 10 LOs linked to the specific competences of each degree programme. Accompanied by an application guide, this prompt was developed in accordance with the recommended 'action verb + content/object + context/condition' structure established in the main literature recommendations for formulating LOs (Catalan University Quality Assurance Agency [AQU], 2022; Biggs et al., 2022; Ibarra-Sáiz et al., 2023; Rodríguez-Gómez et al., 2025), and the corresponding Spanish Qualifications Framework for Higher Education (MECES) levels and graduate profiles, to ensure the alignment of the LOs with labour market needs (Appendix 1).

Once the LOs had been generated and validated with the aid of artificial intelligence by the lecturers responsible for each subject, they were reviewed by the relevant academic degree coordinator. Thereafter, the LOs were integrated into the questionnaires, which were then introduced into the corresponding platforms (Moodle and Canvas), with a score of 0.3 points out of 15 awarded simply for completing each questionnaire. The inclusion of these questionnaires within the continuous assessment framework acknowledges their status as a metacognitive pedagogical task. In this way, students were prompted to reflect at the beginning of each subject course on their degree of proficiency in relation to the subject's LOs. Subsequently, by completing the second questionnaire at the end of the academic year, they were prompted to evaluate perceived shifts in their outcomes, thereby fostering an expected greater awareness of their academic progress.

The research protocol was approved by the Ethics Committee of the collaborating university. Voluntary participation and procedures were in accordance with the ethical guidelines of the 1964 Declaration of Helsinki and its subsequent revisions (World Medical Association, 2024).

Techniques and instruments

Competence self-assessment questionnaire for students

An ad hoc questionnaire was developed for each of the 57 subjects comprising the 12 postgraduate degree programmes included in the research. Each questionnaire included between six and ten LOs linked to the key competences of each subject (e.g., "Differentiate between the modalities of educational research and innovation, and understand their relationship with various research paradigms and approaches"). Participants had to rate their self-perceived competence for each stated action or LO on a scale from 1 to 10 (with 1 representing the lowest and 10 the highest level of competence). Furthermore, in the post-test phase, an additional item was added to all questionnaires in order to examine their importance as mechanisms of self-assessment and metacognitive reflection: "Completing this questionnaire has helped me reflect on

the acquisition of the stated competences". This item was rated on a scale from 1 to 10 (with 1 being the lowest and 10 the highest degree of agreement).

These questionnaires were designed as criterion-referenced instruments aligned with specific LOs, rather than psychometric scales intended to measure a latent construct. Each item represented a discrete competence performance mapped to the official curricular competences and the corresponding MECES level. Content validity was established through the initial generation of LOs from these competences and subsequent expert review by the lecturers responsible for each subject. In this way, curricular coherence and the conceptual adequacy of the instrument within its specific educational context were safeguarded.

Teaching staff questionnaire

To gather the teaching staff's perceptions of the effectiveness of the competence self-assessment instruments, an ad hoc questionnaire comprising 6 items was developed (e.g., "The problems worked on in the classes of my subject are oriented towards the acquisition of the key competences that have been defined"), which were rated using a 5-point Likert scale (1 = Strongly disagree; 5 = Strongly agree). In addition, an open-ended question was added so that the teaching staff could make any comments they deemed relevant regarding the innovation project. To facilitate qualitative analysis, responses from this cohort were assigned the code 'L' for 'lecturer'.

Interviews with academic degree coordinators

In order to obtain contextualised and in-depth information on the main objectives of the project, the 12 academic degree coordinators (coded as C1-12) were interviewed as key informants within the framework of the project, given their knowledge of the student profile, training needs, and the professional context associated with the study. These semi-structured interviews were conducted via Microsoft Teams and lasted approximately 30 minutes each. Initial transcripts were generated automatically by the platform, and then subsequently reviewed by the research team.

Observational analysis

Systematic observation was employed to determine whether the project had been successfully integrated into the classroom environment. To this end, three sessions were observed for each subject, with lecturers selected at random when several were involved. First, the presentation session was analysed to assess whether lecturers had communicated and explained the value of the competence self-assessment questionnaires. Second, an intermediate session was observed to determine the pedagogical orientation of the educational process towards the LOs. Third, the final session for each subject was observed to identify concluding reflections on the questionnaires and acquired learning. In total, 192 class observations were conducted.

Data collection was conducted utilising an ad hoc checklist developed specifically for this study. The checklist incorporated the following observation criteria: (a) explicit explanation of the purpose of the self-assessment questionnaires in the initial session; (b) references to learning outcomes during class sessions and the

alignment of classroom activities with these outcomes in the intermediate session; and (c) invitation for final reflection on the learning outcomes and questionnaires in the final session. Each criterion was measured on a dichotomous scale (presence/absence) and supplemented by brief narrative notes to contextualise the observations. The observations were performed by a member of the research team in accordance with established recording guidelines.

Data analysis

To achieve the specific objectives of this research, univariate descriptive statistical analyses (mean, standard deviation, and percentages) were used. First, lecturers' and students' perceptions concerning the effectiveness of the self-assessment questionnaires were examined. Second, students' self-perceived competence levels across the subjects included in the study were analysed. Third, qualitative content analysis was applied to the open-ended responses from lecturers and the interviews with academic coordinators. Finally, observational data were used to identify the proportion of lecturers who explicitly presented the questionnaires and adopted competence-based approaches during their sessions. Statistical processing was performed using Microsoft Excel (2019). Qualitative data were coded using a deductive approach focused on three core categories: the perceived effectiveness of the self-assessment instruments, reflections on the implementation of the initiative, and the interpretation of findings in relation to specific degree programme profiles.

Finally, the quantitative and qualitative data are presented concurrently throughout the following sections to facilitate methodological integration between the two research paradigms. This approach is recognised as a benchmark of rigour in mixed-methods evaluations of educational programmes (López-Meseguer & Valdés, 2020).

RESULTS

The findings of this study will be divided into three sections according to the predetermined specific objectives.

Implementation of the competence self-assessment questionnaires

Table 1 shows the results concerning the teaching staff's perceptions of the effectiveness of the self-assessment questionnaires as an educational innovation.

Table 1
Effectiveness of the competence self-assessment questionnaires

Item	Degree of agreement (%)				
	1	2	3	4	5
The competences generated in the competence self-assessment questionnaires integrate the main practical learning outcomes that students must acquire in taking my subject.	0	0	9.84	39.34	50.82
The generated key competences have helped me orient the classes towards the achievement of specific learning outcomes.	1.64	1.64	0	40.98	55.74

The 'problems' worked on in my subject's classes are oriented towards the acquisition of the key competences that have been defined.	0	0	3.28	29.51	67.21
The continuous assessment activities for my subject are oriented towards the acquisition of the key competences that have been defined.	0	0	3.28	34.43	62.30
The competence self-assessment questionnaires seem to me a suitable instrument for students to reflect on their learning process.	1.64	0	0	36.07	62.30
The Competences Project, in general, has had a positive impact on my students' learning.	1.64	0	9.84	40.98	47.54

Note: 1 = Strongly disagree, 2 = Disagree, 3 = Neither agree nor disagree, 4 = Agree, 5 = Strongly agree.

More than 80% of the surveyed lecturers agreed or strongly agreed on the relevance of self-assessment questionnaires for the development of competence-oriented teaching and learning processes. This suggested that the AI-generated instruments successfully integrated the primary LOs and facilitated the orientation of classes towards their attainment, while similarly highlighting the importance of practical classroom problems and continuous assessment activities for this purpose.

Furthermore, students reported that completing the self-assessment questionnaires significantly facilitated reflection on their acquisition of key competences, as evidenced by the high mean score of 9.07 (SD = 0.89). Across the 57 subjects analysed, individual subject means for this reflective dimension ranged from 8.25 (SD = 1.27) to 9.66 (SD = 0.68).

Finally, content analysis of the lecturers' open-ended responses, along with the interviews with academic coordinators, demonstrated alignment with the positive reception of the pedagogical innovation indicated by the quantitative data. For instance, it was widely highlighted that the initiative was viewed very positively: "It is a positive project that encourages both students and lecturers, visibly demonstrating progress and learning" (C4). "I see only benefits, no negative aspects; the questionnaire is a very useful and necessary tool" (C12). "The students themselves expressed their satisfaction, on various occasions, at having achieved the learning outcomes" (L44). Regarding the implementation of the project, findings documented that the initiative contributed to the reinforcement of a cohesive pedagogical model: "it generated a collective identity; lecturers felt part of something bigger" (C7). The contribution of AI to the process was also evidenced: "it is positive in this AI-assisted project-based learning to be able to convey the importance of these initiatives and to have teaching staff that understand the message" (C4). Furthermore, the importance of establishing participation incentives for both students (integration into continuous assessment) and lecturers (recognition for participation in an innovation project) was emphasised.

Analysis of self-perceived competences by postgraduate students

Table 2 provides an illustrative overview of the variations in students' self-perceived competence across the participating degree programmes. For this purpose, data from all 57 subjects were analysed. Subsequently, these findings were used to prepare individualised reports for each programme, which were shared with their respective academic coordinators.

Table 2
Self-perceived competence in postgraduate students

Degree programme	Pre-test *M* (*SD*)	Post-test *M* (*SD*)	Δ (post–pre)
UM in Account Auditing	5.16 (1.42)	7.60 (1.14)	2.44
UM in Cybercrime	5.82 (1.17)	8.97 (0.79)	3.15
UM in Economic Criminal Law	6.32 (1.08)	8.52 (1.02)	2.20
UM in Mathematics Education	5.40 (1.31)	8.80 (0.82)	3.40
UM in Video Game Design and Development	3.79 (1.72)	7.21 (1.23)	3.41
UM in Technological Project Design and Management	4.90 (1.47)	6.46 (1.29)	1.56
UM in Creative Writing	4.96 (1.43)	8.47 (0.95)	3.51
UM in Gerontology	6.31 (1.23)	8.26 (1.05)	1.94
UM in Digital Marketing	3.81 (1.82)	8.02 (1.21)	4.21
UM in Family Educational Guidance	6.74 (1.12)	8.64 (0.93)	1.90
UM in Psychotherapy: Third Generation Therapies	3.98 (1.67)	7.99 (1.22)	4.01
UM in Advanced Digital Journalism Projects	4.72 (1.38)	8.30 (1.12)	3.58

Note: M = mean, SD = standard deviation, Δ = difference between post-test and pre-test means.

The greatest variation between pre-test and post-test scores was observed in the UM in Digital Marketing (4.21 points) and the UM in Psychotherapy: Third-Generation Therapies (4.01 points). Students enrolled in these degree programmes perceived a higher level of competence regarding the LOs during the second measurement phase compared to the first. Conversely, students on the UM in Technological Project Design and Management (1.56 points), the UM in Family Educational Guidance (1.90 points), and the UM in Gerontology (1.94 points) perceived a lower level of competence development.

Furthermore, the qualitative analysis identified three primary functions attributed to the self-assessment questionnaires by participants: individual student reflection, lecturers' pedagogical orientation towards practice, and their utility as a complementary quality indicator. From the participants' perspective, it was noted that the questionnaire encourages students to 'stop and think' about their learning, and acts as a mechanism prompting a review of knowledge and competences acquired throughout the course: "I find it very useful for students to ask themselves whether they have learned something or not. It makes them pause, think, and say: Right, what do I know? What have I learned?" (C2). "It helps students focus on what is important and place greater value on practical classes and the competences that will be most useful in their professional careers" (C5).

Regarding the lecturers, it was primarily highlighted that the innovation facilitated the integration of an outcomes-based pedagogical philosophy: "Lecturers sometimes forget to emphasise the practical component. This questionnaire serves as a useful reminder to ground the content" (C1).

Finally, from the perspective of the academic coordinators, the competence self-assessment questionnaires served as a quality indicator complementary to traditional student surveys: "The data are useful as a quality indicator to calibrate learning and inform decision-making regarding the degree programme" (C3). "It allows for the quantification of the utility of the Master's contents. Students leave knowing 30% more than when they started" (C7).

Analysis of the change in the teaching model: outcomes orientation

Table 3 shows the descriptive results of the observational analysis to determine potential changes in the orientation of teaching towards a more competence-based model (based on the LOs included in the self-assessment questionnaires).

Table 3
Observational analysis: changes in the orientation of teaching

Faculty	Degree programme	1	2	3
FEB	UM in Digital Marketing	40%	20%	20%
	UM in Account Auditing	60%	0%	40%
SET	UM in Video Game Design and Development	50%	50%	25%
	UM in Technological Project Design and Management	50%	40%	40%
LAW	UM in Cybercrime	40%	40%	40%
	UM in Economic Criminal Law	60%	20%	20%
ART-SSC	UM in Advanced Digital Journalism Projects	100%	80%	60%
HEALTH	UM in Gerontology	40%	40%	60%
	UM in Psychotherapy: Third Generation Therapies	60%	0%	60%
EDU-HUM	UM in Family Educational Guidance	20%	80%	20%
	UM in Mathematics Education	60%	60%	60%
	UM in Creative Writing	80%	20%	40%
Total		55%	37.5%	40.4%

Note. FEB = Faculty of Economics and Business; SET = School of Engineering and Technology; LAW = Faculty of Law; ART-SSC = Faculty of Arts and Social Sciences; HEALTH = Faculty of Health Sciences; EDU-HUM = Faculty of Education and Humanities. 1, 2, 3 = Percentage of lecturers who introduced the self-assessment questionnaires and oriented teaching towards a competence-based model in the initial (1), intermediate (2), and final (3) observation session of each course. Total = Percentage of lecturers who oriented teaching towards the competence-based model.

As observed, half of the examined lecturers (55%) explained the competence self-assessment questionnaires to students during the presentation session. Of particular note was the UM in Advanced Digital Journalism Projects, which utilised a standardised presentation template for all subjects. This facilitated the inclusion of the assessment instrument in every instance. Conversely, only 20% of the lecturers analysed in the UM in Family Educational Guidance referred to the importance of the self-assessment questionnaires during the initial session.

Regarding the second session analysed, it was observed that only 37.5% of the observed lecturers oriented the educational process towards the LOs included in the self-assessment questionnaires. Only in the UM in Advanced Digital Journalism Projects and the UM in Family Educational Guidance did involvement rates among academic staff reach 80%. In contrast, no lecturers in the UM in Account Auditing or the UM in Psychotherapy: Third-Generation Therapies oriented their teaching towards the defined LOs.

Observations from the final session indicated that a minority of lecturers (40.4%) encouraged final reflection on the questionnaires and the learning acquired. In this case, the highest percentage achieved by several UM programmes was 60% (e.g., UM in Gerontology), contrasting with the 20% observed among lecturers of other degree programmes (e.g., UM in Digital Marketing).

The qualitative data provided a more contextualised understanding of these observational results. Most notably, it was highlighted that the invitation to complete the competence self-assessment questionnaires (observation sessions 1 and 3) was also extended to follow-up meetings between academic coordinators and students: "In the follow-up meetings we hold with students, we strongly emphasised the importance of completing the questionnaires" (C5). Nevertheless, as reflected in the observational data, further progress is necessary for lecturers to fully incorporate competence-based teaching and learning oriented towards practical learning outcomes in their classes. The qualitative findings suggest that this is part of a process that does not occur instantaneously: "Every new culture or change faces resistance; it is not enough for someone to say it has to be done, it has to be constructed gradually" (C6).

DISCUSSION & CONCLUSIONS

The findings of this study facilitate a comprehensive analysis of the significance of competence self-assessment questionnaires as metacognitive instruments in higher education. First and foremost, the positive perception of lecturers of the suitability of the questionnaires is consistent with scholarly literature emphasising the necessity to align assessment methods and instruments with learning outcomes (Biggs et al., 2022; Ibarra-Saiz et al., 2023). Over 80% of lecturers acknowledged that these instruments assisted in orienting teaching towards the attainment of specific competences defined by the LOs. These findings support recommendations to promote constructive alignment that ensures pedagogical coherence across teaching, learning, and assessment (Rodríguez-Gómez et al., 2025).

From the students' perspective, the high mean score achieved in the item addressing the effectiveness of the self-assessment questionnaires confirms the potential of these instruments as a mechanism to promote metacognitive reflection on acquired competences. Furthermore, as noted by Zabalza and Lodeiro Enjo (2019) or Astigarraga Echeverría et al. (2020), self-assessment extends beyond merely verifying achievements, as it promotes the student's critical awareness of their progress and areas for improvement, fostering self-regulated learning and positioning the student at the centre of the formative process (assessment as learning). These results are also interpretable within the framework of the self-regulated learning model, in which self-assessment constitutes a cyclical process influencing competence perception, motivation, and planned adjustment of study (Simón Medina et al., 2023). The use of structured questionnaires generated with AI not only optimises assessment, but also provides opportunities for performance appraisal and reflection, strengthening awareness of learning outcomes, and promoting a more autonomous regulation of academic progress (Ortega-Ruipérez, 2022). Thus, the implemented questionnaires not only act as diagnostic tools but as metacognitive scaffolds aligned with the assessment as learning approach (Villalonga-Gómez et al., 2023). Likewise, the empirical evidence presented in this study supports the appropriateness of integrating this type of instrument into continuous assessment, given its formative impact (Farrés-Tarafa et al., 2020; Lattek et al., 2024; López-Núñez et al., 2022).

Regarding self-perceived competence levels, the pre- to post-test increases suggest that the questionnaires not only have a reflective effect, but also show significant potential as a complementary quality indicator to traditional student satisfaction self-reports. Furthermore, this aspect was clearly confirmed in the interviews with the academic coordinators of the degree programmes. Collectively,

these findings constitute a substantial contribution to the discourse on quality in higher education, reinforcing the need to supplement performance-focused competence assessments with student self-assessment as a mechanism for analysing one's own learning (Rutherford et al., 2025; Shivoro et al., 2018; Villalonga-Gómez et al., 2023; Zabalza & Lodeiro Enjo, 2019). Conversely, variations in increases in self-perceived competence also revealed heterogeneity across degree programmes, coinciding with previous studies that noted a need to design instruments adjusted to each disciplinary field in order to guarantee the relevance of the competence assessment (Pérez Navío et al., 2019; Santiago Gómez et al., 2018). In this regard, the integration of AI to generate specific LOs, as in this project, is emerging as a promising pathway to overcome previous limitations in LO formulation and better align assessment with professional demands (AQU, 2022; Jiménez-García et al., 2025; Molina-García et al., 2025; Xia et al., 2024).

In this study, observational analysis provided a key nuance: the gap between the theoretical acceptance of the questionnaires and their effective integration into teaching practice. This finding aligns with difficulties noted in the literature regarding the effective implementation of learning outcomes in universities, where confusion persists between competences and the achievements or indicators derived from them (Astigarraga Echeverría et al., 2020; Rodríguez-Gómez et al., 2025; Santiago Gómez et al., 2018).

Overall, the results demonstrate that assessing self-perceived competence through questionnaires is an effective tool for strengthening students' awareness and self-regulation, as well as for guiding teaching towards a competence-based approach focused on learning outcomes. Nevertheless, the implementation variability highlights the need to continue advancing the training of teaching staff and the design of contextualised instruments.

Limitations and research prospects

This study is not without limitations that should be addressed in future research. First and foremost, the degree programmes involved in the study were chosen through incidental non-probability sampling, limiting the representativeness of the sample, requiring the results to be interpreted in the specific context of the study, and restricting their generalisability to other university environments. Given that there was no known probability of inclusion for all potential participants, the external validity of the findings is inherently limited. To mitigate this issue, the use of probabilistic sampling for the selection of degree programmes is advised, along with an expansion of the study universe. This would reduce subjectivity during the selection process and increase the potential for more objective and reliable inferences.

Second, although the questionnaires are low-cost instruments and easy to administer, their integration in virtual classrooms involved certain operational costs, hindering the deployment of the proposed innovation and its development in a greater number of degree programmes. Nevertheless, this problem could be mitigated in future applications through the automation of many processes using artificial intelligence.

Third, the study did not incorporate student narratives regarding the utility of the questionnaires as a mechanism for competence-based reflection. Analysing student voices through interviews, focus groups or discussion sessions would complement the quantitative data obtained through the questionnaires. Furthermore, such qualitative

approaches could yield proposals for instrument optimisation, granting students a more prominent role in processes of innovation in postgraduate studies.

Finally, possible sociodemographic and contextual variables that could interfere with the results were not analysed. Examining these attributes would allow for a deeper understanding of the variations in students' self-perceived competence. Similarly, the analysis of such variables among lecturers would facilitate the discovery of elements that either support or hinder the orientation of teaching towards more competence-based models.

Practical implications

The implementation of these questionnaires represents a shift in the conceptualisation of competence assessment in postgraduate students. In practice, this implies a necessary step towards pedagogical models oriented towards the attainment of learning outcomes mapped to the competences prescribed within each degree programme (Garcés & Bastías, 2025). On the one hand, this initiative amplifies the student voice by enabling reflection on knowledge and skills acquired. Students emerge as active agents of their own learning, while the lecturer assumes the role of facilitator in accordance with current self-regulated learning frameworks. Such integration can help students develop planning, self-assessment, and strategy adjustment habits, consistent with self-regulation models that have demonstrated positive impacts on academic performance and engagement (Ortega-Ruipérez, 2022; Simón Medina et al., 2023). On the other hand, it mandates that university lecturers clearly define the specific learning outcomes underpinning subject-level and programme-level competences, while also ensuring their systematic monitoring.

Within this framework of redefining assessment, AI has emerged as a tool that can support and collaborate with teachers, contributing new ideas and possibilities within educational management and planning (Jiménez-García et al., 2025; Xia et al., 2024). Indeed, at the host institution where the intervention occurred, the prompt has since been integrated into a dedicated AI assistant for generating learning outcomes, which is now widely utilised by teaching staff. Furthermore, the implementation of these questionnaires is currently being expanded across a broader range of degree programmes.

In conclusion, gaining insight into postgraduate students' perceptions of their competence development through self-assessment questionnaires and on lecturers' evaluations constitutes a significant step towards aligning higher education with contemporary academic, social and professional demands. Within this process, artificial intelligence is poised to play a transformative role.

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APPENDICES

Prompt
(Generation of learning outcomes)

Context

Your task is to formulate specific learning outcomes for university subjects, to assist lecturers in this task.

You will be provided with information about a subject [attached document] that may include its expected planning (topics), pedagogical and professional approach, and associated competences.

Task

1. ***Detection of the type of study***
   - **If STUDY_TYPE = "Degree":**
   - Apply the generic descriptors of MECES 2 (EQF 6):
     1. Advanced knowledge at the forefront of the field.
     2. Creative application in complex professional environments.
     3. Compilation, interpretation and critical reflection (social, scientific, ethical).
     4. Performance in complex situations and generation of new solutions.
     5. Clear and precise communication to specialist and non-specialist audiences.
     6. Autonomous learning and continuous self-regulation.

   - Prioritise verbs and activities that reflect a general education oriented towards professional practice and international mobility.
   - **If STUDY_TYPE = "Master's":**
   - Applies the descriptors of MECES 3 (EQF 7):

a. Advanced knowledge and understanding in a research or highly specialised context.
b. Application and integration in new and multidisciplinary environments.
c. Critical evaluation and selection of theory and methodology with social/ethical reflection.
d. Prediction and control of complex situations using innovative methodologies.
e. Clear and unambiguous communication about advanced research or innovation.
f. Autonomy to participate in research, development and innovation projects.
g. Responsibility for one's own professional development and specialisation.

- Prioritize verbs and activities that highlight specialisation, innovation, and research leadership.

2. **Quantity assignment*

- The total number of learning outcomes must be [value added by the lecturer]

3. **Drafting of each competence*

- Length: **15-35 words**.
- Main verb: one of medium or high level in Bloom's Taxonomy (or synonym), observable, and implying action, application, or production.
- Avoid generic or unobservable verbs: to know, to understand, to study, to identify, to differentiate, etc.
- Practical and professional orientation: formulated as assessable results in specific formative or professional contexts.
- Alignment with the planned contents of the subject and the professional profile of the degree that you can observe in the curricula.

Checks to be made

Before submitting, make sure that each competence:

- Has between 15 and 35 words.
- Uses a medium/high Bloom verb.
- Is observable and assessable.
- Includes a professional/applied context.
- Aligns with the subject's contents.
- Meets the total number required.

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