2026 ASEE ANNUAL CONFERENCE June 21–24, 2026 | Charlotte Convention Center, NC
Host Sponsor UNC Charlotte
ASEE AMERICAN SOCIETY FOR ENGINEERING EDUCATION
Paper ID #52879

Digital Platform for Competency-Based Assessment and Monitoring in Engineering Education: Design and Pilot Study

Mrs. Kelly Cristina Ferreira Dias, Universidade Federal Do Rio Grande Do Sul

Kelly Cristina Ferreira Dias is a Ph.D. candidate in Industrial Engineering at the Federal University of Rio Grande do Sul (UFRGS), Brazil. Her research focuses on competency-based education, technology foresight, and digital transformation in engineering education. She has experience in innovation management and applied research in collaboration with industry, working on projects related to educational technology, data analytics, and strategic intelligence. Kelly is also involved in initiatives that connect academia and industry to promote continuous improvement and the development of adaptive learning ecosystems.

Prof. Christine Tessele Nodari, Universidade Federal Do Rio Grande Do Sul

Full Professor at the Federal University of Rio Grande do Sul (UFRGS) and recipient of a CNPq Research Productivity Fellowship (Category C), with expertise in Transportation Engineering and Road Safety. She holds a B.Sc. in Civil Engineering (1992), an M.Sc. (1996), and a Ph.D. (2003) in Production Engineering from UFRGS, including a study period at the University of British Columbia (Canada). Her work focuses primarily on road safety, active mobility, and engineering education. She has been dedicated to promoting the internationalization of research and academic training through partnerships and collaborative projects with foreign institutions. Currently, she serves as Associate Thematic Coordinator for the Education in Transportation area of ANPET — the National Association for Research and Education in Transport — and as Deputy Coordinator of the Undergraduate Committee of the Department of Production and Transportation Engineering (DEPROT) at UFRGS. Throughout her career, she has participated in numerous university extension projects focused on traffic safety and sustainable transport, aiming to integrate academia with society and local needs.

Maria Auxiliadora Cannarozzo Tinoco, Universidade Federal Do Rio Grande Do Sul

Maria A. Cannarozzo Tinoco is a professor in Industrial Engineering Program at the Federal University of Rio Grande do Sul (UFRGS) in Brazil. She currently coordinates the Institutional Modernization Proposal for the modernization of the Industrial Engineering Undergraduate Program, managed by the School of Engineering at UFRGS, under the Graduation Modernization Program (PMG) promoted by CAPES (Brazilian funding agency) and the Fulbright Commission since 2019.

Italo Rodeghiero Neto, Universidade Federal Do Rio Grande Do Sul

Post doctoral researcher in Industrial Engineering from the Federal University of Rio Grande do Sul (UFRGS), Brazil. Temporary professor at the same university. Doctor and Master of Industrial Engineering from UFRGS (2020). His research mainly spans engineering education, ergonomics, human factors, and accessibility.

Paula Kvitko de Moura, Federal University of Rio Grande do Sul

Paula Kvitko de Moura, PhD, is a Postdoctoral Researcher in Industrial Engineering at the Federal University of Rio Grande do Sul (UFRGS), Brazil, and a Deep Tech Specialist at the UFRGS Science and Technology Park. She also serves as a Professor and as an Analyst in the Undergraduate Modernization Program, where she supports pedagogical innovation, stakeholder engagement, and strategic development across the School of Engineering. Her research focuses on innovation ecosystems, startup innovation, digital transformation, and active learning in engineering education. She is also an International Research Partner at the Technical University of Munich (TUM), collaborating on initiatives related to innovation and technology-driven education.

Mr. Igor Eduardo Santos de Melo, Universidade Federal Do Rio Grande Do Sul

DIGITAL PLATFORM FOR COMPETENCY-BASED ASSESSMENT AND MONITORING IN ENGINEERING EDUCATION: DESIGN AND PILOT STUDY

Abstract

This empirical full paper presents the development and pilot testing of a digital platform designed to support competency-based assessment and monitoring in engineering education. Engineering education has increasingly incorporated competency-based approaches, which pose significant challenges related to the assessment and monitoring of competency development throughout undergraduate programs. Predominantly summative assessment practices, often confined to isolated courses, are limited in capturing the progressive, cumulative, and transversal nature of professional competencies. In this context, digital platforms emerge as promising alternatives to operationalize more integrated and longitudinal assessment processes. This paper presents the development and pilot application of a digital platform designed to support competency assessment and monitoring in an undergraduate Industrial Engineering program at a Brazilian public university. The platform integrates student self-assessment, faculty assessment, and analytical visualizations, structured around a set of fifteen competencies that define the program's graduate profile. The pilot study was conducted during the first semester of 2025 and involved students at different stages of the program as well as faculty members responsible for courses associated with the assessed competencies. The results indicate that the platform is both technically viable and pedagogically appropriate, enabling longitudinal tracking of competency development and the integration of multiple assessment perspectives. The analyses reveal consistent patterns of perceived progression across the program, as well as complementary dynamics between student self-assessments and faculty assessments. User perceptions point to an overall positive evaluation of the platform, particularly regarding its alignment with program objectives and competency-based assessment guidelines. This study contributes to the literature by providing empirical evidence on the use of a digital platform specifically designed to support formative assessment and competency-based curriculum management in engineering education.

Keywords: engineering education; competency-based assessment; longitudinal monitoring; educational digital platforms; student self-assessment; faculty assessment.

1 Introduction

Engineering education has increasingly shifted toward competency-based approaches, aiming to prepare professionals capable of integrating technical knowledge, cognitive skills, and attitudes in complex and dynamic contexts. This transition moves the focus away from content-centered instruction toward the definition of learning outcomes aligned with the graduate profile, responding to current demands from industry and society [1], [2]. Despite its conceptual consolidation, the operationalization of competency-based education poses significant challenges, particularly with respect to assessment. Competencies develop progressively, cumulatively, and transversally throughout the program, which limits the effectiveness of assessment practices that are predominantly summative and confined to isolated courses. Evidence from the literature highlights the need for methods capable of tracking competency development over time and supporting continuous improvement in engineering programs [3].

Systematic reviews indicate that, although rubrics and questionnaires are widely used in competency assessment in engineering, many applications lack longitudinal monitoring mechanisms, integration across curricular components, and robust evidence of validity and reliability [3]. In this context, student self-assessment has been recognized as a relevant element, as it fosters self-regulated learning and student agency; however, when applied in isolation, it tends to present limitations related to data consistency and articulation with assessments conducted by faculty [4]. Recent longitudinal empirical studies show that engineering students' self-assessments of competencies evolve in a non-linear manner throughout the program, varying according to the formative stage and educational context. These findings reinforce the need for systems capable of continuously and systematically monitoring competency development [5].

The implementation of digital educational platforms emerges as a promising alternative to address these challenges. Digital systems enable the structured collection, storage, and integrated analysis of educational data, supporting continuous monitoring of competencies at individual, cohort, and institutional levels. Studies suggest that platforms designed for competency-based assessment can simultaneously support students, faculty, and academic managers by integrating assessment instruments, formative feedback, and analytical visualizations to inform decision-making and evidence-based curriculum management [6]. Despite these advances, there are still relatively few empirical studies describing and analyzing digital platforms specifically designed to operationalize longitudinal competency assessment in engineering programs, particularly those that integrate student self-assessment, faculty assessment, and program-level monitoring [2], [7]. Previous contributions demonstrate the potential of web-based platforms for competency assessment in educational contexts, while also highlighting the need for more integrated solutions aligned with curricular demands of engineering education [8].

This article presents the development and pilot testing of a digital platform designed to support competency assessment and monitoring in engineering education. The pilot study involved undergraduate students and faculty members, using student self-assessment and faculty assessment data collected through the platform to analyze competency development over time. The results indicate that the solution enables longitudinal tracking of competencies and provides relevant information for students, instructors, and academic managers, contributing to formative assessment practices and data-driven curriculum management in engineering education [2], [7].

2 Methodology

This study adopts an applied empirical research approach, structured into two complementary stages: the development of a digital platform for competency assessment and longitudinal monitoring in engineering education, and the pilot application of the platform in a real higher education context. The methodological design combines principles of design and development research with a pilot study, enabling the evaluation of both the solution design process and its initial use in an authentic educational environment. This approach allows the investigation to address not only the technical and functional aspects of the platform but also its pedagogical adequacy and practical feasibility when implemented within an undergraduate engineering program. The integration of development-oriented research with empirical testing supports iterative refinement of the platform while generating empirical evidence regarding its applicability for competency-based assessment and monitoring in

engineering education.

2.1 Development of the Platform

The development of the digital platform followed an incremental and applied design logic, aimed at operationalizing competency assessment and longitudinal monitoring within the context of engineering education. The construction of the solution was motivated by the need to structure a system capable of consolidating evaluative information that had previously been fragmented, thus enabling systematic monitoring of competency development throughout the program and supporting formative assessment practices and evidence-based curriculum management [2], [3]. The platform was conceived as a support environment for competency-based assessment, structured around the set of competencies defined for the Industrial Engineering program and their associated assessment instruments. Competencies constitute the central organizing axis of the system, guiding both the assessment logic and the organization of information. This design choice is aligned with prior studies emphasizing the importance of educational systems grounded in program-level competency frameworks to structure assessment processes and support academic decision-making [1], [6]. The platform is implemented through a dedicated web-based interface; however, the access link has been temporarily omitted to ensure compliance with the double-blind peer-review policy.

The development process included a detailed analysis of curricular documents and existing assessment instruments used in the program, with the objective of identifying the information required to support longitudinal monitoring of competency development. Based on this analysis, the platform was created to enable periodic student self-assessments and the systematic recording of faculty assessments by competency, allowing for the collection of structured evaluative data at multiple points along the students' educational trajectory. The platform integrates student self-assessment and faculty feedback to capture diverse evaluative perspectives in one place. Using performance scales mapped to each competency, the system records how students and instructors view the progress achieved. This inclusion of self-assessment supports formative learning by emphasizing student agency and self-regulation [4], [9]. The platform stores assessment data structurally to enable consolidation and longitudinal analysis. By maintaining historical records, the system tracks competency development throughout the program, overcoming the limitations of isolated or episodic assessment practices. In engineering education, longitudinal studies underscore the importance of this approach to understand how student perceptions and performance evolve over the degree [5]. Analytical dashboards present the consolidated data, synthesizing evaluative information to facilitate interpretation. These visualizations help users track competency trajectories, identify patterns, and detect learning gaps—an approach supported by research on digital platforms for competency assessment [8], [10]. By unifying competencies, assessment instruments, and analytics, the platform operationalizes competency-based assessment longitudinally. This supports formative evaluation and enables evidence-based curriculum management in engineering education [2].

2.2 Competency Framework

The competency framework adopted in this study comprises fifteen competencies defined at the program level and aligned with the graduate profile of the Industrial Engineering program, as well as with the Brazilian National Curriculum Guidelines for Engineering Education [11]. These competencies are organized into two categories: technical

competencies and transversal competencies. Technical competencies encompass core engineering domains related to modeling, optimization, Industrial and operations management, data analysis, project management, quality and process improvement, problem solving, and technological innovation. Transversal competencies include communication, teamwork, ethical and professional responsibility, socio-environmental responsibility, leadership, systems thinking, and lifelong learning. This structure is consistent with competency-based education principles discussed in the literature [1], [3]. Table 1 presents the complete list of competencies considered in the assessment framework, including their categorization and brief descriptors.

Code	Competency	Category
C1	Systems Modeling and Analysis	Technical
C2	Optimization and Decision-Making	Technical
C3	Industrial and Operations Management	Technical
C4	Data Analysis and Interpretation	Technical
C5	Project Management	Technical
C6	Process Improvement and Quality Management	Technical
C7	Engineering Problem Solving	Technical
C8	Technological Innovation and Digital Transformation	Technical
C9	Communication	Transversal
C10	Teamwork and Collaboration	Transversal
C11	Ethical and Professional Responsibility	Transversal
C12	Socio-environmental Responsibility	Transversal
C13	Leadership	Transversal
C14	Systems Thinking	Transversal
C15	Lifelong Learning	Transversal

Table 1 - Competencies considered in the assessment framework

The Acompanha platform was developed as a program-level support system for competency-based assessment and longitudinal monitoring, rather than as a standalone instructional technology. Its development preceded the pilot application and was informed by existing curricular documents and assessment practices within the program. At the time of this study, the platform was not yet deployed continuously across all semesters; instead, it was intentionally designed to be applied at predefined formative stages to support institutional monitoring, enable feasibility testing, and refine assessment workflows prior to broader adoption.

2.3 Pilot Application of the Acompanha Platform

The pilot application of the Acompanha digital platform was conducted during the first semester of 2025 in an undergraduate Industrial Engineering program at a Brazilian public university, as part of ongoing institutional efforts to implement competency-based assessment. The pilot represents the first structured application of the platform and was designed to evaluate its technical functionality, usability, and clarity of competency descriptors, as well as to examine how students and faculty engage with the system during assessment activities. The pilot also aimed to verify the feasibility of collecting comparable student self-assessment and faculty assessment data and of operationalizing longitudinal monitoring of competencies at the program level. Student self-assessment was implemented across four course sections selected to represent different formative stages of the program: an entry stage (incoming students), an initial

stage (4th semester), an intermediate stage (7th semester), and a final stage (10th semester). This distribution allowed the assessment process to be tested at distinct points of the academic trajectory and supported evaluation of the instrument's adequacy for students at varying levels of formative maturity.

Both student self-assessment and faculty assessment were conducted using a standardized 10-point performance scale, applied consistently across all competencies. Each competency was assessed independently, with scores ranging from 1 (very low development) to 10 (very high development). For analytical purposes, a score of 6 was defined as the minimum performance threshold indicating satisfactory attainment of the competency at the expected formative stage. This threshold was established by the program's curriculum committee and aligns with existing institutional assessment practices. Student participation in the self-assessment activity was mandatory as part of the program's institutional monitoring process; however, no grades or academic credit were assigned. The activity was explicitly framed as formative, aiming to foster reflection, self-regulation, and awareness of competency development rather than summative evaluation, in line with prior research on competency-based assessment practices [2]. Self-assessments were conducted in person during mandatory courses, following a brief introduction by instructors explaining the objectives of the platform and clarifying that the evaluation referred to the program as a whole rather than to the specific course context. Students accessed the platform using personal devices and completed the assessment individually.

The self-assessment instrument does not consist of multiple Likert-type items per competency. Instead, students provide a single holistic rating for each competency using the standardized scale, reflecting their overall perceived level of development within the program. Individual responses are directly mapped to the corresponding competencies without intermediate aggregation. While the self-assessment process is intended to support agency and self-regulation, these constructs are treated as pedagogical outcomes emerging from repeated reflective engagement over time rather than as independently measured psychometric variables. Across all formative stages, participation rates were high, and no significant technical issues were reported. Completion times ranged from approximately 10 to 18 minutes for incoming students and remained consistently below 15 minutes for students in the initial, intermediate, and final stages. Minor conceptual questions related to competency descriptors arose primarily in the entry-stage cohort and were promptly clarified during the application, indicating adequate clarity and usability of the instrument across different levels of academic maturity.

Concurrently with student self-assessment, faculty members conducted individual assessments of students using competency-aligned rubrics defined during curriculum planning. Instructors assessed only those competencies meaningfully addressed within their respective courses and recorded evaluations directly in the platform using the same 10-point scale applied in the self-assessment process. Competencies were mapped to specific courses at the program level prior to data collection, and at each formative stage only selected courses participated, based on their relevance to the targeted competencies. This approach ensured that faculty evaluations were grounded in observable learning evidence within defined curricular contexts.

Following the pilot application period, a separate instrument was administered to collect students' and faculty members' perceptions regarding platform use. This instrument addressed aspects related to the clarity of competency descriptors, perceived usefulness

of the information generated, and the platform's contribution to monitoring competency development throughout the program. Data collected during the pilot were organized into two datasets. The first dataset comprised assessment records extracted directly from the platform, including student self-assessment scores and faculty assessment scores, consolidated by competency, course, and formative stage. The second dataset consisted of responses to the perception instrument, including closed-ended and open-ended items. These datasets were integrated into a structured database to support descriptive, cross-sectional, and longitudinal analyses of competency development, as well as exploratory examination of alignment and divergence between student and faculty perspectives.

3 Results

This section presents the results obtained from the pilot application of the Acompanha Platform, focusing on empirical evidence derived from data recorded within the syste, namely, student self-assessments and faculty competency assessments, as well as on students' and instructors' perceptions regarding platform use. The findings are discussed with an emphasis on the longitudinal monitoring of competency development and on the integration of multiple evaluative perspectives within the program context, reinforcing the platform's role as a support tool for competency-based assessment at the curricular level [2].

3.1 Results of Student Self-Assessments

A consistent pattern of perceived competency development is revealed through the analysis of student self-assessments, supporting the longitudinal design of the platform. Lower performance ratings are generally assigned by students in the early stages, followed by a progressive increase in the intermediate and final stages. This trend suggests a growing perception of mastery regarding the competencies defined in the graduate profile. The distribution of students who performed at or above the established threshold across different stages is illustrated in Figure 1. The transition from the entry stage to the initial stage shows the most significant growth, suggesting that the first semesters constitute a critical milestone in the development of academic and professional identity. As indicated in Figure 1, this upward trend is observed across most competencies, with a substantial rise in the proportion of students reaching the expected performance level. In later stages, this growth becomes more gradual, reflecting the consolidation and refinement of previously acquired competencies.

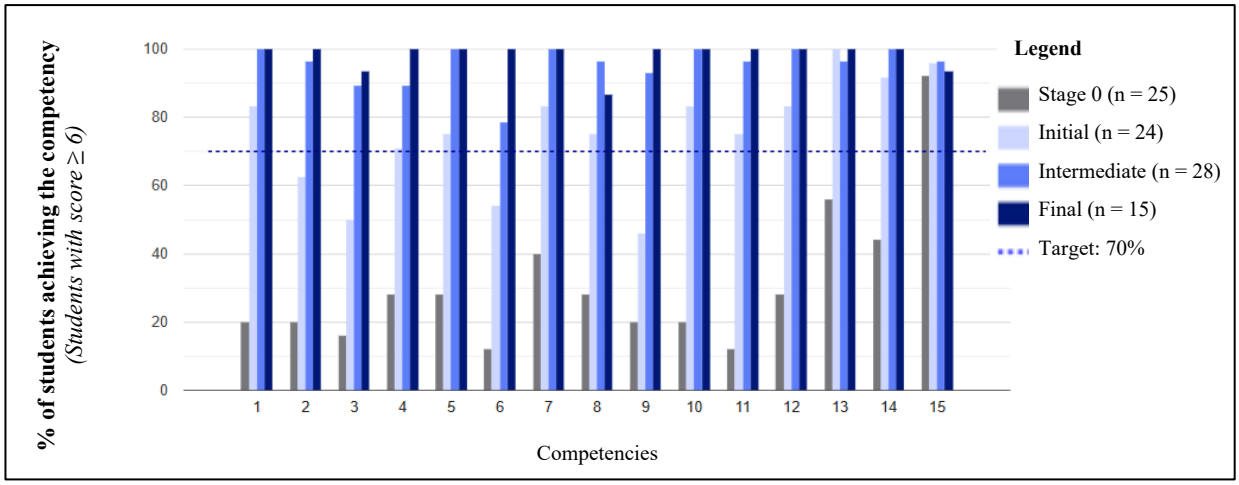

Figure 1: Student self-assessment results across 15 competencies (C1–C15). Technical competencies: C1–C8. Transversal competencies: C9–C15.

When analyzed individually, the competencies exhibit distinct trajectories of perceived development. Transversal competencies, such as communication, teamwork, and lifelong learning, tend to present relatively high levels of perceived attainment from the early stages onward, maintaining consistently high achievement rates throughout the program, as illustrated in Figure 1. In contrast, competencies related to technical and analytical content, systems thinking, and market orientation show more pronounced growth in the intermediate and final stages, reflecting students' increased exposure to professional-oriented courses, integrative projects, and extracurricular experiences characteristic of these phases of the program. The analysis of relative competency behavior across stages further indicates that perceived development does not follow a linear or homogeneous pattern. As shown in Figure 1, certain competencies become more prominent only in the final stages of the program, whereas others maintain stable and high levels of perceived attainment throughout the curriculum. This pattern suggests that students' perceptions of competency development are sensitive to the nature of the academic experiences encountered at each stage of their educational trajectory. Furthermore, comparisons across stages reveal stable perception patterns initially, followed by a more distinct reconfiguration in the intermediate and final stages. This finding indicates that self-perception is refined as the program progresses, enabling a clearer distinction between development levels and the recognition of specific advances gained through academic and practical experiences. The integrated data visualization offered by the platform, as shown in Figure 1, underscores its potential for longitudinal monitoring in engineering education. Moreover, the longitudinal structure of the self-assessment process shifts the focus from isolated performance judgments toward a progress-oriented approach. By revisiting the same competencies at different stages, comparative reflection and self-regulation are fostered, allowing for a better understanding of both current development and the overall trajectory. This aspect is particularly relevant in competency-based education, where development is cumulative and distributed across the curriculum. Consequently, the role of self-assessment is strengthened as a formative, rather than merely diagnostic, instrument.

3.2 Results of Faculty Assessments and Their Relationship with Student Self-Assessments

A distinct pattern is observed in faculty assessments, marked by lower variability in performance ratings across formative stages compared to student self-assessments. In general, more stable evaluations are assigned by instructors, as these are typically grounded in observable learning outcomes, specific pedagogical criteria, and the evidence produced by students within the curricular context. This pattern is illustrated in Figure 2, which displays the proportion of students rated as meeting or exceeding the established performance threshold for each competency across different stages of the program.

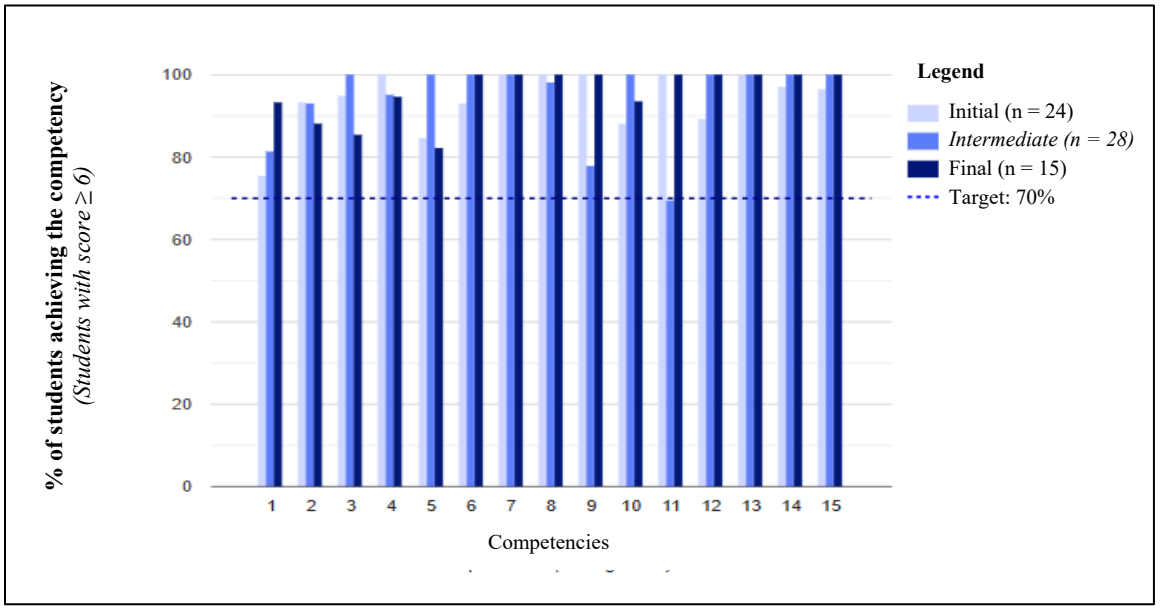

Figure 2: Faculty assessment results across formative stages

As illustrated in Figure 2, competencies associated with technical and analytical content tend to receive more cautious evaluations from faculty, particularly at the initial and intermediate stages of the program. This pattern is likely related to the higher performance standards typically associated with these domains, as well as to the inherent difficulty of fully observing their manifestation within isolated course contexts. In contrast, competencies related to ethical reasoning, communication, and interpersonal skills show higher rates of attainment of the established performance threshold, especially in the final stages of the program, indicating stronger faculty recognition of student maturation in these areas. A comparison between faculty assessments and student self-assessments reveals an evolving relationship between the two evaluative perspectives across formative stages. In the early stages of the program, faculty assessments generally exceed student self-assessments, suggesting that students may initially underestimate their competencies relative to external evaluations. At the intermediate stage, a closer alignment between the two perspectives is observed across most competencies, indicating a gradual calibration of student self-perception as academic experience accumulates and familiarity with assessment criteria increases. In the final stage, student self-assessments tend to exceed faculty evaluations in several competencies, particularly those associated with transversal and integrative learning experiences, while faculty assessments remain comparatively stable.

Given the pilot and exploratory nature of the study, the comparison was conducted descriptively by examining the proportion of students achieving the performance threshold (score ≥ 6) under each assessment perspective and the direction of deviations between student and faculty evaluations. Although no inferential statistical tests were performed due to limited sample sizes at each formative stage, the descriptive patterns observed provide consistent evidence of meaningful developmental trends over time. Taken together, these findings highlight the importance of considering both evaluative perspectives when monitoring competency development. Student self-assessments capture subjective perceptions of progress and confidence, whereas faculty assessments provide an external reference grounded in observable academic evidence and program-level standards. When analyzed jointly, these perspectives reveal systematic patterns of alignment and divergence that would not be visible through a single assessment source.

From a longitudinal standpoint, the differences observed across stages suggest a process of gradual calibration in how competencies are perceived. Early underestimation may reflect limited academic self-efficacy or uncertainty regarding performance expectations, while later overestimation may be associated with increased confidence derived from capstone projects, internships, and professional engagement. These dynamics are consistent with research indicating that self-assessment accuracy develops over time and should be interpreted primarily as a formative mechanism rather than a precise measure of performance, particularly in the early stages of competency-based education.

3.3 Perceptions of Students and Faculty Regarding the Platform

The analysis of user perceptions reveals a positive evaluation of the Acompanha platform by both students and faculty. Technical aspects, including system stability, response time, and cross-device functionality, were rated favorably, suggesting that fundamental usability and reliability requirements for educational use were met. Regarding pedagogical intent, the platform was recognized as a relevant tool for supporting reflection on competency development. Agreement was expressed by both groups concerning the alignment between the platform and the program's objectives, confirming its adherence to established curricular guidelines. Primary divergences in perception are centered on user guidance and support. While these elements were evaluated more positively by faculty, a greater need for clearer instructions and additional support was indicated by students. This finding suggests that user experience is influenced by both prior familiarity with the tool and the intensity of pedagogical mediation provided during implementation. Open-ended responses complement these findings by highlighting suggestions for improvement that address both functional aspects, such as interface design and reporting features, and pedagogical aspects, particularly regarding the integration of student self-assessment and faculty assessment. These qualitative insights reinforce the platform’s potential as a formative assessment tool and point to concrete directions for its refinement in future applications.

4 Lessons Learned and Recommendations for Implementation

The pilot application of the Acompanha platform generated a set of practical insights related to the implementation of competency-based assessment systems in engineering

education. As the study was exploratory and focused on feasibility, the lessons learned are primarily process-oriented and derived from observations during platform use and interaction with students and faculty. A first lesson concerns the importance of clearly framing the purpose of student self-assessment. Explicitly communicating that the assessment refers to the program proved essential for reducing student confusion and improving the quality of responses, particularly in the early formative stages. Short introductory explanations provided by instructors prior to platform use were effective in aligning student expectations and should be considered a key implementation practice. A second lesson relates to the design of the self-assessment instrument. The use of a single holistic rating per competency, rather than multiple item-level questions, facilitated student engagement and reduced completion time without compromising interpretability for longitudinal monitoring. This approach was particularly suitable for a pilot context and for repeated application across different stages of the program, minimizing assessment fatigue. Faculty participation highlighted the importance of clearly mapping competencies to specific courses in advance. Restricting faculty assessment to competencies meaningfully addressed within each course increased instructor confidence in the evaluation process and helped ensure that assessments were grounded in observable learning evidence. This mapping also reduced perceived workload and improved consistency across evaluators.

Based on these lessons, several recommendations can be offered for programs interested in adopting similar platforms. First, implementation should be embedded within existing curricular structures, preferably using mandatory courses to ensure participation while maintaining a non-punitive, formative framing. Second, assessment instruments should balance simplicity and analytical usefulness, particularly in early implementation phases. Third, competency–course mapping should be defined collaboratively during curriculum planning to support faculty engagement and assessment validity. Pilot implementations should be explicitly framed as iterative learning processes. Early cycles are best used to refine descriptors, workflows, and user guidance rather than to generate summative judgments or prescriptive benchmarks. As longitudinal data accumulate, future iterations may support more advanced analyses and the development of evidence-based implementation guidelines.

5 Conclusions

This study presented the development and pilot implementation of the Acompanha digital platform, designed to support the assessment and longitudinal monitoring of competencies in engineering education. By integrating student self-assessment, faculty assessment, and analytical visualizations, the platform sought to operationalize core principles of competency-based education within the context of a Industrial Engineering undergraduate program. This proposal directly addresses gaps identified in the literature regarding the need for systems capable of articulating multiple assessment instruments at the program level, overcoming fragmented and discipline-centered approaches [2], [3]. The pilot results indicate that the platform is both technically viable and pedagogically appropriate for supporting competency-oriented assessment processes. Analysis of student self-assessments revealed a consistent pattern of perceived progression across formative stages, with more pronounced growth in the early semesters and gradual consolidation in the final stages of the program. This pattern is

consistent with empirical evidence from longitudinal studies in engineering education, which demonstrate that competency development is cumulative, non-linear, and sensitive to the formative context [1], [5]. Accordingly, the findings reinforce the importance of longitudinal approaches for understanding competency development, surpassing the limitations of isolated, discipline-specific assessments.

Complementary dynamics between student and faculty perspectives were revealed through the comparison of assessments. While performance was tended to be underestimated by students in the early stages and overestimated in the final stages, faculty evaluations remained more stable and conservative, grounded in observable evidence within disciplinary contexts. This relative misalignment is identified in the literature as an expected phenomenon in competency-based education, underscoring the necessity of integrating multiple assessment sources to strengthen interpretive validity [2], [4]. Perceptions of the platform were generally positive, particularly regarding technical stability, pedagogical purpose, and alignment with course objectives. These findings align with studies on digital platforms where usability and descriptor clarity are highlighted as critical factors for effective use [6], [9]. The identified divergences, specifically concerning user guidance, provide concrete input for platform refinement and emphasize the role of pedagogical mediation in the user experience.

From a theoretical and methodological standpoint, this study contributes to the engineering education literature by providing empirical evidence of a digital platform designed for longitudinal competency assessment. The integration of multiple perspectives at the program level is particularly relevant, given the limited number of empirical studies describing integrated digital solutions for continuous monitoring [8], [2]. Practically, the Acompanha platform is demonstrated to be a promising tool for supporting formative assessment, self-regulated learning, and data-informed curriculum management. Several limitations are identified in this study. The pilot was restricted to a single program and involved a limited number of participants, constraining the generalizability of the findings. Furthermore, the observation period was limited to an initial cycle of use; consequently, long-term impacts on pedagogical practices or learning outcomes could not be assessed. These constraints are common in the early-stage implementation of educational technologies and highlight the necessity of iterative evaluation and refinement cycles, a principle central to design and development research. Future research should expand the application of the platform to other programs and institutions, as well as conduct longitudinal studies following multiple student cohorts throughout the entire undergraduate program. Further investigation is also recommended into how platform-generated data are used by faculty and academic managers in curriculum-related decision-making, as well as into the integration of the platform with more complex assessment methods, such as scenario-based and authentic task assessments, which have been identified in the literature as promising approaches for developing behavioral and professional competencies in engineering education [10].

References

[1] J. Malhotra, M. Massoudi, and R. Jindal, “Shifting from traditional engineering education to competency-based learning,” Journal of Engineering Education, 2023.

[2] M. A. Tinoco, M. N. Cortimiglia, A. Ghezzi, and A. G. Frank, “Proposition of a method to monitor higher education students’ competence development through assessment rubrics,” Studies in Higher Education, vol. 48, no. 9, pp. 1550–1566, 2023, doi: 10.1080/03075079.2022.2108203.

[3] C. Cruz, W. Saunders-Smits, and P. Groen, “Evaluation of competency-based education implementation in engineering programs: A systematic review,” European Journal of Engineering Education, vol. 45, no. 6, pp. 1–21, 2019.

[4] A. Boud and N. Falchikov, Rethinking Assessment in Higher Education: Learning for the Longer Term. London, UK: Routledge, 2007.

[5] J. Valdes-Ramírez, J. Grijalva-Quiñonez, and J. Zavala, “Longitudinal analysis of competency self-assessment in engineering education,” IEEE Transactions on Education, vol. 64, no. 4, pp. 356–364, 2021.

[6] A. Carvajal-Ortiz, A. Florian-Gaviria, and J. Díaz, “Assessment of professional competencies in higher education using digital platforms,” International Journal of Emerging Technologies in Learning, vol. 14, no. 21, pp. 178–193, 2019.

[7] L. Duarte et al., “Digital platform for competency assessment and monitoring in engineering education,” Proceedings of COBENGE, 2025.

[8] J. Jerez, M. Guenaga, and A. Núñez, “Competence assessment in engineering education using web-based tools,” Computers in Human Behavior, vol. 31, pp. 476–484, 2014.

[9] L. Duarte and M. A. Tinoco, “Analysis of user profiles in digital platforms for competency-based assessment,” *Proceedings of COBENGE*, 2024..

[10] A. Georgiev, P. Mihnev, E. Stefanova, N. Nikolova, A. Antonova, and K. Stefanov, “Digital tools to support competence-based learning approaches in higher education,” in *Proc. 15th Int. Technology, Education and Development Conf. (INTED)*, Valencia, Spain, 2021, pp. 1–10, doi: 10.21125/inted.2021.0967.

[11] Ministry of Education (MEC), National Council of Education, “Resolution CNE/CES No. 2, April 24, 2019: Establishes the National Curriculum Guidelines for Engineering Undergraduate Programs,” *Official Gazette of the Federative Republic of Brazil*, Brasília, Brazil, 2019. [Online]. Available: http://portal.mec.gov.br/index.php?option=com_docman&view=download&alias=112681-rces002-19&category_slug=abril-2019-pdf&Itemid=30192