MLS – PEDAGOGY, CULTURE AND INNOVATION (MLSPCI)
https://www.mlsjournals.com/pedagogy-culture-innovation

(2024) MLS-Pedagogy, Culture and Innovation, 2(2), 165-184

CURRICULAR ALIGNMENT FOR THE DEVELOPMENT OF ENGINEERING COMPETENCIES AT THE ISPB

Alineación curricular para el Desarrollo de Competencias en Ingeniería en el ISPB

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Manuscript information:

Recibido/Received:19/0425
Revisado/Reviewed: 20/05/25
Aceptado/Accepted:13/11/25

Keywords:
curricular alignment, professional competencies, engineering, ISPB, evaluation, curricular design, higher education

ABSTRACT

This study explores the alignment between learning objectives, contents, teaching activities and evaluation systems in the engineering programs of the Instituto Superior Politécnico de Benguela (ISPB). The objective of the research is to evaluate the effectiveness of the competency-based curricular design implemented at the ISPB. Through a mixed methodological approach that includes surveys, interviews and documentary analysis, data were collected from students, teachers and career coordinators. The results indicate that there are significant gaps in the alignment of its components. Furthermore, learning objectives do not always translate into teaching activities that encourage the development of the expected competencies. Assessment systems are not designed to comprehensively measure the complex competencies required by professional profiles. Among the recommendations, the need to strengthen teacher training in the design of learning activities based on problems and projects, as well as the development of more precise evaluation instruments, stands out. It is also suggested to periodically review and update study plans to ensure their relevance in a constantly evolving work context.

Palabras clave:
Alineación curricular, Competencias Profesionales, ingeniería, ISPB, Evaluación, Diseño Curricular, educación superior.

RESUMEN

Este estudio explora la alineación entre los objetivos de aprendizaje, contenidos, actividades de enseñanza y sistemas de evaluación en los programas de ingeniería del Instituto Superior Politécnico de Benguela (ISPB). El objetivo de la investigación es evaluar la efectividad del diseño curricular basado en competencias implementado en el ISPB. Mediante un enfoque metodológico mixto que incluye encuestas, entrevistas y análisis documental, se recolectaron datos de estudiantes, docentes y coordinadores de carrera. Los resultados indican que, existen brechas significativas en la alineación de sus componentes. Ademas, los objetivos

	de aprendizaje no siempre se traducen en actividades de enseñanza que fomenten el desarrollo de las competencias esperadas. Los sistemas de evaluación no están diseñados para medir de manera integral las competencias complejas requeridas por los perfiles profesionales. Entre las recomendaciones, se destaca la necesidad de fortalecer la formación docente en el diseño de actividades de aprendizaje basadas en problemas y proyectos, así como en la elaboración de instrumentos de evaluación más precisas. También se sugiere revisar y actualizar periódicamente los planes de estudio para garantizar su pertinencia en un contexto laboral en constante evolución.

Introduction

In a globalized and highly technological world, higher education faces the challenge of training professionals capable of adapting to a constantly changing work environment. Traditional curricula, focused on the transmission of theoretical knowledge, have proven to be insufficient to respond to current demands (López, et al., 2023). In this context, the competency-based approach has emerged as an innovative alternative to guarantee the relevance and pertinence of academic training.

Internationally, numerous studies have shown that curriculum alignment, i.e., coherence between learning objectives, content, teaching methodologies and assessment systems, is a key factor in the development of professional competencies (Álvarez, et al., 2023). However, the implementation of competency-based curricula in different educational systems presents particular challenges related to cultural, socioeconomic and political factors (Santander, S. C. 2024).

In Angola, the education sector has experienced significant growth in recent decades, driven by the country's development policies. However, engineering programs, like other disciplines, face the challenge of adapting their curricula to the new demands of the labor market (Acosta, R. C., & Chana Cassungo Cruz, R. B. 2024). In this regard, the Instituto Superior Politécnico de Benguela (ISPB) has set itself the goal of improving the quality of its academic offerings through the implementation of a competency-based curriculum design (Acosta, R. C., & Chana Cassungo Cruz, R. B. 2024).

The competency-based approach is a pedagogical strategy that seeks to develop professionals capable of applying their knowledge effectively in real contexts (Melillán & Cravero, 2022). The synergy between theory and practice is fundamental to achieve this objective, as it allows students to develop the skills and attitudes necessary to perform successfully in their future careers (Flórez Torres & J. L. 2022). Development of transferable skills; competencies go beyond specific knowledge; they include skills such as problem solving, effective communication, teamwork and adaptation to new contexts. These skills are highly valued in the labor market and allow professionals to perform effectively in different situations (Acosta, R. C., & Chana Cassungo Cruz, R. B. 2024).

The findings presented by Lic. Nelson Giraul Pio Salazar (2019) in his analysis of the curriculum of the Bachelor of Science in Education, specialization in physics, at the Higher Pedagogical School of Namibe, Angola, offer significant coincidences with the approaches being explored in the present research (Martin, et al., 2024). First, the relevance of the link between theory and practice in the teaching-learning process is aligned with the need for a curriculum that not only transmits knowledge, but also fosters practical skills in real contexts.

Almeida Leyva and Rodriguez Alfonso (2023) provide a revealing comparative analysis of English teaching programs in Angolan universities. Their findings, when contrasting public and private institutions, show a marked tendency toward differentiated pedagogical approaches. Private universities prioritize professional practice and the development of communication skills, while public universities focus on theory (Buanga, P. M. S. S. 2014). This dichotomy aligns with current discussions on the relevance of practical training in higher education (Martínez, et al., 2023).

Buangaprimer et al.'s (2014) study on teacher training for environmental education in Angola reveals a significant gap between theory and practice, highlighting that, despite the importance of articulating the local and the global in environmental education, ISCED-Cabinda teachers do not implement this connection in their classrooms. Research emphasizes the importance of designing curricula that effectively integrate

theoretical knowledge with practical experiences, promoting critical reflection and the development of competencies for action (Yap Hilario & L. O. 2022).

From the perspective of curricular work, this need to link theory and practice is fundamental for meaningful learning (Álvarez, et al., 2023). The mere transmission of theoretical knowledge without its corresponding practical application can result in a superficial training, where educators fail to connect what they learn with real situations. (Martínez, et al., 2023). This reflection also applies to our research, where it becomes evident that curriculum alignment should include an approach that combines theory and practice (López, et al., 2023).

Curriculum alignment in the field of engineering has become an increasingly relevant issue, given the dynamic and changing context of the labor market (Álvarez, et al., 2023). At the Higher Polytechnic Institute of Benguela (ISPB), a competency-based curriculum design has been implemented, with the objective of preparing students not only in theoretical knowledge, but also in practical skills that will enable them to face the challenges of a constantly evolving professional environment (Martinez, et al., 2023).

The present research focuses on analyzing the curricular alignment in the engineering programs of the ISPB, with the objective of identifying the strengths and weaknesses of the current curricular model and proposing strategies to improve the training of future Angolan engineers (Briones, et al., 2023). Through a mixed methodological approach, we seek to understand how the competency-based approach has been implemented in the ISPB, what are the main challenges faced and what actions can be taken to strengthen curricular alignment (Acosta, R. C., & Chana Cassungo Cruz, R. B. 2024).

Method

The study focuses on evaluating the effectiveness of competency-based curriculum design at the Instituto Superior Politecnico de Benguela (ISPB), Angola, specifically in the Computer Engineering course. For this purpose, a mixed methodology combining quantitative and qualitative approaches was used, allowing a deeper understanding of the educational reality in this institution.

Methodological Design

1. Quantitative Approach

- Objective: Evaluate the perception of students and teachers on the curricular design and its effectiveness in the development of competencies.
- Instruments used: Survey: A structured questionnaire was designed that included dichotomous and Likert-type questions. This questionnaire was administered to a representative sample of students (456) and teachers (40).

Table 1.
Analysis of Collected Data

Method of Analysis	Description	Result	Interpretation
Software Used	Analysis of collected data.	SPSS	Statistical tool used for the analysis.

Method of Analysis	Description	Result	Interpretation
Factor Analysis	Evaluation of the structure of correlations between variables.	-	It allows the identification of patterns and relationships between variables.
Bartlett's test	Sphericity test to verify the adequacy of the factor analysis.	0.00	Significant ($p < 0.05$); indicates correlation between variables.
Kaiser-Meyer-Olkin (KMO)	Measure of sample adequacy for factor analysis.	0.546	Considered good; acceptable value (greater than 0.5).

Source: Own elaboration.

The analysis of the data collected was carried out using SPSS software, a tool recognized in the statistical field for its capacity to perform complex analyses. In this context, fundamental statistical tests were applied to assess the adequacy of the data for factor analysis.

The Kaiser-Meyer-Olkin (KMO), which reached a value of 0.546, is considered an acceptable indicator to determine the adequacy of the data in the factor analysis. This value, which exceeds the minimum threshold of 0.5, suggests that the sample is adequate and that the correlations between the variables are sufficiently strong to justify the application of this type of analysis. A KMO in this range indicates that there is an interrelationship between the variables that can be effectively explored.

On the other hand, Bartlett's test, which yielded a value of 0.00, is a test of sphericity that evaluates whether variables are correlated in a correlation matrix. A significant result, with a p-value of less than 0.05, indicates that the variables are not independent of each other, which reinforces the hypothesis that there is a relationship between them. This is an essential criterion for proceeding with factor analysis, since it suggests that the variables share variance and, therefore, can be grouped into common factors.

Overall, the results of the KMO and Bartlett's test provide strong support for performing the factor analysis, indicating that the data are adequate and that the selected variables have significant correlations. This allows inferring that factor analysis can reveal underlying structures in the data, facilitating the identification of patterns and relationships that may be fundamental for the development of competencies in the investigated context.

2. Qualitative Approach:

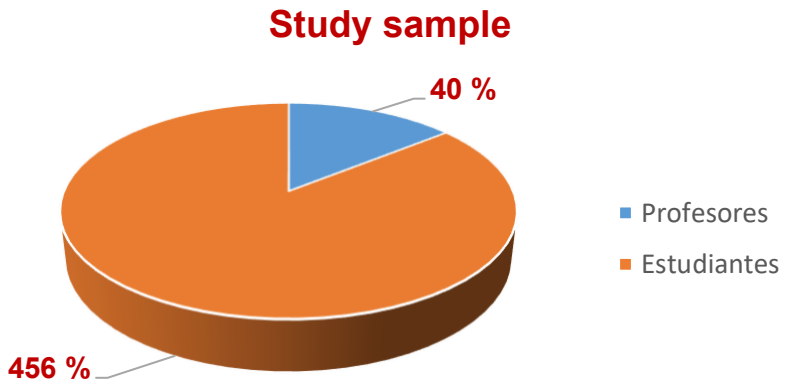
- Objective: To deepen participants' perceptions and experiences regarding the curriculum and its implementation.
- Instruments used:
- Semi-structured interviews: Interviews were conducted with teachers and career coordinators, allowing for an in-depth exploration of their opinions on the curricular design and its impact on the development of competencies.

- Documentary analysis: Institutional documents, study plans and evaluation reports were reviewed to obtain a comprehensive view of the curriculum and its alignment with the competencies required in the labor market.

Sample

The total population of the study consisted of 596 subjects, including students, teachers, managers and representatives of companies linked to the ISPB. A representative sample was selected from this population:

Figure 1. Sample of study.



Source: Own elaboration.

Table 2.
Data Analysis

Evaluation Method	Description	Result
Internal Consistency	Internal consistency analysis using the Kuder-Richardson test 20.	0.896
Analysis of Two Halves	Evaluation of internal consistency using the Spearman-Brown test.	0.693
Cronbach's alpha	Evaluation of homogeneity in dichotomous responses; interpreted through Kuder-Richardson.	High homogeneity

Source: Own elaboration.

The results obtained from the internal consistency analysis of the survey reveal a high level of reliability. The Kuder-Richardson 20 coefficient, which reached a value of 0.896, indicates a robust internal consistency among the dichotomous variables evaluated. This finding suggests that the survey items are well aligned and consistently measure the same underlying construct, which is critical to the validity of the results. The high homogeneity in the responses implies that the participants shared similar perceptions regarding the items presented, which reinforces the credibility of the data collected.

On the other hand, the analysis of two halves, with a Spearman-Brown coefficient of 0.693, suggests moderate to high consistency in responses when splitting the survey. This result,

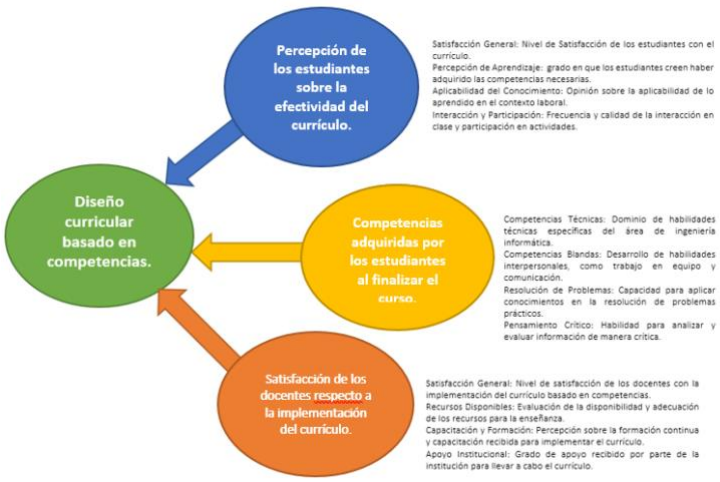
although lower than the Kuder-Richardson result, is still acceptable and points to a reasonable stability in the responses throughout the different sections of the survey. The variability observed could indicate differences in the interpretation of certain items, which deserves attention in future research to improve the clarity and precision of the questions asked.

The use of Cronbach's alpha, although no specific value was presented, in conjunction with the Kuder-Richardson, reinforces the conclusion that the items are consistent and reflect a high degree of agreement among participants. This is crucial to ensure that the results obtained are reliable and allow valid inferences about the population studied.

The survey demonstrates high reliability, which supports the validity of the results and suggests that they can be used to inform informed decisions in academic or research contexts. The quality of the data is essential to ensure the integrity of the analysis and the conclusions derived, underscoring the importance of continuing to evaluate and refine the measurement instruments used in future studies.

In the quantitative phase of the research, a non-probabilistic purposive sampling was used in order to obtain primary information from the various actors involved in the educational process of the ISPB. The total population consisted of 596 individuals, including students as well as teachers and members of the administration. From this population, a representative sample was selected consisting of 456 students, representing 76.51% of the total, and 40 teachers and managers, equivalent to 6.71%. This sampling approach ensured that the information collected adequately reflected the perceptions and experiences of the different groups within the educational community, thus guaranteeing the validity and relevance of the results obtained for the analysis of the competency-based curriculum design.

The study variables and their dimensions were structured according to the theoretical framework. It is described below in **Figure 2**:



Source: Own elaboration.

Study Variables

X_1=Independent Variable: Competency-based curriculum design.

Y_1= Dependent Variables: Student perceptions of curriculum effectiveness.

Y_2= Dependent Variables: Competencies acquired by students at the end of the course.

$Y_{3=}$ Dependent Variables: Teachers' satisfaction with the implementation of the curriculum.

The questionnaires were administered face-to-face to the sample participants in their respective work and academic environments, which allowed for the collection of significant opinions and perceptions. The choice of a non-probabilistic purposive sampling facilitated the identification of relevant cases, allowing an in-depth analysis of the subject under study.

In addition, semi-structured qualitative interviews were conducted with experts in educational management from various universities in Benguela. This complementary approach enriched the findings, providing valuable perspectives based on experience and knowledge of the local context.

To guarantee the content validity of the data collection instrument, the “expert judgment” technique was applied. Based on the evaluators' recommendations, adjustments were made to the wording and style of the items, as well as the elimination of some of them, thus strengthening the quality of the questionnaire.

Data analysis was performed by factor analysis, using Bartlett's test and the Kaiser-Meyer-Olkin index (KMO) to assess the feasibility of factor clustering. A significance threshold of $p > 0.05$ was established for Bartlett's test, and 20% was considered a minimum value for the observation of factorial weights. The KMO statistic yielded a value of 0.546, which indicates acceptable adequacy, given that values above 0.5 are considered satisfactory. Likewise, Bartlett's test resulted in a value of 0.00, which confirms its significance as it is lower than 0.05.

Subsequently, students were surveyed and a reliability analysis was performed using the Internal Consistency technique, together with the Kuder-Richardson 20 test. The results indicated high internal consistency, with a coefficient of 0.894 for dichotomous variables and a result of 0.693 in the analysis of two halves according to the Spearman-Brown test. The Internal Consistency analysis was performed with SPSS v.21.0 statistical software, applying Cronbach's Alpha. Since the responses were dichotomous, interpretation was carried out using the Kuder-Richardson test 20.

The results obtained show a high degree of homogeneity in the responses to each of the items by all the participants in the study. Based on the validity and reliability findings, it is concluded that the questionnaire is valid and reliable. Reforms were made to the wording of the items and categories to improve their reliability, and one item was deleted and replaced by another with similar characteristics, thus optimizing the data collection instrument.

The mixed methodology applied in this study allowed for a comprehensive evaluation of the effectiveness of competency-based curriculum design in the ISPB. The results obtained through the surveys, interviews and documentary analysis provide a solid basis for future improvements in the training of engineering professionals, contributing to educational and professional development in Angola.

Results

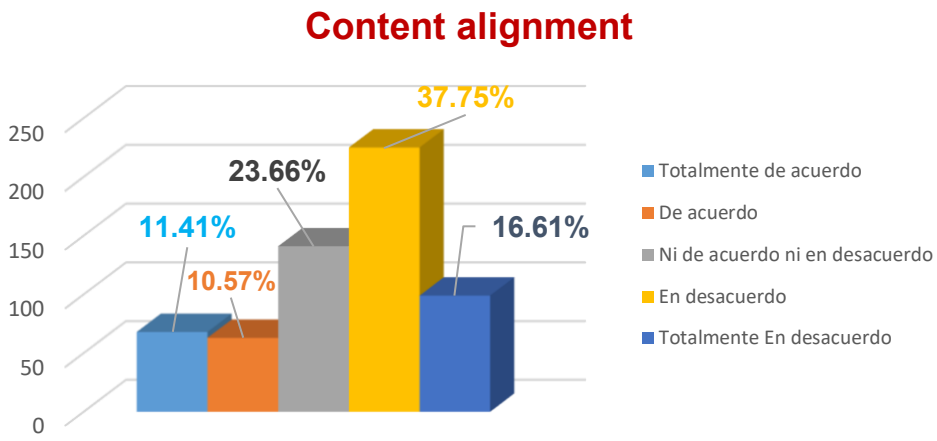
This section presents the findings obtained from a rigorous research process that includes questionnaires and interviews with teachers and students, as well as a detailed analysis of curricular documents. Key aspects of curriculum alignment and the development of engineering competencies in the context of the Instituto Superior Politecnico de Benguela (ISPB) will be addressed. These results offer a critical and informed perspective on the quality and

effectiveness of competency-based curriculum design, thus contributing to a deeper understanding of its impact on students' academic and professional development.

Figure. 3

Content Alignment

On a scale of Strongly Agree; Agree; Neither Agree nor Disagree; Disagree; Strongly Disagree. How much do you agree that the contents of the subjects are related to the competencies that a computer engineer is expected to develop?



Source: Own elaboration.

When analyzing the students' perception of the curricular alignment, it was found that 37.75% do not agree that the contents of the subjects are related to the competencies required for a computer engineer. This finding suggests a gap between what is taught and what students are expected to be able to do.

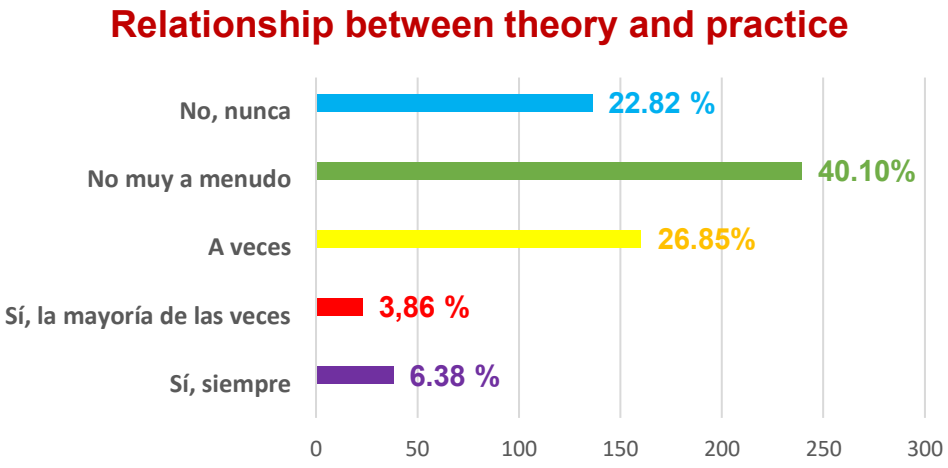
The results of the semi-structured interviews conducted with teachers corroborate this perception. Some teachers pointed out that 'there is a disconnect between theory and practice', while others mentioned that 'the assessments do not really evaluate the competencies they seek to develop'.

These results could indicate a need to revise the curriculum to ensure greater coherence between learning objectives, content and assessments. In addition, it would be convenient to implement pedagogical strategies that promote a more active learning focused on problem solving.

Figure. 4

Relationship between Theory and Practice

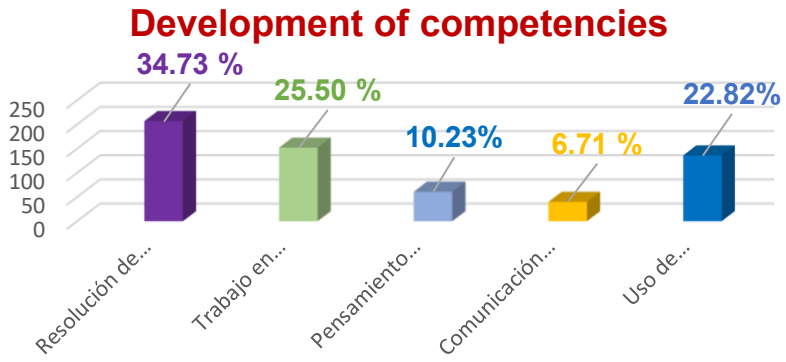
Do you consider that there is an adequate relationship between the theoretical knowledge acquired in the classes and the practical activities carried out?



Source: Own elaboration.

The survey results reveal a troubling disconnect between students' perceptions of curricular alignment and the relationship between theory and practice. A 40.10% of respondents expressed disagreement with both statements, suggesting a significant gap between what is taught and what students are expected to be able to do in their future professional practice. These findings could indicate an urgent need to revise the curriculum and pedagogical strategies to ensure greater coherence between learning objectives, content and assessments.

Figure. 5
Competency development: To what extent do you consider that the curriculum has enabled you to develop the following competencies?



Source: Own elaboration.

1. Problem Solving (34.73%)
The relatively high percentage of agreement on this competency suggests that students recognize the value of activities designed to promote problem-solving skills. However, the

existence of room for improvement indicates that the curriculum could benefit from the inclusion of more complex and authentic problems that simulate real-world scenarios. Educational literature supports the idea that problem solving is essential in engineering education, as it fosters critical thinking and creativity (Jonassen, 2000).

2. Teamwork (25.50%)

The moderate percentage in the perception of teamwork suggests that, although group activities exist, they may not be sufficient to develop critical interpersonal competencies. Training in leadership, negotiation and conflict management skills is essential in the professional environment (Clemente-Ricolfe, et al., 2013). It is recommended that the curriculum incorporate more structured collaborative projects that allow students to practice and reflect on these skills.

3. Critical Thinking (10.23%)

The low percentage in the perception of the development of critical thinking is alarming. This finding suggests that the current curriculum does not sufficiently emphasize the importance of critical analysis and evaluation of evidence. Engineering education should include teaching methods that stimulate critical thinking, such as problem-based learning (PBL) and critical discussion (Facione, 2011). Without adequate training in this area, students may be ill-prepared to face the complex challenges they will encounter in their professional careers.

4. Effective Communication (6.71%)

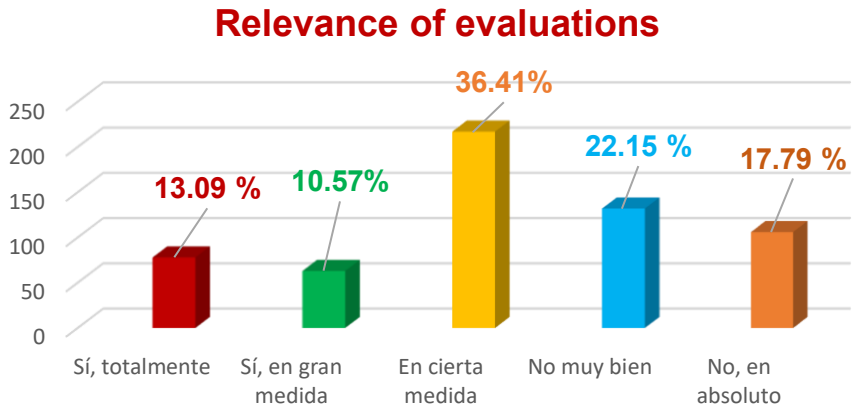
The extremely low percentage in the perception of communication skills development is a clear indicator of deficiencies in the curriculum. Effective communication is essential for professional success, as engineers must be able to convey complex ideas clearly and persuasively (Romero, et al.,2014). It is imperative that written and oral communication components be integrated into various subjects to address this gap.

5. Use of Computer Tools (22.82%)

Although the percentage is relatively low, it suggests that students perceive limited opportunities to develop competencies in the use of computer tools. In an increasingly digital world, it is crucial that the curriculum not only includes technical training, but also integrates digital competencies as a cross-cutting element in all subjects (Bawden, 2008). This could significantly improve students' perception of their preparedness in this area.

Figure. 6

Relevance of the evaluations: Do you consider that the evaluations carried out in the subjects adequately assess the development of the competencies established in the curriculum?



Source: Own elaboration.

The data reveal heterogeneity in students' perceptions of the adequacy of the assessments. Yes, totally (13.09%) and Yes, to a great extent (10.57%): A relatively low percentage of students consider that the evaluations adequately assess the development of competencies. This suggests that there is significant room for improvement in the design and implementation of evaluations. To some extent (36.41%): A considerable percentage of students consider that the evaluations assess competencies to some extent, indicating an ambivalent perception. Not very well (22.15%) and Not at all (17.79%): A considerable percentage of students consider that the evaluations do not adequately assess the development of competencies. This is a red flag indicating a possible disconnect between the learning objectives and the evaluative activities.

Suggestions: What suggestions do you have for improving curricular alignment and competency development in the Computer Engineering curriculum?

Table 3.
Summarizes the results of the interviews conducted with teachers

Aspect Evaluated	Interview Results
Clarity of Curricular Objectives	Most of the teachers consider that the objectives are clear, but some mentioned the need for more detail on certain topics.
Content Relevance	Teachers highlight that the content is relevant, although they suggest the inclusion of more case studies and current market examples.
Teaching Methodologies	There is a variety in the methodologies used, but some teachers feel that there is a lack of training in active methodologies.
Learning Assessment	The teachers believe that the evaluations are adequate, but propose diversifying the methods to include more formative evaluations.
Overall Satisfaction with the Curriculum	Most are satisfied with the curriculum, although some express concern about the workload and lack of resources.
Institutional Support	There is a mixed perception of institutional support; some faculty feel that there is good support, while others feel that more logistical and administrative support is lacking.
Training and Education	Many teachers are requesting more opportunities for ongoing training to adapt to changes in the competency-based curriculum.
Interaction with Students	The importance of interaction is emphasized, and teachers believe that more dialogue and active student participation should be encouraged.

Source: Own elaboration.

Interviews with ISPB teachers have revealed a number of strengths and areas for improvement in relation to competency-based curriculum design. In terms of strengths, teachers positively value curricular alignment and content relevance. This perception suggests that the curriculum is designed in a way that matches the needs of the labor market and the competencies required in the field of engineering. However, this positive assessment may contradict the areas for

improvement identified, which include the need for more robust teacher training, diversification of teaching methodologies and greater institutional support.

Table 4.
Summarizes the results of the interviews conducted with students

Aspect Evaluated	Interview Results
Clarity of Curricular Objectives	Students consider that the curriculum objectives are mostly clear, although some mention that they could be more specific.
Content Relevance	Most students feel that the content is relevant, but some express that certain topics are too theoretical and not applicable.
Teaching Methodologies	Students value the active methodologies positively, but criticize the lack of variety in the practical activities.
Learning Assessment	Many students consider the evaluations to be fair, although they suggest that they should include more hands-on and collaborative projects.
Overall Satisfaction with the Curriculum	Overall satisfaction is moderate; some students feel prepared, while others feel there is a lack of depth in certain topics.
Interaction with Teachers	Students value the interaction with teachers, but some feel that they do not receive sufficient feedback on their performance.
Applicability of Knowledge	There is a perception that, although knowledge is acquired, it is not always easily applicable in real or work situations.
Peer Support	Students stress the importance of peer support, but mention that sometimes there is competition rather than collaboration.

Source: Own elaboration.

Interviews conducted with ISPB students have provided valuable information on their perception of competency-based curriculum design. In terms of strengths, students recognize the clarity of objectives and relevance of content, suggesting good curricular alignment. This clarity can facilitate learning, as students better understand what is expected of them and how it relates to their future professional roles. However, this positive perception may contrast with the identified areas for improvement, which include the need for diversification in teaching methodologies, greater practical application of content and more effective feedback from teachers.

Analysis of Curricular Documents.

The findings from the analysis of curricular documents reveal a number of critical areas that require attention to improve curricular alignment and competency development in the context of the Computer Engineering program of the ISPB Engineering Department. First, it was identified that, although the curricular objectives are defined, their clarity and coherence are not always consistent (Santana, et al., 2021) (Santana, et al., 2021). Many documents lack an

explicit articulation between the expected competencies and the contents taught, which makes it difficult to understand how these are integrated into the students' training (Luis Julião, A. 2021).

The review of curricula and subject guides showed that, although key competencies such as critical thinking and problem solving are mentioned, their implementation in educational practices is insufficient (Flórez Torres & J. L. 2022). This suggests that the curriculum does not adequately respond to the demands of the labor market, where practical skills and the ability to work in teams are increasingly valued (Briones, et al., 2023). The lack of practical experiences that allow students to apply their knowledge in real situations is a significant gap that needs to be addressed.

In terms of teaching methodologies, there was a trend towards traditional approaches that limit meaningful learning (Yap Hilario & L. O. 2022). Although some documents propose active methodologies, their application in the classroom is scarce. This highlights the need to integrate innovative practices, such as project-based learning and the use of educational technologies, which could enrich the formative experience and foster the development of essential transversal competencies in the professional sphere (Melillán & Cravero, 2022).

The evaluation mechanisms were also deficient. The alignment between assessment methods and learning objectives was inconsistent, which compromises the effectiveness of the curriculum design (Wchima, et al., 2022). The evaluations, for the most part, focused on the acquisition of theoretical knowledge, leaving aside the practical application of competencies. The lack of formative assessments and continuous feedback limits the integral development of the students (Buanga, P. M. S. 2014).

Finally, feedback from teachers and students revealed a lack of effective mechanisms for reviewing and updating the curriculum. The need for a dynamic process that considers the opinions of the stakeholders involved is essential to ensure that the curriculum adapts to the changing demands of the professional environment (Acosta, R. C., & Chana Cassungo Cruz, R. B. 2024). This commitment to continuous improvement is essential to ensure that curriculum documents are not only relevant, but also responsive to the current and future needs of students (Cedeño, et al., 2015).

Discussion and Conclusions

The analysis of the students' perception of the curricular alignment in the ISPB Computer Engineering program has revealed significant findings that indicate a disconnection between the current curriculum and the competencies expected in the professional environment. 37.75% of the respondents do not consider that the contents of the subjects are aligned with the required competencies, which suggests the need for a thorough review of the curriculum to ensure its relevance and applicability in the work environment.

The discrepancy is even more evident in critical areas such as teamwork (25.50%), critical thinking (10.23%) and effective communication (6.71%). These percentages indicate that, although there are activities designed to promote specific skills, their implementation is not sufficient to develop interpersonal and analytical competencies that are essential in the training of a computer engineer. The low perception of the development of critical thinking and effective communication is especially alarming, as these skills are critical to professional success in an increasingly complex and collaborative world (de Almeida Leyva, et al., 2023).

Interviews with teachers have highlighted strengths in curricular alignment and content relevance, suggesting that, despite shortcomings, there is recognition of the need to prepare students for the labor market (Salazar, N. G. P. 2019). However, areas for improvement were also identified, such as the need for more robust teacher training and the diversification of

teaching methodologies (Martín, et al., 2024). This indicates that, although teachers value the curriculum positively, they are aware of the limitations in its implementation and interaction with students.

On the other hand, students' perceptions of the clarity of the objectives and relevance of the content contrast with the areas for improvement noted, such as the lack of practical application and feedback (Santander, S. C. 2024). This suggests that, although students understand what is expected of them, the lack of practical experiences and effective feedback may limit their ability to apply what they have learned in real contexts (Clemente-Ricolfe, et al., 2013).

The analysis of curricular documents has evidenced that, although the objectives are defined, their clarity and coherence are not consistent (Murillo Moreno, W. G. 2018). The lack of articulation between competencies and contents makes it difficult to understand how they are integrated in the training of students (Bawden, D. 2008). In addition, the tendency towards traditional pedagogical approaches limits meaningful learning, which highlights the need to incorporate active methodologies and educational technologies that promote more dynamic and practical learning (Romero, et al.,2014).

Practical implications:

Research has revealed a significant gap between theoretical training and professional practice in the field of engineering.

Key Implications Derived from the Research

- Align training with the demands of the labor market: Curricula must be constantly adapted to the needs and trends of the productive sector.
- Encourage problem-based learning: Students must face real challenges and apply their knowledge in practical contexts.
- Promote the development of transversal competencies: In addition to technical knowledge, it is essential to develop skills such as teamwork, effective communication and problem solving.
- Establish close links with the productive sector: Collaborate with companies to offer internships, joint projects and employment opportunities.

Adaptations for Engineering Courses at the ISPB

Electronics, Telecommunications and Computer Courses:

- Design projects: Implement projects involving the design and construction of electronic prototypes, communication systems or software.
- Equipped laboratories: Ensure that laboratories are equipped with state-of-the-art tools and technologies for hands-on experimentation by students.
- Simulations: Use simulation software to model complex systems and analyze their behavior.
- Hackathons and competitions: Organize events that allow students to apply their knowledge in a competitive and collaborative environment.

How to Integrate this Practice into Other Areas of Engineering Education

- Development of interdisciplinary projects: Encourage collaboration between different areas of engineering (electronics, computer science, civil, etc.) to address complex problems.
- Creation of innovation centers: Establish spaces where students can develop innovative and entrepreneurial projects.

- Implementation of active methodologies: Use methodologies such as problem-based learning, collaborative learning and flipped learning.
- Formative evaluation: Implement evaluation systems to monitor student progress and adjust teaching strategies.

The present research has revealed a significant gap between the theoretical training provided at the ISPB and the practical skills demanded by the labor sector in the field of computer engineering. One of the most notable findings has been the difficulty of graduates to apply the knowledge acquired in real scenarios, suggesting a disconnection between theory and practice. This dissociation between the academic and the professional limits the ability of junior engineers to adapt to the challenges of an increasingly dynamic and demanding work environment.

To address this problem, a thorough revision of the curriculum is recommended, prioritizing the alignment between the theoretical contents and the competencies required in the industry. The incorporation of practical projects, simulations and case studies will allow students to apply the knowledge acquired in real scenarios, strengthening their problem-solving and critical thinking skills. It is also necessary to invest in continuous teacher training, providing them with the necessary tools and knowledge to implement active teaching methodologies that promote autonomous and collaborative learning.

Formative evaluation plays a crucial role in this process. By integrating competency-based assessments, a more complete picture of student performance can be obtained and teaching strategies can be adjusted as needed. In addition, it is essential to establish closer ties with the productive sector in order to learn about the real demands of the labor market and adapt curricula accordingly.

Finally, future research is suggested to deepen the relationship between the competencies developed during academic training and professional performance. It is also relevant to explore the perception of employers regarding the competencies of computer engineering graduates, which will allow for a more precise adjustment of the curricula.

The results of this research highlight the need to transform computer engineering education to ensure that graduates are prepared to face the challenges of today's world of work. The implementation of the proposed recommendations will contribute to reducing the gap between theory and practice, improving the quality of education and increasing the employability of engineers.

Acknowledgments

This work is the result of an educational research project: Medição do modelo de formação dos estudantes do Departamento de Engenharia do ISPB. by the author: Roberto Cruz Acosta, being held at the Instituto Superior Politecnico Bneguela (ISPB), 2024.

Conflict of Interest

There are no conflicts of interest on the part of the authors in the writing or publication of this article.

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