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Incorporating active learning strategies into an Electronic Engineering academic program

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***Abstract*– This study explores the adoption of active learning methodologies in university-level Electronic Engineering education and their relationship with student satisfaction. Through a quantitative research design, we analyzed data collected from teaching performance surveys conducted over two semesters in 2023. Initiated in 2020, these surveys assess students' satisfaction with teaching methodologies and the educational services provided.**

Our findings reveal a pronounced preference for interactive and applied pedagogical methods, highlighting the need for teaching strategies that align with current learning expectations and styles. A significant gap was identified between faculty competencies and student expectations, particularly within the Science and Engineering faculty of a university in Lima, which recorded the lowest scores in teaching quality, course mastery, and student-teacher rapport. These results underscore the imperative to enhance teaching competencies and align them with effective teaching methodologies to improve students' educational experience.

The proposed class session model is centered around the integration of active learning methodologies selected by students, addressing areas for improvement and adaptable to various topics and course levels within the Electronic Engineering program. This model emphasizes technical knowledge and the development of soft skills and generic competencies, preparing students to be competent professionals and socially responsible individuals.

For successful implementation, a sustained commitment to faculty training and adaptability to the evolving needs of students and society is essential. The integration of comprehensive projects, digital game-based learning, and micro-learning strategies for personalized and effective learning was highlighted. Continuous assessment and the development of improvement plans based on teaching competencies are crucial for tailoring education to accreditation process demands and student needs.

The study also examines the impact of micro-learning on scientific research education, suggesting that presenting content in small segments significantly enhances the understanding and retention of concepts in Electronic Engineering. Moreover, it discusses the development of generic competencies such as empathy, ethics, and social responsibility, complementary to technical skills through "Knowing how to be" in Engineering and the flipped classroom methodology.

The conclusion is that the adoption of active learning methodologies holds promise for enhancing educational quality in Engineering. It emphasizes a holistic approach that considers faculty training and the implementation of innovative pedagogical practices. The necessity for pedagogical innovation and continuous improvement is crucial for maintaining the relevance and effectiveness of Engineering programs, ensuring students are prepared for a constantly changing world.

This work proposes a paradigm shift in university teaching, highlighting the importance of adapting educational methodologies to meet the needs of contemporary students. Future research should focus on the large-scale implementation of this model and evaluating its impact on the professional and personal preparedness of Engineering students.

***Keywords*— Active learning methodologies, student satisfaction, educational quality, teacher training.**

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I. INTRODUCTION

The teaching of Electronic Engineering in higher education faces significant challenges that demand continuous pedagogical innovation and adaptation. The quality of instruction and the achievement of educational objectives are intrinsically linked to the faculty's profile and competencies, as well as to the implementation of effective teaching strategies that meet the dynamic changes of the educational and professional environment.

It is important to align the skills and abilities of the faculty with the specific needs of each academic program, revealing a gap between the current level of teacher specialization and the requirements of thematic categories in Electronic Engineering. This alignment is crucial for the development of improvement plans and quality assurance within the accreditation process, emphasizing the need for specialized and targeted teacher training [1].

In this context, the LACCEI initiative to develop the Engineering Education Capability Maturity Model (EE-CMM) and collaborative efforts to enhance the accreditation of engineering programs underscore the importance of adopting innovative and effective educational practices that meet international quality standards. The Tampico Declaration, resulting from the LACCEI conference, lays the groundwork for an accreditation system that promotes the adoption of active, student-centered methodologies, recognizing the diversity and autonomy of nations [2].

Furthermore, the impact of micro-learning on the teaching of scientific research, illustrates how innovative teaching strategies can significantly improve student learning. The use of brief, specific, and digital technological resources facilitate a personalized and effective learning process, highlighting the need to adapt educational methodologies to the preferences and needs of contemporary students [3].

This paper seeks to explore how the implementation of active methodologies, including micro-learning and adaptation to students' learning styles, can improve educational quality and student satisfaction in Electronic Engineering courses. By integrating these methodologies with a focus on professional teacher development and alignment with accreditation standards, we propose a teaching model that not only responds to current challenges but also prepares students and academic programs for the future.

II. Methodology

This research adopts a quantitative approach to explore the necessity of implementing active learning methodologies in the teaching of Electronic Engineering by measuring student satisfaction through a survey designed and applied by the university, named "Teaching Performance Survey." The methodology is divided into several key phases: survey application, data analysis, discussion, and results, described as follows:

A. *Survey design*

Surveys were designed to measure the satisfaction of Electronic Engineering students for the 2023-1 and 2023-2 semesters. The surveys included questions to evaluate the students' preference and perception of active learning methodologies, aimed at assessing their satisfaction with the educational service received. These surveys are validated and consolidated instruments that have been conducted frequently and uninterruptedly in the faculty since the 2020-1 semester.

B. *Sample selection*

Stratified sampling was used to select a representative sample of Electronic Engineering students from the 2023-1 and 2023-2 semesters, ensuring the inclusion of various academic profiles and study levels.

C. *Data collection*

Data were collected through the university's official platform, ensuring the anonymity and confidentiality of the students' responses. A collection period of two weeks was established for each semester, followed by frequent reminders to maximize the response rate, as well as establishing its mandatory nature.

Fig. 1 Mandatory survey filling notice sent to students at a university in Lima. The start and end dates are indicated, as well as the link for completion and its mandatory nature.

D. *Data analysis*

Groupings and correlations were performed with the collected data to analyze the survey responses, identifying significant findings related to students' preferences regarding active learning methodologies.

TABLE I
Comparative consolidation of student satisfaction results by faculty. "Teacher satisfaction surveys" 2023-1 and 2023-2.

	Faculty average				
	Accounting, Economics, and Finance Sciences	***Health Sciences***	***Humanities and Social Sciences***	***Science and Engineering***	***Total***
Course Mastery	17,17	17,10	17,48	16,63	17,10
Teaching-Learning Process	17,02	16,91	17,25	16,41	16,91
Student-Teacher Relationship	17,12	16,90	17,24	16,62	16,98

Table 1 shows that the Faculty of Science and Engineering, to which the Electronic Engineering academic program belongs, has the lowest faculty rating in categories related to the quality of class sessions: Course Mastery, Teaching-Learning Process, and Student-Teacher Relationship.

TABLE II
CONSOLIDATED RESULTS BY ACADEMIC PROGRAM. "TEACHER SATISFACTION SURVEY", 2023 CONSOLIDATION.

	Final Score				
	Quantity	***Mean***	***SE Mean***	***Minimum***	***Maximum***
Administration	124	16,91	,21	9,06	20
Accounting	136	17,54	,22	10,17	20
Marketing and International Business	80	16,91	,40	3,75	20
Nursing	152	17,00	,12	10,53	20
Psychology	124	17,02	,22	7,32	20
Pharmacy and Biochemistry	44	17,32	,25	13,85	20
Nutrition and Dietetics	12	17,49	,56	13,68	19,90
Early Childhood Education	216	17,32	,17	8,59	20,00
Primary Education	134	17,35	,19	9,77	20,00
Communications and Digital Marketing	6	17,66	,35	16,15	18,37
Law	18	18,09	,26	15,80	19,69
Electronic Engineering	113	16,39	,32	2,19	20,00
Systems Engineering	135	16,68	,22	5,00	20,00
Industrial Engineering	88	16,57	,41	3,13	20,00
Environmental Engineering	12	17,34	,43	14,38	19,72

Table 2 and Figure 2 show that the Electronic Engineering program has the lowest student satisfaction score across the university, presenting teachers with the minimum value and the lowest average score.

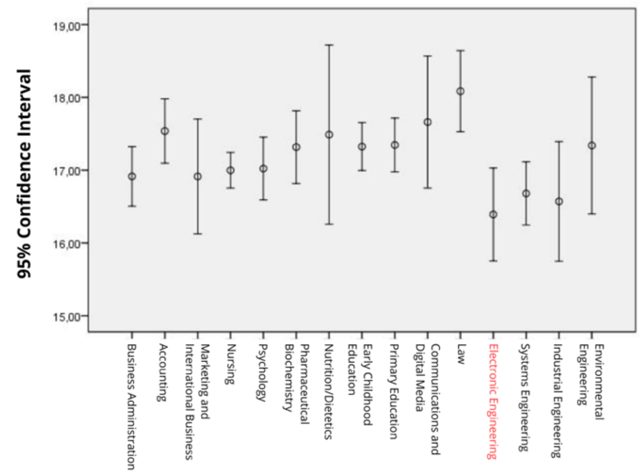

Fig. 2 Comparative scores obtained by faculty.

FACULTY EVALUATION BY PROGRAM

STUDY PROGRAM:	
INSTRUCTOR:	
COURSE:	

MASTERY OF THE COURSE	
1	In the development of the class, the professor presents ideas and concepts clearly
2	The professor provides examples drawn from their experience and applications to the practical/professional field
3	The professor demonstrates knowledge and mastery of the course

TEACHING-LEARNING PROCESS	
4	In the development of the class, the organization and prior planning is evident, addressing concepts from the simplest to the most complex.
5	The professor poses questions about what you know on the subject at the start of the class or before the start of the class through the virtual classroom.
6	The professor applies various active, dynamic, and collaborative methodologies, among others, aiming to achieve student learning.
7	The professor promotes research among students through the creation and use of summaries, monographs, essays, applied research, and complementary certifications related to the course.
8	The professor uses different technological tools in the development of in-person and virtual classes to encourage student participation.
9	The professor continuously evaluates what has been learned in a comprehensive manner, providing timely feedback and corrections.
10	The professor prepares useful physical or audiovisual material for the teaching-learning process.

STUDENT-TEACHER RELATIONSHIP	
11	Answers questions accurately and promptly, clarifying students' doubts through various means (face-to-face, email, chat, forum, video conferences, among others).
12	Fosters a positive environment, providing confidence and encouraging student participation with tolerance and flexibility for each student who faces difficulties.

ETHICS	
13	Promotes academic honesty by avoiding plagiarism and respecting copyright through the use of citations and bibliographic references.
14	Fosters horizontal and respectful communication among students, without expressing any form of racism, homophobia, or xenophobia.
15	Demonstrates responsibility in teaching practice by attending classes punctually and timely uploading grades and class materials.

Fig. 3 Satisfaction survey format.

Figure 3 displays the questions applied as part of the teaching satisfaction survey. The questions used for this study correspond to sections I, II, and III detailed and translated in the following table.

TABLE III
QUESTIONS PERTAINING TO THE "TEACHER SATISFACTION SURVEY" CONSIDERED FOR THE PRESENT STUDY.

Category / Question	
I	COURSE MASTERY
1	*In the development of the class, the instructor presents ideas and concepts clearly.*
2	*The professor provides examples drawn from their experience and applications to the practical/professional field*
3	*The professor demonstrates knowledge and mastery of the course*
II	TEACHING-LEARNING PROCESS
4	*In the development of the class, the organization and prior planning is evident, addressing concepts from the simplest to the most complex.*
5	*The professor poses questions about what you know on the subject at the start of the class or before the start of the class through the virtual classroom.*
6	*The professor applies various active, dynamic, and collaborative methodologies, among others, aiming to achieve student learning.*
7	*The professor promotes research among students through the creation and use of summaries, monographs, essays, applied research, and complementary certifications related to the course.*
8	*The professor uses different technological tools in the development of in-person and virtual classes to encourage student participation.*
9	*The professor continuously evaluates what has been learned in a comprehensive manner, providing timely feedback and corrections.*
10	*The professor prepares useful physical or audiovisual material for the teaching-learning process.*
III	STUDENT-INSTRUCTOR RELATIONSHIP
11	*Answers questions accurately and promptly, clarifying students' doubts through various means (face-to-face, email, chat, forum, video conferences, among others).*
12	*Fosters a positive environment, providing confidence and encouraging student participation with tolerance and flexibility for each student who faces difficulties.*

The student satisfaction survey questions considered for the current study are grouped into three fundamental categories that cover the teacher's course mastery, the teaching-learning process, and the student-teacher relationship. Each category consists of questions designed to evaluate specific aspects of the educational experience.

In the Course Mastery category, the questions assess the clarity with which the teacher presents ideas and concepts, the inclusion of relevant examples from their experience applicable to the practical or professional environment, and their substantial knowledge and mastery of the course. This section seeks to measure the teacher's competence and preparation in the subject matter they teach.

The second category, Teaching-Learning Process, focuses on the effectiveness of the teaching methodology. It investigates the organization and planning of the classes, the teacher's ability to generate initial dialogue on the topic through questions or the use of the virtual classroom, the application of active and collaborative methodologies, the promotion of research among students, the use of technological tools to increase student participation, continuous evaluation and feedback, and the preparation of didactic material. This category aims to identify how teachers facilitate and encourage active learning and student participation.

Finally, the Student-Teacher Relationship category examines the interaction and atmosphere created by the teacher. It values the teacher's ability to answer questions accurately and timely through multiple channels, and their ability to foster a positive classroom environment that provides confidence, promotes active participation, and shows tolerance and flexibility, especially towards those students who face difficulties.

This set of questions provides a comprehensive evaluation of the educational experience from the student's perspective, offering relevant information for the continuous improvement of teaching quality in the university context.

E. Data analysis

Based on the results of the analysis, a class session model was developed that incorporates the active learning methodologies preferred by students and addresses the identified areas for improvement. This model was designed to be adaptable to various topics and course levels within the Electronic Engineering program.

III. DISCUSSION

A. Contribution of studies on faculty profile and accreditation strategies

To ensure the quality of teaching, the importance of a strong academic background, relevant practical experience, and effective communication skills is emphasized. A well-prepared teacher is essential for the successful implementation of active learning methodologies, as these strategies require flexible adaptation to different learning styles and the ability to facilitate rich and meaningful classroom discussions. This need is evident in the results shown for the 2023-1 and 2023-2 consolidations of the "Teacher Satisfaction Survey" [1].

Furthermore, the accreditation and educational quality efforts described in LACCEI initiatives emphasize the need for structured and continuously improved educational processes [2]. This focus on continuous improvement and the adoption of innovative and effective educational practices that meet international quality standards is crucial for the development and implementation of the class session model based on active methodologies, which is necessary according to the results presented in the preceding section.

B. Incorporation of active methodologies and innovative pedagogies

The innovative model that links formative research and accreditation [4] emphasizes the importance of incorporating active learning methodologies to enhance the research and social skills of students. This contribution is crucial for our class session model, as it suggests that adopting comprehensive projects and an active approach to curriculum development can significantly improve student learning.

The inclusion of socio-scientific controversies and learning based on digital games [5][6] provides further evidence of the effectiveness of active methodologies in increasing student interest and enhancing their cognitive and affective skills. These studies highlight how adapting teaching to hybrid and active formats, and including technologies and simulations, can enrich the educational experience in engineering.

C. Micro-learning and development of specific competencies

Providing information in specific, small chunks enhances student learning by allowing them to personalize their educational process. This finding supports the integration of microlearning into our model as a strategy to improve the understanding and retention of complex concepts in Electronic Engineering [3].

D. "Knowing how to be" in Engineering and the flipped classroom

Finally, the discussion on the "Knowing How to Be" in Engineering [7] and the application of a new flipped classroom methodology [8] contribute to the proposed model by highlighting the importance of developing generic competencies, such as empathy, ethics, and social responsibility, alongside technical skills. These approaches complement active methodologies by promoting comprehensive learning that prepares students for professional and personal challenges.

IV. RESULTS

The integration of contributions from these studies into the class session model for the teaching of Electronic Engineering demonstrates a holistic approach to engineering education. This model not only focuses on technical knowledge but also on the development of soft skills and generic competencies, preparing students to be competent and socially responsible professionals. The successful implementation of this model requires an ongoing commitment to teacher training, the assessment of educational processes, and adaptability to the changing needs of students and society. Future research should explore the applicability of this model in different areas of engineering and educational contexts to validate its effectiveness and adaptability.

The results of the “Teacher Satisfaction Survey” and subsequent analysis revealed a student preference for interactive and applied pedagogical approaches, as well as the identification of gaps in faculty competencies that need to be addressed through specialized training plans.

The suggested class session model proposes the integration of integrative projects, digital game-based learning, and micro-learning strategies to foster more effective and personalized learning.

A. Integrative projects and digital game-based learning

These approaches promote the practical application of knowledge in real and virtual contexts [4][5].

B. Micro-learning

Learning capsules will be integrated to allow students to access information in brief, specific segments, facilitating a personalized and flexible learning process [3].

C. Continuous assessment and improvement

Continuous assessment and the development of improvement plans, as well as evaluating the effectiveness of microlearning, are essential elements for adapting teaching to the needs of students and accreditation requirements [1][3].

D. Development of the class session model

To develop a class session model in the teaching of Electronic Engineering that includes integrative projects, digital game-based learning, micro-learning, and continuous assessment, a modular structure can be established that facilitates both active learning and the constant adaptation of the educational process.

A detailed model is presented below, which is suggested for application in the academic program of Electronic Engineering.

Class Session Model for Electronic Engineering	
Preparation of the session	
Pre-reading/Micro-learning (prior assignment) Students will receive learning capsules covering key concepts before the class. These capsules may include short videos, infographics, and brief readings.	
Beginning of the Session	*XX minutes*
Quick review A fast-paced quiz or interactive game to review the assigned micro-learning capsules and activate prior knowledge.	
Development of the Session	*XX minutes*
Presentation of concepts A brief exposition of concepts that will be essential for the integrative project or digital game of the session. **Digital game-based learning activity** Students will engage in a simulation or serious game that allows them to apply the concepts in a realistic virtual context. **Integrative project work** In groups, students will work on a project that integrates the knowledge acquired with practical applications, such as designing a circuit or programming an electronic device.	
Evaluation and Feedback	*XX minutes*
Formative assessment Quizzes or practical exercises to assess understanding of concepts and practical application.	
Feedback and continuous improvement	*XX minutes*
Group discussion to share findings and reflect on learning. The teacher will collect feedback to adjust future sessions. **Individual Interventions** The teacher will gather individual feedback from students as needed.	

Fig. 4 Proposed session model.

TABLE IV

INTERACTIVE DIGITAL GAMES FOR THE SECTIONS: PRE-READING/MICRO-LEARNING (PRIOR ASSIGNMENT), QUICK REVIEW, AND PRESENTATION OF CONCEPTS FROM THE PROPOSED SESSION MODEL.

	Tool	*Description*	*Educational objective*
1	Kahoot!	Game-based learning platform with quizzes.	Encourage participation and active learning through games and competitions.
2	Quizizz	Quiz tool for autonomous learning or in groups.	Allow for playful and flexible practice and review of knowledge.
3	Socrative	Real-time assessment app to get instant feedback.	Assess understanding and progress of students in real time.
4	Poll Everywhere	Live survey tool to collect opinions.	Generate interactive discussions and collect immediate feedback from students.
5	Gimkit	Educational game platform that allows quiz creation.	Motivate learning through games and the possibility of earning points or "virtual money".
6	Padlet	Collaborative virtual wall to share ideas and resources.	Facilitate collaboration and the exchange of ideas in a common space.
7	Plickers	Classroom response system that uses QR code cards.	Enable participation of all students without the need for digital devices.
8	Mentimeter	Tool for interactive presentations with surveys and quizzes.	Engage the audience and collect their opinions or knowledge in real time.
9	Nearpod	Educational platform that allows creation of interactive lessons.	Improve student engagement with interactive content and assessments.
10	Edpuzzle	Tool to create and edit interactive educational videos.	Facilitate learning through personalized videos with questions and pauses.
11	JeopardyLabs	Platform to create Jeopardy-style trivia games without software.	Conduct topic reviews in a playful and competitive manner.
12	Flipgrid	Short video platform to foster discussion and reflection.	Promote oral expression and communication among students on specific topics.
13	GoFormative	Online tool to create interactive assessments and activities.	Collect responses and feedback in real time to adapt teaching to the group's needs.
14	Classcraft	Gamification platform that turns learning into an adventure.	Improve student engagement and motivation through game mechanics.
15	Blendspace	Tool to create digital lessons with multimedia content.	Organize educational resources efficiently to facilitate autonomous learning.
16	Quizlet Live	Real-time team game based on Quizlet study sets.	Foster collaborative learning and concept review in a game format.
17	Answergarden	Real-time brainstorming and feedback tool.	Collect short answers from students to stimulate discussion and creativity.
18	Seesaw	Learning platform to document and share progress.	Facilitate communication between students, teachers, and families about learning.
19	LearningApps	Platform to create and use small educational apps.	Support the learning process with personalized interactive applications.
20	Spiral	Set of tools for collaborative activities in class.	Encourage active participation and teamwork in the classroom with technology.

The inclusion of digital educational tools in the proposed class session model seeks to offer a wide range of possibilities to enrich the learning process. This approach not only facilitates the understanding of complex concepts but also promotes the active participation of students, adapting to their individual learning needs and paces.

For the pre-reading and micro-learning phase, tools such as Edpuzzle allow the creation of interactive learning capsules by inserting questions into videos, which can ensure that students understand key concepts before the class. Padlet can serve to share additional resources and infographics, fostering a collaborative space where students can also contribute materials found during their prior research. Quizlet live offers a dynamic way to study and review important terms and definitions through games and flashcards.

The start of the session can be managed with tools like Kahoot! and Quizizz, which allow the creation of interactive quizzes to quickly review the concepts covered in the micro-learning capsules. These games promote healthy competition and maintain student interest. Plickers is another useful tool for collecting quick responses without the need for all students to have electronic devices, ideal for classrooms with limited resources.

For the presentation of new concepts, Nearpod allows the creation of interactive lessons that can include quizzes, videos, and collaborative activities, ensuring active student participation in the exposition of essential concepts. Mentimeter offers the possibility to collect instant feedback through surveys and word clouds, which can be used to adjust the presentation in real-time according to student comprehension.

Tools such as Seesaw and GoFormative can be used for formative assessment and continuous feedback, allowing students to demonstrate their understanding by creating digital portfolios and performing practical exercises. Flipgrid encourages reflection and debate among students through the creation of short videos, ideal for feedback sessions and continuous improvement.

The implementation of these digital tools not only enriches the learning experience but also prepares Electronic Engineering students for the management of current and future technologies. By integrating these tools into the class session model, an interactive and personalized learning environment is promoted, crucial for the development of essential competencies in the field of engineering.

TABLE V
SERIOUS DIGITAL GAMES SUGGESTED FOR THE SECTION DIGITAL GAME-BASED LEARNING ACTIVITY OF THE PROPOSED SESSION MODEL.

	Tool	***Description***	***Educational Objective***
1	Circuit Scramble	Simulation game for solving puzzles by constructing circuits.	To promote understanding of electronic circuits and programming logic.
2	ElectroDroid	App with electronic tools and references such as resistance calculators and Ohm's law.	To support learning in the calculation and design of electronic circuit parameters.
3	LogicCircuit	Educational simulator for the design and simulation of digital logic circuits.	To enhance skills in the design and analysis of logical circuits and digital systems.
4	Space Engineers	Sandbox game that allows the design and management of spatial structures and electrical systems.	To encourage understanding of engineering principles and physics in a spatial environment.
5	Labster	Virtual lab platform with simulations in electronics and physics.	To enable virtual experimentation in electronics to learn about circuits, signals, and systems.
6	Minecraft Education Edition	Educational version of Minecraft to build and test circuits with "Redstone".	To introduce basic electronic concepts and the design of complex systems in a collaborative virtual environment.
7	PhET Interactive Simulations	Interactive simulations of math and science, including electrical circuits.	To experiment with electronic components and understand the principles of electricity and magnetism.
8	Automation	Automotive strategy and management game that includes vehicle design and electronic systems.	To apply electronic and mechanical knowledge to the design of automotive vehicles and systems.
9	RoboCode	Programming game to control robotic tanks.	To teach programming and robotics principles in a playful and competitive environment.
10	Kerbal Space Program	Space flight simulator to build and launch rockets and spacecraft.	To understand the application of electronic systems in aerospace engineering.

In the context of the proposed session model, the integration of serious games into the learning process emerges as an innovative and effective pedagogical strategy, especially in the section of the digital game-based learning activity of the proposed class session model. Serious games, by combining game principles with educational objectives, offer a dynamic platform for the practical application of theoretical concepts in a controlled and stimulating environment. Below, we discuss how the selection of proposed serious games can be effectively implemented in this educational context.

Circuit Scramble and ElectroDroid are presented as fundamental tools for introducing and reinforcing concepts of electronic circuits and components. By engaging in challenges that require the creation or solution of circuits, students can apply theoretical knowledge in a practical context, enhancing their understanding and problem-solving skills.

LogicCircuit and PhET Interactive Simulations provide interactive platforms for experimenting with circuit logic and physical principles, respectively. These games allow students to visualize the behavior of circuits and physical phenomena, facilitating a deeper understanding of abstract concepts through experimentation and the direct manipulation of variables.

Space Engineers, Kerbal Space Program, and Minecraft Education Edition provide rich and complex sandbox environments where students can design, build, and test engineering solutions in contexts ranging from spacecraft construction to the creation of electronic systems in virtual worlds. These platforms promote creative thinking, strategic planning, and teamwork, key competencies in the training of electronic engineers.

Labster and Automation stand out for offering detailed simulations of laboratory and engineering processes, respectively. Labster allows students to perform virtual experiments that could be difficult to replicate in a physical laboratory, while Automation introduces concepts of design and manufacturing, crucial for understanding the product development lifecycle of electronic products.

RoboCode offers a unique platform for learning programming and artificial intelligence strategies by designing and competing with virtual robots. This hands-on approach to coding and AI prepares students to face real challenges in software design for electronic systems.

The implementation of these serious games in digital game-based learning activities allows students in the Electronic Engineering academic program to apply theoretical concepts in virtual environments that simulate real-life challenges. This approach promotes not only the acquisition of technical knowledge but also the development of soft skills such as teamwork, problem-solving, and creativity. By integrating these serious games into the curriculum, an active and participatory learning environment is encouraged that can significantly increase student motivation and engagement, effectively preparing them for their professional future.

V. CONCLUSIONS AND FUTURE WORKS

The integration of active methodologies, including micro-learning, in the teaching of Engineering presents a promising path towards the enhancement of educational quality. These strategies not only cater to student learning preferences but also address the challenges identified in the alignment of teaching competences. It is crucial to adopt a holistic approach that considers both faculty training and the implementation of innovative pedagogical practices to meet the demands of the accreditation process and to prepare students for future challenges.

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