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# Innovation and challenges in the creation of digital contents: A study of the virtual classroom at the University of Guayaquil

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## Abstract

Higher education is undergoing a transformation driven by the integration of digital technologies, accelerated by the COVID-19 pandemic. In this context, the ADDIE instructional design model has gained relevance in the creation of virtual learning environments, such as the virtual classroom at the University of Guayaquil. This study aims to analyze students' perceptions of digital content and the challenges faced in this environment. A mixed research design was used, combining quantitative and qualitative methods, where a questionnaire was applied to a stratified sample, and interviews and focus groups were conducted. Quantitative results indicate that 84% of students believe that the virtual classroom significantly contributes to their learning, while 78% highlighted the organization of the content. However, challenges such as initial technical difficulties (72%), connectivity issues (64%), and adaptation to the digital methodology (58%) were reported. Interviews revealed that, at the beginning, students faced a steep learning curve that generated some resistance. However, most managed to adapt progressively. The findings suggest that, although the implementation of the virtual classroom is perceived positively, the

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transition to digital methods faces obstacles that need to be addressed, such as the need for technological training and adequate infrastructure. It is concluded that, to maximize the benefits of the ADDIE model, it is essential to strengthen technological training and improve digital connectivity, always considering students' perceptions to optimize the educational experience in virtual environments.

Keywords: Educational technology; ADDIE model; Virtual classroom; Student perceptions; Digital challenges.

## Innovación y desafíos en la creación de contenidos digitales: Un estudio del aula virtual de la universidad de Guayaquil

### Resumen

La educación superior está experimentando una transformación impulsada por la integración de tecnologías digitales, acelerada por la pandemia de COVID-19. En este contexto, el modelo de diseño instruccional ADDIE ha adquirido relevancia en la creación de entornos virtuales de aprendizaje, como en el caso del aula virtual de la Universidad de Guayaquil. Este estudio busca analizar las percepciones de los estudiantes sobre los contenidos digitales y los desafíos enfrentados en este entorno. Se utilizó un diseño de investigación mixto, combinando métodos cuantitativos y cualitativos, donde se aplicó un cuestionario a una muestra estratificada y se realizaron entrevistas y grupos focales. Los resultados cuantitativos indican que el 84% de los estudiantes considera que el aula virtual contribuye significativamente a su aprendizaje, mientras que el 78% destacó la organización de los contenidos. Sin embargo, se reportaron desafíos como dificultades técnicas iniciales (72%), problemas de conectividad (64%) y la adaptación a la metodología digital (58%). Las entrevistas

evidenciaron que, al inicio, los estudiantes enfrentaron una curva de aprendizaje pronunciada que generó cierta resistencia. Sin embargo, la mayoría logró adaptarse progresivamente. Los hallazgos sugieren que, aunque la implementación del aula virtual es percibida positivamente, la transición hacia métodos digitales enfrenta obstáculos que deben ser abordados, como la necesidad de capacitación tecnológica y una infraestructura adecuada. Se concluye que, para maximizar los beneficios del modelo ADDIE, es fundamental reforzar la formación tecnológica y mejorar la conectividad digital, considerando siempre las percepciones estudiantiles para optimizar la experiencia educativa en entornos virtuales.
**Palabras claves:** Tecnología educativa; Modelo ADDIE; Aula virtual; Percepciones estudiantiles; Desafíos digitales.

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## INTRODUCTION

Higher education is undergoing a radical transformation driven mainly by the integration of digital technologies, a phenomenon notably accelerated by the pandemic of COVID-19 (Area-Moreira et al., 2020). This scenario calls for the adoption of innovative methodological models capable of responding to contemporary pedagogical and technological challenges. Among these, the ADDIE model (Analysis, Design, Development, Implementation and Evaluation) has gained relevance as an effective methodological framework for structuring virtual learning environments, standing out especially in higher education institutions that require robust and clear digital platforms (Gómez-Trigueros et al., 2021; Cabero-Almenara & Llorente-Cejudo, 2020).

The ADDIE model presents significant advantages for academic contexts due to its systematic and sequential structure, which facilitates an orderly planning and evaluation of educational processes in virtual environments. However, various research also recognizes that this sequentiality may limit the flexibility required in highly dynamic contexts, where rapid iterations and constant adaptations to technological and pedagogical changes are needed (Molenda, 2003; Allen & Sites, 2012). In the face of this criticism, other approaches such as the SAM (Successive Approximation Model) or the TPACK model have emerged offering greater degrees of flexibility and integration between pedagogical, technological and disciplinary knowledge (Branch, 2009; Clark & Mayer, 2016).

The University of Guayaquil has adopted the ADDIE model in its virtual classroom in order to significantly improve academic results, addressing the growing need for educational digitalization. Prior to this implementation, the institution faced challenges in terms of limited technological integration and insufficient training for both teachers and students. The previous institutional context revealed significant digital gaps and initial resistance to methodological change, which justified the selection of a model with a clear and methodologically sound structure, such as ADDIE.

Several studies point out that technological innovation in higher education faces considerable challenges, including resistance to change, digital divides and the imperative need to develop robust teaching competencies in ICT (Rebolledo & Granados ,2023;García-Peñalvo, 2022; Collazos-Ordóñez et al., 2021). These difficulties directly affect student perception, a crucial factor to evaluate the real success of any digital educational platform (Quiroga et al., 2019). Therefore, it is essential to analyze in detail how these factors impact specifically in Latin American contexts, providing solid empirical evidence to overcome such challenges.

In this sense, the main objective of this study is to analyze students' perceptions of the digital content developed under the ADDIE model and to explore the specific challenges faced in the virtual classroom at the University of Guayaquil. The research question guiding this work is: What are the perceptions and challenges faced by students in the use of the virtual classroom developed under the ADDIE model at the University of Guayaquil? For this purpose, the study is based on recent research, particularly those available in databases such as SciELO and Redalyc, which have addressed the adoption and use of ICT in Latin American higher education (Ramírez-Montoya & Lugo-Ocando, 2020).

Finally, the present research offers a significant contribution by providing a contextualized analysis on the effective implementation of the ADDIE model, providing valuable data on student perceptions and proposing specific recommendations to optimize the educational experience on virtual platforms.

## METHODOLOGY

The present study employed a sequential explanatory mixed design (Creswell & Creswell, 2018), integrating quantitative and qualitative methods to obtain a comprehensive and deep understanding of the investigated phenomenon. This approach was chosen because it allows combining statistical rigor with interpretive depth, facilitating the identification and explanation of patterns in student perceptions regarding the use of the virtual classroom developed under the ADDIE model.

In the quantitative phase, a structured questionnaire was applied, previously validated through expert judgment in digital education methodologies (Hernández-Sampieri & Mendoza, 2018). The questionnaire consisted of 25 items distributed in three main dimensions: (1) usability of the platform, (2) satisfaction with the

digital resources provided, and (3) perception of the pedagogical effectiveness of the virtual classroom. Each item was assessed using a five-point Likert scale, which allowed to clearly quantify the general perceptions of the students regarding the implemented digital environment. The sample used was an intentional non-probabilistic sample, made up of 50 students enrolled in subjects related to pedagogy at the University of Guayaquil during the 2024-2025 academic year. This methodological choice was based on the direct accessibility of the participants, their active participation in the virtual classroom, and the need to obtain a representative sample in terms of diversity of academic performance and technological familiarity.

The quantitative data were processed using the SPSS version 21 statistical program, performing reliability tests (Cronbach's alpha) and correlational analyses to determine the internal consistency of the instrument and to identify statistically significant patterns in the responses obtained. These analyses made it possible to detect general trends and provide a solid quantitative basis for the subsequent interpretation of the qualitative findings.

In the qualitative phase, semi-structured interviews and focus groups were conducted with a purposive subsample of 15 participants, specifically selected to reflect diversity in terms of academic performance and technological experience. This qualitative approach allowed us to explore in greater detail specific aspects such as challenges faced by students, perceptions of teacher-student interaction, and concrete suggestions for improving the implementation of the ADDIE model in the virtual classroom. The interviews and focus groups were conducted following standardized protocols to ensure the reliability of the data obtained.

The qualitative analysis was developed following the guidelines of grounded theory (Strauss & Corbin, 2015), applying open and axial coding procedures to identify relevant emerging categories. These categories were contrasted and validated through a triangulation process with the quantitative results, thus ensuring a deep and multidimensional understanding of the phenomenon studied.

Finally, methodological rigor was ensured by applying strict criteria of internal validity and reliability, including triangulation by methods and sources, standardized protocols and peer review. In addition, ethical aspects were respected at all times, following the guidelines of the Declaration of Helsinki, obtaining explicit informed consent and guaranteeing the anonymity and confidentiality of the participants. This robust methodological combination, supported by recent literature in mixed methods and qualitative analysis (Flick, 2018; Anguera et al., 2020), ensured a rigorous analysis and a holistic understanding of the results derived from the use of the ADDIE model in the specific context of higher education.

Population and sample

The study population consisted of students enrolled in pedagogy-related subjects at the University of Guayaquil during the 2024-2025 academic year. This population was selected because of their constant interaction with the virtual platform, offering a propitious context to evaluate in detail the impact of the ADDIE model on the digital educational experience.

A non-probabilistic purposive sample of 50 students was used. This methodological decision was based on specific criteria such as direct accessibility, active and frequent participation in the virtual platform, as well as the diversity of experiences and academic

performance of the participants. The purposive selection of this sample sought to ensure a sufficient representation of the existing diversity among students in terms of previous technological skills, attitudes towards educational technology and academic performance.

In addition, for the qualitative phase, an additional subsample of 15 students was intentionally selected, specifically considering their diversity in terms of technological familiarity and academic performance. This subsample allowed to deepen and contextualize the quantitative findings, providing valuable insights on personal and group perceptions that could not be fully captured by quantitative techniques.

The sample size and sampling strategy chosen were considered adequate to achieve the objectives of the study, allowing for a detailed and in-depth analysis on the perceptions and challenges faced by students in relation to the implementation of the ADDIE model in the virtual classroom.

Table 1. Different Instructional Design Models

| Model | Structure | Advantages | Limitations | Ideal context |
|---|---|---|---|---|
| **ADDIE** | Sequential | Methodological clarity, solid structure | Rigid, not very adaptable | Traditional or blended education |
| **SAM** | Iterative | Flexibility, rapid prototyping | Requires high technical preparation | Agile digital content development |
| **TPACK** | Integrative | Promotes comprehensive teaching competence | Difficult to operationalize | Teacher training with a holistic approach |

Source: Researcher's data

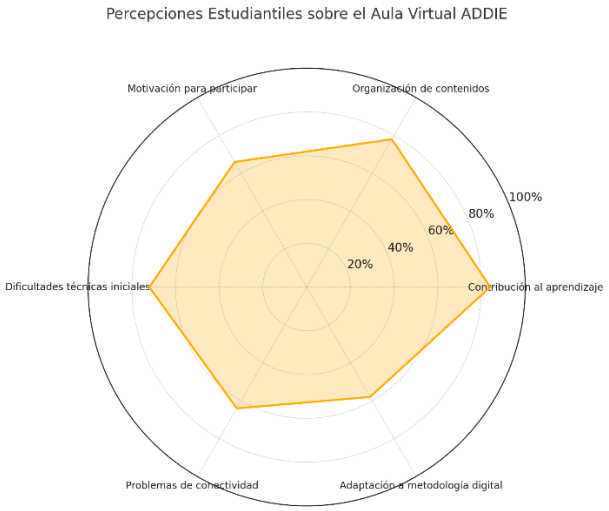
## RESULTS

Table 2. Student perceptions about the ADDIE virtual classroom

| Category evaluated | % of positive response |
|---|---|
| Contribution to learning | 84% |
| Content organization | 78% |
| Motivation to participate | 66% |
| Initial technical difficulties | 72% |
| Connectivity problems | 64% |
| Adaptation to digital methodology | 58% |

Source: Researcher's data

Figure 1. Student Perceptions




Source: Researcher's data

The results obtained partially coincide with previous studies conducted in similar Latin American contexts, such as those carried

out by Quiroga et al. (2019), especially highlighting the importance of continuous and effective teacher training. The concordance of these results suggests that the success of the ADDIE model does not depend solely on the technical structure, but also on prior technological preparation and constant institutional support.

A relevant finding in this study is the identification of technological infrastructure as a critical factor, particularly in relation to the quality and stability of Internet access. The evidence obtained from both quantitative and qualitative data underscores the urgent need to improve digital connectivity and develop robust technology training programs for students and teachers, ensuring a more effective and less problematic transition to digital educational methods.

Another relevant aspect identified is the technological infrastructure, which is revealed as a critical factor, the importance of ensuring stable and quality connectivity for digital content to be accessible and effective. The qualitative evidence also underscores the need for more robust and continuous initial training for students and teachers, favoring a smoother and more effective implementation of the model.

## CONCLUSIONS

The virtual classroom implemented by the University of Guayaquil under the ADDIE model has proven to offer significant benefits in terms of educational innovation and effective learning. However, there are still important challenges related mainly to the technological infrastructure and the initial preparation of both teachers and students in digital competencies.

To maximize the potential of the ADDIE model, it is crucial to implement continuous and effective technological training programs specifically oriented to the needs identified in this study. In addition, it is recommended to significantly improve the university digital infrastructure, especially connectivity, to facilitate more equitable and efficient access to digital content.

Finally, it is essential to actively involve students and teachers in processes of continuous feedback and co-creation of content, thus ensuring that the implementation of the ADDIE model not only responds adequately to current pedagogical needs, but also guarantees its long-term sustainability and effectiveness.

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