Systematic Review on Graphic Design to Optimize Interactive Learning in Rural Areas

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Abstract*– The aim of this systematic literature review (SLR) is to analyze graphic design in optimizing interactive learning, with a particular focus on rural contexts. The methodology used was PICO and PRISMA, encompassing a comprehensive analysis of studies published between 2020 and 2024 in academic databases. The review explores previous research related to visual interfaces, immersive technologies such as augmented reality (AR) and virtual reality (VR), as well as hybrid methodologies, including problem-based learning (PBL) and gamification. The results show that these tools have significantly contributed to improving accessibility, student motivation and the understanding of complex concepts. But there are critical gaps, such as the long-term sustainability of these solutions and their personalization for students with diverse cognitive abilities. In technical disciplines such as engineering and computer-aided design (CAD), virtual laboratories and online learning platforms have proven effective in improving information retention. It is concluded that interactive graphic design is positioned as a key tool for creating participatory educational environments. It is recommended to develop accessible and culturally relevant technologies, design inclusive tools for students with diverse abilities, and foster institutional collaborations to ensure sustainable implementation.

Keywords*-- Graphic design, graphic resources for learning, interactive learning, learning experience, visual design.

I. Introduction

Graphic design offers far more than meets the eye; it is a dynamic tool that blends creativity and strategy to convert ideas into impactful visual experiences. As a universal language, it effectively conveys messages and plays a vital role in the educational sector [1]. However, in areas with limited educational resources and restricted access to technology, significant challenges arise. These barriers impede the effective and aesthetic communication of ideas, resulting in poor comprehension and retention of information. To address these issues, educational institutions have historically implemented pedagogical strategies prior to introducing technological tools into classrooms.

For example, in rural areas, Problem-Based Learning (PBL) using visual materials (such as informative infographics) serves as a fundamental basis before implementing digital solutions [3], [5]. Similarly, physical educational games and comics have been shown to increase interest and interactive learning before moving to digital platforms [2], [17].

Research highlights the importance of focusing accessibility and technology efforts on improving education through appropriate strategies and comprehensive teacher training [1], [2], [3]. Furthermore, it is crucial to evaluate learning outcomes using traditional methods alongside new tools to compare their effectiveness. Such evaluations enable the adaptation of educational content to diverse learning styles without disregarding the value of traditional approaches [4], [5], [8], [9], [10]. Case studies have also proven essential for analyzing events that influence academic development, offering insights into various factors affecting the educational landscape [4], [11].

Given these considerations, conducting a new Systematic Literature Review (SLR) is essential to assess the role of graphic design in optimizing interactive learning, particularly in rural areas. This requires a rigorous methodology to define clear inclusion and exclusion criteria for selecting high-quality, relevant information. An agile methodology is well-suited for this purpose, facilitating a comprehensive and efficient analysis [6]. To this end, the study employs the PICO framework to formulate a detailed search equation within SCOPUS databases and adopts the PRISMA methodology to refine search criteria and ensure the reliability of the review process.

This SLR is structured as follows: the introduction outlines the significance of graphic design in education and establishes the research objectives. The methodology section describes the systematic approach, including search strategies and inclusion criteria. Results summarize the findings from the reviewed literature, while the discussion interprets these findings, connects them to broader trends, and identifies areas for further exploration. The conclusion distills the key insights and implications of the study. Finally, the references provide a comprehensive list of sources that underpin and validate the research.

II. Methodology

A. PICO and PRISMA Methods

The development process of this SLR is centered on the Kitchenham guidelines [6]. In this sense, this research is categorized by literature directly related to Graphic Design to optimize interactive learning in rural areas. The steps of the methodology are documented as shown below.

B. Research Questions

Try Our main research question (RQ) which is designed considering our Problem, Intervention, Context and Results (PICO) [6]. Hand in hand with Graphic Design to Optimize Interactive Learning in Rural Areas, Table 1 shows the PICO summary for the structure of the proposed research questions. Likewise, a variety of keywords and motivations are shown in Table 2.

TABLE I
SUMMARY OF PICO

Problem	Literature on Graphic Design to Optimize Interactive Learning in Rural Areas
Intervention	Literatures on graphic design principles
Context	Interactive learning in rural areas
Result	Efficiency of the interactive learning method

TABLE II
RESEARCH QUESTIONS FOR LITERATURE REVIEW

RQ	Research question	Motivation
RQ1	What types of interactive learning problems have been solved with graphic design in rural areas?	Graphic Design to optimize interactive learning are identified
RQ2	What types of tools and methodologies have been used in graphic design for interactive learning in rural areas?	Works on the types of learning are considered to be of greater importance
RQ3	In what types of spaces is graphic design used to improve learning within the educational field in rural areas?	It can be inferred from the significant works about the spaces where the principles of Graphic Design are being applied in interactive learning.
RQ4	What kind of results have been obtained from the use of graphic design tools in interactive learning in rural areas?	The results and efficiency of applying the principles of Graphic Design in interactive learning are associated
General search equation (1627 documents) (TITLE-ABS-KEY (“Graphic design” OR “Interactive learning” OR “Rural areas” OR " Learning problems") AND TITLE-ABS-KEY (methodology OR "Graphic Resources") AND TITLE-ABS-KEY ("Educational field" OR application OR materials OR useful* OR didactic OR space) AND TITLE-ABS-KEY (results OR optimization))		

For this reading, a variety of titles and summaries were analyzed, as well as introductions and content of each of the literatures. Therefore, the criteria [7] observed in Fig. 1 were considered.

C. *Criteria for inclusion and exclusion (PRISMA)*

Within this structure, 6 inclusion criteria and 5 exclusion criteria were used, which made it possible to select 32 documents to develop this SLR. The following criteria were used:

CI: Inclusion Criteria

1) *All Open Access.*
2) *The title of the article must be directly related to the SLR topic.*
3) *The article must be in a time range of 2020-2024.*
4) *The language of the article is English or Spanish.*
5) *The article must be in the area of graphic design engineering.*
6) *Research and review articles.*

For the exclusion criteria, the following were used:

CE: Exclusion Criteria

1) *letter Duplicity of titles.*
2) *Articles before 2020.*
3) *Books.*
4) *Articles that do not have English or Spanish language.*
5) *Articles whose access is closed.*

Following the established search guidelines, no duplicate articles were obtained. This search yielded 1,627 results within SCOPUS. The combination of keywords using Boolean operators resulted in 0 duplicate articles, which were determined by isolating the data source to proceed with the collection. According to these criteria, 32 potential articles were considered for this SLR, omitting 1,577 records. Additionally, a manual review was performed to obtain relevant articles for the systematic review, 52 records were obtained, which were used in the SLR results. Fig. 1 shows the PRISMA flow chart used to select scientific articles that meet the appropriate guidelines.

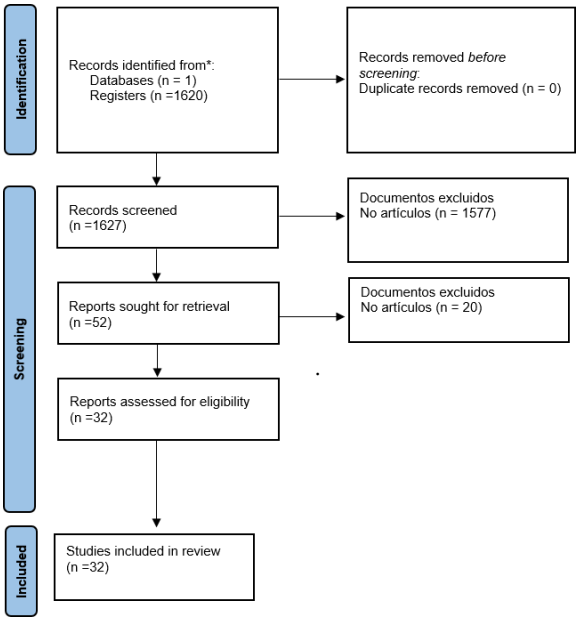

Fig. 1 PRISMA diagram.

To carry out this review, the following research question was proposed: How can graphic design optimize interactive learning in rural areas? This question is within the organizational criteria of the PICO methodology that allows identifying the components of the question (see Table 1) and associating them with keywords (see Table 2), with a view to carrying out a structured search of scientific literature. This allowed the construction of the search equation (see Fig. 1) that was applied within the SCOPUS databases.

The PRISMA methodology was then used to guide the screening process. This included the application of inclusion

and exclusion criteria, as well as the review of texts, titles and abstracts of different studies. Consequently, the studies that met the necessary criteria were selected to serve as the basis for the next phase of the study: data extraction and analysis of results.

Considering the main research question, different points of view on graphic design were evaluated to optimize interactive learning in rural areas. Therefore, review questions of the PICO search strategy were developed, considering the proposed questions with which the keywords of the information to be compiled can be identified, these are observed in Table 1.

III. Analysis of the Results

A. *Bibliometric Results*

According to the SCOPUS database, Graphic Design in interactive learning has been relevant since the end of the 20th century, but its greatest boom is seen at the beginning of the 21st century, as seen in Fig. 2.

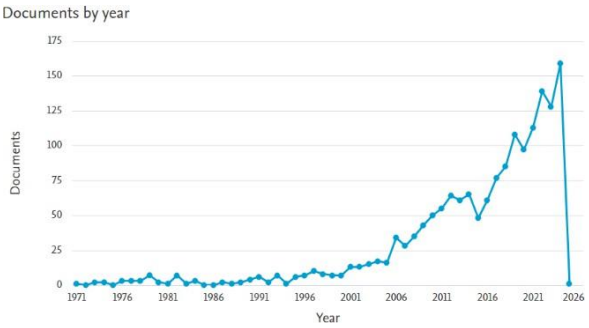

Fig. 2 Representation of publications per year.

In this same order of ideas, within Fig. 3, in relation to the same database, it is shown that the United States represents the country with the most participation on Graphic Design in interactive learning, followed by Spain, India, the United Kingdom, China, Italy, Australia, Brazil, Germany, Canada, among others.

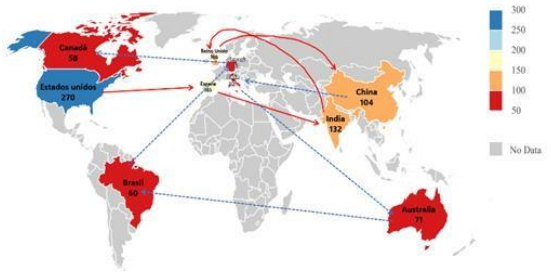

Fig. 3 Countries with the greatest contribution in interactive learning.

Fig. 4 below shows the frequency of use of the keywords used in this SLR. It highlights that learning systems is the most used word in research related to the topic of Graphic Design and Interactive Learning, followed by machine learning. The word design is also used in studies, among others.

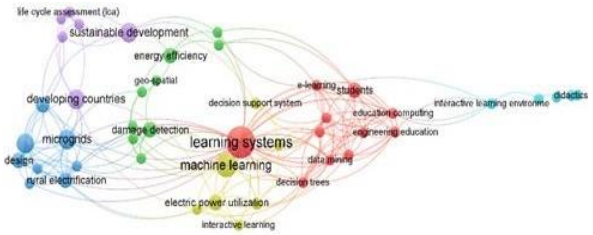

Fig. 4 Network Visualization.

For the following Fig. 5, the interest that the different authors have had in the use of these keywords can be observed according to the SCOPUS database and that in the case of this SLR it is related to Graphic Design and interactive learning.

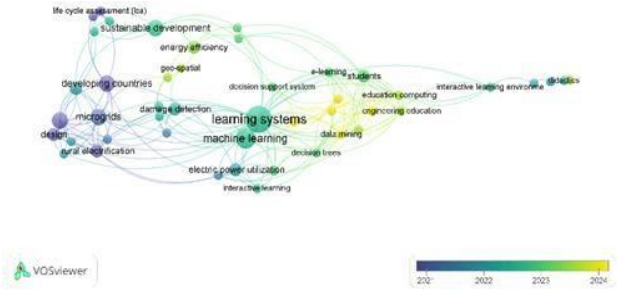

Fig. 5 Overlay Visualization.

Within this order of ideas, the results obtained from the analysis of 52 documents collected within the SLR are explained to answer not only the questions using the PICO methodology: but also, to define, through relevant research, the concepts of Graphic Design, interactive learning and its importance in the context of Design engineering, namely:

First, graphic design could be defined as the process of creating attractive images that convey messages and promote products or services. Through the combination of elements such as colors, shapes and textures, facilitating the communication of ideas that help guide people in their learning.

On the other hand, interactive learning is a way of teaching that focuses on active interaction between the student and his or her environment, allowing him or her to learn through experience and practice. The integration of graphic design into interactive learning contributes to improving comprehension, motivation and increasing skills in students. In this circumstance, the first research question is formulated.

RQ1: ¿What types of interactive learning problems have been solved with graphic design?

Reviews of academic literature show that Graphic Design contributes significantly to the optimization of interactive learning, especially in rural environments and for people with learning difficulties. However, rural areas face practical challenges such as limited technology, cultural disconnection, and scarce specialized training, which hinder the effective implementation of graphic design solutions. Addressing these

issues ensures equitable access to quality education. Designing engaging and didactic visual interfaces facilitates access to education and improves the understanding of learning in remote communities and students with different needs [1], [24], [12], [17]. In addition, immersive technologies such as augmented reality and virtual reality are effective for teaching in STEM disciplines and technical learning, by understanding complex concepts and increasing student participation [4], [25], [13], [16], [8], [11], [18].

On the other hand, there are educational interfaces that help students understand intuitive and attractive navigation, facilitating learning. In areas such as basic electronics, simulators and virtual environments improve knowledge retention and motivation [5], [22], [28], [14], [19], [9], [32]. In addition, graphic design helps solve motivation problems and improve information retention in educational environments, since attractive visual elements capture attention and enrich the experience for the student [3], [2], [26], [30].

In fields such as engineering and architecture, graphic design fosters the development of spatial visualization skills, crucial for understanding complex structures and solving technical problems, making them part of interactive learning [21], [20], [23], [29]. Finally, intuitive graphic design and efficient iconography in educational platforms organize and optimize cognitive processing, improving understanding and retention in interactive environments, making it a user- friendly educational platform [15], [10], [27], [31].

In the following figure 5 it is evident that graphic design has solved some interactive learning problems in this SLR.

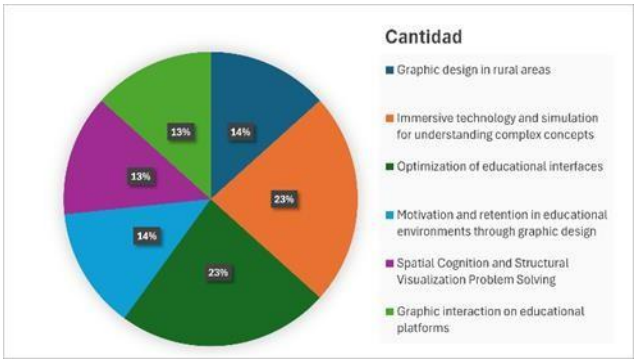

Fig. 6 Interactive learning and graphic design.

As can be seen in Fig. 6, the problems addressed by interactive learning graphic design generate a focus on graphic design in rural environments and cognition approximately 20% each. Likewise, immersive technologies, educational interfaces, motivation and spatial visualization share 60% of relevance, each contributing 15%. On the other hand, Table 3 below provides a brief description of the Graphic Design to optimize interactive learning, namely:

TABLE III
Impact of Graphic Design on Interactive Learning

Contribution area	Impact of graphic design	References
Rural environments and accessibility	– Optimizing interactive learning.	[1], [24], [12], [17].
Immersive Technologies	– Understanding complex concepts.	[4], [25], [13], [16], [8], [11], [18].
Educational Interfaces	– Improved knowledge retention.	[5], [22], [28], [14],[19], [9], [32].
Motivation and retention	– Improved information retention.	[3], [2], [26], [30].
Spatial cognition	– Development of spatial visualization skills.	[21], [20], [23], [29].
Graphic interaction	– Optimization of the cognitive process.	[15], [10], [27], [31].

RQ2: ¿What types of tools and methodologies have been used in graphic design for interactive learning?

As seen, academic reviews in educational graphic design highlight the role of various technological tools and methodologies in enriching the learning experience in an interactive way and motivating student participation. Among these, the use of Augmented Reality (AR) and Virtual Reality (VR) has proven to be fundamental, since it allows creating immersive environments that facilitate the understanding of complex concepts, promoting participation and visual commitment of students [4], [25], [18]. Likewise, graphic design improves accessibility by developing inclusive materials tailored to diverse abilities and cultural contexts, ensuring equitable learning experiences for students in varying environments. Techniques such as gamification and educational games are considered valuable strategies to motivate learning. By integrating game elements, students experience content in a visual and interactive way, which makes learning more attractive and dynamic [1], [24], [2], [11].

On the other hand, Problem- and Project-Based Learning (PBL) is a key methodology that encourages the use of theoretical knowledge in practical situations, helping students develop skills to solve problems effectively. This practical approach reinforces student engagement and facilitates the application of knowledge in real-life contexts [3], [28], [16], [19], [23], [32]. In relation to practical teaching, tools such as simulation and virtual laboratories allow students to interact in controlled environments, using resources such as drones and 3D scenarios. These activities provide a deep understanding of various concepts through immersive activities that increase their participation [21], [12], [13], [26], [27].

Furthermore, interactivity and user experience evaluation focus on usability optimization and qualitative analysis, to improve learning effectiveness through more satisfying and

personalized experiences [10], [30]. Meanwhile, ICT and advanced visual resources, such as geomatics software and orthogonal projection algorithms, are essential to centralize and visualize data, which encourages collaborative and visual learning. Methodologies such as TPACK and SAMR also contribute to a culturally adapted content design, facilitating contextualized and accessible learning [5], [14], [15]. Structural modeling and simulation, together with machine learning

techniques and neural networks, are other key tools in the development of interactive educational environments.

These technologies provide students with practical and technical skills in graphic design [22], [29]. In addition, visual and optical assessment using techniques such as eye tracking and user experience questionnaires allows measuring visual effectiveness and satisfaction, thus optimizing the presentation of content and improving the most effective learning process [31].

Finally, immersive and multimodal learning, especially through virtual reality, offers personalized interactions that promote information retention, achieving a complete and comprehensive educational experience [20], [8], [9]. The use of hybrid methodologies and a user-centered design, which combines tools such as Android Studio, Mockups and Google Forms with methodologies such as Design Thinking enables the creation of educational experiences tailored to the needs of students, promoting personalized and adaptable education [17]. Together, these technologies and methodologies underline the importance of integrating innovative resources in educational graphic design, strengthening participation, commitment and learning effectiveness in interactive and personalized environments. The following percentage distribution of methodologies used for interactive learning can be seen in Fig. 7.

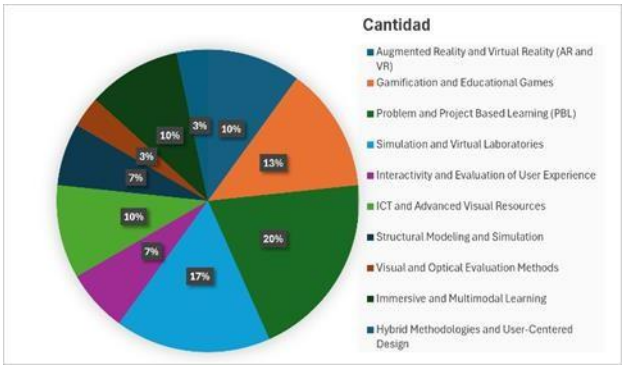

Fig. 7 Interactive learning and graphic design.

In Fig. 7 we can see that the highest percentage is with 20% problem- and project-based learning (PBL), also, with 17% virtual laboratories and simulation, followed by gamification and educational games with 13%, AR and VR together with immersive learning and advanced visual resources also represent great importance in the methodologies used, each of these having a weight of 10% and below this percentage would be hybrid methodologies, modeling, visual evaluation methods and interactivity and user experience evaluation.

On the other hand, Table 4 below shows a brief description of the types of tools and methodology that have been used in graphic design for interactive learning, namely:

TABLE IV
Graphic Design Methodologies for Interactive Learning

Methodology	Main Features	References
Problem and Project Based Learning (PBL)	– Development of problem-solving skills.	[3],[28],[16], [19],[23], [32]
Virtual laboratories and simulation	– Use of drones and 3D scenarios.	[21], [12], [13], [26],[27]
Gamification and educational games	– Dynamic and engaging experience.	[1], [24], [2], [11].
Augmented reality and virtual reality	– Understanding complex concepts.	[4], [25], [18].
Advanced Visual Resources	– TPACK and SAMR methodologies.	[5], [14], [15].
Hybrid methodologies	– Various virtual platforms.	[17]
Structural modeling and simulation	– Development of technical skills.	[22], [29].
Visual and optical evaluation	– Content optimization.	[31]
Interactivity and evaluation of the experience	– Personalized experiences.	[10], [30].
Problem and Project Based Learning (PBL)	– Development of problem-solving skills.	[20], [8], [9]

RQ3: ¿In what types of spaces is graphic design used to optimize learning within the educational field?

According to literature reviews, it can be observed that graphic design is performed within virtual environments such as virtual classrooms and interactive laboratories, this facilitates both practical and theoretical learning with multiple visual experiences. Optimizing understanding and encouraging interaction within technical disciplines [1], [25], [32], [16], [9], [26]. In addition, it can be deduced that there was an improvement in learning in rural educational environments, facilitating access to educational content and through immersive experiences promoting interactive learning [5], [12], [17], [15].

Additionally, in rural contexts, graphic design provides culturally adapted visual content and low-cost educational resources. These strategies improve access to education and

enhance comprehension, even in technologically limited settings. On the other hand, graphic design proposes improvements through visualization and simulation in technical education for understanding in technical spaces such as engineering laboratories and CAD classrooms, using advanced visualizations and simulations that promote collaborative and practical learning of complex concepts [21], [19], [23], [28],

[10], [29].Interactivity and educational games are also part of an improvement within the educational field, educational games and virtual escape rooms promote participation and interactive learning, which provides students with a way to evaluate their knowledge in an immersive way [24], [2], [32].

Likewise, graphic design also provides digital tools and e-learning platforms that help optimize and improve the learning experience, this facilitates the understanding of educational material by giving it intuitive and interactive graphic representations [30], [31], [14], [20], [27].

Similarly, the inclusion of augmented reality and immersive experiences in the educational field promote the visualization of complex concepts, both formal and informal, for academic enrichment through immersive experiences such as 3D environments [22], [8], [11], [18]. Likewise, there is an improvement in visual communication in educational spaces within classrooms and educational events to improve visual communication, to present learning in a more attractive way through interactive and realistic visual resources [3], [4].

Finally, the addition of virtual reality and immersive environments to optimize the visualization and cognition of students in academic contexts to promote the understanding of complex concepts [13]. Within Fig. 8 based on spaces where graphic design is used to optimize interactive learning, the importance of graphic design to optimize learning within the educational field can be observed.

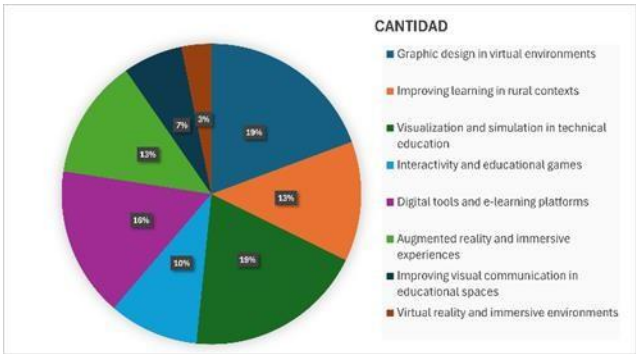

Fig. 8 Graphic design to optimize learning in the educational field

As a result, in Fig. 8 it can be seen that visualization and simulation form the largest percentage together with graphic design in virtual environments, having a total participation of 38% together, followed by digital tools and e-learning platforms with 16%, spaces such as rural contexts and AR have a participation of 13% each, finally, improvement of visual communication, interactivity and educational games, VR and immersive environments form part of the 20% together.

On the other hand, Table 5 below provides a brief description of spaces where graphic design is used to optimize interactive learning, namely:

TABLE V
Graphic Design Application Spaces for Learning Optimization

Application spaces	Main Features	References
Visualization and simulation in technical education.	– Advanced visualizations.	[21], [19], [23], [28], [10], [29].
Virtual environments	– Interactive laboratories.	[1], [25], [32], [16], [9], [26].
Digital tools and e-learning platforms	– Interactive interfaces.	[30], [31], [14], [20], [27].
Rural educational environments	– Improving learning.	[5], [12], [17], [15].
Augmented reality and immersive experiences	– Formal and informal learning.	[22], [8], [11], [18]
Visual communication	– Interactive visual resources.	[3], [4].
Interactivity and educational games	– Gamification of educational content.	[24], [2], [32].
Virtual reality	– Immersive environments	[13]

RQ4: ¿What kind of results have been obtained from the use of graphic design tools in interactive learning?

Recent research has highlighted several benefits of using graphic design tools to improve the effectiveness of interactive learning in different educational contexts. In this sense, the use of virtual laboratories and graphic tools has managed to optimize the understanding and retention of knowledge, also allowing effective adaptation to the specific needs of students [1], [3], [29]. Furthermore, these tools promote greater student participation and motivation, facilitating collaborative learning environments that increase commitment and enhance academic performance [4], [24], [17], [2], [11].

On the other hand, it has been observed that the use of graphical tools allows students to understand and retain complex concepts in greater depth, which is particularly relevant in technical disciplines. In this way, enriching educational experiences are generated that favor continuous evaluation, sustained attention and general satisfaction in the learning process [25], [22], [28], [20], [8], [9], [27]. In this framework, the development of practical and collaborative skills has also been strengthened with technologies such as drones and simulators, promoting team collaboration and facilitating the technical understanding necessary in

engineering projects and other complex areas [21], [12], [18], [19], [26].

In addition, initiatives have been promoted that promote inclusion and accessibility in interactive learning, which allows students from misunderstood contexts to develop digital skills and actively participate in their education, achieving greater equity in access to educational resources [5], [14], [15], [32]. In addition to this, the increase in usefulness and improvement in the learning experience have been notable, since the optimized visual design facilitates clarity and order in the content, increasing student satisfaction and attention [23], [10], [30], [31].

On the other hand, we say that the use of graphic design tools in interactive learning translates into a more effective, inclusive education adapted to current needs, contributing both to the acquisition of practical skills and to the development of more accessible and attractive learning for all students. In Fig. 9 we can see what kind of results have been obtained from the use of graphic design tools with the greatest relevance in interactive learning.

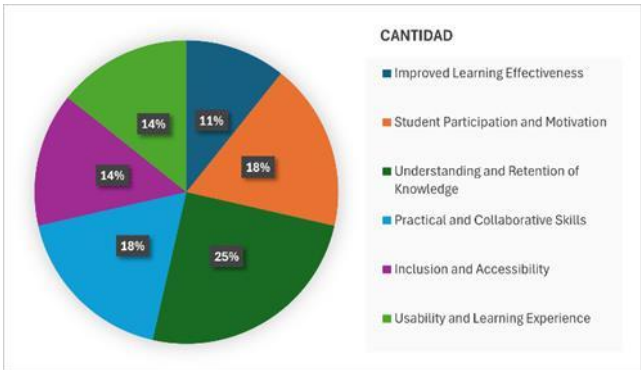

Fig. 9 Using Graphic design tools in interactive learning

According to Fig. 9, shows the indisputable use of optimization for educational interfaces and immersive technology in conjunction with simulation for complex learning, both tools together make up 43% of the participation within the articles reviewed. In addition, motivation and retention in educational environments and graphic design in rural areas have a percentage of 14% each, followed by graphic interaction in educational platforms and the solution of spatial cognition problems and structural visualization that represent the remaining 29%. On the other hand, Table 6 below shows a brief description of the results obtained from the use of graphic design tools to optimize interactive learning, namely:

TABLE VI
Tools and Benefits of Graphic Design in Interactive Learning

Tools and benefits	Main Features	References
Optimization of educational interfaces.	– Enriching educational experiences.	[25], [22], [28], [20], [8], [9], [27]
Immersive technology and simulation	– Development of practical skills.	[21], [12], [18], [19], [26].
Motivation and retention in educational environments	– Improving academic performance.	[4], [24], [17], [2], [11].
Graphic design in rural environments	– Development of digital skills.	[5], [14], [15] , [32].
Graphic interaction in educational platforms	– Structural visualization.	[1], [3], [29].
Cognition problem solving	– Enhanced spatial cognition.	[23], [10], [30], [31].

IV. Discussion of the Results

The reviewed literature shows that graphic design has solved a variety of problems related to optimizing interactive learning, especially in rural and technical contexts. Findings point to the fact that the design of intuitive visual interfaces, the use of immersive technologies (such as augmented reality and virtual reality), and the implementation of simulators and virtual environments have improved educational accessibility and the understanding of complex concepts [1], [25], [22], [24]. This significantly addresses the problems of motivation, knowledge retention, and accessibility (especially in rural areas) [12], [17], [18]. However, the gap identified is the long-term effectiveness of these solutions. Although the literature indicates improvements in motivation and access, the sustainability and continued integration of these solutions in rural settings requires further research [5], [15], [32]. What is important is the understanding that the impacts of these solutions can remain relevant and effective in the rural context as technologies advance [3], [22], [23].

It is worth noting that the graphic design shows that it uses a variety of tools and methodologies, such as: Augmented Reality (AR), Virtual Reality (VR), gamification, and Problem-Based Learning (PBL) to facilitate participation and active learning in interactive environments [1], [3], [22], [12], [4]. Likewise, the analysis reveals that hybrid methodologies, such as the use of e-learning platforms combined with interactive approaches, are gaining ground, but require further studies on their adaptation to different educational contexts. For example, although gamification has a positive impact on motivation, the effectiveness of these methods in rural contexts and with students of diverse cognitive abilities has not been explored in depth [1], [124], [2]. This is a significant gap, as the literature reveals that personalization is key to the success of these tools.

Otherwise, there is little evidence on how to achieve effective personalization in resource-limited rural settings [5], [14], [11].

Furthermore, it is evident that the most common application spaces include virtual classrooms, interactive laboratories, e-learning platforms, and rural environments. Graphic design in virtual environments and data visualization in technical spaces such as engineering laboratories and CAD classrooms are highlighted as crucial for the optimization of interactive learning [22], [12], [23], [32].

In this order of ideas, one of the main complications is the transferability of these solutions to other contexts. While virtual laboratories and digital platforms work well in urban environments or with adequate access to technology, effective implementation in rural communities with limited infrastructure or without stable internet access remains a limitation [5], [21], [22]. Furthermore, the cultural and local adaptation of graphic designs and technological methodologies in these spaces is another important limitation that is not fully addressed in the literature [17], [18], [20].

Thus, graphic design tools have improved understanding of complex concepts, student motivation, and information retention, particularly through the use of optimized educational interfaces and immersive technologies such as AR/VR **[4],** [25], [22]. These benefits are evident in technical and rural contexts, supporting the hypothesis that interactive graphic design can significantly enhance learning in challenging environments. Based on this evidence, for effective implementation, hybrid strategies with physical materials and offline applications must be used, digital infrastructure must be improved through partnerships, and a gradual curriculum with teacher training must be implemented. It is also essential to adapt educational resources to each community.

However, practical implications suggest that while the benefits are clear, there are limitations to the accessibility of these technologies in rural communities [5], [14], [32]. Graphic design, although effective, does not by itself guarantee that all students in rural contexts have the same access or the same ability to interact with educational platforms. In turn, the suitability of content and the usability of tools for students with different cognitive needs (such as those with learning disabilities) are also partially resolved, but not exhaustively, in the literature [23], [10], [30].

IV. Conclusion

The reviewed literature shows that graphic design, through tools such as augmented reality (AR), virtual reality (VR), and gamification, has optimized interactive learning in technical and rural contexts. These advances have improved motivation, knowledge retention, and educational access. In this sense, online learning for educators emerges as a key complement, requiring analogous characteristics: interactivity, self-reflection, and creativity, through the use of diverse media and modalities to maximize participation and pedagogical relevance.

However, limitations related to long-term sustainability and personalization in resource-limited environments persist. The integration of hybrid methodologies and digital platforms stands out as a key opportunity, although it requires further research on their adaptability to diverse contexts.

To overcome these limitations, it is essential to explore strategies that ensure technological and cultural accessibility in rural communities. It is suggested to prioritize the creation of intuitive interfaces, adapted to students with diverse cognitive abilities, and the development of inclusive content. Likewise, the promotion of public-private collaborations can facilitate the necessary infrastructure. These actions are essential to guarantee the lasting and equitable impact of graphic design in interactive education, especially in challenging contexts.

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