

Use of Kahoot, Quizizz and Educaplay as formative assessment for student learning in elementary school

Uso de Kahoot, Quizizz y Educaplay como evaluación formativa para el aprendizaje de los estudiantes en la educación primaria

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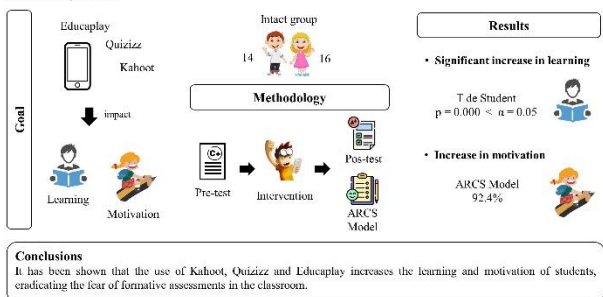
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Abstract

The present research was developed in an elementary school in the city of Ocosingo, Chiapas, Mexico; It focused on the use of applications such as Kahoot, Quizizz, Educaplay, internet and mobile devices, to carry out formative evaluation in the classroom and determine its impact on the learning of 4th grade students, on the topic of Mesoamerican Cultures in the subject of History. The study was carried out under a descriptive quantitative approach with a quasi-experimental design, using as data collection instruments a performance test and a questionnaire to measure students' Motivation through the ARCS Model (Attention, Relevance, Confidence and Satisfaction). The results show that the use of these applications significantly increases student learning, developing motivation to study and learn the topic addressed.

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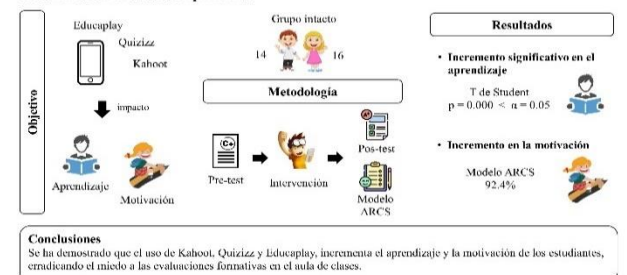


Applications; ARCS Model; Formative evaluation; Elementary school

Resumen

La presente investigación se desarrolló en una escuela primaria de la ciudad de Ocosingo, Chiapas, México; se centró en la utilización de aplicaciones como Kahoot, Quizizz, Educaplay, internet y dispositivos móviles, para realizar la evaluación formativa en el aula de clases y determinar su impacto en el aprendizaje de los estudiantes del 4º. Grado, en el tema de las Culturas Mesoamericanas de la materia de Historia. El estudio se realizó bajo un enfoque cuantitativo descriptivo con diseño cuasiexperimental, utilizando como instrumentos de recolección de datos un test de rendimiento y un cuestionario para medir la Motivación de los estudiantes a través del Modelo ARCS (Atención, Relevancia, Confianza y Satisfacción). Los resultados demuestran que la utilización de éstas aplicaciones incrementa significativamente el aprendizaje de los estudiantes, desarrollando la motivación por estudiar y aprender el tema abordado.

Uso de Kahoot, Quizizz y Educaplay como evaluación formativa para el aprendizaje de los estudiantes en la educación primaria.



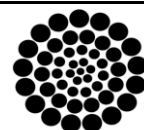
Aplicaciones; Modelo ARCS; Evaluación formativa; Educación primaria

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Introduction

Technology has come to revolutionise the way in which teachers are teaching and learning in the classroom; however, it has not been an easy task to adapt to these current pedagogical changes, which demand the integration of technology into the curriculum at different educational levels, especially in basic education.

Nowadays, students are digital natives, as they learn to use technology naturally, so teachers must acquire digital competences to strengthen the teaching and learning process, in order to get the attention of students, so that they acquire the knowledge and skills that are intended to be achieved in the objectives of the subjects.

This points to a scenario for a pedagogical and didactic change in teaching practice, where one must move from transmitter of knowledge to facilitator of access, selection, evaluation and transformation of the same to students, so that a competent teacher would be the one who integrates a triple focus knowledge: disciplinary, pedagogical and technological (Díaz-Arce & Loyola-Illescas, 2021).

Within this practice, it is very important to assess student learning, we can talk about the most common ones such as formative and summative assessment, in this study we will focus on the first one.

Formative assessment allows to improve student learning, for this, their performance must be evaluated (Moreno, 2016), through the activities developed, where 'the teacher identifies student errors, understands their causes and makes decisions to overcome them, improves both student learning and their teaching performance' (Pasek & Mejía, 2017, cited in Joya, 2020, p. 182); this type of evaluation is applied during the development of the thematic units, where the participation of the teacher is essential, through the monitoring of the results obtained and issuing feedback to students in each evaluation applied, allowing to establish actions to improve and achieve the learning objectives of the thematic units of the subjects (Martínez, 2011, cited in Salazar-Pastrana et al, 2014; Sánchez & Escobar, 2015).

Since the last century, Information and Communication Technologies (ICT) have made it possible to innovate the teaching and learning process with the implementation of digital didactic resources, so that it is attractive and enjoyable at all times for students; this is why teachers must seek 'different methods that promote teaching and learning in students, taking technology as a resource of vital importance, considering that students are attached to ICT from an early age' (Cevallos et al. 2019, p. 88).

Nowadays, there are several applications for formative assessment that allow to increase students' learning and motivation in different subjects (Morón et al., 2022; Arias-Becerra et al., 2022; Medina et al, 2022; Luzardo & Farías, 2021), eradicating the fear of classroom assessments, making them more motivating for students through games, such as Kahoot, Quizz, Educaplay and Socrative (Delgado & Chicaiza, 2022), provided that the teacher makes a good design, development and execution of the activities, playing a very important role in the constant feedback of the activities to generate that motivation (Prada et al., 2021; Walss, 2021).

Problem statement

Education in Mexico has a large educational backlog (3.8 million people), with Chiapas being the state that leads this statistic (REDIM, 2023).

The municipality of Ocosingo is located in the state of Chiapas, at the entrance to the Lacandon Jungle, and is one of the largest municipalities in the state; there is an enormous digital divide in this municipality, as well as in several municipalities in the state of Chiapas and in other states with similar conditions (Lezama & Orizaga, 2024), which is why technology is absent in basic education centres.

According to data from the State Coordination of Continuing Education for In-Service Teachers (2023) of the Ministry of Education of the State of Chiapas, the percentage of teachers trained in pedagogical and technological issues is low in relation to the total number of teachers at the basic level, so that, for them, educational innovation in the use of technological tools to support the teaching and learning process is something complex to assimilate and above all to contextualise.

It is evident that primary schools do not have computer equipment, mobile devices (smartphones, tablets or laptops), internet and projectors available to teachers, to be used in the teaching and learning process as a complement to the activities set out in the free textbooks, however, these books consider as complementary material for student learning, the consultation of videos or external readings that require an internet connection and any of the aforementioned technological equipment.

It is difficult to assimilate that after a global pandemic in which the Mexican Ministry of Education's indication was to transfer face-to-face education to an emergency remote (virtual) education, there is still a lack of computers and internet, which are indispensable in primary schools for the acquisition of digital competences by students from an early age. This absence means that teachers do not have the necessary digital competences to innovate the teaching and learning process, continuing with traditionalist teaching in the classroom.

This is why the Chiapas State Government has designed strategies within the Chiapas State Development Plan 2019-2024, to eradicate school dropout at the basic level, caused by the lack of interest in attending classes or studying, leading to the poor school performance shown by students, as well as, and not least, the lack of interest in the professionalisation of teachers and the lack of innovative proposals in the teaching and learning process that increase this problem.

Objective

Based on the above, this research focused on determining the impact of the use of Kahoot, Quizizz and Educaplay as formative assessment in the learning of students in the 4th. Grade 4 students at Cuauhtémoc Primary School in Ocosingo, Chiapas, in the subject of Mesoamerican Cultures in History.

Methodology

This research was developed under a descriptive quantitative approach with a cross-sectional quasi-experimental design (Hernández-Sampieri & Mendoza, 2018).

Through two dependent groups, with the independent variable being the use of the applications Kahoot, Quizizz and Educaplay during the intervention of the study, and the dependent variables being academic performance and motivation, and therefore, the following hypotheses were established:

H1: The use of Kahoot, Quizizz and Educaplay for formative assessment in the classroom improves the learning of 4th. Grade of Cuauhtémoc Primary School.

H2: The perception of 4th. Grade of Cuauhtémoc Primary School is high in relation to the motivation for their learning with the use of Kahoot, Quizizz and Educaplay for formative assessment in the classroom.

Sample

The study sample was non-probabilistic and intentional, consisting of a group of 30 students, in which parents gave their written consent for their children to participate in the study, mentioning that the data collected would be treated confidentially and for statistical purposes; the segmentation by gender consisted of 16 girls and 14 boys, between 9 and 10 years of age.

Data collection instruments

As data collection instruments, a performance test was applied to measure the variable 'academic performance', designed and validated by the teachers of the 4th grade of the Cuauhtémoc Elementary School in Cuauhtémoc.

The test was made up of 25 questions to evaluate the topic of Mesoamerican cultures in the subject of History. To determine the normality of the data, the Shapiro-Wilk test was performed through the R Software Version 2023.12.0, where a value of $p = 0.0181$ was obtained for the pre-test and $p = 0.8921$ for the post-test, due to the fact that the pre-test is less than the established significance level value of $\alpha = 0.05$, the data do not behave normally, as shown in graphs 1 and 2, therefore, the non-parametric Wilcoxon Signed Ranks test was applied to calculate the difference in means, which will allow us to evaluate the H1 of the research.

Box 1

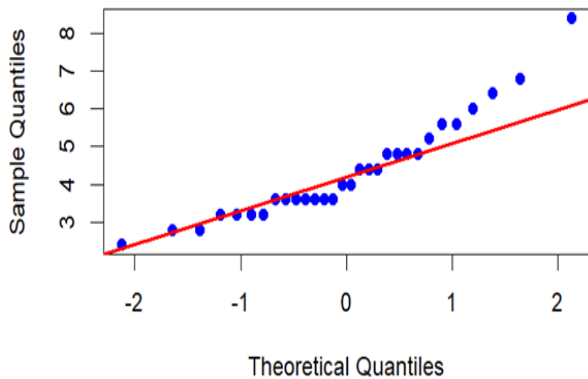


Figure 1

Pre-test quantile plot for normality of data
Source: Research data

The graph above shows that some of the data are far from the line, indicating that the data do not follow a normal distribution.

Box 2

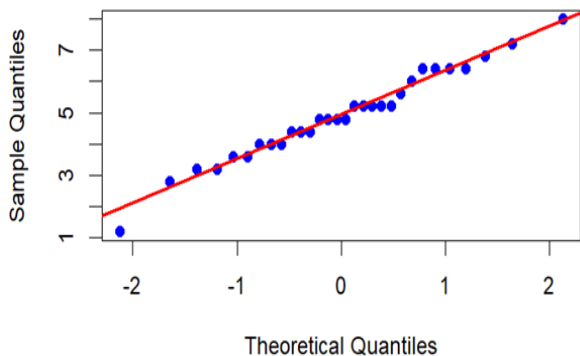


Figure 2

Post-test quantile plot for normality of data
Source: Research data

In the graph above, it can be seen that most of the data are very close to the line, indicating that the data follow a normal distribution.

On the other hand, for the variable "motivation", the questionnaire was adapted to measure Motivation through the ARCS Model (Attention, Relevance, Confidence and Satisfaction), designed and validated by Aroca-Reyes & Llorente-Cejudo (2023), the instrument consists of 3 questions in each of the dimensions mentioned as shown in Table 1.

Box 3

Table 1

Survey to measure motivation

Dimension	Ítems
Attention	1. Did you enjoy doing these learning activities?
	2. Do you feel happy for the effort made in these activities?
	3. Would you like to continue doing this kind of learning activities?
Relevance	4. ¿Habías utilizado éstas aplicaciones para realizar las actividades?
	5. ¿Te ha gustado utilizar las aplicaciones para realizar éstas actividades?
	6. ¿Te gustaría volver a utilizar las aplicaciones para aprender otros temas?
Trust	7. Were you confident in carrying out these activities using the apps?
	8. Did you learn how to use the applications when doing these activities?
	9. Would you feel confident to use these applications again another time?
Satisfaction	10. Did you maintain your attention while doing the activities with the apps?
	11. Did the use of the apps help you to stay attentive while doing the activities?
	12. Did the use of several apps help you to maintain your attention to perform the activities?

Source: Adapted from Aroca-Reyes and Llorente-Cejudo (2023, p. 153).

In order to calculate the reliability of the instrument, a pilot test was carried out with a sample of 21 4th grade students. Grade of the Marcos Villanueva López Rural Primary School, using Cronbach's alpha coefficient through the JASP Software version 0.18.1, obtaining a value of $p = 0.721$ located in the High magnitude range (Ruíz, 2013), being an instrument with an Acceptable reliability coefficient, since it is higher than 0.70 (Oviedo & Campo-Arias, 2005).

Box 4

Table 2

Reliability statistics

Estimate	Cronbach's α
Point estimate	0.721
95% CI lower bound	0.498
95% CI upper bound	0.860

Source: Research data

Development of the intervention

The intervention of the study in the 4th. The intervention of the study in the 4th grade of Cuauhtémoc Primary School was developed through the following phases:

Domínguez-Gutú, Jesús, Trejo-Trejo, Gilberto Abelino, Gordillo-Espinoza, Emmmanuel and Constantino-González, Fernando Exiquio. [2024]. Use of Kahoot, Quizizz and Educaplay as formative assessment for student learning in elementary school. Journal Basic Education. 8[19]1-12: e2819112.
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Phase 1. Presentation of the study

The researchers went to Cuauhtémoc Primary School to meet with the Headmaster, to whom the objective of the research study was explained. One teacher was interested in the study and the other two did not want to participate.

Phase 2. Authorisation of the study

The researchers submitted to the principal a consent form for the parents of the students in Grade 4, Group B, in which the parents of the students were asked to give their consent.

The researchers presented the Director with a form to give consent for their children to participate in the study by answering the instruments designed and for photographs to be taken during the intervention. Subsequently, teams of 4 students were formed to carry out the activities during the intervention.

Phase 3. Design of the games

The formative assessments were designed using the applications chosen by the researchers for the development of the intervention: Kahoot, Quizizz and Educaplay. In the first, 2 games were created with 10 multiple choice and true/false questions, establishing a time limit of 1 minute maximum for each question; in the second, 2 games were created with the same number and type of questions, as well as the same time limit established for each one of them; for the third, 4 games were designed: matching columns, crossword, memorama and froggy jumps, establishing the same number of questions and time limit for each one of them.



Figure 3
Examples of questions designed in the Kahoot games
Source: Kahoot



Figure 4
Examples of questions designed in Quizizz games
Source: Quizizz

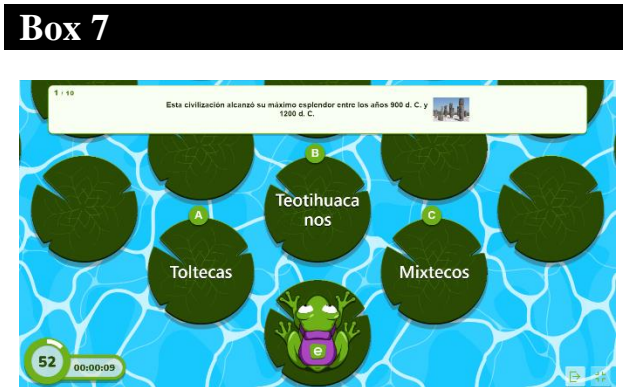


Figure 5
Examples of questions designed in Educaplay games
Source: Educaplay

Phase 4. Intervention

On the first day, the pre-test (performance test) was applied to find out the students' previous knowledge, since the teacher had already taught the topic for the development of the study. On the following days, educational games were developed to reinforce the topic, using the aforementioned applications.

Each day, the points acquired by each of the teams were recorded and medals were awarded to the first, second and third places, which moved as the games progressed; at the end, a prize was awarded to the first three places, based on the final ranking (see Figure 10).

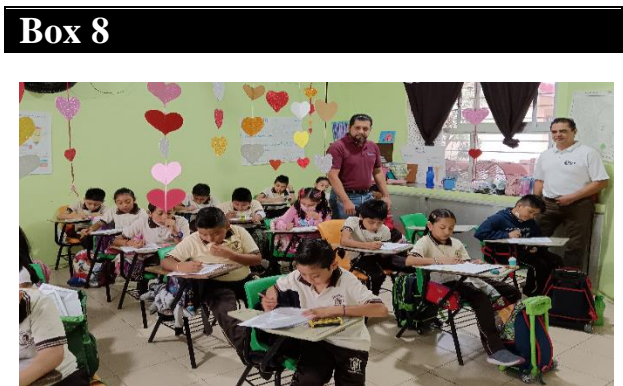


Figure 6
Application of the pre-test
Source: Own creation

Box 9



Figure 7
Games developed in Kahoot
Source: Own creation

Box 10



Figure 8
Games developed in Quizizz
Source: Own creation

Box 11



Figure 9
Games developed in Educaplay
Source: Own creation

Box 12

Equipos	Puntos Juego 1 (Kahoot)	Puntos Juego 2 (Educaplay)	Puntos Juego 3 (Quizizz)	Puntos Juego 4 (Educaplay)	Puntos Juego 5 (Kahoot)	Puntos Juego 6 (Educaplay)	Puntos Juego 7 (Quizizz)	Puntos Juego 8 (Educaplay)	Total
Estrella Fugaz	3,231	0	3,790	2,000	3,938	4,000	4,440	0	23,399
Los Dinos	3,128	0	1,780	2,400	7,803	10,000	6,580	3,000	38,791
Enanitos Toreros	3,598	0	3,470	3,400	3,908	6,000	3,460	4,000	31,836
Michis	4,141	0	2,260	0	4,673	1,000	4,020	1,000	17,094
Conejitos	2,383	1,500	2,460	800	3,633	6,000	6,110	6,000	28,908
Los Capitanes	4,107	1,500	4,480	800	3,068	1,000	3,640	1,500	20,195
Pandas	833	1,400	1,710	2,000	3,308	3,000	3,230	2,500	21,983

Figure 10
Scores obtained by the teams
Source: Own creation

Box 13

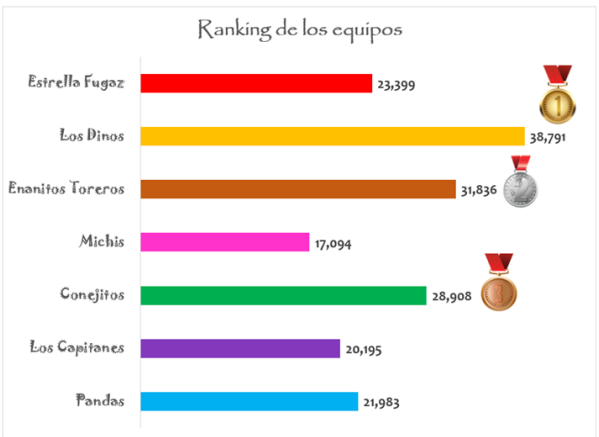


Figure 11
Final ranking after the development of all games
Source: Own creation

Phase 5. Final data collection

On the last day, the post-test (performance test) was applied to find out the learning acquired by the students through the use of these applications; then, the instrument that measured motivation was applied to find out the perception of the students in relation to the development of the designed activities.

Box 14



Figure 12
Application of the post-test
Source: Own creation

Results

Academic performance

For the validation of the hypothesis (H1), the non-parametric Wilcoxon Signed Ranks test for dependent samples was performed, obtaining a value of $p = 0.0269$, which is lower than the established significance level value of $\alpha = 0.05$, therefore, it is concluded that there is a significant difference, rejecting the null hypothesis and accepting the established hypothesis of the study, in which ‘The use of the applications Kahoot, Quizizz and Educaplay as formative assessment in the classroom significantly improves the learning of students in the 4th. Grade of Cuauhtémoc Primary School’.

These results are similar to those found by (Rayan & Watted, 2024), who performed a Student's t-test for independent samples, obtaining a value of $p = 0.000$, demonstrating that there were significant differences in student learning when using Kahoot, likewise, the findings found by Solano & Zamalloa (2022), who used Kahoot and recommended its use to increase the academic performance of students, being this an application that provides legitimate, efficient and useful results to measure learning (Ahzim et al., 2023); as well as in the study conducted by Betancur & Robayo (2023), where they used the applications Kahoot, Quizizz, Quizalize, Educaplay and Math Game, they found that students generated significant learning in their evaluations, demonstrating that the use of these applications increases such learning in various subjects.

On the other hand, the comparison of results between girls and boys was carried out, first performing the Shapiro-Wilk normality test of the data with the Software R Version 2023.12.0, where a value of $p = 0.2534$ was obtained for the academic performance of the girls and $p = 0.6550$ for boys, indicating that in both cases the data behave normally, so Student's t-test for dependent samples was applied, obtaining a value of $p = 0.2182$, which is greater than the established significance value of $\alpha = 0.05$, therefore, there is no significant difference in academic performance between the two sexes.

Motivation

The results obtained from the study are addressed for each of the dimensions of the ARCS Model: Attention, Relevance, Confidence and Satisfaction based on the instrument applied, establishing the following rating scale (Table 3) on the perception of the students, in relation to the relative frequency obtained in the statements of each question.

Box 15

Table 3

Rating scale

Rating	Perception %
Very low	[0 , 20]
Low	(20 , 40]
Medium	(40 , 60]
High	(60 , 80]
Very high	(80 , 100]

Source: Own creation

Dimension Attention

Box 16

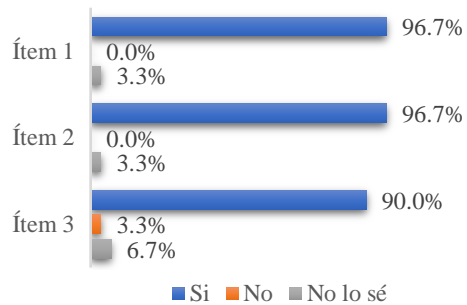


Figura 13

Results of the Attention dimension

Source: Research data

The perception obtained by the students presents a very high level in each item of the Attention dimension, since in Figure 13 it is observed that the vast majority of students said "Yes" in each item, managing to stimulate the curiosity and interests of students within the intrinsic motivation (Keller, 2010), due to the design of activities based on gamification through the use of these applications.

In Table 4, we observe the results segmented by gender, most of the girls and boys answered the option "Yes", presenting a very high level of perception in this dimension.

Box 17

Table 4

Gender perception in the Attention dimension

Ítem	Sí		No		No lo sé	
	F	M	F	M	F	M
1	16 100%	13 92.9%	0 0%	0 0%	0 0%	1 7.1%
2	15 93.8%	14 100%	0 0%	0 0%	1 6.3%	0 0%
3	15 93.8%	12 85.7%	0 0%	1 7.1%	1 6.3%	1 7.1%

Source: Own creation

Dimension Relevance

Box 18

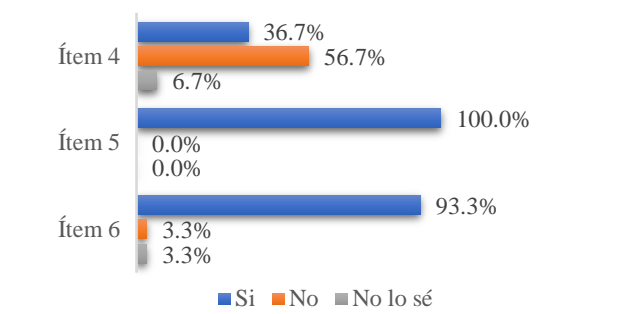


Figure 14

Results of the Relevance dimension

Source: Research data

In Figure 14, it can be seen that the perception obtained by the students in item 4 presents a Medium level, although it can be seen as a negative result for having answered "No", however, it means that most of the students had not used these applications to learn the subject, confirming the lack of technological infrastructure equipment, since they lack accessibility to these and especially internet service (INNE, 2019). In items 5 and 6, the students' perception has a Very high level, indicating that the designed activities are relevant, feeling motivated to learn the topic addressed during the intervention (Keller, 2010).

In Table 5, we observe the results segmented by gender; in item 4, most of the girls answered the option "No", while half of the boys answered that they had already used these applications; on the other hand, most of the girls and boys answered the option "Yes" in items 5 and 6, presenting a very high level of perception (Keller, 2010).

Box 19

Table 5

Perception by gender in the Relevance dimension

Ítem	Yes		No		I don't know	
	F	M	F	M	F	M
4	4 25%	7 50%	11 68.8%	6 42.9%	1 6.3%	1 7.1%
5	16 100%	14 100%	0 0%	0 0%	0 0%	0 0%
6	15 93.8%	13 92.9%	0 0%	1 7.1%	1 6.3%	0 0%

Source: Own creation

Confidence Dimension

Box 20

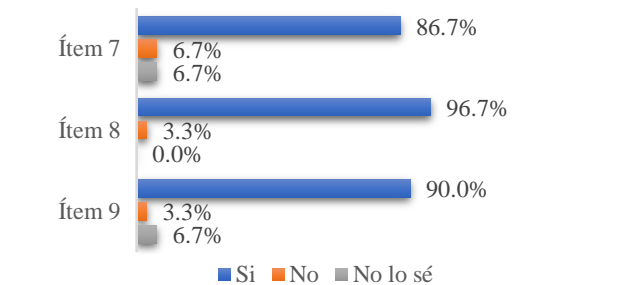


Figure 15

Results of the Confidence dimension

Source: Research data

Figure 15 shows that the perception obtained by students shows a very high level in each item of the Confidence dimension, since the vast majority of students said "Yes" in each item, indicating that they are motivated to learn the subject and are convinced that they will succeed in their learning. (Keller, 2010).

In Table 6, we observe the results segmented by sex, most of the girls and boys answered the option "Yes" in each item, presenting a very high level of perception in this dimension. It is noteworthy that in item 8 all the girls learned to use these applications during the development of the activities.

Box 21

Tabla 6

Perception by gender in the Trust dimension

Ítem	Yes		No		I don't know	
	F	M	F	M	F	M
7	13 81.3%	13 92.9%	1 6.3%	1 7.1%	2 12.5%	0 0%
8	16 100%	13 92.9%	0 0%	1 7.1%	0 0%	0 0%
9	14 87.5%	13 92.9%	0 0%	1 7.1%	2 12.5%	0 0%

Dimension: Satisfaction

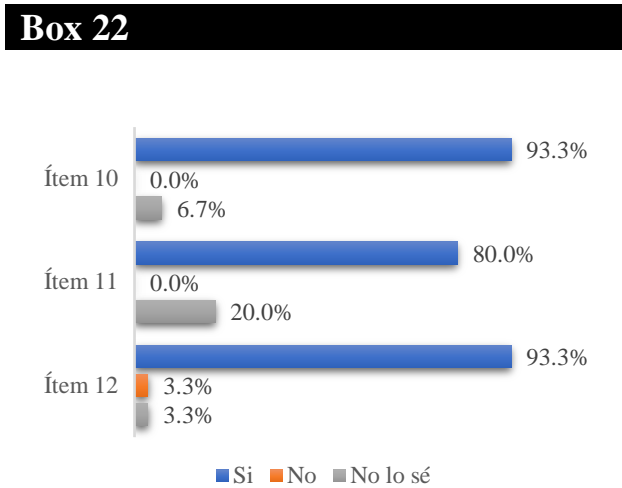


Figure 16

Results of the Satisfaction dimension

Source: Research data

The perception obtained by the students presents a very high level in each item of the Satisfaction dimension, since in figure 16 it can be seen that the vast majority of the students answered "Yes" in each item, showing that the students have managed to motivate themselves to learn the subject during the development of the activities, stimulating satisfaction by achieving better grades as part of extrinsic motivation (Keller, 2010).

In Table 7, we observe the results segmented by gender, most of the girls and boys answered the option "Yes" in each item, presenting a very high level of perception in this dimension. It is noteworthy that in item 10 all the girls maintained their attention during the development of the activities when using these applications.

Box 23

Table 7						
Gender perception in the Satisfaction dimension						
Ítem	Yes		No		I don't know	
	F	M	F	M	F	M
10	16 100%	12 85.7%	0 0%	0 0%	0 0%	2 14.3%
11	13 81.3%	11 78.6%	0 0%	0 0%	3 18.8%	3 21.4%
12	15 93.8%	13 92.9%	0 0%	1 7.1%	1 6.3%	0 0%

Source: Own creation

Based on the results obtained, it is shown that 92.4% of the students present a very high level of motivation in learning the subject, using Kahoot, Quizizz and Educaplay, therefore, the null hypothesis is accepted, because the expectations in relation to motivation were exceeded, and the established hypothesis (H2) ‘The perception of the students of the 4th. Grade of Cuauhtémoc Primary School is high in relation to the motivation for learning with the use of the applications Kahoot, Quizizz and Educaplay as formative assessment in the classroom’.

The results obtained are similar to the study conducted by Huaman (2021), where 91% of the opinions expressed by the students mentioned that they would always and almost always be motivated to learn with the use of Kahoot, due to the fact that it is a visually attractive and easy to use application (Firdiansyah & Pamungkas, 2021, cited in Ahzim et al. , 2023, p. 56).

On the other hand, the use of Quizizz also motivates students to learn, in the study conducted by Romadhon et al. (2023), the students surveyed mentioned that this application motivated them because while learning, they played and competed with their other classmates to achieve higher scores. Likewise, in the study conducted by Dias et al. (2022), they found that the Educaplay platform, in addition to motivating students, develops other skills such as the development of their critical and argumentative capacity, as well as the values of respect towards their classmates and collaborative work.

Conclusions

Creating a technology-mediated learning environment is not an easy task, even more so when teachers lack the digital competences to carry them out. The present study has shown that introducing technologies in the classroom increases student learning; applications such as Kahoot, Quizizz and Educaplay are ideal for eradicating the fear of traditional formative assessments that are still used, such as written exams.

The applications used awaken motivation in students to learn any subject that is addressed with them, because competition is generated between them, which makes them motivated to study, generating interest and enthusiasm to get better scores to excel in the final scores in each game, thus creating a fun learning environment for them, being a natural at that age; therefore, what better to use these applications from an early age, as it has been shown in other studies, the generation of other skills such as critical analysis, reflective and argumentative to avoid making mistakes in the answers.

Based on the favourable results achieved in this study, state and federal education authorities in Mexico, and why not in other countries, are urged to invest in technological infrastructure for classrooms in basic level schools, in order to generate digital competencies in students from the first grades of their educational training, As well as to implement a teacher training programme in which teachers acquire digital competences, allowing them to generate learning environments where technology is included, in order to improve and develop meaningful learning in students, as well as to acquire other skills and values that complement their academic training.

Some open lines for the future that this research leaves open are to study the critical and reflective analysis of students in the use of these applications, in a context where there is a lack of technological devices such as the internet and computers in the classroom, especially in rural schools in various states of the Mexican Republic; the perception generated in teachers by the introduction of these applications in their daily practice; and the generation of reading skills in students using these applications from an early age.

Declarations

Conflict of interest

The authors declare no conflict of interest. They have no known competing financial interests or personal relationships that could have appeared to influence the article reported in this article.

Authors' contributions

Domínguez-Gutú, Jesús: contributed with the idea of the project; the methodological approach, scope and design of the research; the design of the activities in the applications; adaptation of the instruments; systematisation and statistical analysis of the results; and writing of the article.

Trejo-Trejo, Gilberto Abelino: contributed to the adaptation of the instruments; application of the instruments; systematisation and statistical analysis of the data; and drafting of the article.

Gordillo-Espinoza, Emmanuel: contributed to the systematisation of the background for the state of the art; the design of the activities in the applications and revision of the article.

Constantino-González, Fernando Exiquio: contributed to the application of the instruments; systematisation of the data and revision of the article.

Availability of data and materials

The Cuauhtémoc Primary School provided the classroom, furniture and multimedia equipment for the development of the study intervention.

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Abbreviations

ARCS	Attention, Relevance, Trust and Satisfaction
INNE	National Institute for the Evaluation of Education
REDIM	Network for Children's Rights in Mexico
TIC	Information and Communication Technologies

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Background

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