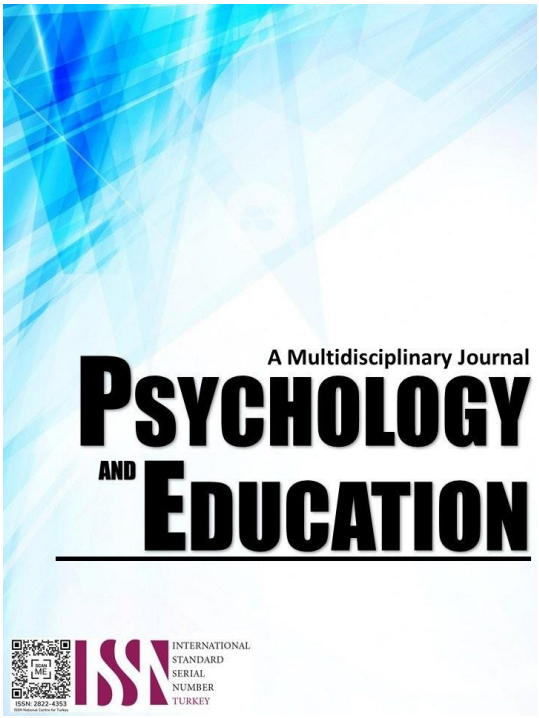
INTEGRATION OF SYNC BUZZER APPLICATION IN TEACHING MATHEMATICS I IN EUSTACIO BARCATAN ELEMENTARY SCHOOL



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Research Article

Integration of Sync Buzzer Application in Teaching Mathematics I in Eustacio Barcatan Elementary School

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Abstract

The integration of online applications in education has been widely recognized for its potential to enhance learning outcomes. This study assessed the effectiveness of the Sync Buzzer Application in improving the mathematics performance of Grade 1 learners at Eustacio Barcatan Elementary School in the Polomolok 1 District, South Cotabato Division. The research aimed to evaluate the learners' performance by comparing pretest and posttest results and identifying any significant differences in their mathematical abilities after the intervention. Additionally, the study explored the relevance of integrating the Sync Buzzer Application as an instructional tool in teaching mathematics. A pre-experimental research design with a quantitative approach was employed, utilizing a pretest-posttest framework and an adopted questionnaire to gather data. Results indicated that prior to the intervention, the learners' performance in mathematics was at the beginning level. Following the use of the Sync Buzzer Application, their performance improved to an "approaching proficiency" level. Statistical analysis revealed a significant difference between the pretest and posttest scores, highlighting the application's effectiveness in enhancing learners' mathematical skills. As a result of the findings, a program model titled SOLVE was developed to address and support the least learned competencies. The study recommends further exploration of the Sync Buzzer Application's integration across other grade levels and subject areas to validate its broader applicability and impact.

Keywords: *sync buzzer, performance, pre-experimental design, explanatory sequential, intervention*

Introduction

The advancement of technology has brought about innovative solutions to enhance teaching and learning processes. Among these, the integration of digital tools in the classroom has proven to foster engagement and improve understanding, particularly in challenging subjects such as mathematics. Understanding technology helps people recognize the difference between natural events and human-made creations. Technology is not random; it is carefully designed by individuals. As computer technology continues to advance, it influences education, homes, and workplaces in significant ways.

Despite the strong evidence supporting the effectiveness of digital teaching strategies in boosting student learning, the problem of low exam scores among struggling learners remains a significant challenge for both teachers and students. The issue also persists at Eustacio Barcatan Elementary School. Out of 205 students who took the early grades numeracy assessment, 200 Grade 1 learners scored below 75% for non-numeracy skills, while only 5 Grade 1 learners scored above 75% for numeracy skills during the 2023-2024 school year. This challenge creates an environment that inhibits learners from fully participating in the learning process.

The integration of the Sync Buzzer app is anticipated to address the identified challenges by promoting active participation, immediate feedback, and collaborative learning. This study aims to contribute to the growing body of research on technology-enhanced learning, particularly in improving learners' mathematical performance. It also seeks to provide educators with practical insights on utilizing digital tools to engage students effectively.

Consequently, studies have shown that interactive digital tools significantly improve learner engagement and performance in mathematics. According to Smith and Jones (2021), gamified learning environments using apps increase motivation and reduce math anxiety. However, Purmayanti (2022) highlights three main obstacles students face when incorporating digital literacy into education: These include limited access to necessary digital resources, a deficiency in digital literacy skills among educators and learners. The widespread utilization of digital tools has become increasingly prevalent in daily life, serving various functions from information retrieval to communication.

Furthermore, the gap in access to digital technologies among individuals from diverse cultural, demographic, and socio-economic backgrounds continues to widen and become more evident. Although young individuals are commonly branded as 'digital natives,' implying they are adept and at ease with digital tools, the reality is more intricate than this portrayal suggests (Janschitz et al., 2022). Numerous governments prioritize digital literacy in education, aiming to enhance students' digital skills through policies and curricula. However, this effort faces challenges like insufficient teacher training, unequal digital infrastructure across school districts, and uneven access to digital media among students. While the integration of digital literacy in the classroom is crucial, it is evident that learners encounter challenges in its implementation (Weninger, 2022).

This research aims to examine the Sync Buzzer application used by teachers and assess the performance of mathematics among learners, which serves as the primary motivation in pursuing this study.

Research Questions

This study determined the effect of sync buzzer application in teaching mathematics 1 in Eustacio Barcatan Elementary School. Specifically, the study sought answers to the following questions:

1. What is the performance of the grade 1 learners in mathematics before the utilization sync buzzer application?
2. What is the performance of the grade 1 learners in mathematics after the utilization of sync buzzer application?
3. Is there a significant difference between the performance of Grade 1 learners in mathematics before and after the utilization of sync buzzer application?
4. What program model in mathematics 1can be developed to improve the performance of the learners?

Methodology

Research Design

The research design in this study employed a pre-experimental design with a quantitative approach. Creswell (2008), expressed that quantitative research in educational research involves the researcher selecting the topic, posing specific, focused questions, gathering quantifiable data from participants, analyzing these data using statistical methods, and conducting the inquiry impartially and objectively.

Quantitative research utilizes statistical techniques to comprehend and elucidate phenomena. Experimental research investigates the impact of systematically manipulating one variable on another. The manipulated variable, known as the experimental treatment or independent variable, aims to establish cause-and-effect relationships. The primary objective of experimental research is to examine whether a particular approach or method is superior to a traditional one (Ary et al., 2010).

In this study, a single pre-experimental design was employed, which offers limited control over extraneous variables, utilizing a one-group pretest-posttest design. This approach involves administering a pretest to measure the dependent variable, implementing the experimental treatment, and then administering a posttest to evaluate the impact of the treatment. The differences observed between pretest and posttest scores are attributed to the application of the experimental treatment.

Respondents

The research participants of this study were the sixty-five (65) Grade 1 learners who are chosen purposively regardless of their age and gender as long as their final rating in the previous school year in Mathematics was 80%. This technique is appropriate for this study as Cresswell, and Plano Clark (2011) suggested that purposive sampling involves the identification and selection of individuals or groups with significant knowledge or experience in a specific area of interest.

Instrument

The needed data for this study was gathered using a test questionnaire pretest and posttest adapted from the self-learning modules of the Department of Education (see appendix C) were used to assess the mastery level of the learners in mathematics 1 about time and nonstandard units of length, mass and capacity. Solves problems involving time (days in a week, months in a year, hour, half-hour, and quarter-hour). Compares objects using comparative words: short, shorter, shortest; long, longer, longest; heavy, heavier, heaviest; light, lighter, lightest. The questionnaire consisted of thirty (30) items and had different levels of difficulty based on the designed Table of Specifications (see appendix D) considering the cognitive levels of Revised Bloom's Taxonomy (Anderson & Krathwohl, 2001). The reliability of the questionnaire was assessed by using the split-half method. Right answers were given 1 point, and wrong answers were given 0 points following the descriptive rating of learner's mastery level score by Tan and Andamon (2018).

Procedure

The data collection process commenced with the preparation of request letters seeking authorization for the study. Initially, these letters were sent to the School's Division Superintendent of South Cotabato (see appendix A), the District Head of Polomolok 1, the School Principal (see appendix B) and the selected school, requesting permission to conduct the study. Upon obtaining permission, the school head of the selected institution will be notified, and a convenient schedule were arranged for test questionnaire administration.

On the designated date and time, the researcher distributed the test questionnaires to the participants. Prior to this, the researcher clarified any unclear aspects in the test questionnaire and provides an explanation for the purpose of the study. The researcher emphasized the importance of honest responses and assures the confidentiality of their identities. After the participants had completed all questionnaire items, the researcher collected and organized the data, which would then be submitted to a statistician for thorough analysis.

Data Analysis

To determine the pretest and posttest performance of the Grade 1 learners in Mathematics 1 mean was used.

A paired T-Test was employed to analyze the significant difference between the pretest and posttest scores of Grade 1 learners in

Mathematics 1. This statistical method was chosen because it is specifically designed to compare two related groups — in this case, the same group of learners' performance before and after an intervention.

Ethical Considerations

The Mindanao State University- General Santos Institutional Ethics Review Committee (MSU-General Santos IERC) has recently reviewed the responses to the conditions placed upon the ethical approval for the research/project. The research paper was deemed to meet the requirements of the PHREB (2017) and full ethical approval has been granted with the approval number 270-2024-MSUGSC-IERC (see appendix F).

Likewise, the researcher ensured that all participants, including parents and school administrators, are fully informed about the study's purpose, procedures, potential risks, and benefits before agreeing to participate. Participants should have the right to withdraw from the study at any time without facing consequences. The researcher is responsible for safeguarding the confidentiality and anonymity of participants' information. Sensitive data should not be disclosed in any publications or presentations resulting from the study. Measures should be taken to protect participants' identities, and data should be stored securely. The researcher guarantees that participation in the study is entirely voluntary and free from coercion or undue pressure. Parents should feel empowered to decline participation without facing reprisals or negative consequences for themselves or their children. The researcher also respects the autonomy and decision-making capacity of parents, allowing them to make informed choices about their involvement in the study and their children's education. Additionally, researchers should engage parents in the research process in a collaborative and respectful manner, acknowledging their expertise and perspectives.

All research processes complied with the Data Privacy Act (Republic Act No. 10173). Information collected will remain confidential, respecting participants' privacy and anonymity. Utmost care, objectivity, and accuracy will be ensured during data handling, analysis, and interpretation.

Results and Discussion

This section presents the results, analyses, and interpretations of the data gathered to answer the study's problems. Tables, figures, and texts are used to present, interpret, and analyze the data gathered for the study.

Performance of the Grade 1 Learners in Mathematics before the Integration of Sync Buzzer Application.

Table 1 presents the performance in mathematics before the utilization of sync buzzer application. Results reveal that the learners have beginning level of performance in mathematics before the utilization of sync buzzer application with 67.7% and have developing performance with 32.3%. None of the learners have approaching proficiency, proficient, and advanced level of performance in mathematics before the utilization of sync buzzer application.

The mean of 4.51 is described as beginning implies that the learners have very low level of performance in mathematics before the utilization of sync buzzer application. Very low performance in mathematics is attributed to many factors. Accordingly, routine drills and rote memorization are major components of many traditional arithmetic teaching methods. These approaches might not adequately engage young students or meet their developmental needs, which could lead to a poor comprehension and memory of mathematical ideas.

In addition, interactive or visually exciting components that hold young learners' attention are frequently absent from traditional teaching approaches. Without stimulating resources, first-graders may find it difficult to maintain motivation and concentrate due to their innate curiosity and propensity for distraction. Moreover, the abstract nature of mathematics needs to be taught with much considerations of the manipulatives. Mathematics at this level often introduces abstract concepts like numbers, shapes, and basic arithmetic operations. Without hands-on, practical tools or visual aids, young learners may find it challenging to grasp these concepts.

A study conducted by Ludwig (2021) highlights that low performance in mathematics is influenced by various factors, including student attitudes, teaching methods, language proficiency, and socio-economic status. Negative perceptions and anxiety about math hinder engagement, while strict or ineffective teaching methods and a lack of engaging strategies exacerbate challenges. Language barriers impact understanding, with non-native speakers often struggling more. Socio-economic disparities limit access to quality resources, affecting learning outcomes. Early intervention, such as numeracy screening and targeted support, is crucial for improving performance. Addressing these issues through supportive teaching, equitable resources, and early action can enhance students' mathematical achievement.

Acar-Güvendir (2016) conducted a study examining the relationship between intrinsic and extrinsic motivation levels and mathematical achievement of eighth-grade students and used Trends in International Mathematics and Science Study data in 2011 in this context. The results of the research showed that students' interests in mathematics, self-efficacy, mathematics perceptions, frequency of mathematics exams, and teachers' interest in students were related to mathematics achievement.

The findings showed that intrinsic motivation is associated with mathematics achievement more than extrinsic motivation. A general analysis of the study also showed that mathematics achievement is related to both intrinsic and extrinsic motivation sources that need

to be addressed by mathematics experts and teachers (Becker, McElvany, & Kortenbruck, 2010; Vansteenkiste, Timmermans, Lens, Soenens, & Van den Broeck, 2008)

Table 1. *Performance of the Grade 1 Learners in Mathematics Before the Integration of Sync Buzzer Application.*

No. of Items	*Percentile*	*f*	*%*	*Description*	*Verbal Interpretation*
30					
25-30	81-100	0	0.00	Advanced	Very High
19-24	61-80	0	0.00	Proficient	High
13-18	41-60	0	0.00	Approaching Proficiency	Moderate
7-12	21-40	21	32.3	Developing	Low
0-6	0-20	44	67.7	Beginning	Very Low
Mean		4.51		Beginning	Very Low

Performance of the Grade 1 Learners in Mathematics After the Integration of Sync Buzzer Application.

Table 2 presents the performance in mathematics after the integration of sync buzzer application. Results reveal that the learners have approaching proficiency and developing level of performance in mathematics with both 49.2% after the integration of sync buzzer application. There is 1.5% who is at the proficient level and none of the learners have advanced and beginning level of performance in mathematics after the integration of sync buzzer application. The mean of 12.83 is described as approaching proficiency. This means that the learners have moderate level of performance in mathematics after the integration of sync buzzer application.

The term “moderate” Students demonstrate a fundamental understanding of mathematical principles, but they may find it difficult to understand more abstract or sophisticated ideas. While pupils may not have continuously displayed greatness or mastery, a middling performance result in mathematics usually means that they have exhibited a satisfactory or adequate comprehension of mathematical ideas. Learners may need assistance or direction when faced with difficult or unusual tasks. In adequate review or practice of mathematical ideas or enthusiasm for mathematics.

Accordingly, the result implies that the very low mean score of 12.83 indicates that learners have not successfully mastered mathematical concepts and skills after the integration of sync buzzer application in mathematics in some reasons: first differentiated instruction to meet the diverse needs of learners, second parent-teacher collaboration to foster partnership between parent and teachers to support math learning and lastly, lack of interest in learning mathematics. Moreover, technology can be utilized to provide more customized education, such as by presenting many approaches to a task's solution. For instance, the instructor might support. Students should use technology to solve problems on their own, self-check their solutions, and compare and assess different ways to solving problems.

A study conducted by Hillmayr et al., (2020) highlights that Low performance in mathematics arises from factors such as negative attitudes, ineffective teaching methods, language barriers, and socio-economic challenges. Many students harbor anxiety and dislike for math, which hinders engagement. Strict or unengaging teaching further exacerbates difficulties, while language proficiency significantly impacts understanding. Socio-economic disparities limit access to quality resources, affecting learning outcomes. Early interventions, including numeracy screening and targeted support, are crucial for improving performance. Addressing these issues through supportive teaching, equitable resources, and timely interventions can enhance mathematical achievement.

In addition to being useful for learning new mathematical concepts, digital technology can also be helpful for refining and honing previously learned skills, which is crucial for example to promote mathematical concepts at a lower level (Hillmayer et al., 2020). Teachers can connect mathematical ideas to real-world situations by using technology, issues enabling pupils to investigate mathematical ideas. On the other hand, the use of technology in math classes boosts students' engagement in the the process of studying mathematics. The quantity of technological resources accessible to educators and learners is growing. Consequently, educators must create creative programs to help their pupils get more out of learning situations that use technology (Getenet, 2020).

Table 2. *Performance of the Grade 1 Learners in Mathematics After the Integration of Sync Buzzer Application.*

No. of Items	*Percentile*	*f*	*%*	*Description*	*Verbal Interpretation*
30					
25-30	81-100	0	0.00	Advanced	Very High
19-24	61-80	1	1.5	Proficient	High
13-18	41-60	32	49.2	Approaching Proficiency	Moderate
7-12	21-40	32	49.2	Developing	Low
0-6	0-20	0	0.00	Beginning	Very Low
Mean		12.83		Approaching Proficiency	Very Low

Significant Difference Before and After the Integration of Sync Buzzer Application.

Table 3 presents the paired t-test on the performance of grade 1 learners in mathematics before and after the integration of sync buzzer application. Results show that there is a significant difference between the means of the pretest scores and posttest scores in the performance of grade 1 learners in mathematics before and after the integration of sync buzzer application. This is supported by a t-computed value of 26.125 and a p-value of .000. A p value of less than .05 (p=.000 < .05) indicates that there is a significant difference in the performance level of the learners using their pretest and posttest scores in mathematics.

Results also reveal that the utilization of sync buzzer application has improved the performance level of learners in mathematics. This further means that the technological learning approaches are effective in increasing the performance level of learners in mathematics.

This finding is supported by Noreen and Rana (2019) that learners taught through activity-based teaching performed better in post-test. It is recommended that in future Mathematics may be taught with activities at elementary level. Mathematics kit containing material for activities may be provided to Mathematics teachers.

In addition, Akcay et al (2021) expressed that the technologies used in primary school mathematics teaching have positive effect on students' mathematics achievement. On the contrary, it was discovered that traditional-based learning is more effective than technology-based learning (Ganitano, et al., 2019). Tahiroğlu and Çakır (2014) assert that motivation is a necessary condition for learning. In a brief period of time, pupils learn the subjects that pique their interest and curiosity.Those who are sufficiently motivated will succeed to the extent that they are more inclined to study for their assignments and tests. However, those who lack motivation are also not prepared to learn. Stated differently, motivation and achievement are positively correlated (Akbaba, 2006).

In the study conducted by Ministry of National Education (MoNE, 2016a), the effect of Turkish students' emotional characteristics on the mathematics achievement in PISA 2012 was examined based on the results. The study was a literature review, and the results obtained from other researches in this field and the mathematics education programs prepared by the MoNE were used. The results of the study indicated that self-efficacy and self-confidence, which is one of the emotional characteristics of the students, had an effect on learning in mathematics. It was seen that while the students who had high mathematics self-efficacy had higher academic achievement because they made more effort towards mathematics; in general, although the students had a positive attitude towards mathematics, it was found that students' mathematics achievement remained low.

Table 3. *Paired t-test on the Performance of Grade 1 Learners in Mathematics Before and After the Integration of Sync Buzzer Application*

Experimental Group	*Mean*	*SD*	*t computed*	*p- value*	*Remark*
Posttest	12.83	2.73	26.125	.000	Significant

Integration of Solve Model Program Using Sync Buzzer Application

A. Introduction

Eustacio Barcatan Elementary School, with the school ID 208509, was established in honor of the late Eustacio Barcatan, a teacher, and the donor of the land on which the school is built. Located in the eastern part of Barangay Poblacion, Polomolok, South Cotabato, the school occupies a 5,530-square-meter property. It is currently the second-largest school in the Polomolok Central 1 District based on student enrollment, with a consistent annual growth rate of 10% in its student population. The school also demonstrates academic progress, highlighted by its recent participation in the Research Congress.

In today's highly connected and technology-focused world, university students need to cultivate advanced skills, adaptability, and flexibility to thrive in a workplace shaped by rapid digital transformations across industries. In education, disruption refers to abrupt shifts that lead to substantial changes, redefining learning quality. To keep pace with the growing demand for varied skills from employers, students must embrace lifelong learning, continuously acquiring, discarding, and refining their skills.

In this study, the mathematics performance of Grade 1 learners prior to the use of the Sync Buzzer Application is presented in Table 2, highlighting their abilities before incorporating sync buzzer. The results show that 67.7% of the learners were at the beginning level, while 32.3% demonstrated developing performance. Notably, none of the learners achieved levels of approaching proficiency, proficient, or advanced in mathematics prior to the integration of sync buzzer application. The mathematics performance of learners after implementing sync buzzer shows significant improvement. The results indicate that 49.2% of the learners reached the approaching proficiency level, while another 49.2% remained at the developing level. Additionally, 1.5% achieved the proficient level, with no learners falling into the advanced or beginning performance categories following the use of sync buzzer application.

The term "moderate" refers to students who display a basic understanding of mathematical concepts but may struggle with more abstract or complex ideas. While they might not consistently show excellence or mastery, a moderate performance in mathematics generally indicates a satisfactory or adequate grasp of mathematical principles. These learners may require support or guidance when tackling challenging or unfamiliar tasks, which could stem from insufficient review, practice, or a lack of enthusiasm for mathematics.

Furthermore, digital technology is not only valuable for introducing new mathematical concepts but also for enhancing and reinforcing

previously acquired skills, which is essential for building foundational mathematical understanding. By incorporating technology and well-structured contingency plans, teachers can relate mathematical concepts to real-world scenarios, allowing students to explore and deepen their understanding of these ideas.

B. Objectives

The objectives of the integration of Sync Buzzer Application are as follows:

1. To utilize the Sync Buzzer application to create an interactive learning environment that actively engages learners and encourages their participation in mathematics lessons.
2. To promote critical thinking and problem-solving by integrating competitive and collaborative digital activities that challenge learners to apply mathematical concepts in real-time scenarios.
3. To utilize digital platforms to offer regular practice and instant feedback, supporting learners in reinforcing and mastering essential mathematical concepts.
4. To use the Sync Buzzer to cater to diverse learning needs by customizing activities that address varying skill levels, allowing students to progress at their own pace.
5. To employ digital tools to track learner progress through instant results and analytics, enabling teachers to identify strengths and areas for improvement effectively.

C. Utilization of Sync Buzzer as Learning Approach in Mathematics 1

First, the preparation stage involves defining learning objectives by identifying specific mathematical concepts or skills to be taught, such as basic addition, subtraction, patterns, or shapes. Develop a set of questions aligned with these objectives, ensuring they are suitable for the learners' grade level. Set up and test the sync buzzer system or app, ensuring all devices are properly connected. Finally, organize supplementary materials like visual aids, manipulatives, or worksheets to support the activity.

Second, begin the activity by explaining the rules of the sync buzzer system, including how to buzz in and answer questions. Establish behavior guidelines, such as waiting for the question to be fully read, answering respectfully, and fostering teamwork. Organize students into balanced teams or pairs to promote collaboration and equitable participation.

Third, conduct the activity by presenting questions using the sync buzzer system, either visually or verbally, one at a time. Facilitate interaction by allowing students to buzz in when ready, giving the first responder the chance to answer. Provide immediate feedback, confirming correct answers or offering explanations and opportunities for others to respond if the answer is incorrect.

Fourth, encourage engagement by setting time limits for buzzing in to maintain the activity's pace. Introduce bonus questions or varying difficulty levels to keep it stimulating. Use positive reinforcement, such as points or rewards, to motivate and recognize correct answers.

Lastly, after the activity, review key concepts, address challenges, and encourage students to reflect on their learning experience. Assign follow-up practice, such as worksheets or games, to reinforce understanding. Evaluate students' performance to assess learning outcomes, and gather feedback from students and co-teachers to improve future activities. Conclude by celebrating achievements, encouraging further practice, and thanking participants for their enthusiasm. This approach makes the sync buzzer a dynamic and effective tool for engaging students and enhancing their grasp of foundational mathematical concepts.

Matrix of Integration of Solve Model Program Using Sync Buzzer Application

Area of Focus	*Objective*	*Activity*	*Expected Outcome*	*DepEd Goal Alignment*
Engagement & Participation	To create an interactive learning environment that actively engages learners and encourages participation.	- Implement the Sync Buzzer for interactive group sessions. - Organize competitive activities that require participation.	- Increased student participation in lessons. - More active engagement in mathematical discussions.	K to 12 Curriculum: Promote active learning and student-centered pedagogy. Active Learning Standards.
Critical Thinking & Problem-Solving	To promote critical thinking and problem-solving through competitive and collaborative digital activities.	- Develop and integrate real-time competitive questions that challenge students' ability to think critically. - Implement problem-solving tasks with varied difficulty levels.	- Enhanced problem-solving skills in mathematics. - Students will develop the ability to think critically during math challenges.	DepEd Vision: Encourage learners to apply problem-solving skills in real-life scenarios.
Skill Reinforcement & Mastery	To offer regular practice and instant feedback for reinforcing and mastering essential mathematical concepts.	- Use the Sync Buzzer's real-time feedback system to review answers. - Regularly assign tasks that require mastering specific math concepts.	- Improved mastery of foundational math concepts through continuous practice and immediate feedback.	K to 12 Standards: Ensure continuous practice and mastery of mathematical principles. Assessment and Evaluation Framework.

Area of Focus	*Objective*	*Activity*	*Expected Outcome*	*DepEd Goal Alignment*
Customization for Diverse Needs	To cater to diverse learning needs and allow students to progress at their own pace.	- Customize the difficulty of questions based on the learners' abilities. - Provide different sets of tasks for different learner levels.	- Tailored learning experiences that meet the needs of all learners. - Students can progress at their own pace.	Inclusive Education: Address diverse learning needs and create equitable learning opportunities.
Data-Driven Learning	To track learner progress through instant results and analytics.	- Utilize the Sync Buzzer's analytics feature to collect data on student responses and performance. - Use the data for individualized learning support.	- Data-driven insights into each student's performance. - Teachers will be able to identify strengths and areas for improvement.	DepEd Action Plan: Use technology for effective monitoring and assessment.
Teamwork & Collaboration	To encourage teamwork, collaboration, and social skills among learners.	- Organize students into teams to answer questions. - Foster group discussions after the activity to reflect on solutions.	- Increased collaboration and teamwork skills among students. - Stronger peer-to-peer learning experiences.	Curriculum Framework: Build social and emotional skills for effective communication and collaboration.
Area of Focus	Objective	Activity	Expected Outcome	DepEd Goal Alignment
Classroom Management	To maintain a structured and focused learning environment during activities.	- Establish clear guidelines for buzzing in and answering questions. - Use positive reinforcement techniques (points, rewards) to maintain engagement.	- Smooth classroom management and a positive, well-structured learning environment.	Classroom Management Standards: Foster a safe, respectful, and supportive learning environment.

SOLVE Model

The study findings led to the development of the SOLVE Model, "S" means Solve refers to the process of identifying and choosing the most relevant data. "O" represents to Operate refers to the step where you implement the chosen solution or strategy. "L" stands for Learn it determine if the solution achieved the desired results. "V" denotes Verify means checking and confirming whether the solution solve the problems, lastly "E" represents Evaluate means assessing the quality, effectiveness, and efficiency of the proposed solutions.

This model emphasizes that numerical quantification is accomplished through mathematics and both man-made and spatially natural circumstances. It's employed to address issues and has aided in creating social, economic significant developments in technology. When teaching mathematical problem-solving, the primary objective is for the development of general problem-solving skills and the application of mathematics in practical contexts (Dendane, 2009).

On the other hand, several studies were conducted to improve students' skills in solving mathematics problems. Hoon, Kee, Singh (2013) investigated students' response in applying heuristics approach in solving mathematical tasks, and their abilities in applying the heuristics approach. Moreover, Reiss and Renkl (2002) proposed the use of heuristic worked-out examples in proving. They suggested that this should be integrated into mathematics classroom frequently so that students will learn to extract needed information in the problems.

A low level of digital literacy among math teachers may prevent the adoption of contemporary pedagogical and technological approaches in math learning and teaching. In mathematics education, education and technology have become interdependent concepts. As a result, many math teachers are starting to embrace the idea that learning can only be successful if students build their knowledge rather than merely expand it through memorization. Therefore, teachers should assist students in creating new knowledge as well as applying and reinforcing what they already know. As a result, the teaching methodology changes from being teacher-centered to being more student-centered (Kafyulilo, Fisser,Pieters, Voogt, 2015).

According to studies, incorporating technology into the classroom has the potential to shift instruction toward a more student-centered approach. Constructivist theory is frequently the basis for calls to reform mathematics education by taking into account more creative teaching strategies. Student-centered teaching strategies are crucial to this process. In mathematics education, a number of these teaching strategies (such as problem-based learning) have been created and are beginning to acquire traction (Yigit, 2014).

Kirikçilar, Yıldız (2018) argues that educators should be aware of the potential of educational technologies. There are two ways that technology is used in mathematics education: using domain-specific software (like GeoGebra, https://www.geogebra.org/) and using learning technologies generally (like Moodle, https://moodle.org/). Mathematical-specific software applications are tools that can improve students' conceptual understanding of mathematical modeling, visualization, and simulation.

Essentially, this model emphasizes the importance of technological learning approaches learners can gain new skills and information

by using technological learning approaches, which give them access to a variety of learning resources. Teachers may establish productive, interesting, and welcoming learning environments that equip learners for success in the digital age by incorporating technological learning methodologies. Technology makes it possible to create learning experiences that are specific to each learner's requirements and skills. Technology-based learning methods are accessible from any location and help close geographic divides. Immediate evaluation and feedback promote better comprehension and retention.

The researcher initiated a program at Eustacio Barcatan Elementary School for Grade 1 learners. This program involved the implementing the SOLVE model four times per quarter, specifically during their Mathematics class every two weeks before the summative test. This program supports continuous learning in the performance of grade 1 learners in mathematics in preparing learners for quarterly exam. Implementing a solve model in the classroom can significantly enhance learner's engagement, motivation and overall learning outcomes. Here is a general process to follow: 1.) It is important to Select the problem for the data accuracy and consistency and also it is crucial to be able to face issues head-on, and employing tried-and-true methods will help you identify the finest answers.2.) Operate knowledge aids in understanding the issue and determining the kind of operation needed. By being proficient in operations, the learners may deconstruct difficult issues into smaller, more manageable components. Finding patterns, connections, and dependencies is made easier with an understanding of operations. 3.) Learn Problem-solving skills help develop critical thinking, which enables the learners to make informed decisions and navigate complex situations. Learning problem-solving skills fosters creativity, allowing learners to think outside the box and come up with innovative solutions. And also promote a growth mindset, encouraging learners to continue learning and developing new skills throughout their life. 4.) Verify it helps deepen the understanding of the problem and solution. It gives confidence in the solution's effectiveness and its reliability. 5) Evaluate determines how effectively the solution achieves the intended learning objectives as the learners received clear instruction from the teachers in using technological learning approaches.

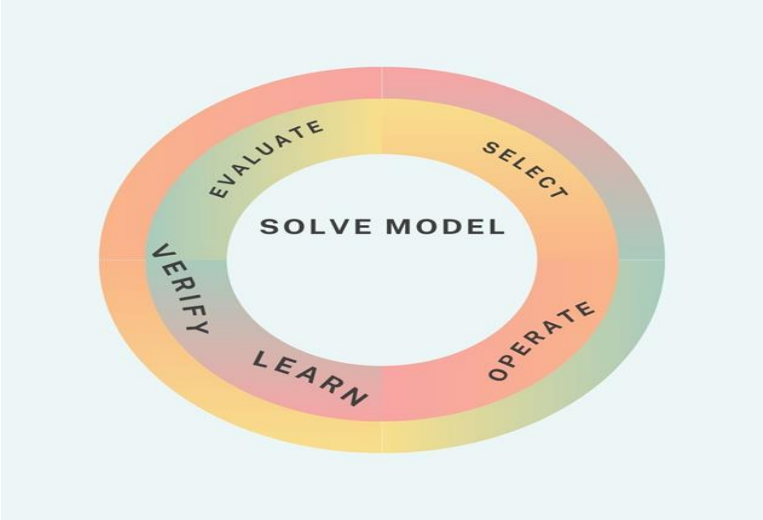

Figure 1. SOLVE Model

Conclusions

Based on the findings, the following conclusions were drawn: The learners have very low level of performance in mathematics before the integration of Sync Buzzer Application. Very low performance in mathematics is attributed to many factors. Accordingly, routine drills and rote memorization are major components of many traditional arithmetic teaching methods. The learners have moderate level of performance in mathematics after the integration of Sync Buzzer Application. The term "moderate" refers to students who demonstrate a fundamental understanding of mathematical principles, but they may find it difficult to understand more abstract or sophisticated ideas. The integration of Sync Buzzer Application has improved the performance level of learners in mathematics. In the form of Sync Buzzer Application, it is effective in increasing the performance level of learners in mathematics. Results also reveal that the utilization of Sync Buzzer Application has improved the performance of learners in mathematics. This further means that the Sync Buzzer Application is effective in increasing the performance level of learners in mathematics.

In the light of the findings from the data, the following are the recommendations: There is a need to integrate Sync Buzzer Application in the performance of Grade 1 learners in teaching Mathematics. There is a need to intensify the utilization of Sync Buzzer Application in teaching mathematics, particularly in Problem Solving. It is recommended to use Sync Buzzer Application in teaching mathematics and other subjects. Replication of the study is highly recommended by conducting the application of technological approaches by increasing the number of sessions or number of engagements of the learners.

References

Admiraal, W., Abuhassna, H., Al-Rahmi, W. M., Yahya, N., Zakaria, M. A. Z. M., Kosnin, A. B. M., & Darwish, M. (2020). Development of a new model on utilizing online learning platforms to improve students' academic achievements and satisfaction. International Journal of Educational Technology in Higher Education, 17, 1-23.

Akhmedova, I. (2024, December). Reimagining pedagogy for the digital age: bridging historical theories and contemporary challenges. In Next Scientists Conferences (pp. 36-48).

Alfia, N., Sumardi, S., & Kristina, D. (2020). Survival skills in digital era: an integration of digital literacy into EFL classroom. Indonesian Journal of EFL and Linguistics, 5(2), 435.

Anthonysamy, L., Koo, A. C., & Hew, S. H. (2020). Self-regulated learning strategies in higher education: Fostering digital literacy for sustainable lifelong learning. Education and Information Technologies, 25(4), 2393-2414.

Ary, D., Jacobs, L. C., & Sorensen, C. (2010). Introduction to research in education. 8th edition. Wadsworth: Cengage Learning

Aslan, A., Silvia, S., Nugroho, B. S., Ramli, M., & Rusiadi, R. (2020). Teacher's leadership teaching strategy supporting student learning during the covid-19 disruption. Nidhomul Haq: Jurnal Manajemen Pendidikan Islam, 5(3), 321-333.

Bacakoğlu, T. Y., & Tertemiz, N. I. (2022). Students' mental addition strategies and the effects of strategy training: A longitudinal study. International Electronic Journal of Elementary Education, 14(4), 557-572.

Basilotta-Gómez-Pablos, V., Matarranz, M., Casado-Aranda, L. A., & Otto, A. (2022). Teachers' digital competencies in higher education: a systematic literature review. International journal of educational technology in higher education, 19(1), 8.

Cardino Jr, J. M., & Cruz, R. A. O. D. (2020). Understanding of learning styles and teaching strategies towards improving the teaching and learning of mathematics. LUMAT: International Journal on Math, Science and Technology Education, 8(1), 19-43.

Creswell, J. W., & Garrett, A. L. (2008). The "movement" of mixed methods research and the role of educators. South African journal of education, 28(3), 321-333.

Csíkos, C. (2016). Strategies and performance in elementary students' three-digit mental addition. Educational Studies in Mathematics, 91, 123-139.

Detrich, R., Keyworth, R., and States, J. (2021). Mastery Learning (Wing Institute Original Paper) DOI: 10.6084/m9.figshare.14270840

Dhlamini, J. (2022). Strategy: An understanding of strategy for business and public policy settings. Journal of Contemporary Management, 19(2), 108-134.

Diano Jr, F., Kilag, O. K., Malbas, M., Catacutan, A., Tiongzon, B., & Abendan, C. F. (2023). Towards Global Competence: Innovations in the Philippine Curriculum for Addressing International Challenges. Excellencia: International Multi-disciplinary Journal of Education (2994-9521), 1(4), 295-307.

Education and Training Monitor. 2019. https://ec.europa.eu/education/sites/default/files/document-library-docs/et-monitorreport-2019-finland_en.pdf (Retrieved 1 June 2021)

Falloon, G. (2020). From digital literacy to digital competence: the teacher digital competency (TDC) framework. Educational technology research and development, 68(5), 2449-2472.

Gabriel, F., Marrone, R., Van Sebille, Y., Kovanovic, V., & de Laat, M. (2022). Digital education strategies around the world: practices and policies. Irish Educational Studies, 41(1), 85-106.

Gadanidis, G., Hughes, J. M., Minniti, L., & White, B. J. (2017). Computational thinking, grade 1 students and the binomial theorem. Digital Experiences in Mathematics Education, 3, 77-96.

Galimullina, E., Ljubimova, E., & Ibatullin, R. (2020). SMART education technologies in mathematics teacher education-ways to integrate and progress that follows integration. Open Learning: The Journal of Open, Distance and e-Learning, 35(1), 4-23.

Genc, M., & Erbas, A. K. (2019). Secondary Mathematics Teachers' Conceptions of Mathematical Literacy. International Journal of Education in Mathematics, Science and Technology, 7(3), 222-237

George, M. J., Jensen, M. R., Russell, M. A., Gassman-Pines, A., Copeland, W. E., Hoyle, R. H., & Odgers, C. L. (2020). Young adolescents' digital technology use, perceived impairments, and well-being in a representative sample. The Journal of pediatrics, 219, 180-187.

Giblin, F., Butler, D., & Kingston, M. (2022). Numeracy and digital learning: use of digital technologies as tools for numeracy development. A review of the literature. Department of Education (Ireland).

Gómez-García, M., Hossein-Mohand, H., Trujillo-Torres, J. M., & Hossein-Mohand, H. (2020). The training and use of ICT in teaching perceptions of Melilla's (Spain) mathematics teachers. Mathematics, 8(10), 1641.

González-Pérez, L. I., & Ramírez-Montoya, M. S. (2022). Components of Education 4.0 in 21st century skills frameworks: systematic review. Sustainability, 14(3), 1493.

Gracia, E. P., Rodríguez, R. S., & Pedrajas, A. P. (2019). Analysis of Science and Technology pre-service teachers' beliefs on the construction of the Teachers' Professional Identity during the initial training process. EURASIA Journal of Mathematics, Science and Technology Education, 15(10), em1756.

Guhl, P. (2019). The impact of early math and numeracy skills on academic achievement in elementary school.

Health and Safety Executive (2023). Competence Definition.

Hillmayr, D., Ziernwald, L., Reinhold, F., Hofer, S. I., & Reiss, K. M. (2020). The potential of digital tools to enhance mathematics and science learning in secondary schools: A context-specific meta-analysis. Computers & Education, 153, 103897.

Howard, S. K., Tondeur, J., Ma, J., & Yang, J. (2021). What to teach? Strategies for developing digital competency in preservice teacher training. Computers & Education, 165, 104149.

Ifinedo, E., Rikala, J., & H¨am¨alainen, T. (2020). Factors affecting Nigerian teacher educators¨' technology integration: Considering characteristics, knowledge constructs, ICT practices and beliefs. Computers & Education, 146,103760. https://doi.org/10.1016/j.compedu.2019.103760

Igcasama, R., Kilag, O. K., Cabonilas, L., Abarias, C. M., Abendan, C. F., & Bubuli, A. L. (2023). Enhancing Numeracy: A Technological Approach to Improve Basic Math Skills. Excellencia: International Multi-disciplinary Journal of Education (2994-9521), 1(6), 455-464.

Irianti, L. (2020). Teachers' perception on flipped classroom model in digital literacy era. Elt-Lectura, 7(2), 94-102.

Janschitz et al., 2022 Mathematics teachers' perceptions of the introduction of ICT: The relationship between motivation and use in teaching function. Mathematics, 8(12), 2158.

Johnson, Jones A. M., Jacovina, M. E., Russell, D. E., & Soto, C. M. (2016). Challenges and solutions when using technologies in the classroom. In S. A. Crossley & D. S. McNamara (Eds.) Adaptive educational technologies for literacy instruction (pp. 13-29). New York: Taylor & Francis. Published with acknowledgment of federal support.

Karsenti, T., Kozarenko, O. M., & Skakunova, V. A. (2020). Digital technologies in teaching and learning foreign languages: Pedagogical strategies and teachers' professional competence. Education and Self Development, 15(3), 76-88.

Kaur, P., & Nadarajan, R. (2020). Language learning and teaching using Kahoot. International Journal of Modern Education, 2(5), 19-28.

Kidd, W., & Murray, J. (2020). The Covid19 pandemic and its effects on teacher education in England: How teacher educators moved practicum learning online. European Journal of Teacher Education, 1–17.

Kilag, O. K. T., Zarco, J. P., Zamora, M. B., Caballero, J. D., Yntig, C. A. L., Suba-an, J. D., & Sasan, J. M. V. (2023). How Does Philippines's Education System Compared to Finland's? EUROPEAN JOURNAL OF INNOVATION IN NONFORMAL EDUCATION, 3(6), 11-20.

Kim, H. J., & Kim, H. (2017). Investigating teachers' pedagogical experiences with tablet integration in Korean rural schools. The Asia-Pacific Education Researcher, 26, 107-116.

Kirange, S., Sawai, D., & Director, I. M. (2021). A comparative study of e-learning platforms and associated online activities. The Online Journal of Distance Education and e-Learning, 9(2), 194-199.

Kumar, V. S., Pullagura, L., Nalli, V. K., Nayak, S. P., Devi, B. P., Alharbi, A., & Asakipaam, S. A. (2022). Internet of Things-Based Patient Cradle System with an Android App for Baby Monitoring with Machine Learning. Wireless Communications & Mobile Computing (Online), 2022.

Li, S., & Shen, D. (2022). Wireless Music Playing Buzzer Sensor-Assisted Music Tone Adaptive Control. Journal of Sensors, 2022(1), 9002533.

Licorish, S. A., Owen, H. E., Daniel, B., & George, J. L. (2018). Students' perception of Kahoot!'s influence on teaching and learning. Research and Practice in Technology Enhanced Learning, 13(1), 1-23.

Liu, Z. Y., Lomovtseva, N., & Korobeynikova, E. (2020). Online learning platforms: Reconstructing modern higher education. International Journal of Emerging Technologies in Learning (iJET), 15(13), 4- 21.

Loi, M. 2020. Many teachers don't use technology in the classroom often: Here's how to change that. Retrieved from https://oecdedutoday.com/teachers-use-technologyclassroom-change.

Ludwig, J. (2021). Poor performance in undergraduate math: Can we blame it on COVID-19 despair. International Journal of Innovation in Science and Mathematics, 9(3), 31-40.

Ma'rifatin, S., Amin, S. M., & Siswono, T. Y. E. (2019, February). Students' mathematical ability and spatial reasoning in solving geometric problem. In Journal of Physics: Conference Series (Vol. 1157, p. 042062). IOP Publishing.

Mahmudah, U., Pramesti, S. L. D., Sufia, N. V., Falasyifa, N., Hayati, N. M., & Maulana, A. (2023, August). Empowering Communities in the Digital Era: Enhancing Mathematical Literacy and Numeracy through Community (ICIS) (pp. 26-33).

Malisch, J. L., Harris, B. N., Sherrer, S. M., Lewis, K. A., Shepherd, S. L., McCarthy, P. C., Spott, J. L., Karam, E. P., Moustaid-Moussa, N., & Calarco, J. M. (2020). Opinion: In the wake of COVID19, academia needs new solutions to ensure gender equity. Proceedings of the National Academy of Sciences, 117(27), 15378–15381.

Munjiat, S. M. (2020). Implementation of Islamic Religious Education Learning in Higher Education on The Pandemic Period. Nazhruna: Jurnal Pendidikan Islam, 3(2), 285– 295. https://doi.org/10.31538/nzh.v3i2 .757

Oberlander, M., Beinicke, A., & Bipp, T. (2020). Digital competencies: A review of the literature and applications in the workplace. Computers & Education, 146,103752. https://doi.org/10.1016/j.compedu.2019.103752

Oginni, O. I., Akinola, A. S., Fadiji, A. E., & Amole, P. A. (2021). Effects of Mastery Learning Strategy on Secondary School Students Performance in Mathematics. European Journal of Education and Pedagogy, 2(5), 59-63.

Oke, A., and Fernandes, F. A. P. 2020. "Innovations in teaching and learning: Exploring the perceptions of the education sector on the 4th industrial revolution (4IR)." Journal of Open Innovation: Technology, Market, and Complexity 6(2): 31.

Ollesch, L., Heimbuch, S., & Bodemer, D. (2021). Improving learning and writing outcomes: Influence of cognitive and behavioral group awareness tools in wikis. International Journal of Computer-Supported Collaborative Learning, 16(2), 225-259

Podlubny, M., Rooksby, J., Rost, M., & Chalmers, M. (2017). Synchronous text messaging: A field trial of curtains messenger. Proceedings of the ACM on Human-Computer Interaction, 1(CSCW), 1-20.

Pratolo, B. W., & Solikhati, H. A. (2021). Investigating teachers' attitude toward digital literacy in EFL classroom. Journal of Education and Learning (EduLearn), 15(1), 97-103.

Purmayanti, D. (2022). The Challenges of Implementing Digital Literacy in Teaching and Learning Activities for EFL Learners in Indonesia. BATARA DIDI: English Language Journal, 1(2), 101-110.

Rabi, J. I. I., Kilag, O. K., Hinayon, K., Peras, C., Dumdum, J. N., & Ledesma, E. N. (2023). TED Talks: A Catalyst for Improving Oral Communication Skills in Educational Settings. Excellencia: International Multi-disciplinary Journal of Education (2994-9521), 1(4), 210-222.

Romero-García, C., Buzón-García, O., & de Paz-Lugo, P. (2020). Improving future teachers 'digital competence using active methodologies. Sustainability, 12(18), 7798.

Schleicher, A. 2020b. TALIS 2018. Insights and Interpretations. OECD publishing, Paris

Sing Yun, W. (2023). Digitalization challenges in education during COVID-19: A systematic review. Cogent Education, 10(1). https://doi.org/10.1080/2331186X.2023.2198981

Sofi-Karim, M., Bali, A. O., & Rached, K. (2023). Online education via media platforms and applications as an innovative teaching method. Education and Information Technologies, 28(1), 507-523.

Tabach, M. (2021). Competencies for teaching mathematics in the digital era: Are we ready to characterize them? Khon Kaen, Thailand 19-22 July 2021.

Tabach, M., & Trgalová, J. (2020). Teaching mathematics in the digital era: Standards and beyond. STEM teachers and teaching in the digital era: Professional expectations and advancement in the 21st century schools, 221-242.

Tan, D. A., & Andamon, J. C. (2018). Conceptual understanding, attitude and performance in mathematics of grade 7 students. International Journal of Scientific & Technology Research, 7(8), 96-105.

Tao, Y., & Zou, B. (2023). Students' perceptions of the use of Kahoot! in English as a foreign language classroom learning context.

Tertemiz, N. I. (2017). İlkokul öğrencilerinin dört işlem becerisine dayalı kurdukları problemlerin incelenmesi. Journal of Turkish Educational Sciences, 15(1)

Thornhill-Miller, B., Camarda, A., Mercier, M., Burkhardt, J. M., Morisseau, T., Bourgeois-Bougrine, S., ... & Lubart, T. (2023). Creativity, critical thinking, communication, and collaboration: assessment, certification, and promotion of 21st century skills for the future of work and education. Journal of Intelligence, 11(3), 54.

Timotheou, S., Miliou, O., Dimitriadis, Y., Sobrino, S. V., Giannoutsou, N., Cachia, R., ... & Ioannou, A. (2023). Impacts of digital technologies on education and factors influencing schools' digital capacity and transformation: A literature review. Education and information technologies, 28(6), 6695-6726.

Trujillo-Torres, J. M., Hossein-Mohand, H., Gómez-García, M., Hossein-Mohand, H., & Cáceres-Reche, M. P. (2020). Mathematics teachers' perceptions of the introduction of ICT: The relationship between motivation and use in the teaching function. Mathematics, 8(12), 2158.

Tuomi, I. 2018. The impact of artificial intelligence on learning, teaching, and education. Luxembourg: Publications Office of the European Union.

UNESCO (2020). Global Education Monitoring Report: Inclusion and Education, All Means. Paris: UNESCO.

Wang, A. I., & Tahir, R. (2020). The effect of using Kahoot! for learning–A literature review. Computers & Education, 149, 103818.

Wargadinata, W., Maimunah, I., Dewi, E., & Rofiq, Z. (2020). Student's Responses on Learning in the Early COVID -19 Pandemic. Tadris: Jurnal Keguruan Dan Ilmu Tarbiyah, 5(1), 141–153.

Weninger, C. (2022). Skill versus social practice? Some challenges in teaching digital literacy in the university classroom. Tesol Quarterly, 56(3), 1016- 1028.

Williams, R., Kaputsos, S. P., and Breazeal, C. 2021. "Teacher Perspectives on How to Train Your Robot A Middle School AI and Ethics Curriculum." In Proceedings of the AAAI Conference on Artificial Intelligence 35 (17) 15678-15686.

Yasar, K. (2023). Digital Definition. Technical Writer.

Zainuddin, Z., Chu, S. K. W., Shujahat, M., & Perera, C. J. (2020). The impact of gamification on learning and instruction: A systematic review of empirical evidence. Educational research review, 30, 100326.

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