North American Academic Research | Volume 5 | Issue 3 | March 2022 | Monthly Journal by TWASP, USA | Impact Factor: 3.75 (2021)

North American Academic Research

Monthly peer reviewed Journal by **The World Association of Scientists & Professionals**

RESEARCH ARTICLE

Research of the influence of Pedagogical Game-Based on Student Mathematics Learning

Yende Moussa Mohamed [1*]

[1]College Of Education, Huzhou University, P.R CHINA

Email: mohamedyende@icloud.com; nanaipee@gmail.com

OPEN ACCESS

Accepted March 29,2022

Published April 14, 2022

***Corresponding Author:** Yende Moussa Mohamed

Funding: No Funding

How to cite this article: Yende Moussa Mohamed (2022). Research of the influence of Pedagogical Game-Based on Student Mathematics Learning. *North American Academic Research, 5(3)*, 310-328. doi: https://doi.org/10.5281/zenodo.6459310

ABSTRACT

The study sought to investigate the perceptions of Mathematics teachers and students on the implementation of the Pedagogical Game-based Learning model; how the use of Pedagogical Game-based Learning mode enhances teaching primary students' mathematics, and the challenges associated with the performance of Pedagogical Game-based Learning model practices in teaching primary students in the Yaoundé Metropolis in Cameroon. The study adopted a descriptive case study approach to involve eight mathematics teachers and forty primary students in the study. A semi-interview guide was the primary research instrument that was adopted for data collection. This enabled an in-depth description of the context and use of pedagogical game-based teaching strategies in teaching mathematics. The thematic analysis was adopted in analyzing the transcribed data from the interview sessions with both teachers and students. The study found that both teachers and students have a positive perception and experience demonstrated a high level of understanding of the role and value of digital technologies in terms of supporting learning and teaching. Mathematics teachers used the Pedagogical Game-based Learning model in various ways to help primary students' education, including offering rich learning resources, multimodal tools, game scenarios, and in-built instruction and feedback. Digital gameplay, when used once daily over the teaching period, was found to enhance student engagement and interest in learning; many students, however, we're concerned about its effect on academic achievement and eyesight. Teachers indicated some of the obstacles they faced, such as large class size, difficulty evaluating learning outcomes, balancing fun and learning, and compelling game–classroom integration. They further added that minimal faculty interest, ambiguous instructional goals, and indeterminate strategies should be addressed to sustain successful results when utilizing the pedagogical game-based learning model.

Keywords

Pedagogical Game-Based Model, Thematic Analysis, Teaching and Learning, Mathematics

Introduction

Education is critical for societal growth, and the more informed a society's citizens are, the more civilized and regulated the community will be. The goal of using technology-based teaching pedagogy in education is to build interactive experiences for students, making it easier for them to comprehend and remember curriculum material [1]. Technology-based teaching and learning also help teachers differentiate their instruction and meet the needs of students [2]. Providing students with various avenues for recognition technique; processing, designing, or making sense of ideas" is what differentiation is about in teaching and learning. Digital innovations, such as digitally mediated reading and writing [3], have been generally accepted as part of 21st-century learning activities and are becoming more prominent in educational realms. Smart phones and tablets, and other mobile devices, games, for example, are now commonplace in classrooms to aid teaching and learning [4]. However, in primary school education, concerns about the effects of technology on young children's cognitive, emotional, and social growth remain [5]. The biggest concern about primary school children is the use of technologies for entertainment and learning in the classroom and at homes are unacceptable relating to specific computer programs [6], forbidden city content, and threats to students' physical health [7] and mental development (e.g., progression of blurred vision and nearsightedness) [8]. Another apparent concern against young children using interactive devices at home and school is that they endanger cognitive growth and play-centered learning [8]

Amid the above doubts, recent studies have confirmed the advantages of the use of pedagogical-based learning technologies in academic settings, especially for primary school children's development, as they are more successful than their contemporaries in formalizing knowledge, dealing with problems, connecting, and sharing their ideas while using computers and other forms of mobile devices or games that makes learning relatively easier [9][7]. Several reports over the last decades have referred to the use of gaming in teaching and learning strategies as one of the ways of facilitating learning while reducing the time required for teaching subject matter, especially in mathematics [2]. [10] Opined those pedagogical games could be a more accurate representation of the learning style atmosphere in which learners enjoy and excel than the conventional classroom. Research by [11] indicated that digital games in teaching and learning enable players (students) to master critical skills (e.g., effective decision-making, analytical thinking, and problem-solving, and change adaptation) that are in need in the modern workplace. As a result, games are beneficial to students in the twenty-first century. Hence, introducing a game-based learning model is essential in teaching mathematics to primary school students in Cameroon.

In any case, an expanding number of studies have zeroed in on the connections between advances, students, instructional methods, and educational programs from the teachers' viewpoint instead of investigating and recording the genuine utilization of computerized advances in youth or grade school settings [12]. Few detailed examinations explore the execution of computerized advances for multimodal learning with

creative instructional methods in youth training or elementary school settings. To address the current difficulties in early training and early grade school settings, advantages might be acquired by investigating approaches to execute advanced innovations with new teaching methods, to support emotional commitment and new learning, as opposed to simply utilizing computerized advances as instructional devices [13] [14].

The developing utilization of advanced gadgets and the ubiquity of games have started scientists' and teachers' advantage in utilizing computerized games in teaching and learning for students. Supporters contend that games are great learning devices [15] very much planned games can ultimately draw in and submerge major parts in intelligent and testing game universes and make an exceptional feeling of inborn inspiration. Players can learn new ideas, comprehend complex cycles and occasions, and examine and share critical thinking with others while playing [15]. For instruction, it implies that games can create abilities and information, draw in students in complex types of reasoning [16], and support how different frameworks of connections work comparable to one another [17]. They can be valuable assets for supporting the advancement of character and qualities through exercises that recreate callings like antiquarians, designers, and mathematicians [18].

Consequently, different ages and kinds of computerized games have been brought into training since the 1980s, resembling shifts in our comprehension of how people learn [19]. Advanced games were important for instructors' tool compartment across schools in Denmark, Finland, Norway, Portugal, and the US, generally in lower grades [20]. In an examination with 684 K-8 instructors in the US, 74% of the educators say that they instruct with advanced games, and one out of five educators say they use games at any rate consistently [21]. In a new report from the Nordics, including Iceland, Denmark, and Norway, 66% of teachers utilize computerized games [22].

A few ongoing investigations have featured that student learning educators assume an essential part [23] as they affect students' accomplishments. In this manner, computerized games as independent instructive arrangements can't do the work all alone [24]. Exploring various game plans and carrying out games in the homeroom is undoubtedly not a simple errand. It requires sufficient assets and careful coordination of different information areas [23]. [25] Choosing, arranging, executing, and evaluating the learning around and in games can overwhelm instructors. Regardless, educators have been under-addressed in game-based learning writing, and instructors' training-based utilization of advanced games has been a less investigated territory [26].

Notwithstanding the way that for most Cameroon primary students, games are an indispensable piece of life, computerized games and how educators use them in Cameroon schools are minimal comprehended. To use the possibilities of automated games in the truth of Cameroon schools, first, we need to get why and how educators themselves execute advanced games. Hence, the need to conduct this study. This paper is divided into five parts. This article begins with an introduction part that gives context for the research subject and the study's shortcomings. Section 2 examines the literature on sustainable supply chains, their methods,

and their performance. Section 3 covers the technique, whereas Section 4 presents the data analysis results. Finally, Section 5 discusses the paper's findings, ramifications, and future research issues, thus completing the paper's goal.

Ρεσεαρχη Θυεστιονσ

The following research questions fortified the study:

1. What are the perceptions of Mathematics teachers and students on implementing the Pedagogical Game-based Learning model in teaching primary students in the Yaoundé Metropolis in Cameroon?
2. How does the Pedagogical Game-based Learning mode enhance teaching primary students' mathematics in the Yaoundé Metropolis in Cameroon?
3. What are the challenges of implementing Pedagogical Game-based Learning model practices in teaching primary student's mathematics in the Yaoundé Metropolis in Cameroon?

Significance of the Study

The results of this research may empower educational program engineers, educators, and students to take advantage of the force of academic game-based-learning advances more adequately and take an interest in more drew in instructing and learning. The investigation will evoke more data and give functional instances of procedures to advance instructive game-based learning advances for profound learning in the grade school setting. The learning stories recorded in my investigation depict instructors' academic decisions, the students learning and their advanced assignments, and the computerized learning content, adding to another comprehension of approaches to unload the capability of automated innovations, including their availability and multimodal highlights to work with students' education and numeracy learning. The writing audit uncovers a hole in the documentation of the possible utilization of advanced advances, particularly in the Cameroon setting, where the educational program and learning are vigorously impacted by formative hypothesis and a sociocultural viewpoint. The taking in stories from my investigation gives rich direct proof and great execution models that fill this exploration hole in the field and show the elements that may add to educators' utilization of computerized innovations for better broadening youthful students' learning in early elementary school settings.

Review of Related Literature

Use of Game-Based Learning in Mathematics Instruction

Interest has grown in the use of game-based learning environments to enhance the teaching of science, technology, engineering, and math (STEM) subjects [27], and this trend is powerful in the domain of

mathematics [28]. Generally, the use of technology in mathematics education is emphasized strongly in many curricula, as it provides opportunities that can transform mathematics teaching and learning [29]. Numerous reviews and meta-analyses have explored the use of technology, including different forms of game-based knowledge, in the field of mathematics instruction [30] [31]. Most of these field-specific reviews mirror the findings from studies published in the public domain of game-based learning and show small but positive effects of technology-supported instruction over more traditional instructional methods [30] [31] a lack of large-scale randomized studies [30] [31]effect sizes shaped by the type of technology used and the study's methodological quality and issues with aligning learning outcomes' measures with complex learning objectives [31]

A few examples of previously published studies using game-based learning environments that aimed to promote more complex and deeper-level mathematical skills and include learning objectives such as number sense (flexibility with numbers and operations, and an understanding of properties of numbers), pre-algebra skills (reasoning about relations between quantities) and multiplicative reasoning (understanding of multiplicative relations and the relationship between multiplication and division). A common feature in these game-based learning environments is that they aimed to promote students' reflection on alternative ways to solve mathematical problems and encourage students' understanding and use of numerical relations and properties of numbers in their situation solving. Not surprisingly, the type of game-based learning environments used in the studies mentioned above is very different. In some, game features are limited and serve rather as a motivational factor. Conversely, some of the studies focused mainly on design aspects and the relationship between game features and mathematical content, but not on the relationship between these and outside-game measures of mathematical learning outcomes.

In summary, a need seems to exist for tools that develop higher-level mathematical knowledge, such as flexibility and adaptivity with arithmetic, which entails understanding numerical relations and the use of these relations in novel arithmetic contexts. While the affordances of games offer many opportunities to develop complex and flexible mathematical learning environments, research shows that disconnect exists between theoretical claims and research practice [29]. Most game-based learning environments have limited mathematical learning objectives, the relationship between game features and mathematical learning content is problematic, and measures of mathematical learning outcomes often are disconnected from the skills and knowledge practiced within game contexts [29] [30] [31] Thus, the present dissertation aimed to develop and test a game-based learning environment that can be used flexibly to develop both essential arithmetic fluency and more complex mathematical skills and knowledge, such as adaptive number knowledge and pre-algebra knowledge. Furthermore, the various studies' objectives in this dissertation aimed to provide a comprehensive overview of the relationships among game design, mathematical learning objectives, and the measurement aspect of these new types of complex mathematical learning outcomes.

Challenges of Game-Based Learning in Mathematics Instruction

Specific challenges must be addressed to sustain successful results when utilizing instructional technology, such as DGBL. Millions of dollars have been dedicated to the purchase of instructional technology in schools. Still, many educators are not using the equipment and the programs in the classrooms for their intended purpose [32]. Some critics express concern that the incorporation of instructional technology will weaken traditional education. There has been inadequate research to convince critics to abandon this view opposing the widespread implementation of instructional technology [33]. One challenging issue is that the adoption of instructional technology has not equated to the integration of instructional technology in the classroom for several potential reasons such as minimal faculty interest, ambiguous instructional goals, and indeterminate strategies [32]. As a result, technology is not sufficient to ensure that student engagement with the subject matter will increase [34]. Educators administering DGBL must possess proficient knowledge of both the programs and the devices to aid efficient utilization.

Substantial training is required to understand the capacity of technological devices and software programs to perform complex operations and promote higher-level thinking skills [35]. Another significant issue with implementing instructional technology in the classroom is the widening gap between the researcher and the classroom teacher [36]. Technology designers often develop programs based upon their pedagogical practices without customization options [36]. As a result, educators are deprived of the ability to personalize the programs to fit their instruction. To ensure that the implementation of new digital devices achieves the intended purpose, software developers and school administrators must take responsibility for proper integration in the classroom [36].

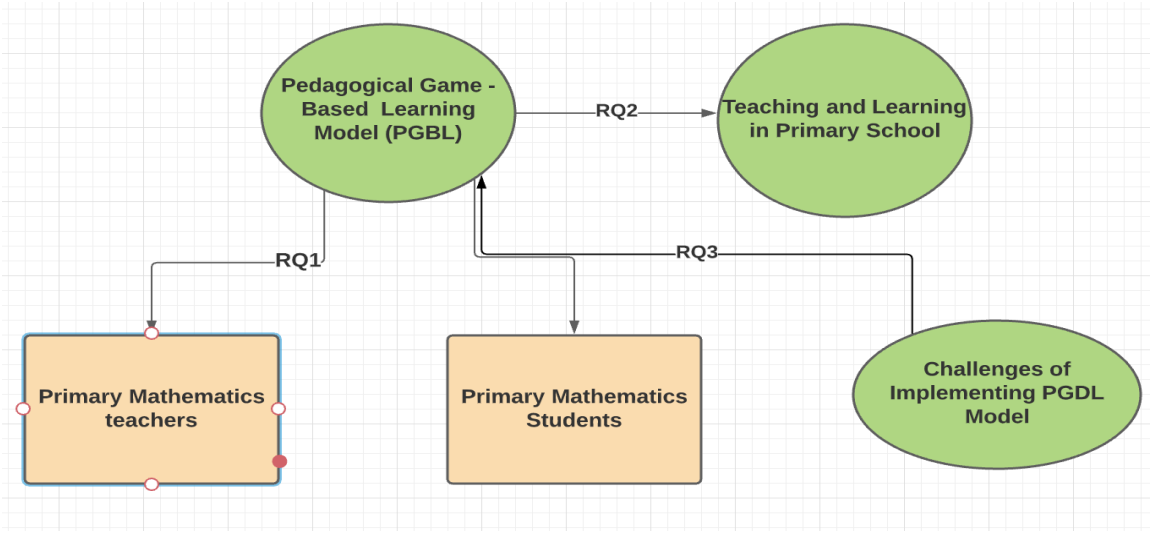
Another significant challenge in the utilization of instructional technology in the classroom is that learners enter the classroom with varying levels of technological proficiency, requiring that some undergo instruction in operating and manipulating the devices and the programs [35]. Due to limited time spent on one subject area in the classroom, learners may spend their instructional time focused on the digital device instead of engaging with the mathematical concept [34]. Without appropriate guidance and helpful instruction, the frustration level of the learners may increase, diminishing the efficiency of technological devices and programs such as DGBL. Learners may exhibit adverse reactions when subjected to unfamiliar concepts that they are unable to govern [37]. As a result, learners may avoid participating in the task due to loss of self-confidence and the inability to perform the job successfully, creating a withdrawal response from the learners [37]. Learners may become frustrated by differences in the input devices such as keypads or calculators that do not operate similarly to familiar devices. Learners may be incapable of manipulating the program in congruence with their expectations creating heightened frustration levels that may have been alleviated by explicit instruction on the appropriate method for navigating the digital device [37]. Additionally, introducing DGBL and other instructional technology using previously mastered concepts may provide the learners with increased fluency before attempting more complex tasks [36]. Outcomes of DGBL may also be improved by

frequent integration into classroom discussions and instruction because the repetition allows familiarity to enhance the ability of learners to manipulate software applications and digital devices [38].

Gaps in Literature

The amount of research on the impact of instructional technology on academic achievement has been insufficient to determine the effectiveness of technology when used instead of traditional teaching methods [33]. Furthermore, there are undetermined barriers between technology adoption and integration into classroom instruction [32]. Without identifying the obstacles that prevent educators from utilizing instructional technology in the classroom, administrators and researchers' development of instructional goals and sound instructional strategies is complex [32]. Additional research may provide educators, administrators, and stakeholders improved direction for integrating technology into the classroom. Educators have expressed concerns regarding the limited research on specialized curricula for learners [39]. Additionally, there has been minimal research on instructional tools and practices that may motivate learners in the discipline of mathematics [40]. Educating learners requires specialized procedures due to the demands encountered when establishing an educational environment that engages the learners in such a way to encourage optimal growth [41]. Due to an inadequate number of research studies analyzing how the learning environment affects motivation and how DGBL impacts mathematical learning, educators may be unable to bridge the gap between learners and their counterparts to realize optimal mathematics achievement relative to learners' abilities [42]. This gap is significant because when learners continue to be underserved, enormous losses to society may result from untapped potential. Figure 1 describes the conceptual model that guided the study based upon the research questions of the study.

Conceptual model of the study



Research Methodology

Research Design

A descriptive case study approach was employed to investigate the use of pedagogical -based learning model for primary school students' mathematical skills in Cameroon. [43] Illustrates that descriptive research design such as the case study research approach defines and provides in-depth explanations of how situations and issues under investigation usually include evaluating respondents' behavior, viewpoint regarding other respondents, institutions, practices, and procedures many more. The study adopted a descriptive survey design because it makes it easier for researchers to collect in-depth and detailed information from several respondents at a quick response time and inexpensively. According to [44], a case study is likely to be the most suitable approach for discovering, identifying, describing, and analyzing the variables of a complex social situation.

Data Collection Instrument

The study adopted a semi-structured interview as the main instrument for the case study of primary schools in the Yaoundé in my research to provide rich detail and learn about the school's diverse technical learning environment [45] [46]. After observing teachers in teaching, the research assistants conducted 15 to 20 minutes focus group interviews with students and 40 to 50 minutes interviews with teachers in eight primary schools. Eight (8) mathematics teachers from eight primary schools were involved in the study. Forty students were interview for the task. Students' interactions using interactive games in the classroom, the disparities between game-based and everyday learning, feelings about collaborative learning, the relationship between games and mathematics, and the learning outcomes obtained from gaming were discussed in advance focus groups. The teacher's interview questions centered on game use in the classroom, variations between fun and standard classes, instructional goals, tactics, design intentions, and challenges faced in game-based learning. In addition, during the student and instructor interviews, the researchers noted and explored other pertinent issues. These semi-structured interviews were audio-recorded and then transcribed.

Data Collection Procedure

Before directing the exploration, my delegates of research assistant paid a visit to elementary schools to check the chief's advantage in taking an interest in the interview project in July 2020. After a positive reaction to our underlying visit, I led a casual gathering with the head and pioneer educators from primary school to give them a foundation about the interview and acquire their view on a fundamental authorization level. As a feature of the information assortment, my research aides visited the school a few times to get comfortable with the school's actual climate, plan, class plan, and choose homerooms for information assortment. Eight mathematics teachers were browsed eight schools to be associated with the examination because of their geological areas, which permitted my exploration partners to move between them effectively in the primary structure for the meeting. Every one of the primary teachers disclosed the interview to their students while I was available in their study hall, and afterward, information assortment started. I typically went through around 2-4 hours for every visit in the first part of the day and early evening meetings because of my timetable. We embraced first-round interviews with instructors during the third term of 2020, and the second round of the meetings was conducted in the initial period of 2020.

Ethical Consideration

This study adhered to the ethical guidelines of the Human Research Ethics (HRE) procedures enforced by Huzhou University. Consent was obtained from all participants in writing. Each participant also received a letter outlining the purpose of the research, and a written consent form was brought before the interviews commenced. All information provided by the participants was used solely for the proposed study and was not shared without the prior consent of the interviewees. Pseudonyms were used for the names of participants and their schools. Interview transcripts were also shared with all participants to ensure that misinterpretations had not occurred. The Huzhou University granted ethics approval before research because the investigation involved the primary school in Cameroon. After the ethics application was approved for this study, I contacted the school and potential teachers to explain the brief information about the research project. All the participants were given printed details about the nature of the research and possible implications to ensure they were informed consent, including the children, in line with the view that children's permissions should be sought like any other adult participants. Participation in the investigation was voluntary, and a reason for refusal was not required. All participants had an opportunity to ask questions about the research before signing the consent forms.

Results and Discussions

Background Information of Respondents

Eight mathematics teachers from eight schools were involved in the study. Five (5) of the teachers were males, while the remaining three (3) were females. The majority of the teachers (6) 75%, had teaching experience of more than five years while their counterparts (2) 25% of teachers' population had less than five years of teaching experience in mathematics and also in the use of pedagogical game-based learning model in the Yaoundé metropolis in Cameroon. Three (3) representing 37.5% of the teachers had the masters' degree qualification in teaching mathematics in the schools selected for the study. The remaining five representing 62.5% of the populace of teacher-respondents, possessed the bachelor's degree qualification to teach mathematics and be trained in the use of modern pedagogical game-based learning model. Forty (40) students were chosen to be involved in the study on the students' respondents. Students were put into five groups and interviewed for 15-20 minutes using the focus group interview. Eighteen (18), representing 45% of the students, were females, while twenty-two (22), representing 55% of the total students' population, were males. The dominance of male teachers and students in the study reflects the unbiased nature of the populace of males and females in the educational ladder of Cameroon.

Research Question One: What are the perceptions of Mathematics teachers and students on implementing the Pedagogical Game-based Learning model in teaching primary students in the Yaoundé Metropolis in Cameroon?

Over the past decades, the teaching of mathematics for primary students has been delivered in classrooms with educators conveying information followed by assessments that measure the ability of learners to recall concepts [47]. Such pedagogical practices repudiate students the opportunity for meaningful educational experiences that increase engagement by motivating lessons where learners actively participate in collaborative educational activities [48]. As learners progress from concrete to abstract mathematical concepts, an increased number of instructional tools, pedagogical practices, and learner models should accompany the shift to ensure meaningful student engagement. One such tool is the implementation of instructional technology.

The majority of teaches interviewed described their experience in use as very good. Mr. A signaled "The use of games or game-based learning environments which involves enables us to adopt different genres and design principles, and also target a wide variety of learning outcomes, such as skills, conceptual understanding, motivation, behavior." Teachers briefly described how the use pedagogical Game-Based Learning Model in teaching student's mathematics in their classroom. Another teacher also opined "the use of pedagogical game-based learning models has captivated the attention of large numbers of students by providing elements of challenge and fantasy." This is in line with the findings of [49] that pedagogical game-based learning facilitates problem-solving and analytical thinking skills in all subject areas such as

mathematics. The majority of the teachers described pedagogical game-based model "Some of the basic components of instructional games are the inclusion of instructional goals, clear rules, single or multi-player capabilities, concise directions, constraints, rewards and penalties, and the provision of player choices." The use of the model had gained recognition and acceptance in all the schools that the teacher's respondents are teaching as a viable educational tool. A teacher hinged, "One of the key components of DGBL is the ability of the model to provide students with skill mastery by activating higher-level thinking skills such as strategic thinking, in solving mathematical problem solving and adaptability."

A significant number of the teachers echoed that their educational experience in adopting the model has helped both as teachers and their students. Teachers speculated, "The use of pedagogical game-based learning around has promoted creative, socio-cultural interactive learning activities, problem-solving, and collaboration among students and teachers as well. These games were built on concepts from constructivism and situated learning theory based on Vygotsky's work on the social aspects of learning [19]. The learning experience is not limited to the interaction between the players and the game, as discussed by [15]. Still, teachers are seen as central facilitators whose role is to adapt the games to classroom teaching and engage the students in hands-on activities.

Through the focus group discussion, most students also shared the same opinions as to their teachers. They have an excellent perception of using pedagogical game-based learning models by their teachers during mathematics classroom sessions. In one group, most students revealed "we have become proficient at solving mathematics classroom problems within the context of a specific game-based learning environment and can connect this learned material with the material in the context of the regular classroom." Another student re-echoed "the use of games makes us active in learning and hence we are motivated to learn mathematics in a fun way." Studies done by [50] [51] have suggested that the use of digital-based learning model in teaching students creates an intrinsic feeling where learner participates in a task due to interest, or motivation may be extrinsic where the learner participates due to external forces related to the potential outcomes. There is no denying that digital games are in high demand year after year.

These statistics clearly show that digital games are indeed in high demand. Among the reason for this increased demand is that digital games offer very much sought-after for every individual, entertainment, and satisfaction. The enjoyment and pleasure shown by digital games have contributed to this increasing demand due to the ability of digital games to attract attention, encourage engagement, provide immersive content, and spark high appreciation. Computerized advances and redid projects and apparatuses suit understudies' adapting needs, permitting understudies to achieve undertakings freely. Some shut-end instructive applications, like Literacy Planet, Reading Eggs, d Athletics, allowed the understudies in my examination to learn without anyone else. They were given fair criticism to check their answers and consider their earlier information about education and numeracy. Students had the option to self-survey their perception and comprehension by doing various decision tests, reacting to short answer questions, and understanding clear

filling assignments in the wake of perusing eBooks on Literacy Planet. Criticism permits the understudies to ponder their earlier information and urges them to consider their learning interaction reliably.

Research Question Two: How does the Pedagogical Game-based Learning mode enhance teaching primary students' mathematics in the Yaoundé Metropolis in Cameroon?

The effective integration of instructional technology requires a shift in the classroom environment that reverses the role of the educator and the learner. This requires educators to create a student-centered classroom that integrates problem-based learning provides more significant opportunities for self-regulated learning [52]. This is only possible if students experience enhanced learning efficiency as they are provided technological tools to problem solve. An example of this student-centered approach is game-based learning that stimulates students learning interests to encourage academic growth. The implementation of DGBL may offer educators an instructional tool capable of meeting the needs of learners while promoting intellectual development in mathematics. The second research objective was to discover how the Pedagogical Game-based Learning mode enhances teaching primary students' mathematics in the Yaoundé Metropolis in Cameroon.

"The use of Pedagogical game-based learning model in teaching mathematics encourages students to solve problems and learn new things through constructing knowledge," as opined by one teacher. Another teacher revealed that the model connected with students' competencies, communication, creative expressions in mathematics, and many more. When students make their games, they have the opportunity to create what they would like to see and play. They can design their learning outcomes and develop their creativity and problem-solving skills. From this perspective, the focus is on creative games where learning emerges from experimentation and shifts the focus from a teacher-centered to a learner-centered approach. Generally, the use of technology in mathematics education is emphasized strongly in many curricula, as it provides opportunities that can transform mathematics teaching and learning [29]. Most of these field-specific reviews mirror the findings from studies published in the public domain of game-based education and show small but positive effects of technology-supported instruction over more traditional instructional methods that the game-based format served only as an alternative content-delivery medium.

Most of the game-based learning environments examined used drill-and-practice, which the authors defined as a 'gamified version of paper-based worksheets'. This format limited possible learning outcomes to the practice of procedural fluency in regular school math tasks (i.e., numbers and operations, algebra, and geometry). Very few examples exist of game-based learning environments that aim to promote more complex mathematical skills and knowledge beyond routine classroom math practice. A teacher revealed that one of the standard features in using game-based learning environments is that they aimed to "promote students' reflection on alternative ways to solve mathematical problems and promote students' understanding and use of numerical relations and properties of numbers in their problem-solving." Not surprisingly, the type of game-based learning environments used in the studies mentioned above is very different. In some, game features are

limited and serve instead as a motivational factor. Few examples of previously published studies using game-based learning environments that aimed to promote more complex and deeper-level mathematical skills and knowledge include learning objectives such as number sense (flexibility with numbers and operations, and an understanding of properties of numbers), pre-algebra skills (reasoning about relations between quantities) and multiplicative reasoning (understanding of multiplicative relations and the relationship between multiplication and division).

My exploration shows solid proof that computerized advances improve student's mathematics learning. The understudies' mathematics abilities like checking, activity, and information dissecting and addressing were created when learning with their iPads. Advanced innovations give learning devices and assets to students to use to investigate better approaches to tackle life-related numerical issues. Group found that Year Two understudies from Taiwan experienced better learning results when utilizing computerized advances in numeracy learning since game highlights and in-constructed guidelines disposed of understudies' feelings of dread and dissatisfaction they did numerical undertakings. The students seemed to appreciate and feel persuaded towards acquiring and rehearsing numeracy abilities and information. My information from educators' meetings affirmed that understudies could associate adequately with iPads when chipping away at Mathletics. They got backing and direction, for example, in-fabricated guidelines and quick input from the program. This empowered them to reliably think about their learned numerical hypotheses and ideas like the standards of number requests, number qualities, and computation. Hence, it very well may be inferred that "multimodal capacities and instructive numeracy games increment understudies" inspiration and interest in doing arithmetic errands, which improves their understudies' numerical appreciation and application.

My exploration discoveries infer those computerized innovations as a viable educating approach stand firm on a vital foothold intending to the gaining needs from assorted foundations and capacities of the understudies for the situation study school. Teacher e affirmed that students acquired a better autonomous learning experience when utilizing computerized innovations. The educators announced that iPads and automated assets permitted youthful understudies to learn at their speed and level; for example, perusing applications could give various degrees of eBooks and related proficiency assignments like understanding appreciation, phonic games, and spelling games understudies that fit their intellectual capacities and understanding necessities. Advanced assets from Literacy Planet and Ready Eggs set the understudies in their levels to focus on their objectives better. For instance, the understudies had their computerized libraries with sets of eBooks coordinating with their education capacities. Also, numeracy applications, such as Mathletics, give numeracy assignments including adding, esteem setting and shape conforming related to understudies' numeracy capacities. As per, advanced advances advance free learning by permitting understudies to learn at their speed, dependent on their advantages and adapting needs. Likewise detailed those computerized

advancements to offer freedoms to the platform and back youthful understudies with various capacities, adapting needs, and different social foundations to learn more viably.

Research Question Three: What are the challenges of implementing Pedagogical Game-based Learning model practices in teaching primary student's mathematics in the Yaoundé Metropolis in Cameroon?

The third research investigated the challenges of implementing Pedagogical Game-based Learning model practices in teaching primary student's mathematics in the Yaoundé Metropolis in Cameroon. Questions such as Does the Pedagogical Game-based Learning Model in teaching mathematics pose any difficulty for yourself and the students? Do you wish to abandon the Pedagogical Game-based Learning Model in teaching mathematics? Does the use of the model pose an additional burden on you as a teacher to spend extra time and resources in lesson preparation? And Is the use of games in teaching mathematics realistic in attaining classroom objectives? A teacher opined, "there are specific challenges that must be addressed to sustain successful results when utilizing instructional technology such as DGBL." Millions of dollars have been dedicated to the purchase of instructional technology in schools. Still, many educators are not utilizing the equipment and the programs in the classrooms for their intended purpose (Reid, 2014). Some critics express concern that the incorporation of instructional technology will weaken traditional education.

"For example, they may present tools, problems, and challenges with incremental difficulty and include scaffolding that helps the player engage with the game world. "As these types of games can become progressively complicated, it can be time-consuming to master the rules and game set-up. Designers might over-simplify objects when creating the game world, and the knowledge from games may be superficial, flawed, and result in a potentially faulty teaching tool. This is also one of the fundamental critiques of using entertainment games in an educational context. One challenging issue is that the adoption of instructional technology has not equated to the integration of instructional technology in the classroom for several potential reasons such as minimal faculty interest, ambiguous instructional goals, and indeterminate strategies [32]. As a result, "the presence of games is not sufficient to ensure that student engagement with the subject matter will increase" Educators administering DGBL must possess proficient knowledge of both the programs and the devices to aid in efficient utilization.

With advancements in technology frequently surpassing the available training in specialized programs and devices, utilizing technology in the classroom is often deemed complicated and unreliable. Surveys of faculty members that utilize technology reported that once an educator makes an unsuccessful attempt to use a specific technology, they seldom attempt to use the same technology in the future [32]. Another significant challenge in the utilization of instructional technology in the classroom is that learners enter the classroom with varying levels of technological proficiency, requiring that some undergo instruction in operating and manipulating the devices and the programs [35]. Due to limited time spent on one subject area in the classroom, learners may spend their instructional time focused on the digital device instead of engaging with

the mathematical concept [34]. Without appropriate guidance and helpful instruction, the frustration level of the learners may increase, diminishing the efficiency of technological devices and programs such as DGBL. One of the principal challenges of integrating instructional technology in the classroom is unrealistic academic expectations that often accompany the new programs and devices. Instructional technology is not designed to overcome instructional deficiencies or replace sound instructional practices [38]. Administrators may incorporate instructional technology in the classroom to compensate for an incompetent teacher, or classroom teachers may employ instructional technology as a primary method of instruction. In either scenario, replacing the teacher is not the intended design for instructional technology [38]. When games lack user-friendly capabilities, the likelihood of the technology being implemented incorrectly rises substantially, voiding any alignment with the previous research-based results." Another challenge is that some teachers limit the capabilities of the instructional technology by failing to exert the required effort to ensure the technology is utilized in the intended method that the technology was designed to perform [35]. Due to the rate of advancement frequently surpassing the ability of educators to keep pace, software applications and digital devices may be implemented in the classroom before the establishment of appropriate supports hindering the maximization of achievement [36]

Every forty students in the gathering of five pulled out for special meetings remarked on the amount more they appreciated numerical when it was educated as a game. The three significant patterns that emerged from the discussions were expanded development outlook, critical thinking abilities, and commitment. As far as development attitude, the students offered remarks, for example, "I'm improving at math now," and "I took in a ton about arranged sets. I didn't realize it was conceivable, yet I see quite a lot more at this point." These remarks show that the students have started to see their number-related capacity as liquid, or something created through challenging work and commitment. Many students who initially accepted they were terrible at math guaranteed in their meeting that they currently get they can prevail with more fun and drew by and by. Another regular topic that emerged from the discussions had to do with the critical thinking abilities reinforced through accomplice collaboration. At the point when inquired as to whether the students delighted in working in accomplices, they once asserted, "Definitely, I like working in accomplices because I think uniquely in contrast to many individuals. So having an accomplice is incredible since, supposing that I think one path about something and they think an alternate way, we can assemble our thoughts and ideally get something right." Many different students repeated this conclusion with remarks, for example, "I loved having the option to work so anyone can hear while I was thinking," and "my accomplice got confounded one time, yet I assisted her with thoroughly considering her slip-up."

Conclusions

This investigation meant to see how an educator and her study apparent and experienced learning through advanced games. It found that Cameroon test arranged culture profoundly impacts their insights and

encounters, showing a conflicting demeanor that is both supporting and concerned. This disposition is infrequently seen in the related Western examination. The discoveries give observational proof that could help change educating and learning strategies, coordinate innovation into instructing, and advance students focused change on Cameroon science training. Steady with this investigation uncovered those computerized games could build commitment and advance students' focused climate. Game-based learning permitted the educator to break liberated from the talk-based class structure, making more independent investigation, and thinking opportunities. Students additionally interfaced, imparted, and worked together more with their friends and instructor.

In this more loosened-up climate, students delighted in diminished jobs and developed from being aloof beneficiaries to dynamic scholars. Nonetheless, students' mental weight additionally expanded since Cameroon culture emphatically stresses scholastic accomplishment. However, students in this examination preferred game-based adapting but noted that it would not show them enough mathematical information and accordingly influence their educational objectives and accomplishments. They likewise accepted the game could hurt their physical and emotional wellness. For the educator, game-based learning was new. Yet, she said it "gives a fascinating encounter to students" and might assist them with creating higher-request thinking, joint effort, correspondence, and numerical displaying abilities. After tracking down that numerous student student's experimentation to discover arrangements, she received "critical thinking educating" and "make-thinking-apparent" systems to boost students' time spent in scholarly commitment. "Critical thinking instructing" draws on "five-venture showing strategy," while "making thinking noticeable with pencil and paper" draws from customary educating. Such systems helped overcome any barrier between the game world and math learning.

In conclusion, teachers should be opened to incorporating more technology into the classroom, especially those shown to increase student engagement and, in some cases, achievement. Education games have been shown to have social, cognitive, and emotional benefits in studies. As opposed to the conventional classroom, game-based learning offers educators the type of learning experience that they prefer while also allowing them to acquire the skills that are expected of them in the workforce. Except in the cases of individual student choice and instructor changes, there are no overtly harmful effects of GBL learning, as shown in the literature review. As a result, teachers should be able to use games to reinforce and consolidate subjects for their students both in the classroom and, if possible, as homework.

References

[1] Beck-Hill YR&. Intertwining Digital Content and a One-To-One Laptop Environment in Teaching and Learning. Journal of Research on Technology in Education. 2012; 44(3):225–41.

[2] Divjak B, Tomić D. The impact of Game-based learning on the achievement of learning goals and motivation for learning mathematics - literature review. J. inf. organ. sci. (Online) [Internet]. 2011 Jun. 27 [cited 2022 Mar. 17]; 35(1). Available from: //jios.foi.hr/index. php/jios/article/view/182

[3] Natalia K. Children's interactions with iPad books: research chapters still to be written. Frontiers in Psychology. 2013; 4:995.

[4] Lynch, J., & Redpath, T. Technology under construction: A case study of iPad use in an Australian primary classroom. In Learning with New Media Research Group Inaugural Conference: Critical Perspectives of Learning with New Media. In Australia: Monash University; 2012. p. 19–21.
[5] John Siraj-Blatchford DW. Supporting ICT in the Early Years. UK: McGraw-Hill Education; 2003.
[6] Healy JM. Failure to connect: how computers affect our children's minds--for better and worse. New York: Simon & Schuster; 1999.
[7] Plowman, L., & Stephen, C. Guided Interaction: Exploring how Adults can Support Children's Learning with Technology in Preschool Settings. Hong Kong Journal of Early Childhood. 2013 Jul 31; 12(1):15–22.
[8] Cordes C, Miller E. Tech Tonic: Towards a New Literacy of Technology. 2004.
[9] Jackie Marsh, Greg Brooks, Jane Hughes, Louise Ritchie, Samuel Roberts, Katy Wright. Digital beginnings: Young children's use of popular culture, media and new technologies. 2005.
[10] Kebritchi, M., Hirumi, A., & Bai, H. The effects of modern mathematics computer games on mathematics achievement and class motivation. Computers & Education. 2010; 55(2):427–43.
[11] Spires HA. Digital Game-Based Learning. Journal of Adolescent & Adult Literacy [Internet]. 2015; 59(2). Available from: http://dx.doi.org/10.1002/jaal.424
[12] Cviko A, McKenney S, Voogt J. Teachers as co-designers of technology-rich learning activities for early literacy. Technology, pedagogy and education. 2015 Sep 1; 24(4):443-459. https://doi.org/10.1080/1475939X.2014.953197
[13] Yelland, Nicola, Gilbert, Caja and Turner, N. iPlay, iLearn, iGrow: Using iPads in a play-based kindergarten program. Every Child. 2014; 20(3):14–5.
[14] Yelland N, Cope B, Kalantzis M. Learning by Design: Creating pedagogical frameworks for knowledge building in the twenty-first century. Asia-Pacific Journal of Teacher Education. 2008 Dec 1; 36(3):197-213. https://doi.org/10.1080/13598660802232597
[15] Gee JP. Good Video Games and Good Learning Collected Essays on Video Games, Learning and Literacy. New York; 2007.
[16] Yasmin B. Kafai QB. Connected Gaming; What Making Video Games Can Teach Us about Learning and Literacy. Cambridge: MIT Press; 2016.
[17] Bogost I. Persuasive Games; the Expressive Power of Videogames. Cambridge: MIT Press; 2007.
[18] Shaffer DW. Epistemic frames for epistemic games. Computers & Education. 2006; 46(3):223–34.
[19] Egenfeldt-Nielsen S. Third generation educational use of computer games. Journal of Educational Multimedia and Hypermedia. 2007; 16(3):263–81.
[20] Egenfeldt-Nielsen S. What Makes a Good Learning Game? Going beyond edutainment. e Learn Magazine. 2011.
[21] Takeuchi LM, Vaala S. Level up Learning: A National Survey on Teaching with Digital Games. 2014.
[22] Fran C. Blumberg,Kirby Deater-Deckard,Sandra L. Calvert,Rachel M. Flynn,C. Shawn Green,David Arnold,Patricia J. Brooks. Digital Games as a Context for Children's Cognitive Development: Research Recommendations and Policy Considerations. 2019.
[23] Huizenga, J. C., Ten Dam, G. T. M., Voogt, J. M., & Admiraal, W. F. Teacher perceptions of the value of game-based learning in secondary education. Computers & education. 2017; 110:105–15.
[24] Becker K. Choosing and Using Digital Games in the Classroom. Switzerland: Springer; 2017.
[25] Bourgonjon, J., De Grove, F., De Smet, C., Van Looy, J., Soetaert, R., & Valcke, M. Acceptance of Game-Based Learning by Secondary School Teachers. Computers & Education. 2013; 67:21–35.
[26] Kangas PM, Hyvönen PT, Randolph J, Ruokamo HMA. Teachers' Engagement and Students' Satisfaction with the Playful Learning Environment. Teaching and Teacher Education. 2017 Jan 19; 63:274–284. https://doi.org/10.1016/j.tate.2016.12.018
[27] Boyle E, Hainey T, Connolly TM, Gray G, Earp J, Ott M et al. An update to the systematic literature review of empirical evidence of the impacts and outcomes of computer games and serious games. Computers and Education. 2016 Mar; 94:178-192. https://doi.org/10.1016/j.compedu.2015.11.003

[28] Hainey T, Connolly TM, Boyle EA, Wilson A, Razak A. A systematic literature review of games-based learning empirical evidence in primary education. Computers & Education. 2016 Nov 30; 102:202 - 223. https://doi.org/10.1016/j.compedu.2016.09.001
[29] Bray, A., & Tangney, B. Technology usage in mathematics education research A systematic review of recent trends. Computers & Education. 2017; 114:255–73.
[30] Cheung, A. C., & Slavin, R. E. The effectiveness of educational technology applications for enhancing mathematics achievement in K-12 classrooms: A meta-analysis. Educational Research Review. 2013; 9:88–113.
[31] Slavin and Cynthia Lake R. Effective Programs in Elementary Mathematics: A Best-Evidence Synthesis. Review of Educational Research. 2008; 78(3):427–515.
[32] Reid P. Categories for barriers to adoption of instructional technologies. Education & Information Technologies. 2014; 19(2):383–407.
[33] Reeves TC, Oh EG. The goals and methods of educational technology research over a quarter century (1989–2014). Educational Technology Research and Development. 2017 Apr 1; 65(2):325-339. https://doi.org/10.1007/s11423-016-9474-1
[34] Hilton A. Engaging Primary School Students in Mathematics: Can iPads make a Difference? International Journal of Science and Mathematics Education. 2018; 16:145–65.
[35] Hillman AM. A literature review on disciplinary literacy: How do secondary teachers apprentice students into mathematical literacy Journal of Adolescent & Adult Literacy? 2014; 57(5):397–406.
[36] Musti-Rao, S., Lo, Y. Y., & Plati, E. Using an iPad App to Improve Sight Word Reading Fluency for At-Risk First Graders. Remedial and Special Education. 2015; 36(3):154–66.
[37] Ku, O., Chen, S. Y., Wu, D. H., Lao, A. C., & Chan, T. W. The Effects of Game-Based Learning on Mathematical Confidence and Performance: High Ability vs. Low Ability. Educational Technology & Society. 2014; 17(3):65–78.
[38] Jackson, A., Brummel, B., Pollet, C., & Greer, D. An evaluation of interactive tabletops in elementary mathematics education. Educational Technology Research & Development. 2013; 61(2):311–32.
[39] Callahan, C. M., Moon, T. R., Oh, S., Azano, A., & Hailey, E. P. What Works in Gifted Education: Documenting the Effects of an Integrated Curricular/Instructional Model for Gifted Students. American Educational Research Journal. 2015; 52(1):137–67.
[40] Asmundis, R. D., Bitonto, P. E., D'Aprile, G., & Severino, A. U. Social, constructivist and informal learning processes: Together on the edge for designing digital game-based learning environments. The Italian e-Learning Association Journal. 2015; 11(3), 23-39
[41] Jong, M. S. Y., & Shang, J. Impeding phenomena emerging from students' constructivist online game-based learning process: Implications for the importance of teacher facilitation. Journal of Educational Technology & Society. 2015; 18(2), 262-283.
[42] Lüftenegger, M., Kollmayer, M., Bergsmann, E., Jöstl, G., Spiel, C., & Schober, B. Mathematically gifted students and high achievement: The role of motivation and classroom structure. High Ability Studies. 2015; 26(2), 227-243.
[43] Creswell JW. Research Design Qualitative, Quantitative, and Mixed Methods Approaches. Los Angles: Sage Publishers; 2009.
[44] Outhwaite, W. Concept Formation in Social Science. London: (Routledge Revivals). Routledge; 2010
[45] Cope, B., & Kalantzis, M. "Multiliteracies": New literacies, new learning. In Framing Languages and Literacies.) Routledge. 2013; 115–45.
[46] Flewitt, R. Using video to investigate preschool classroom interaction: Education research assumptions and methodological practices. Visual communication. 2006; 5(1), 25-50.
[47] Hallström, J., Hultén, M., & Lövheim, D. The study of technology as a field of knowledge in general education: historical insights and methodological considerations from a Swedish case study. International journal of technology and design education. 2014; 24(2), 121-139.
[48] Nel, L. Students as collaborators in creating meaningful learning experiences in technology-enhanced classrooms: An engaged scholarship approach. British Journal of Educational Technology. 2017; 48(5), 1131-1142.
[49] Mavridis, A., Katmada, A., & Tsiatsos, T. Impact of online flexible games on students' attitude towards mathematics. Educational Technology Research and Development. 2017; 65(6), 1451-1470.

[50] Katai, Z., Toth, L. & Adorjani, A.K. Multi-Sensory Informatics Education. Informatics in Education. 2014; 13(2), 225-240

[51] Proulx, J. N., Romero, M., & Arnab, S. Learning mechanics and game mechanics under the perspective of self-determination theory to foster motivation in digital game based learning. Simulation & Gaming. 2017; 48(1), 81-97.

[52] Huang, T. H., Liu, Y. C., & Chang, H. C. Learning achievement in solving word-based mathematical questions through a computer-assisted learning system. Journal of Educational Technology & Society. 2012; 15(1), 248-259.