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Battlemath: The Ultimate E-Learning Experience for Grade 5 Elementary Mathematics

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ABSTRACT

It is basic mathematics which is the critical foundation that gives the predictability of the overall success of a student during his or her whole course of study. The delivery of knowledge in the contemporary educational setup entails the application of many different modalities of learning, ranging from simple printed handouts to complicated computerized programs. More importantly, the active learning process is not limited to the school environment, but it continuously goes on even at home. This paper provides a comprehensive developmental history and systematic analysis of BattleMath, which is a narrative-based mobile application designed as a universal learning tool in Grade 5 mathematics. The educational tool has been carefully created in consideration of the requirement of the national curriculum with reference to the Agile Development Model and the Mechanics-Dynamics-Aesthetics (MDA) model. The application directly tackles the psychological obstacle of math anxiety by creatively encoding the abstract division problems into a thrilling hero-villain experience. The player takes the adventurous role of Arlo, and he must successfully defeat the antagonist, Chronus, by being consistently accurate in his mathematical calculations. The researcher performed a detailed descriptive study to test the prototype, which involved gathering the necessary assessment data of Grade 5 students and their teachers at Maawi Elementary School, which served as the primary research site. It was found that the application has high technical quality, achieving an Excellent rating on Usability and a Very Good rating on Functional Suitability. Such highly beneficial acceptability scores indicate that BattleMath is acceptable and usable as a supplementary tool alongside conventional teaching strategies in various primary learning environments.

Keywords: BattleMath, Mobile Learning, Grade 5 Mathematics, Agile Model, Gamification, E-Learning Assessment

INTRODUCTION

Modern education poses a dynamic challenge to educators and learners. Without guaranteed access to physical classrooms, teachers must find other ways of ensuring that students remain engaged as they learn complex subjects. Technology is one of the mediators. Game-based learning has emerged as a vital method for dismantling traditional psychological barriers to learning mathematics [8]. This paper introduces BattleMath, which is a specialized tool that applies to Grade 5 classroom settings to deal with the problem of math anxiety. The data obtained to carry out this study was collected at Maawi Elementary School in order to pilot the prototype, yet the system rationale and alignment of the curriculum is equivalent to the overall Grade 5 education setup.

The primary objective of this research is closing the gap between classroom instruction and practice at home through mobile technology. Narrative is currently recognized as one of the most essential components of serious games [10]; without it, educational activities will look like detached tasks. The student in BattleMath has the role of the hero, Arlo, who fights with the villain, Chronus, using mathematical accuracy. This approach aligns with modern techniques for supporting narrative design, ensuring the story remains central to the educational experience [4]. This makes sure that the learners are fully immersed in the story, as assuming a character's role directly involves the player in the results [11].

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Objectives of the Study

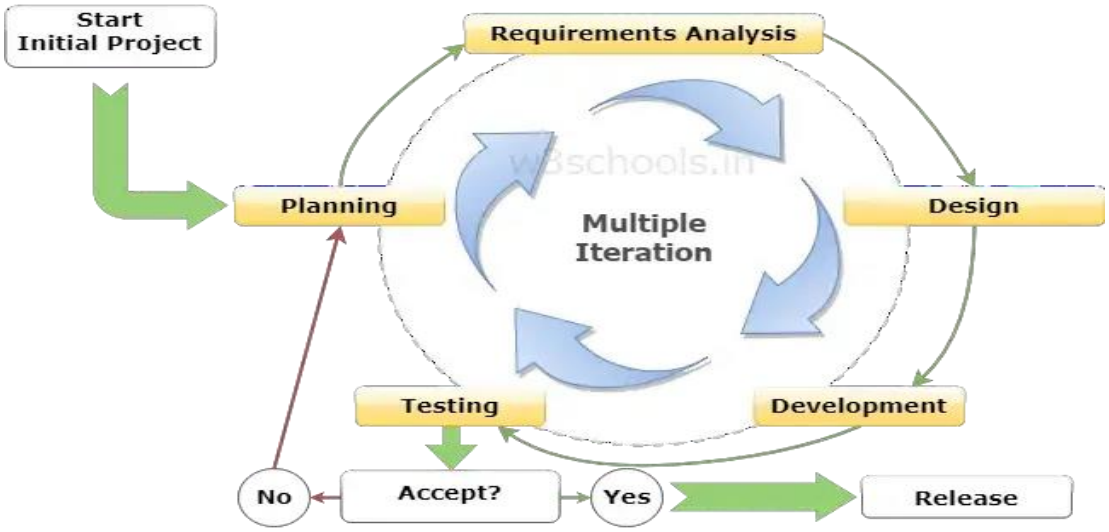
The objective of this study is to develop an interactive e-learning platform that utilizes game-based learning to serve as an acceptable and usable supplementary tool for Grade 5 students. Specifically, the study aims to:

1. To create a storyline for the proposed mobile game application, making learning mathematics more engaging for students.
2. To create game mechanics that promote active learning and problem-solving skills in mathematics.
3. To determine the acceptance level of the developed gamified app platform among students and teachers for Grade 5 students.

METHODOLOGY

This study utilized a descriptive research design to measure the effectiveness of BattleMath. To build the software, the researchers applied the Agile Development Model. Agile techniques enable software enhancement through specific iterations known as 'Sprints' [1].

Figure 1. Agile Methodology



This incremental design would be critical in streamlining the math engine where every division would be correct with the exact Grade 5 requirements of the Department of Education.

Technological Architecture BattleMath is based on a powerful Android architecture. The battle system and 2D pixel-art were executed in the Unity Game Engine. The program is written in C# scripts to manage the logic of the game, specifically the Random Number Generator (RNG) that provides students with a different set of problems each session. SQLite is used to manage data, such as the progress of local players, including levels unlocked and badges earned. This is an essential local storage solution; it would allow the app to operate in even rural settings where internet access is imperfect, which is a key factor of inclusive education.

The development process utilized the Mechanics, Dynamics, and Aesthetics (MDA) framework designed for elementary-level software [12]. Such a design enabled the researchers to relate design to emotion, visualizing how rules of the game (Mechanics) provoke player behavior (Dynamics) to generate an emotional investment (Aesthetics). The aesthetic layer of the game employs specific storytelling techniques to create an engaging narrative for the target age group [6].

The ISO/IEC 25010 standard [5] was utilized for the assessment of software quality with eight characteristics. The data were provided by a total of 44 respondents including students, teachers at Maawi Elementary School. Given that the primary users of the application are minors, strict ethical guidelines were followed during the

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evaluation phase. Prior to data collection, informed consent was secured from the parents or legal guardians of all participating Grade 5 students, alongside institutional approval from the administration of Maawi Elementary School. To ensure the protection of child data, no sensitive personally identifiable information (PII) was required to operate the application. Furthermore, leveraging BattleMath's offline-first architecture, all gameplay progress, assessment metrics, and localized data were stored securely on the individual test devices using the SQLite database, entirely eliminating the risk of unauthorized external access or cloud-based data breaches. Competitive leaderboards were implemented specifically because they have been shown to enhance academic performance in young students [2].

RESULTS AND DISCUSSION

The development phase successfully yielded a robust mobile application engineered to facilitate complex, multi-step division logic. The outcomes of the assessment show that the target age cohort thought that the technical design was stable, responsive, and intuitive. One of the findings of this research is that the problem of students struggling with mathematics can be mitigated by providing visually stimulating immediate feedback. In the battle mode of BattleMath, the system examines what the student is typing, and a real-time presentation is shown when the correct answer is entered, triggering an animation of the hero attacking the opponent. The immediate feedback loop provided by these battle animations serves to balance the learning experience through the application of Self-Determination Theory [3].

The primary means of engagement with the student is outlined in the Use Case narratives, which trace the detailed steps the player takes to follow the math material.

Table 1a. Use Case Narrative: Play

Step	Player Action	System Response
1		Displays Main Menu.
2	Taps/Touches Home button.	
3		Displays the main menu or another section of the game.

Table 1b. Use Case Narrative: Battle

Step	Player Action	System Response
1		Displays Main Menu.
2	Taps/Touches "Play" Button.	
3		Displays available stages and levels based on the player's progress.
4	Taps/Touches specific stage or level to play.	
5		Loads the selected gameplay environment.
6	Starts the battle to play.	
7		Saves the player's progress.

Table 1c. Use Case Narrative: Exit

Step	Player Action	System Response
1	Taps/Touches Exit option from the main menu or during gameplay.	
2		Prompts the player to confirm their choice to exit the game.
3	Taps/Touches Confirm Button.	
4		Saves the player's progress.
5		Closes the game.

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As illustrated in Figure 1, the development of BattleMath followed an iterative Agile Software Development Model. During the Planning and Requirements Analysis phases, the research team identified the specific multi-step division requirements aligned with the Grade 5 Department of Education curriculum. The Design and Development phases involved creating the 2D pixel-art battle system in the Unity Game Engine and programming the C# logic for the Random Number Generator (RNG). Finally, the Testing phase was conducted incrementally, allowing the team to gather immediate feedback and refine the software mechanics before the final Release.

Table 2. Overall Acceptability Test Result

Acceptability	WM	Description
Functionality Suitability	4.05	Very Good
Performance Efficiency		
Compatibility	4.15	Very Good
Usability		
Reliability	4.02	Very Good
Security	4.41	Excellent
Maintainability	4.06	Very Good
Portability	3.98	Very Good
	4.13	Very Good
	4.25	Excellent
Average Weighted Mean	4.13	Very Good

The summary of the evaluation is shown in Table 2. The weighted mean of Functional Suitability was 4.05, interpreted as Very Good. This indicator proves that BattleMath satisfies the needs of the user in terms of content accuracy. It is worth noting that the Web-Based Dashboard added for the teacher also contributed to this score because now teachers can keep track of progress and update the question bank in real-time without the need to re-install the application. The validity of any educational tool hinges on its merit, and it must be managed with necessary ease, as demonstrated in [9].

Usability received the best rating in the study at 4.41 ("Excellent"). This implies that the interface is well-geared towards 10-to-11-year-olds. The results indicate that students are able to determine how to play with practically no guidance. This high rating justifies the decision to utilize standard.

Portability was also rated highly at 4.25 (Excellent). This suggests that BattleMath can be regarded as an efficient substitute for traditional pen-and-paper worksheets. This supports the finding that digital solutions can effectively perform tasks traditionally handled on paper [7].

While BattleMath demonstrated high usability and functional suitability, several methodological limitations must be acknowledged. This study utilized a descriptive design focused primarily on software quality evaluation (ISO/IEC 25010) rather than the direct, quantitative measurement of mathematical anxiety reduction or pre- and post-test learning gains. Additionally, the sample size was limited to 44 respondents from a single institution, Maawi Elementary School, which restricts the external validity of the findings. The highly positive acceptability scores may also be partially influenced by the novelty effect of introducing an interactive, game-based digital medium into the classroom. Consequently, these results confirm the application's technical readiness and user acceptance, but further empirical study is required to validate its long-term academic efficacy.

CONCLUSION

The study findings conclude as follows: BattleMath is acceptable and usable as a supplementary Grade 5 Mathematics learning tool. Gamification based on narratives provides an engaging, usable alternative format for students to practice multi-step division. The high rating of 4.41 (Excellent) in Usability is empirical evidence that young learners can use complex software when the UI is constructed with consideration of their cognitive

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capability. Furthermore, the Agile Development Model helped the researchers to develop logic iteratively until it acquired a Very Good functionality rating (4.05).

On the basis of these conclusions, the following recommendations can be offered:

For Schools: Make BattleMath a formal auxiliary Blended Learning material. To make screen time productive, teachers are required to specify battle stages relevant to the lesson of the day.

For Developers: The system already has a web dashboard on which content can be tracked and updated; thus, further enhancement with Predictive Analytics is needed in the future. Instead of just displaying scores, the dashboard ought to analyze gameplay data to identify students at risk by highlighting those who are not progressing well with specific mechanics (e.g., remainders or steps of long division) and intervene before they fail a formal test.

Future Research: To build upon the foundational acceptability and usability findings of this study, future research must transition from descriptive evaluation to quasi-experimental designs to measure true academic impact. Specifically, an empirical study spanning 4–6 weeks should be conducted to evaluate actual learning gains in division skills, utilizing a pre-test and post-test methodology alongside a control group assigned to traditional worksheet practice. Furthermore, the quantitative usability metrics gathered in this study should be supplemented with qualitative thematic analysis. Conducting structured teacher interviews and student focus groups will provide deeper, explanatory insights into why the application's usability is highly rated, while also pinpointing any specific game mechanics that may still cause learner frustration, thereby guiding the next iteration of Agile development.

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REFERENCE

1. Abrahamsson, P. (2002). Agile software development methods. Vourimiehentie, Finland: VTT Publications.https://publications.vtt.fi/pdf/publications/2002/P478.pdf
2. Balci, S., Secaur, J. M., & Morris, B. J. (2022). Comparing the effectiveness of badges and leaderboards on academic performance and motivation. Education and Information Technologies, 27(6), 8669–8704. https://link.springer.com/article/10.1007/s10639-022-10983-z
3. Chen, J. (2023). Electronic game’s feedback loops: Balanced design feedback loops by applications of SDT. Lecture Notes in Education Psychology and Public Media, 15, 186–193. https://www.researchgate.net/publication/374999915_Electronic_Games_Feedback_Loops_Balanced_Design_Feedback_Loops_by_Applications_of_SDT_Enhance_Players_Motivation

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue IV, April 2026

4. Gutiérrez Vela, F. L., Medina-Medina, N., Gallardo, J., Paderewski, P., & Cerezo, E. (2024). Supporting narrative design in video games. International Journal of Human-Computer Interaction, 1–25. https://www.tandfonline.com/doi/full/10.1080/10447318.2024.2440143
5. ISO/IEC 25010. (2011). Systems and software engineering - Systems and software Quality Requirements and Evaluation (SQuaRE). https://www.iso.org/standard/78175.html
6. Juego, A. (2024). Game Storytelling Secrets: Creating Engaging Narratives. https://www.juegostudio.com/blog/mastering-game-storytelling-crafting-compelling-narratives
7. Kimble, T. (2020). The impact of gamification on elementary math. Retrieved from digitalcommons.kennesaw.edu. https://digitalcommons.kennesaw.edu/teachleaddoc_etd/43/
8. Mahmud, M. S., & Hui. (2023). Game-based learning in math education. Frontiers in Psychology. https://www.researchgate.net/publication/370023100_Influence_of_game-based_learning_in_mathematics_education_on_the_students'_cognitive_and_affective_domain_A_systematic_review
9. Malabayabas, M. Y. (2024). Effectiveness of math-gamified applications. Advanced Journal of STEM Education, 31–42. https://www.researchgate.net/publication/383232386_Effectiveness_of_Mathematics-Gammified_Applications_for_Learners_Interactive_Numeracy_Growth_Math-Galing_in_Enhancing_the_Academic_Performance_of_Grade_11_Learners
10. Naul, E., & Liu, M. (2020). Why story matters in serious games. Journal of Educational Computing Research, 58(3), 621–643. https://journals.sagepub.com/doi/abs/10.1177/0735633119859904
11. Porohk, A. (2023). The Art of Storytelling: How is Storytelling Used in Video Games. https://kevurugames.com/blog/the-art-of-storytelling-how-is-storytelling-used-in-video-games/
12. Putra, S. D., & Yasin, V. (2021). MDA framework approach for gamification-based elementary mathematics learning design. International Journal of Engineering, Science and Information Technology, 1(3), 35-39. https://www.researchgate.net/publication/356064528_MDA_Framework_Approach_for_Gamification-Based_Elementary_Mathematics_Learning_Design