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AccelQuest: A Gamified Educational Tool to Enhance Grade 8 Learner's Academic Performance in Law of Acceleration Lesson

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A B S T R A C T :

This action research examined the effectiveness of AccelQuest, a gamified educational tool, in enhancing the academic performance of Grade 8 students in the Law of Acceleration under the Matatag Curriculum at Dimasalang National High School. The intervention transformed traditional instruction into an interactive, game-based learning experience using Microsoft PowerPoint with animations, hyperlinks, and problem-solving challenges aligned to the 7Es lesson format. Thirty-four (34) Grade 8–Archimedes learners participated in the one-group pretest–posttest design. A student attitude survey and pre- and posttests were used to validate the data that was gathered. The mean percentage scores significantly improved from 52.35% (pretest) to 65.00% (posttest) ($t = -11.1$, $p < .001$), according to statistical analysis using the Paired Samples t-Test. This suggests that the conceptual understanding of Newton's Second Law of Motion has improved. High levels of student engagement, enjoyment, and perceived learning effectiveness are demonstrated by the attitude survey tool's overall weighted mean of 3.75 ("Strongly Agree"). Results indicate that using gamified resources such as AccelQuest can improve learners' motivation, help them grasp abstract physics concepts, and support the objectives of science education in the twenty-first century. The study recommends the broader adoption of gamified strategies across other science topics to address persistent low performance and engagement in the subject.

Keywords: AccelQuest, Gamified Educational Tool, Academic Performance, Interactive, Game-Based Learning, Microsoft Powerpoint

1. Introduction

The concern over Filipino students' academic performance in science has grown in recent years. Filipino 15-year-olds received an average score of 357 in science on PISA 2018, the first time the Philippines participated. Out of the 79 participating countries, the Philippines ranked in second place in science, making it one of the lowest-ranked countries in the world. The Philippines' average score in PISA 2022 dropped by a small 1 point, to 356—a drop that is not statistically significant. Out of the 81 participating countries, the nation came in third-lowest in the global rankings. Furthermore, only 23% of students achieved level 2 proficiency in science, which is significantly less than the 76% OECD average. In a similar vein, the nation received the lowest science score of 249 out of 58 countries taking part in the 2019 Trends in International Mathematics and Sience Study (TIMSS).

The Masbate Schools Division Office has created science-focused, innovative interventions like comics and NLC fun-filled activities, as well as locally founded programs like Project LAMBAT and Project KATIG, to improve the literacy, numeracy, and scientific skills of Masbateño students. But even with these initiatives, there are still clear obstacles to learning science.

At Dimasalang National High School, based on the PIRPA result during School Year 2024–2025, the Mean Performance Score (MPS) of Grade 8 learners in Physics was only 35.64%, which is significantly below the desired proficiency level. Observations in the classroom also showed that many students struggle to grasp abstract ideas like force, mass, and acceleration, which lowers their interest in and engagement with science classes.

The primary issue found is the poor academic achievement and disinterest of eighth-grade physics students, especially when it comes to the Law of Acceleration. The low MPS of 35.64% indicates that traditional lecture-based methods are insufficient in maintaining student interest, leading to poor conceptual mastery.

This problem is consistent with the findings of previous studies, which emphasized that science concepts are often complex for students to comprehend due to their abstract nature and the lack of interactive, contextualized, and student-centered teaching approaches (De-Marcos, Domínguez, Saenz-de-Navarrete, & Pagés, 2014).

In addition to these academic issues, there is a growing tendency in the classroom where students use digital devices, especially mobile games, extensively. This change in behavior has sparked worries since students are using their mobile phones to play games more frequently, at the expense of their ability to concentrate and be productive in class. One contributing factor to the decline in the academic performance of Filipino learners in science is the growing addiction to mobile and computer games, which has also been visibly observed among Grade 8 learners at Dimasalang National High School. A study by Farillon (2022) states that "if there is a higher level of computer game addiction, class performance will suffer" which found a significant negative correlation between the level of computer game addiction and class performance. These findings underscore how excessive gaming can reduce study time, hinder focus, and limit engagement in academic activities, ultimately affecting science learning outcomes. Even though digital games can be entertaining, Domínguez et al. (2013) the excessive use of it could interfere with academic obligations unless educational systems adapt and incorporate game-based elements into classroom settings. Therefore, by using gamified teaching resources, this challenge presents an opportunity to redirect students' gaming passions towards learning objectives.

Consistently performing poorly in science has a negative impact on students' confidence, critical thinking, and preparing for additional science-related coursework. This issue needs to be addressed because science education is crucial for fostering creativity and helping students become better problem solvers. Enhancing physics student performance supports the school's objective of turning out graduates who are scientifically literate and able to apply scientific concepts to practical circumstances, as well as the K–12 Science Curriculum Standards.

It seeks to improve understanding of complex scientific subjects in the use of gamified learning strategies like AccelQuest to increase student engagement and enhance comprehension of complex scientific topics. Gamification has been demonstrated to significantly improve students' motivation, interest and academic performance by incorporating components like rewards, levels, and interactive challenges (Li, Ma, & Shi, 2023). AccelQuest's use is especially appropriate in light of kids' increasing screen time and usage of digital platforms, particularly mobile games. Academics show that students are heavily engrossed in digital technology, especially mobile games, which frequently cause them to become distracted from their academics (Domínguez et al., 2013).

To address the identified problem, AccelQuest, a gamified educational tool, will be administered in transforming mobile devices, which are a significant source of distraction, into interactive learning tools. According to Duterte 2024, gamification can lead to substantial improvements in academic performance, especially when they are exposed to gamified learning environment. They showed better test scores compared to those in traditional settings. AccelQuest leverages students' interest in technology and gaming to deliver content through interactive lessons, problem-solving challenges, and digital rewards. In study by Mao and Lucas 2024, gamification elements such as badges and leaderboards have been found to boost student motivation and engagement by fostering a sense of competition and achievement. AccelQuest seeks to increase student engagement and academic success. In addition, the strategy backs the Schools Division of Masbate's continuous efforts to raise the quality of science instruction.

The AccelQuest gamified educational tool was created as a creative intervention using Microsoft PowerPoint which combined with sound effects, animations, hyperlinks, and trigger-based navigation. Using Canva, animated objects (GIFs) were made to improve visual engagement and add interactivity to the learning process. Inspired by the growing trend of students' fascination with mobile games and digital technology, AccelQuest transforms learning into an engaging, game-like journey, integrating the lesson on Newton's Second Law of Motion (Law of Acceleration) into a format that appeals to digital-native learners. The use of gamification in Microsoft PowerPoint ensures the possibility of access to all teachers since it is embedded in the application software in their laptops or computers making it accessible to any device with the program installed. Students can now enjoy interactive, game-based science lessons without worrying about connectivity or data costs, even in places with little to no internet. It is simple for teachers to use in the classroom or distribute via flash drives, guaranteeing inclusive and seamless learning at any time and location.

AccelQuest is anticipated to increase student interest and achievement by merging the academic rigor of Physics with the motivating elements of game-based learning. Additionally, by encouraging critical thinking and problem-solving skills in junior high school students, this innovation advances the goals of Project Sci-TUKDO Plus.

1.1. Statement of the Problem

The study aimed to develop a Gamified Educational Tool to be called AccelQuest and to investigate its impact in science 8 Class under the Matatag Curriculum at Dimasalang National High School. Specifically, it seeks to determine how this teaching strategy affects the effectiveness of using gamified lessons on student learning outcomes during class discussions. The primary concern is whether utilizing gamified lessons can enhance student engagement, understanding, and retention without compromising the depth of instruction.

The following questions guided the conduct of the action research:

1. What is the academic performance of Grade 8 students in the topic Law of Acceleration under MATATAG curriculum before and after the implementation of AccelQuest?

2. Is there a significant difference between the performance of students in the topic Law of Acceleration before and after the implementation of AccelQuest?

3. How do students describe their experiences with gamified lessons (AccelQuest) as a teaching strategy in the classroom?

2. Methodology

2.1. Research Design

This tool was designed to enhance the academic performance of Grade 8 Archimedes learners at Dimasalang National High School for School Year 2025–2026. It is in line with the Fourth Quarter Most Essential Learning Competencies (MELCs) for Grade 8 Science, particularly focusing on the Law of Acceleration. With permission from the school principal, the intervention was carried out for two hours. AccelQuest's design and content adhere to the 7E's lesson plan format, guaranteeing alignment with the science learning cycle recommended by the Department of Education.

Prior to its implementation, AccelQuest was reviewed and validated by the School Quality Assurance Team, which composed of two Master Teachers, two Teacher III, and one Teacher I. It was officially approved for use by two school principals, confirming its instructional quality and relevance to classroom learning.

The game design follows the 7E's lesson plan format in science and consists of seven interactive levels, each corresponding to a different phase of learning. Learners used laptops or desktop computers to explore each level: (1) Acceleration Detector (Elicit) challenges students to identify correct statements about the Law of Acceleration; (2) Speed Clash (Engage) asks them to predict outcomes of force-based scenarios; (3) Mission Accel-Race (Explore) involves solving motion problems against the clock; (4) Law Unlocked (Explain) requires unlocking key concepts of Newton's Second Law; (5) Force Quest: Real-World Rescue (Elaborate) tasks learners to apply their knowledge to real-life situations; (6) The Acceleration Awakens (Evaluate) reinforces mastery of the law through critical challenges; and (7) Acceleration Architects (Extend) invites students to apply concepts to real-world problems through creative design or analysis, either individually or in pairs, as part of their assignment. Each level includes gamified activities that match the learning objectives and structure of a science lesson. After each task, automatic feedback and scores are provided to ensure mastery before proceeding.

Figure 1. The step-by-step procedure on how to play the AccelQuest

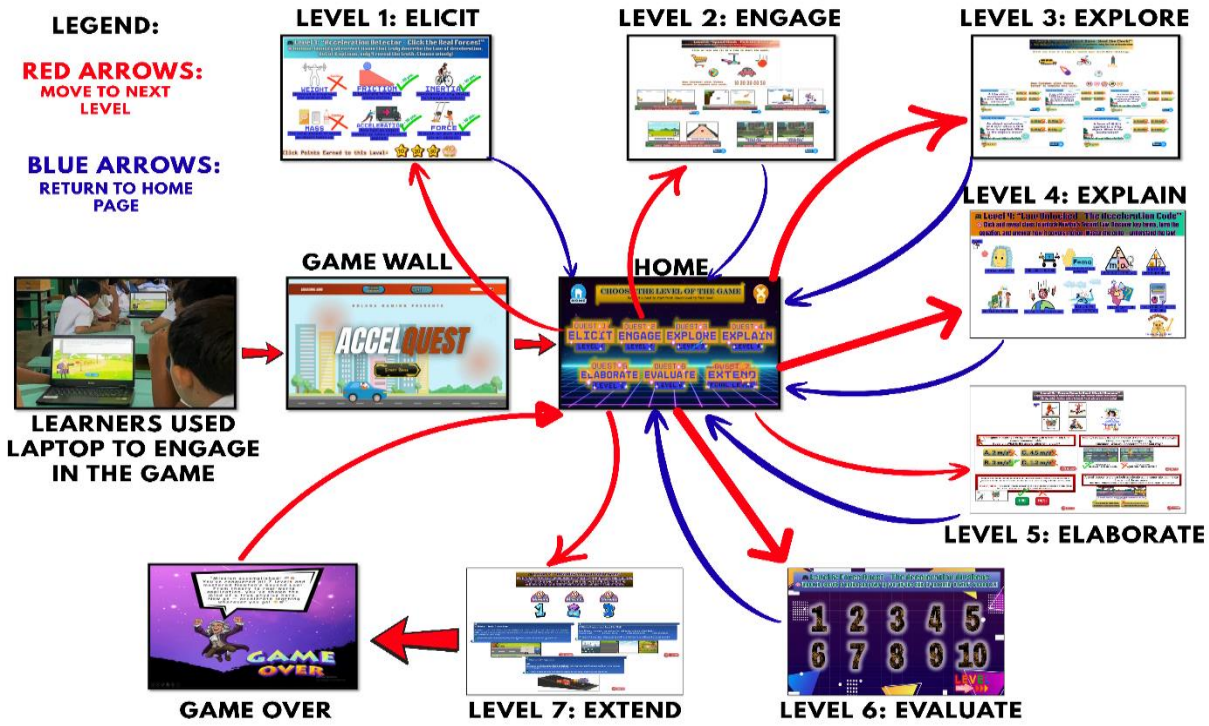

Figure 1 showed the step-by-step procedure on how the game was played. As the prescribed gadget in the game, the learners used laptops to engage in the activity. The first part of the game appeared on the start wall, where they saw the title screen. Once the start button was clicked, they were directed to the homepage where they could choose the level of the game.

Similar to the games they played on their mobile devices or computers, AccelQuest also began with Level 1: Elicit. After completing the task, they returned to the homepage to click on the next level, which was Level 2. The same process was followed until they completed all levels up to Level 7. After that, the game ended with a "Game Over" screen. Finally, when the game was over, learners were still able to play again and repeat the tasks in each level for mastery of both the game and the lesson.

Throughout the session, the teacher closely monitored students' progress, ensuring that all learners were actively engaged, had equal access to the intervention, and demonstrated improved comprehension of the lesson content. The interactive setup of AccelQuest aimed to reduce boredom and increase cognitive engagement.

2.2. Respondents

The participants in the study were 34 Grade 8 Archimedes students of Dimasalang National High School composed of 11 males and 23 females. The class were heterogenous, with students demonstrating a range of performance levels, learning preferences, and academic aptitudes. This diversity provided a representative setting for evaluating the effectiveness of the AccelQuest gamified tool in enhancing learning outcomes.

Table 1. The participants of the study

Male	Female	Total
11	23	34

2.3. Data Gathering Methods

By comparing students' scores before and after the intervention, the data used a One-Group Pretest-Posttest Design to evaluate how well gamified lessons improved their academic performance. The data's normality will be examined using the Shapiro-Wilk test, which will direct the relevant statistical analysis. The overall experience of students' during the implementation of the Gamified Lesson will be determined through descriptive data analysis. Over the course of a week, the data collection procedure was carried out in the following sequential order:

1. Participant selection and parental consent. To ensure free, prior, and informed consent, a parental consent form was administered and collected prior to the start of data collection. Parents' consent and students' willingness to take part in the study were both indicated on the forms.

2. Giving a pre-test that has been validated. Eleven males and twenty-three females made up the diverse group of Grade 8 Archimedes learners who responded. There are just ten multiple-choice questions on the pretest.

3. AccelQuest, a gamified teaching method, is implemented over a predetermined amount of time. AccelQuest was created to help students master concepts through interactive game-based learning.

4. Administering a validated posttest that is comparable in terms of its scope and level of difficulty. The pretest that was given prior to the intervention and the posttest have a similar format.

5. Survey tool on learners' attitude towards AccelQuest was administered to gather data, offering insights into its perceived effectiveness and impact on their learning experience.

Collecting, recording, and analyzing both Pretest and posttest scores to measure learning gains. After data collection, all responses from the Pretest and posttest were checked, compiled, and analyzed using appropriate statistical tools. The results were interpreted and discussed about the objectives of the study, enabling for insights into how well the effectiveness of the AccelQuest intervention in enhancing learners' understanding and attitudes toward the concept in Physics, specifically, the Law of Acceleration (Newton's Second Law of Motion)

Figure 2. The implementation of AccelQuest to Grade 8 Archimedes Learners

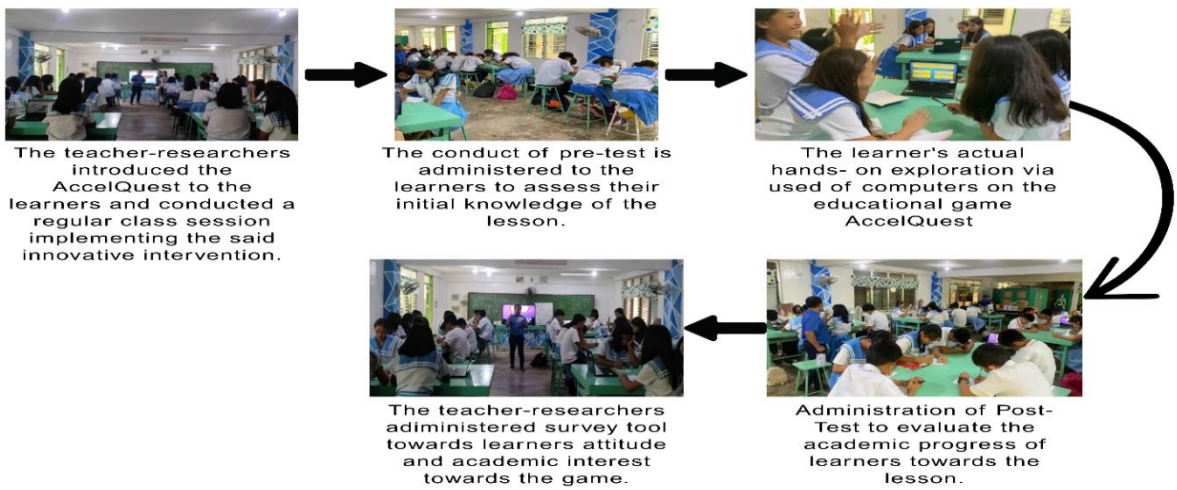

Table 2. Tool for Students' Attitude Towards AccelQuest: A Gamified Educational Tool to Enhance Grade 8 Learners' Academic Performance in Law of Acceleration Lesson

Questions	1 Strongly Disagree	2 Disagree	3 Agree	4 Strongly Agree	WM	Interpretation
1. I feel that I can learn better through gamified lessons like AccelQuest.						
2. I enjoy using AccelQuest more than traditional lectures when learning about acceleration.						
3. AccelQuest helped me understand Newton's Second Law of Motion more clearly.						
4. I became more engaged in the lesson because of the AccelQuest activities.						
5. I would like similar gamified tools to be used in other Science topics.						
6. AccelQuest made learning about force, mass, and acceleration fun and exciting.						
7. I would recommend AccelQuest to other students learning the Law of Acceleration.						
8. I feel more confident in solving problems involving F = ma after using AccelQuest.						
Total						

2.4. Statistical Treatment

The study used several statistical techniques to analyze the data collected from the pre-test and post-test assessments, as well as the students' attitude survey regarding the use of AccelQuest, a gamified educational tool. To evaluate the normality of the pre-test and post-test scores, Shapiro Wilk Test was applied. The distribution of the data was then visually examined using Q-Q plots. To make sure the presumptions for parametric testing were fulfilled, these actions were performed.

Given the nature of the study, which involved a single group of learners was measured before and after the intervention, to determine whether there was a significant difference in the students' performance, a Paired Samples T-Test was used. Additionally, the responses from the students' attitude survey were analyzed using the weighted mean to provide a descriptive interpretation of learners' perceptions and experiences with AccelQuest as an instructional strategy.

3. Results and Discussion

3.1. Research Design

This section shows the results and analysis of the data collected from Grade 8 Archimedes at Dimasalang National High School. The primary objective of this action research was to enhance Grade 8 learners' academic performance in the law of acceleration lesson. The AccelQuest Gamified Lesson was used to achieve this goal.
The analysis addressed the following research questions:

1. **What is the academic performance of Grade students in the topic Law of Acceleration under MATATAG curriculum before and after the implementation of AccelQuest?**

The Grade 8-Archimedes learners took a pre-test to assess their existing knowledge about the Law of Acceleration (Newton's Second Law of Motion) before the AccelQuest Educational Tool was applied as an intervention. The results of the pre-test were assessed by evaluating the mean percentage scores to identify their initial performance levels.

After using the AccelQuest as a learning tool, the learners took a post-test reflecting the duplicate content and degree of difficulty as the pre-test. The mean percentage scores were calculated, and the post-test results were also examined.

The results of the pre-test and post-test were compared to assess whether using AccelQuest resulted in an improvement in the students' performance. This comparison made it easier to evaluate the effectiveness of the intervention in improving the students' comprehension of the Law of Acceleration lesson.

Table 3 presents the Mean Percentage Scores (MPS) of the Pre-test and Post-test of Grade 8-Archimedes. N represents the total number of students with the Highest Possible Score (HPS) of 10. The total mean percentage score in the pre-test was 52.35%, while the post-test MPS increased markedly to 65%. These results indicated that there was a consistent improvement in learners' performance after the intervention of AccelQuest, and suggesting that the intervention was effective in enhancing students' engagement, understanding, and retention of the Law of Acceleration. These findings are consistent with relation to a study by Chang, Chen, Lin, and Sung (2008) that showed how incorporating game-based learning strategies into physics classes, greatly enhance students' academic performance and conceptual understanding, especially when teaching concepts like force and motion.

Table 3. Mean Percentage Scores of the Pretest and Posttest of Grade 8 - Archimedes Learners

N	HPS	Pre-test MPS	Post-test MPS
34	10	52.35%	65.00%

2. Is there a significant difference between the performance of students in the topic Law of Acceleration before and after the implementation of AccelQuest?

In order to assess the impact of AccelQuest Tool on Grade 8 Archimedes students' performance, it was crucial to guarantee the results' dependability and accuracy. Considering the crucial nature of the data collected from pre-tests and post-tests were put through a normality test using the Shapiro-Wilk method in Jamovi, an intuitive statistical program, to interpret performance improvements. Given that the overall quantity of responders was just 34, using the Shapiro-Wilk test was both statistically appropriate and valid because of its ability to detect deviations from normality, the test is advised for sample sizes under 50.

The normality test was necessary to determine whether the data had a normal distribution before selecting the appropriate statistical test. The use of Shapiro-Wilk test step was required to avoid misunderstandings and guarantee the validity of the results because it validated the data's assumed normality and helped identify the best inferential test to determine whether student performance differed significantly. Accurate interpretation was made possible by the use of Jamovi, which made the statistical process visually understandable and accessible.

Table 4. Normality Test of Pretest and Posttest Using Shapiro Wilk Test

Performance	N	Mean	SD	SW-test	P-value	Interpretation
Pretest	34	5.24	1.65	0.940	0.063	Normally distributed
Posttest	34	6.50	1.67	0.902	0.005	Not normally distributed

Note: A low p-value suggests a violation of the assumption of normality.

Table 4 represents the results of the Shapiro-Wilk test both the pre-test and post-test scores to determine the normality of the data distribution. The pre-test scores yielded a Shapiro-Wilk value of W = 0.940 with a p-value of 0.063, which is greater than the significance level of 0.05. On the other hand, the post-test scores returned a Shapiro-Wilk value of W = 0.902 and a p-value of 0.005, which is below to the 0.05 threshold. The result suggests that the distribution of post-test scores significantly deviated from normality and is therefore considered not normally distributed. These findings serve as the basis for selecting the most appropriate statistical tool to determine the effectiveness of the intervention.

Figure 3. The Post-Test Q-Q Plot Test

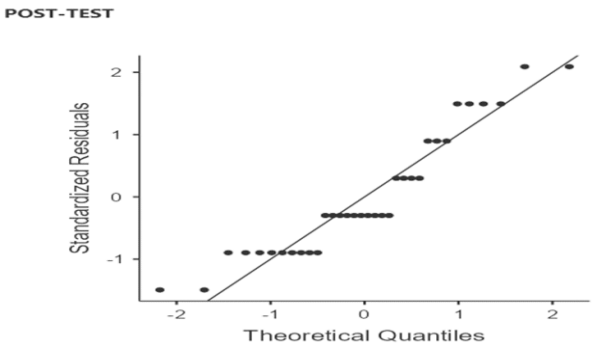

Figure 3 shows the Q-Q plots' post-test scores confirming that the residuals closely follow the diagonal line, indicating that they are approximately normally distributed. Although the Shapiro- Wilk Test suggested non-normality, the sample size of 34 allows the Central Limit Theorem to support the assumption of normality. Thus, the Q-Q plot validates the use of parametric tests, confirming the reliability of the statistical results obtained.

Consequently, the Paired Samples t-Test was applied to assess whether if there a statistically significant difference between the pre-test and post-test means. This statistical method was deemed appropriate as the study involved a single group measured at two time points, and the sample size was adequate to ensure robustness even in the presence of slight non-normality.

Table 5. Paired Samples T-Test for Pre-test and Post-test Scores

	t-statistics	df	p	Interpretation
Pre-test **Post-test**	-11.1	33.0	<.001	Statistically Significant

The outcome of the Paired Samples t-Test, which was used to ascertain whether the learners' scores before and after the gamified lesson were implemented differed statistically significantly, are shown in Table 4. With 33 degrees of freedom, the test produced a t-value of -11.1 and a p-value below 0.001. Therefore, the difference between the pretest and posttest scores is statistically significant, as indicated by the p-value, which is much lower than the traditional alpha threshold of 0.05.

The learners' performance improved significantly after the intervention, as indicated by the negative t-value, which suggests the posttest results were substantially higher than the pretest scores. As a result, the alternative hypothesis—which shows a significant change—was accepted in place of the null hypothesis, which holds that there is no difference between the means. These results support the effectiveness of the gamified lesson in enhancing student learning outcomes.

3. **How do students describe their experiences with gamified lessons (AccelQuest) as a teaching strategy in the classroom?**

The survey revealed that Grade 8 students exhibited a highly positive attitude toward the use of AccelQuest - a gamified educational tool designed to improve learning on the Law of Acceleration. With an overall Weighted Mean (WM) of 3.75, interpreted as Strongly Agree, the data suggest that learners found AccelQuest to be an effective, engaging, and enjoyable medium for science instruction.

With all the eight attitudinal statements received high WM scores, ranging from 3.68 to 3.82, indicating strong student agreement across all aspects of the gamified experience. Notably, students strongly agreed that they learned better through gamified lessons (WM = 3.71) and preferred AccelQuest over traditional lectures (WM = 3.76). This demonstrates how the tool can increase learner motivation and engagement. Additionally, learners confirmed that AccelQuest made learning about force, mass, and acceleration exciting and enjoyable (WM = 3.82), the highest-rated item in the survey, and that it improved their understanding of Newton's Second Law (WM = 3.79).

Students also reported feeling more involved in class (WM = 3.68), and they wanted to see similar gamified resources applied to other science subjects. AccelQuest's acceptance and perceived efficacy are further supported by a high willingness to suggest it to other students (WM = 3.79). Students also exhibited an increased confidence in solving problems about Law of Acceleration, especially those involving the formula F = ma (WM = 3.76), reflecting in enhanced conceptual understanding and stronger problem-solving skills.

To sum up, the results offer compelling proof that AccelQuest significantly improved students' understanding of the Law of acceleration by making complex ideas into more approachable, engaging, and entertaining. The consistent "Strongly Agree" interpretations validate the instrument's potential as an effective teaching tool by demonstrating its capacity to promote deeper understanding and active engagement.

Table 5. Tool for Students' Attitude Towards AccelQuest: A Gamified Educational Tool to Enhance Grade 8 Learners' Academic Performance in Law of Acceleration Lesson

Questions	1 Strongly Disagree	2 Disagree	3 Agree	4 Strongly Agree	WM	Interpretation
1. I feel that I can learn better through gamified lessons like AccelQuest.	0	0	10	24	3.71	Strongly Agree
2. I enjoy using AccelQuest more than traditional lectures when learning about acceleration.	0	0	8	26	3.76	Strongly Agree

3. AccelQuest helped me understand Newton's Second Law of Motion more clearly.	0	0	7	27	3.79	Strongly Agree
4. I became more engaged in the lesson because of the AccelQuest activities.	0	0	11	23	3.68	Strongly Agree
5. I would like similar gamified tools to be used in other Science topics.	0	0	11	23	3.68	Strongly Agree
6. AccelQuest made learning about force, mass, and acceleration fun and exciting.	0	0	6	28	3.82	Strongly Agree
7. I would recommend AccelQuest to other students learning the Law of Acceleration.	0	0	7	27	3.79	Strongly Agree
8. I feel more confident in solving problems involving F = ma after using AccelQuest.	0	0	8	26	3.76	Strongly Agree
Total					**3.75**	**Strongly Agree**

4. Conclusion and Recommendations

4.1 Conclusion

According to the study's findings, Grade 8 Archimedes students' attitudes towards the Law of Acceleration lesson and academic performance both improved dramatically with the addition of AccelQuest. The paired t-test results ($t = -11.1$, $p < .001$) supported the comparison of pre-test (MPS = 52.35%) and post-test (MPS = 65.00%) scores, which demonstrated a statistically significant improvement in student learning outcomes. The Q-Q plot and the Central Limit Theorem supported the use of parametric analysis even though the post-test data displayed minor departures from normalcy. With an overall Weighted Mean of 3.75 (Strongly Agree) highlighted that AccelQuest has a capacity to promote engagement, enjoyment, and conceptual understanding and also showed that students had a very positive attitude. These results affirm the value of Gamified learning as an innovative instructional strategy that not only improves performance but also fosters learner motivation and active participation.

4.2 Recommendations

Considering the results and findings of this study, the following recommendations are highly suggested.

1. **Broader Implementation and Validation**
   AccelQuest may be administered to other Grade 8 sections and other schools to validate effectiveness across different learner groups, classroom contexts, and teaching environments.
   Future studies may explore its use in higher grade levels and in other science topics under the MATATAG curriculum to test its adaptability
2. **Compatibility and Accessibility of Devices**
   Optimize AccelQuest for multiple platforms (such as mobile devices) to improve accessibility and ensure consistent functionality and graphics across different gadgets.
3. **Teachers' Integration and Sustainability**
   Encourage integration of AccelQuest as a supplementary learning tool, not just for intervention, but as part of regular instruction in physics and other related concepts.
4. **Longitudinal and Comparative Research**
   Conduct longitudinal studies to identify whether the learning earned from AccelQuest is retained over time, then compare its effectiveness with other teaching strategies (e.g., traditional teaching methods or other gamified teaching tools)
5. **Learner's Engagement and Feedback**
   Continue gathering student feedback on usability and engagement to come up with suggestions that may turn into future version of the tool.

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