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## Research Article

### Integration of Gamification in Teaching and Students' Academic Performance: Basis for Action Plan

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#### ABSTRACT

Gamification has been noted to be very helpful to learners in increasing their collaboration, motivation, interest, engagement, and teamwork in the classrooms. This is the reason that this work was conducted to determine the extent of the integration of gamification in teaching as a step to help address the alarming performance of the learners in the international and local examinations. Using the descriptive-correlational research design with use of a survey questionnaire as the main data gathering tool, this work was implemented to junior high school science and mathematics teachers in the districts of Guinsiliban, Sagay and Catarman. Appropriate statistical tools were used to analyze the data to answer the inquiries of the study. Results showed that most of the respondents in science and mathematics were females, and majority of them were in Teacher I position, on the age group of 20 to 40, served for at most 10 years, proceeded to graduate studies, and specialized in science education. The respondents had moderately integrated gamification in teaching science and mathematics. While the learners of the respondents had a very satisfactory performance in science and mathematics. Demographic variables like sex, age, educational attainment, number of years of teaching, field of specialization, and teaching position did not influence the extent of integration of gamification in teaching. The study also found a positive, low correlation but significant relationship between the extent of integration of gamification and the academic performance of the learners. Lack of gadgets like laptops and computers, internet connection, lack of access to online game-based platforms, computer literacy of teachers, and time management were the most common challenges in the integration of gamification in the learning sessions of science and mathematics. The researcher recommended that future researchers may replicate this study in schools where gadgets and internet connection are available.

**Keywords:** *Academic performance, Collaboration, Gamification, Integration*

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## **Introduction**

Delivery of quality education is the goal of the education sector in a government. However, there has been a trend for over two decades about the decline of the quality of education delivered to learners as revealed in the local and international test results. This low academic performance, according to Wu (2019), was due to lack of enthusiasm, motivation, interest, willingness to learn as well as poor learning ability of the learners. This is the reason that educators have been looking for ways to improve learning in the classroom. Various educational practices, interventions, and innovations were introduced to the field, but the trend remains the same.

In a bid to really improve the academic performance of the learners in schools, gamification and game-based learning were introduced which attracted the interest of educators in recent years (Roy & Zaman, 2018; Mariscal et al., 2023). These studies pointed to the idea that the use of different games in the learning sessions could increase the motivation, engagement, and assessment results of the learners. Therefore, this is another approach to address the alarming decline in the academic performance of the learners.

However, the study of Raitskaya and Tikhonova (2019) pointed out the need for more proof on the potential of gamification and game-based teaching process. But Kalogiannakis et al. (2021) and Montengero-Rueda et al. (2023) were in a position that gamification and game-based learning could pave the way for improved learning outcomes.

The study of Nguyen (2021) claimed that teachers are now increasingly introducing games, be it online or offline, to improve students' academic performance. Accordingly, this teaching approach stimulates the learners to pay attention, and perform the task assigned to them. These are some of the reasons that game-based learning or gamification can help learners achieve better performance in the school (Marcaida et al., 2022; Victoria, 2022).

While Sartre (2020) also acknowledged that the use of game-based learning or gamification encourages student motivation and interest in learning. Besides, Arcagok (2021) revealed that the use of game-based learning

strategies in various curricula has impacted a positive academic progress of the learner's performance. While Dahalan (2022) hypothesizes the impact of gamification and game-based learning in developing the 21<sup>st</sup> century skills of the learners in schools. This means that learners interest can be allured through this approach the teachers must employ in the teaching and learning process.

Since every school in the Philippines is accountable of the alarming performance of the learners, this work aimed to determine the possible contribution of gamification in improving the academic performance of the learners. This study may provide some insight as to the strengthening of the employment of gamification in the teaching and learning process to address the learning gaps and contribute meaningfully to providing quality education to the learners, hence, this work was conducted.

## **Methods**

The study utilized the quantitative descriptive correlational research design to answer the factor facilitating and isolating questions. Survey questionnaire was used as the main data gathering tool. From the research instrument, descriptive analysis was used to provide answer to the research question of the present study.

Considering the small number of public secondary schools in DepEd-Division of Camiguin, thirty (30) junior high school science and mathematics teachers in the districts of Mambajao and Mahinog were used as respondents of the pilot testing. While forty-four (44) science and mathematics teachers in the districts of Guinsiliban, Sagay and Catarman were used as actual respondents of the study. This means that the respondents came from different school sizes like small, medium, large, and mega schools. It could be also understood that the respondents belonged to different places in Camiguin.

Upon approval of the research proposal, the researcher sent a letter to the Office of the Schools Division Superintendent asking permission to implement the study. When the letter was inked with approval, the researcher prepared a survey questionnaire aligned to the research questions of the study. This was

subjected to face validation and pilot testing to establish the rigor of the research instrument. For convenience to both the researcher and respondents, an online platform was used due to the ubiquitous of gadgets nowadays.

The researcher considered the research questions in the construction of the research instrument. For this, there were two parts in the survey questionnaire. The first part was about the demographic variables like sex, age, highest educational attainment, years in service and field of specialization, and teaching position. These variables were considered to have an in-depth discussion about the use of gamification in the teaching and learning process in the class.

Before the researcher conducted the final gathering of data, letters containing the link of the online survey questionnaire were sent to the concerned school heads asking support at their end. The researcher requested the school heads to encourage the science and mathematics teachers in the school to respond in the online survey questionnaire during their free time and convenience. The approved letter request from the SDS was also attached as an indication that the researcher followed the research protocol in DepEd-Camiguin. Besides, the researcher also contacted the science and mathematics teachers at the target schools of the study. After two weeks, the researcher downloaded the excel file of the responses for cleansing process. Then, the researcher conducted analysis of the data and information using the appropriate statistical tools and provided interpretation to answer the research questions of the study.

To determine the extent of gamification in the class, a researcher-validated survey questionnaire was used as the main data gathering tool. The indicators focused on the employment of gamification or game-based learning approach in the class. On this, the researcher used a 4-point Likert scale in quantifying the extent of the integration of gamification in teaching science and mathematics in the secondary schools in DepEd-Camiguin.

The validity of the research instrument was done through the face validation of the three experts coming from the education agency and

higher education institutions in Camiguin with authority on the subject matter. Given the indicators, the validators were asked to comment by giving a response of retain, revise, and delete. These responses were quantified by assigning arbitrary values where retain was scored with 3, revise a score of 2, and delete a score of 1. The responses of the validators in each of the indicators were summed up and divided by 3. The quotient was used as to retain, revise, or delete the indicators based on a scoring guideline provided for the purpose.

After the validation, the researcher proceeded to pilot test the survey questionnaire. An online link was given to the pilot test respondents for them to respond within two weeks. After this time frame, the responses were downloaded for reliability test using the Cronback alpha value of 0.05 significance level. Thirty (30) science and mathematics teachers from the junior and senior high schools in the Mambajao NHS and Tupsan NHS were used as respondents in the pilot testing of the online data gathering tool. Two weeks after the link of the online tool was given to the respondents, the researcher downloaded the responses in excel file. This was analyzed using the data analysis toolkit of the excel program.

The use of appropriate statistical tool in analyzing the data and information is indeed very important to provide reliable results, interpretation, and discussion. On this regard, each of the research question is assigned to a particular statistical tool using the data analysis toolkit of the excel program already embedded in the gadget. Moreover, the appropriateness of the statistical tool being used was based on the normal distribution of data.

The responses were quantified by assigning arbitrary values to determine the extent of the integration of gamification in teaching science and mathematics among the junior high school students in the select public schools in DepEd-Camiguin. The researcher used the table below in capturing the purpose of this study.

Table 3 provides the guidelines in determining the extent of integration of gamification in teaching junior high science and mathematics subjects.

Table 3. Guide in Determining the Extent of Integration of Gamification in Teaching

| Arbitrary Values | Limits      | Qualitative Description | Interpretation                         |
|------------------|-------------|-------------------------|----------------------------------------|
| 4                | 3.26 - 4.00 | High Extent             | Gamification is always integrated.     |
| 3                | 2.51 - 3.25 | Moderate Extent         | Gamification is moderately integrated. |
| 2                | 1.76 - 2.50 | Less Extent             | Gamification is seldom integrated.     |
| 1                | 1.00 - 1.75 | No Extent               | Gamification is never integrated.      |

## Results and Discussions

This part provides the statistical data as well as the corresponding analysis and interpretation. The presentation follows the arrangement of the research questions.

### *Demographic profile of the respondents in terms of sex, age, highest educational attainment, years in service, field of specialization, and teaching position*

Out of 54 target respondents, 50 (93%) of them were able to respond the survey

questionnaire. Frequency count and percentage were used to analyze the data to answer the question. This is shown in Table 5.

It can be seen in the table that 41 (82%) of the respondents were females, only 9 (18%) males. This is observable in all schools in DepEd-Camiguin since majority of the teachers are females. For this, it can be understood that science and mathematics are now handled by majority of female teachers. This further means that the once dominated discipline by males are now taken over by females.

Table 5. Demographic Profile of the Respondents of the Study (N = 50)

| Variable                           | Frequency Count | Percentage (%) |
|------------------------------------|-----------------|----------------|
| <b>Sex</b>                         |                 |                |
| Female                             | 41              | 82             |
| Male                               | 9               | 18             |
| <b>Total</b>                       | <b>50</b>       | <b>100</b>     |
| <b>Age</b>                         |                 |                |
| 20 to 30                           | 16              | 32             |
| 31 to 40                           | 17              | 34             |
| 41 to 50                           | 14              | 28             |
| 51 and above                       | 3               | 6              |
| <b>Total</b>                       | <b>50</b>       | <b>100</b>     |
| <b>Teaching Position</b>           |                 |                |
| Master Teacher 1                   | 2               | 4              |
| Teacher 1                          | 29              | 58             |
| Teacher 2                          | 3               | 6              |
| Teacher 3                          | 16              | 32             |
| <b>Total</b>                       | <b>50</b>       | <b>100</b>     |
| <b>Number of Years of Teaching</b> |                 |                |
| 1 to 10 years                      | 34              | 68             |
| 11 to 20 years                     | 8               | 16             |
| 21 to 30 years                     | 6               | 12             |
| 31 years and above                 | 2               | 4              |
| <b>Total</b>                       | <b>50</b>       | <b>100</b>     |
| <b>Educational Attainment</b>      |                 |                |
| Bachelor's Degree                  | 16              | 32             |
| Master's Degree Graduate           | 15              | 30             |
| With Units in Master's Degree      | 19              | 38             |
| <b>Total</b>                       | <b>50</b>       | <b>100</b>     |

| Variable                       | Frequency Count | Percentage (%) |
|--------------------------------|-----------------|----------------|
| <b>Field of Specialization</b> |                 |                |
| Science                        | 28              | 56             |
| English                        | 4               | 8              |
| Mathematics                    | 15              | 30             |
| TLE                            | 3               | 6              |
| <b>Total</b>                   | <b>50</b>       | <b>100</b>     |

The ages of the respondents reveal that 33 (66%) of them were on the combined age groups of 20 to 30 and 31 to 40 years old, only 17 (44%) were on the age groups of 41 to 50 and 51 and above years old. This means that the science and mathematics teachers are young, only a few are nearing retirement, in the districts of Sagay, Guinsiliban and Catarman.

The teaching position of the respondents agrees to their ages. It can be gleaned that 29 (58%) were in Teacher 1 position, 19 (38%) in Teacher 2 and 3 positions, and 2 (4%) in Master Teacher position. This means that more than half of the teachers need mentoring or technical assistance in the delivery of lessons to the learners.

The number of years in teaching also agree to other variables like teaching position and age groups of the respondents. The table shows that 34 (68%) of the respondents served for 1 to 10 years, 8 (16%) for 11 to 20 years, and 8 (16%) for 21 years and above. This implies that more than half of the respondents are young and need technical assistance in delivering lessons to the learners.

However, the highest educational of the respondents shows that 16 (32%) have not yet attempted to enroll in graduate school, 19 (38%) earned already units in master's degree course, and 15 (30%) finished already their master's degree course. This only shows that the respondents felt the need to pursue graduate studies for professional and personal growth.

Since the respondents came from secondary schools, they have their area of specialization or major subject of concentration. It is

noticeable that 28 (56%) of the respondents are major in biological science, followed by 15 (30%) in mathematics, 4 (8%) in English, and 3 (6%) in TLE. It can be recalled that this inquiry is about the integration of gamification in teaching, hence the teachers with English and TLE majors were utilized or given science and mathematics loads in the school. This boils down to the mismatch scenario in secondary schools.

#### ***Extent of the integration of gamification in teaching Science and Mathematics among junior high school students***

Mean and standard deviation were used as tools in analyzing the responses to answer the problem. It can be seen in Table 6 that the indicators were already arranged in descending order through the means of the responses.

The table shows that the respondents had "Moderate" integration of gamification in teaching science and mathematics ( $M = 3.12$ ). This means that the respondents often integrated gamification in the teaching and learning process. While the standard deviation (SD) of 0.85, a value less than one, simply implies that the responses clustered closely to the mean. Meaning, the respondents had almost the same responses to the indicators. This SD value could have been smaller if the responses about using online platform for game-based learning were like the other indicators. It could also be understood that, minus the idea of gadget and internet use in gamification, the overall mean for the extent of the integration of gamification could have been higher if the indicators focused on activities without the use of technology.

*Table 6. Extent of the Integration of Gamification in Teaching Science and Mathematics*

| Indicators                            | Mean | Description |
|---------------------------------------|------|-------------|
| Promoted collaborative activities     | 3.66 | High Extent |
| Used activities that develop teamwork | 3.46 | High Extent |

| Indicators                                             | Mean        | Description     |
|--------------------------------------------------------|-------------|-----------------|
| Grouped students in solving a given problem            | 3.24        | Moderate Extent |
| Encouraged students to engage in classroom competition | 3.20        | Moderate Extent |
| Applied leaderboard approach                           | 2.96        | Moderate Extent |
| Used online platforms for game-based learning          | 2.18        | Less Extent     |
| <b>Overall Mean</b>                                    | <b>3.12</b> | <b>Moderate</b> |
| <b>Standard Deviation</b>                              | <b>0.85</b> |                 |

Two of the indicators got “*High Extent*” which means that gamification was always integrated. The respondents revealed that they always promoted collaborative activities ( $M = 3.66$ ) in the class. This was followed by using activities that develop teamwork ( $M = 3.46$ ). These two indicators are closely related to each other. These activities may not require the participants to use gadgets and internet connection. Collaborative activities may include group discussions and sharing tasks with a partner or in a group. The activities can surely develop teamwork among the learners in a group.

Besides, three of the indicators were responded with means at “*Moderate Extent*”. This implies that the respondents were fairly using gamification in the class. These indicators were composed of students in a group solving a given problem ( $M = 3.24$ ), encouraged students to engage in a classroom competition ( $M = 3.20$ ), and the application of the leaderboard approach ( $M = 2.96$ ). In these indicators, gadgets and internet connection are not necessary to carry out the activities. These are performance tasks the learners perform with fellow learners in the classroom. These are some forms of gamification that can be applied in the classroom to encourage and motivate learners to become active and responsive in the learning activities.

The respondents disclosed that they had “*Less Extent*” in using online platforms for game-based learning ( $M = 2.18$ ). This revelation is highly probable since learners in the public schools do not have personal gadgets like laptops to use in online activities. Moreover, the internet connection in the schools is just enough for the office personnel to use. Hence, it is reasonable to believe that online platforms for game-based learning is rare to happen in the teaching and learning process.

The method used by the respondents in introducing gamification is like the study of Tupas and Palmares (2018). Accordingly, there were materials being used following the concept of gamification for below average learners to help them understand and appreciate the lessons given to them. This answers to the idea that the respondents rarely use online gamification using gadgets since learners and teachers did not have them plus the absence of internet connection in the classroom. For this, the respondents resorted to using activities promoting the concept of gamification like the development of collaboration and teamwork (Boudadi & Gutiérrez-Colón, 2020). This implies that the teachers should not depend too much in online game-based learning materials but be resourceful to use other means to improve learnings.

### ***Academic performance of the junior high school students in the first quarter of the school year 2022-2023***

The academic performance of the respondents' learners is used as basis of understanding further the extent of the integration of gamification in the teaching and learning process. In doing this, the average of the learners' ratings in science and mathematics classes was used as the performance of respondent's class supposedly using gamification in learning the lessons. Hence, the ratings equaled the number of the respondents ( $N = 50$ ).

Table 7 provides the academic performance of the respondents. The researcher grouped the academic performance of the respondents following the rating scale issued to all public elementary and secondary schools in the Philippines contained in DepEd Order No. 8, s. 2015.

Table 7. Academic Performance of the Respondents in Science and Mathematics (N=50)

| Rating Scale                                                  | Frequency Count | Percentage | Description       |
|---------------------------------------------------------------|-----------------|------------|-------------------|
| 90 to 100                                                     | 4               | 8.00       | Outstanding       |
| 85 to 89                                                      | 35              | 70.00      | Very Satisfactory |
| 80 to 84                                                      | 11              | 22.00      | Satisfactory      |
| Overall Mean of the Ratings: <b>86.10</b> (Very Satisfactory) |                 |            |                   |
| Standard Deviation: <b>2.34</b>                               |                 |            |                   |

The table shows that 35 (70%) out of 50 learners got average ratings within the range of 85 to 89 with a description of “*Very Satisfactory*” performance. This means that the learners’ work was accurate and highly acceptable. Then, 11 (22%) had average ratings within the range of 80 to 84 with a description of “*Satisfactory*” performance. This implies that the learners did a fairly good work, with few errors, and of course, acceptable. While only 4 (8%) got ratings within 90 to 100, or in the outstanding level. This means that the learners had accurate and exceptional work performance.

As an overall performance of the respondents’ learners, an average of 86.10 was obtained which fall in the range of 85 to 89 with a description of very satisfactory performance. This means that the performance of the learners was accurate and highly acceptable. The standard deviation ( $SD = 2.34$ ) of the ratings also suggests that, in the first place, the ratings did not have outliers or extreme ratings. This SD value also supports the idea that majority of the ratings clustered to the very satisfactory performance level.

The present study considered the ratings of the learners as a reflection of the administration of gamification in the teaching and learning process. The performance of the

respondents’ learners agrees to the study of Dizon et al. (2022) which used quantitative and qualitative data on the effect of gamification in the achievements of the learners. Although the respondents of the study used only offline activities as gamification approach in the class, still the performance of the learners could attest to the idea that collaboration and teamwork among the learners can help improve learning outcomes. This result also connects to the study of Marcaida et al. (2022) which found out the effect of gamification in the academic performance of the learners, since learning becomes interesting and meaningful to the learners.

#### ***Significant relationship between the integration of gamification in teaching science and mathematics and the academic performance of junior high school students***

The researcher used Spearman rho correlation since the data were found not normally distributed. Table 9 shows that there was a positive but low correlation and significant relationship ( $r(48) = 0.34, p = 0.014$ ) between the extent of integration of gamification and the academic performance of the learners. This implies the rejection of the null hypothesis at 0.05 significance level.

Table 8. Relationship Between Integration of Gamification and Academic Performance of the Students

| Variables               | Coefficient ( $r_s$ ) | t-stat | t-crit | p-value | Decision     |
|-------------------------|-----------------------|--------|--------|---------|--------------|
| Gamification vs Ratings | 0.34                  | 2.54   | 2.01   | 0.01    | Reject $H_0$ |

As shown in Table 8, it can also be understood that 34 percent of the academic performance of the learners was influenced by gamification. This further implies that as the application of gamification increases in the class there is likelihood for the academic

performance to also increase. Integration of gamification was mildly applied.

This correlation result connects to the study of May (2021) which investigated the effect of gamification in the achievement of the learners in the class. According to the previous

study, there is a high probability that the performance of the learners in the class would increase since gamification ushers understanding due to teamwork and collaboration as they engage in learning activities. Hence, the correlation between gamification and academic performance is positive in this present work.

### **Significant difference on the extent of the integration of gamification in teaching science and mathematics to junior high school students when grouped by variable**

The researcher used analysis of variance (ANOVA) to determine the significant difference on the extent of the integration of gamification in teaching by demographics. The data

analysis toolkit of the excel program was used since this is embedded already in the gadget. The result of the test is presented in Table 9.

The table shows that there were no significant differences on sex ( $F(1, 48) = 0.86, p = 0.36$ ), age ( $F(3, 46) = 0.19, p = 0.90$ ), teaching position ( $F(3, 46) = 0.07, p = 0.98$ ), number of years of teaching ( $F(4, 45) = 0.33, p = 0.86$ ), highest educational attainment ( $F(2, 47) = 0.27, p = 0.77$ ), and field of specialization ( $F(3, 48) = 0.86, p = 1.30, p = 0.29$ ). This means a failure to reject the null hypothesis of the study at 0.05 significance level. This implies that the variables did not influence the integration of gamification in teaching the lessons in the class.

*Table 9. Test of Significant Difference on the Extent of Integration Gamification According to Variable*

| Variables                      | F-comp | F crit | P-value | Decision               |
|--------------------------------|--------|--------|---------|------------------------|
| Sex                            | 0.86   | 4.04   | 0.36    | Failed to Reject $H_o$ |
| Age                            | 0.19   | 2.81   | 0.90    | Failed to Reject $H_o$ |
| Teaching Position              | 0.07   | 2.81   | 0.98    | Failed to Reject $H_o$ |
| Number of Years of Teaching    | 0.33   | 2.58   | 0.86    | Failed to Reject $H_o$ |
| Highest Educational Attainment | 0.27   | 3.20   | 0.77    | Failed to Reject $H_o$ |
| Field of Specialization        | 1.30   | 2.80   | 0.29    | Failed to Reject $H_o$ |

The present work aligns to the study of Christopoulos and Mystakidis (2023) the adoption and advancement of gamification entirely depends on the end-users. The failure of the demographics to influence the extent of the integration of gamification could be due to offline activities being used in the class. The respondents did not use online game-based learning approach due to lack of gadgets like laptops and computers and insufficiency of internet connectivity.

### **Challenges encountered by the respondents in the integration of gamification in teaching Science and Mathematics to junior high school students**

The researcher included in the survey questionnaire an open-ended question which asked about the challenges encountered by the teachers in the integration of gamification in teaching. The responses were tallied and ranked as it is presented in Table 10.

*Table 10. Challenges Encountered by the Teachers in the Integration of Gamification*

| Challenges                                    | Rank |
|-----------------------------------------------|------|
| Lack of gadgets like laptops and computers    | 1    |
| No internet connection                        | 2    |
| Lack of access to online game-based platforms | 3    |
| Teachers are not computer literate            | 4    |
| Time consuming                                | 5    |

The responses of the respondents revealed that the absence of laptops or computers and

internet connection in the classroom are the most common reasons for not having online

gamification in the classroom. However, the teachers were able to administer gamification by giving activities that would likely develop collaboration and teamwork among the learners in the class. This means that gamification was experienced minus the gadgets and internet connection.

The teachers also divulged that they could not access online game-based platforms since subscription is required. This means that it needs money to access game-based learning materials to use in teaching Science and Mathematics in the class. This is another reason that the teachers resorted to using activities requiring no gadgets, internet connection, and financial support.

Another challenge is the computer literacy of the teachers. Although teachers were given capability building to use computer for teaching and learning, the teachers cannot practice or put into exercise their knowledge in using computers because they do not have computers to use in school. Besides, it needs time for them to practice the learnings they got from the training. This would then affect the time they need to prepare or plan in teaching a lesson. Hence, computer literacy and time to use are additional challenges encountered by teachers in the integration of gamification in teaching.

These challenges encountered by the respondents are like the findings of the study of May (2021). The use of online game-based learning can be hardly achieved due to challenges so difficult to address. Previous study revealed that the availability of gadgets, the preparedness of the teachers as well as the resistance to use technology are some of the challenges that can hamper the application of gamification in the teaching and learning process. The challenges of the previous study relate so much to the present work since the challenges were on the basic needs of gadgets and internet connection, the ability of the teacher to use the technology, and time management. Hence, the respondents opted offline activities in introducing gamification to the learners.

## Conclusions

From the findings of this work, science and mathematics were handled mostly by the female respondents. Majority were in Teacher I

position who belonged on the age group of 20 to 40 years old, served for a range of 1 to 10 years, obtained graduate studies, and majored in science subject. There was a moderate integration of gamification in teaching Science and Mathematics by using offline activities to develop collaboration and teamwork among the learners in the class. The learners of the respondents had a very satisfactory academic performance in science and mathematics. There was a positive but low correlation as well as significant relationship between the extent of gamification and the academic performance of the learners. Moreover, there were no significant differences on the extent of the integration of gamification in teaching science and mathematics among the respondents when grouped according to sex, age, educational attainment, number of years in teaching, field of specialization, and teaching position. The lack of gadgets like laptops and computers was the most pressing challenge in the integration of gamification.

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