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Chapter 1:

Introduction:

In the education field, the term gamification was underheard of until a little more than two decades ago. There are many publications on the use of gamification in education. A number of researchers reported the effectiveness of using gamification and how it is used as a tool or service incorporating gaming elements such as point scoring and digital badges into other areas of activity to engage students in problem-solving to get better test grades as a result. The introduction of rewards when a student reaches a specific goal is considered one technique in gamification education for motivation and engagement. Some programs such as Khan Academy have a badging system as an educational tool for teaching a specific branch of a subject matter.

The reason for the introduction of gamification in the field of education is that a great number of high school students were struggling with learning specific content areas and that led some of them to suffer from anxiety. Therefore, educators started to consider transferring their teaching methods from just relying on traditional learning to incorporating the gamification of education where learners are open to learning at the comfort of their own pace. Still, little is known about the extent to which digital elements of gamification are being used to help students get better scores on a test at the high school math level in Jersey City public schools in the state of New Jersey and how teachers perceive the usefulness of gamification and incorporate it in their daily lesson to use it more often.

Statement of the Problem:

The problem explored in this study comes from the fact that a large number of students were struggling with various content areas at the high school level, especially in the area of mathematics. The lack of using gamification as a tool to enhance students' progress could be part of causing this issue to erupt. Of course, that does not eliminate traditional teaching completely because the goal is to keep students learning and growing academically. Since the concept of gamification exists, teachers need to evaluate their attitudes for the benefit of utilizing this strategy for their students to enhance their performance, so they can reach their maximum potential and obtain their optimum goal.

Teachers, particularly, in the area of mathematics must evaluate what kind of result they may get when they just depend on traditional teaching on students' scores in a certain assessment in comparison with using a gamification strategy. In fact, algebra I, geometry, and Algebra II involve lots of problem-solving and critical thinking that require using appropriate technology tools that may help to fulfill the purpose. Therefore, in case students do not perform well in such assessments, they will not possess the necessary skills to function after high school and the 21st-century competencies in general. Teachers may think that using gamification in their classes may cause conflict with their role as teachers who lecture in the class. However, students in the 21st century use technology and are heavily dependent on it, so, why can't it be used to improve their learning?

Purpose:

The purpose of the present study is to show the effect of gamification on test scores. It is to reveal how the use of gamification relates to a student's achievement on a single math assessment. So, the study will show if there is a positive correlation, negative correlation, or no correlation. It is also to find out how often high school math teachers use gamification in their math classrooms; is it daily, every other day, or not even using it at all?

The data from this study can be used then to help students do well in various assessments for the math area as well as other content areas at the high school level. Therefore, it is essential for teachers to evaluate their attitudes about the usage of gamification in their math classes. By learning about gamification, teachers get to be convinced to incorporate gamification in their lesson plans. Positive correlations, negative correlations, or even no correlation between the two variables (teachers' attitudes as it affects the usage of gamification and students' scores in an assessment) can be determined from this research study. To address the true correlation, this study seeks to answer the research questions.

Research Questions:

1. How does the use of gamification relate to student achievement on a math assessment?
2. How often do high school math teachers use gamification in their math classrooms?

Chapter 2 - Literature Review

Introduction:

Math is perceived as a complicated and tedious subject for a great number of high school students. Some researchers suggest that students' struggles can be associated with the way the various concepts are taught. Regardless of the method used to teach a subject or even a topic, students need to pass a certain number of math classes to earn their high school diploma. For example, in the Jersey City district, high school students have to complete three math classes (Algebra I, geometry, and Algebra II) to graduate high school and even in some states "Freshman students were required to complete four high school math credits" (Van Slyke, 2021). So, when it's time for an assessment, students need to do well to be able to move successfully from one branch within the math subject to another, as, "Each test comprises content or calls upon processes that contribute specific variance to performance on that test." (Meyer, 2021).

Without a valid intervention, assessments may cause math anxiety in a certain number of high school students. Math anxiety term is defined as "The emotional state exhibited by students when performing mathematical operations" (Clarke, 2021). That gives urgency for teachers to intervene to ease the burden on their students. Teachers need to understand that gamification as a process to game-like can be used in an educational setting to assist students in being ready for such assessment. Some researchers noted that gamification can improve student engagement which leads to better assessment scores since gamified activities make math concepts easier to

remember. However, like most other research studies, there are always shortcomings to the findings, but the positives of the intervention certainly outweigh the negatives.

Studies and Theory:

As mentioned, students' lack of motivation regarding math content has become an issue that needed awareness from math teachers to start using gamification strategies in their classrooms for students to get better scores on an assessments. The utilization of gamification is essential to be incorporated into math topics such as fractions. Research reveals that "Schools face an instructional dilemma with how to create a motivational environment where fractions are fun, interactive, and induce problem-solving skills through the real-time application" (McCray, 2019). Also, students adopt a more positive attitude toward content areas when gamified learning is incorporated. Besides, they are more engaged in the subject as the process of gamification helps relieve the repetitive nature of practicing one question after another. Other benefits of gamification also include increased motivation in learning and productivity.

Innovation in educational technology in the form of game-like emerged in the area of math education besides traditional learning. For example, for students to learn complex algebraic mathematics, they need suitable tools to facilitate the topic so they can do well in an assessment. "Educators could use the elements of game design to facilitate the motivation, engagement, and cognitive skills necessary to better enrich the learning environment" (McCray, 2019)

One of the elements that utilizing gamification is more beneficial to math subjects than just traditional teaching is the motivation and engagement that it yields. Some researchers mentioned that significant increase in motivation with coursework that provided rewards such as digital badges on completion of an assignment compared to similar students who did not receive badges for, “Gamification, the process of using game-like elements in nongame situations, increases student engagement and comprehension” (Marks, 2021)

Another factor for utilizing gamification in math classes is to improve test scores. Since it improves, “Students’ critical thinking and achievement” (Marks, 2021). Therefore if students benefit from the gamification strategy to improve their different skills, that should lead to better test results as it encourages learning beyond textbooks. It brings learning to life and encourages students to make connections between mathematics and the world around them. Consequently, that may hopefully give teachers a chance to see the problem and shift their instruction to using gamification strategies.

Researchers mentioned some drawbacks of gamification as a teaching tool. Some researchers noted that “A part of what makes gamification difficult to study is that it can vary widely in its implementation” (O’Brien, 2021). Furthermore, “It is unclear if teachers have the flexibility and support to implement such innovation” (O’Brien, 2021). As teachers do not seem to have a basis for how to use gamification daily because of insufficient training and unfamiliarity with how and why gamification should be utilized in their classes.

Other researches reveal that the idea of using gamification in classrooms wastes valuable instructional time and shifting to gamification would not maintain the normal classroom setting. Also, because gamification has several elements available that teachers can implement, “It remains unclear as to which strategies teachers already implement and find effective and which require improvement” (O’Brien, 2021) A potential shortcoming of using gamification “Could increase students’ cognitive loads, making the results less beneficial in the long term” (Marks, 2021)

Using gamification is still vital to improving test scores if used efficiently as a tool, therefore, it has to be utilized in math classes regularly when teachers change their attitude and get to know how it is beneficial to their students and start to use it more effectively. Therefore, it is not surprising that gamification has been addressed and implemented in an educational setting by some educators. Research shows that teachers, “Used at least one gamification element at some point in their teaching, used some elements more than others depending on their familiarity with them, and perceived that different elements of gamification affected different students in different ways” (Marks, 2021)

Summary:

Researchers have different findings about gamification in education. The benefits and disadvantages of using gamification in the classroom are both discussed. Some research reveals that it is imperative for teachers to use different tools to allow students to be active participants in their classes. If students are motivated and actively

participate in the subject, they will do well in an assessment. As a matter of fact, it is recommended "... as an assessment tool in higher education" (Zhou et al., 2019)

Some of them found it to be a motivational tool to enhance students' performance. However, other researchers found that it does not do much to students' overall performance. "There is insufficient evidence-based research into the efficiency of all of the gamification's elements" (O'Brien, 2021).

Chapter 3 - Methodology

Introduction:

Gamification is a promising means of motivating students since it is considered a process of a game-like tool. It has many forms and can be used successfully in high school math classes to improve test scores. Unsurprisingly, students work best in math classes when they receive some sort of reward, even the digital one. Teachers can use points or badges or any other rewards of gamification strategies that can improve students' motivation.

This quantitative study will attempt to identify the relationship between gamification as a tool for teaching math to high school students and student scores on an assessment, how often math teachers use gamification in their classrooms and the effect of using it on an assessment. Direction for teachers will be provided through the use of data for their schools and even for future research in the field of math education.

Research Design:

The research design for this study is quantitative. It requires the collection of quantitative data. “The first step in the process of collecting quantitative data is to identify the people and places you plan to study” (Creswell & Guetterman, 2019). It is designed to examine the correlation between two variables. “A correlation is a statistical test to determine the tendency or pattern for two or more variables or two sets of data to vary consistently” (Creswell & Guetterman, 2019).

Correlational research is research that deals with observing how two variables are positively or negatively related or even have no relationship at all. It is useful for, “Testing the correlation of scores on two different measures to gather evidence of validity” (Creswell & Guetterman, 2019). The purpose of this quantitative study is to identify the impact of the variable of gamification on the variable of students’ test scores as teachers use gamification in their classrooms regularly. Pre and post-test learning outcomes and survey data will be analyzed for this research

Hypothesis and scientific methodology are what the entire research will depend on. “Hypotheses are statements in quantitative research in which the investigator makes a prediction or a conjecture about the outcome of a relationship among attributes or characteristics” (Creswell & Guetterman, 2019). Despite that correlational research calculates the relationship between two variables, “It cannot assume cause and effect, so a strong correlation between variables may be misleading” (Creswell & Guetterman, 2019) for this research, a cross-sectional survey design will be used with the quantitative survey to analyze any correlation between gamification and test score. “A cross-sectional study design is when the researcher collects data at one point in time”

(Creswell & Guetterman, 2019). There is an expected relation that the more using gamification in math classes the better the score will be on a test.

Population & Sample:

The population of this study is teachers in high schools who work in the Hudson County school district. “A population is a group of individuals who have the same characteristics... population can be small or large” (Creswell & Guetterman, 2019). The target population for this study is high school teachers in the public school district in Jersey City, New Jersey. “A target population is a group of individuals with some common defining characteristics that the researcher can identify and study” (Creswell & Guetterman, 2019). In fact, it is just high school math teachers who teach grades 9 to 12 “The population is the group that is chosen with characteristics that differentiate them from other groups” (Creswell & Guetterman, 2019) the researcher will use online questionnaires since the ability to gather data from a population in a quick and inexpensive manner. “Convenience sampling will be used based on the participant’s willingness to participate in the survey” (Creswell & Guetterman, 2019)

Instrument:

Appendix A and Appendix B will be used in this research. Appendix A is the letter to the superintendent. Appendix B is the survey for this study to be created. The reason for creating it is because there was no other study found that analyzed the same or even similar information. Some questions in that survey involve demographic information about the high school math teachers. Other questions will determine their attitude toward the use of gamification and its effect on students’ motivation and test

scores as a result. “The survey will be piloted with a group of 15 teachers in their own school district to identify any problems in the survey, such as unclear or poorly worded questions” (Creswell & Guetterman, 2019)

Procedures:

Step 1: obtain authorization from New Jersey City University before conducting the survey.

Step 2: Perform a pilot study with a number of participants to make certain the survey is concise and clear.

Step 3: Send an email (Appendix A; Sample) to the superintendent of Jersey City Public Schools to get consent for the research.

Step 4: Allow teachers three weeks to complete the survey (Appendix C) that will be sent via email to those who voluntarily participate in the research.

Step 5: Send a reminder at the beginning of these three weeks.

Step 6: Close the research at the end of the three-week time frame.

Step 7: Generate a chart and spreadsheets of the quantitative data.

Step 8: Answer the two research questions based on this analysis of the data.

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Appendix A

Superintendent Name

School Address (School City, New Jersey, Zip Code)

Dear _____,

I am writing to request your permission to conduct a research survey with high school teachers. I am currently a doctoral student in the Educational Technology Leadership program at New Jersey City University. This quantitative study describes the effects of gamification on students' assessment. I hope to get all high school teachers in your district to participate in the study. My population will be high school math teachers. They will receive an email from me upon your approval.

Participation is voluntary. High school math teachers feel free to ask any questions after receiving the email. Anonymity will be provided for all participants for they will not be required to disclose their names. I would be happy to answer any questions or concerns you may have. Thank you for your consideration and cooperation. I look forward to hearing from you.

Sincerely,

Janet George

New Jersey City University

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Appendix B

1. What grade level(s) do you teach?
 - ☐ 9
 - ☐ 10
 - ☐ 11
 - ☐ 12
2. How many years have you been teaching in a school?
 - ☐ 1-4
 - ☐ 5-8
 - ☐ 9-12
 - ☐ 13-16
 - ☐ 17-20
 - ☐ 21+
3. Which of the following do you teach this year?
 - ☐ Algebra 1
 - ☐ Geometry
 - ☐ Algebra 2
 - ☐ Algebra 2/Trigonometry
 - ☐ Statistic
 - ☐ Pre Calculus
 - ☐ AP Calculus
4. Which classroom setting are you in this year?
 - ☐ General Ed.
 - ☐ Inclusion
 - ☐ self-contained
 - ☐ Honor
 - ☐ In class-support
5. Do you volunteer to participate in this study?
 - ☐ Yes,
 - ☐ No
6. Which day(s) of the week do you use gamification strategies?

Day of the Week	Yes	No
Monday		
Tuesday		

Wednesday		
Thursday		
Friday		

7. Type of gamification elements used in math class

Element	Yes	No
Points		
Leaderboards		
badges		
Something else (Please specify)		

8. Have you ever used game-like as a graded assessment such as a test?

☐ Yes,

☐ No

9. Indicate how much you agree with the following statement:

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I like to use gamification for teaching math					
Gamification is important for motivating students					
A gamification is an essential tool in math					

