

# A CROSS SECTIONAL QUANTITATIVE ANALYSIS ON THE USE OF GAMIFICATION AND GAMING CONCEPTS TO IMPROVE AND OVERCOME LEARNING OBSTACLES

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### RESEARCH TITLE:

A cross-sectional quantitative analysis on the use of gamification and gaming concepts to improve and overcome learning obstacles

### RESEARCH BACKGROUND:

The learning method and how staff training has been done has remained almost static for the last 100 years with the advent of technology and psychology this has led to the improvement of many fields and systems the primary focus of this paper will be gamification as per Merriam Webster dictionary states “the process of adding games or game like elements to something (such as a task) to encourage participation” and the psychological impact of gamification which one example of the use of gamification through playful logical process developed and determined by the teachers showed a level of min 74% and showed that “ All areas of gamification technique such as academic achievement, cooperation, behaviour, and Familiarizing Modified Filipino Games were all highly received positively” therefore we can conclude that gamification improves education (Maryann H. Lanuza, 2020) (Permanyer and Boertien, 2019) (Nnanyereugo, n.d.)

### RESEARCH PROBLEM:

The schooling and training system tends to favour the select few where the students who can absorb knowledge and regurgitate knowledge excel and those who need a more practical or abstract understanding suffer. (Eccles et al., 1993)

This is found within subjects and career fields such as maths, computer sciences, and software systems. As a case in point, the TikTok CEO interrogation showed little to no retention of technology learning within politicians. (Maruf, 2023)

Ensuring that those who are capable but don't match a specific way of thinking never excel or end up working within said subjects or fields however many changes have been made in equality and accessibility but not method and manner of learning. (NCTE, 2020) (Permanyer and Boertien, 2019)

This needs to be solved as there is a link between high learning anxiety and low satisfaction due to over-testing and rigid learning methods (Wang and Tahir, 2020)

This can be solved with computer sciences as most times the use of software is involved in solving these issues, case in point is the use of Minecraft to teach history which is coded in Java.

problem statement: can gamification improve the problems caused by traditional learning?  
(Nnanyereugo, n.d.)

### RELEVANCE/ MOTIVATION:

AUDIENCE: Department of Education/privatized schools/education research

Case in point as per the above studies many students suffer from learning anxiety and mental blocks which is due to the nature of how the subjects are taught the above citations state that often the students are overburdened by a lack of personalized learning experiences and a heavy reliance on a large number of tests this leads to learning anxiety with subjects such as maths, sciences and computers and its programming, which creates a fundamental flaw for the student as it takes away power from them instead of empowering them and to conclude the analysis will be looking at gamification as a solution and this ties into computer sciences as many of the cases in gamification use apps such as Minecraft Edu, android or iOS Kahoot and class dojo which is covered by most modules in application development (Robertson and Nunn, 2007) (Nnanyereugo, n.d.) (Dobson, 2012)

### RESEARCH QUESTIONS:

How does gamification overcome the general obstacles within the education system?

- What are the effects of gamification in maths, sciences, and English
- What are the Effects and downfalls of gamification learning within problematic subjects?

### RESEARCH HYPOTHESES

Create null hypothesis

- School systems are not affected by the use of gamification
- Gamification can be used to improve learning and teaching capabilities

(Udjaja, Guizot and Chandra, 2018)

## THEORETICAL FOUNDATION:

Gamification learning theory is the method in which systems of teaching and training use games and game-like concepts to enhance the quality and capability of the system allowing for a varied learning process (Sailer and Homner, 2019)

The theory I will be identifying is the shift in education to gamification (Ofosu-Ampong, 2020) is a proposed theory that states the use of gamification in the education system aids learning and reduces issues such as learning and social anxiety and I will be looking at the effects of this using several research papers as such my theory is **the effects of gamification in the education system (Ofosu-Ampong, 2020)** and this is proposed for many reasons such as lack varied learning approaches, lack of understanding, learning anxiety and over-testing, the papers argues that the system does not adequately allow for students to understand and learn about the subject within the system especially within English, maths and sciences often developing learning anxiety from the current methodology and through gamification allowing for a much better avenue in learning and capability through the use of less stringent but playful and logical approach that deals with some of the issues such as the over-testing of applied subjects

This is linked to the research question as there is a prominent issue within the schooling system as stated by (Maryann H. Lanuza, 2020) who looked at mathematics but concluded that this can be applied to any field of learning with above satisfactory results but not restricted from similar papers in which similar effects were found in English and the sciences where gamification aided the learning this was also seen in foreign subjects such as ESL

The integrative Gamification Technique in Teaching Specialization Courses in Mathematics states that the results of the use of gamified mathematics were received positively with a satisfaction rating of a minimum of 73% and can be used in other courses not just the above mathematics which answers the question of "What are the effects of gamification in maths, sciences and English" (Udjaja, Guizot and Chandra, 2018)

## LITERATURE REVIEW:

### INTRODUCTION:

To analyze the contributing factors to the problems of the current method of teaching and learning and how the role of gamification improves or fixes it while improving upon the quality of learning will be analyzed through independent papers per subject allowing for a conclusive finding through maths, science, English, and software

### ***EFFECTS OF GAMIFICATION WITHIN MATHEMATICAL EDUCATION:***

This paper looked at individually and the capability to apply the concept elsewhere and thus allowing to fix multiple issues with similar solutions and starting with the paper titled the As Integrative Gamification Technique in Teaching Specialization Courses in Mathematics , this paper starts of by looking at how it affects mathematics courses which are currently plagued by over testing and anxiety, the paper goes on to explain that there is a high rate of failure among maths students showing a significant decrease in students from first to 4<sup>th</sup> year going from 73 to 31 within the following 6 subjects College and Advanced ,Algebra, Plane Geometry, Solid Geometry, Plane Trigonometry, Calculus 1, and Abstract Algebra then the gamification techniques were applied through playful and logical means and was dependent on the class within the students of 181 and this showed that the men were more receptive to the gamification techniques over women while over the four years showed an improvement satisfaction pass rate of lowest 65% and up to 85.2% , the respective results were as follows: (KARAMERT and KUYUMCU VARDAR, 2021) (Lanuza, 2021).

Calculus 1: 85.29

Solid Geometry: 78.79%

Abstract Algebra: 77.2%

Plane Geometry:74.61%

Plane Trigonometry 73.56 %

Advanced Algebra 65.31%

Similar results were found in The Effect of Gamification on young mathematics learners' Achievements and Attitude where the marks were as follows

Pre-test percentages: 27.89 Post-test percentages: 60.14

Also showing a significant increase in performance (KARAMERT and KUYUMCU VARDAR, 2021,p.103)

However, despite the positive impact a challenge was found and calls for improvement within abstract mathematical concepts which can be improved upon by creating the abstract theology into visual representation such as Minecraft Edu

### CONCLUSION OF MATHEMATIC EDUCATION:

- 1) Significant improvements across the board
- 2) GT can be applied to almost any use case successfully
- 3) innovate teacher's instruction and improve students' engagement, productivity competence, enthusiasm, personality, and diverse learning outcomes
- 4) Not limited to mathematics and can be applied to other courses

Thus, this section can conclude with the improvement on the challenges education systems can be vastly improved through gamification in logical and applied subjects (Lanuza, 2021)

## **EFFECTS OF GAMIFICATION WITHIN SCIENCE EDUCATION:**

### **PAPERS:**

- 1) Gamification in Science Education
- 2) Use of Gamification Applications in Science Education

The papers look at how gamification impacts feedback from students as well as education improvement and learning this allows me to draw a solid conclusion from the papers at the end of the section

- 1) states that the paper looked at 24 studies between 2012 and 2020 allowing for them to come to their conclusions, the methods used in these studies ranged from storytelling to multimedia support testing which went on to show that 11/24 were positive and 11 were not specified however suspected positive and comes to the conclusion that gamification does impact science education positively while increasing effective learning however it can be improved upon and requires an understanding of gamification (Educ and Sci, 2021)
- 2) States that it is a study done on primary school students specifically 4<sup>th</sup> grade students where traditional learning was taken and then the application of the GT app was applied then the tests were redone and the results compared and this was done over 12 weeks and had the following methods had been applied where visual elements were used to apply to the learning from drawing to shared experiments and had improvement sum scores were as follows

Dimensions	PRETEST	POST-TEST
Motivation for doing research	13.50	77.50
Motivation for performance	24	96
Motivation for communication	16	75
Motivation for participation	20.50	84.50
Motivation for cooperative work	23	55

Along with the above student feedback was mostly positive with aptitudes wanting to attend or eager for other classes to have the same system and seeing a much higher motivational need to do work (Hursen and Bas, 2019)

### **CONCLUSION OF SCIENCE EDUCATION**

the increase in motivation saw an increase in performance, communication, and learning capability as well as the increased social capability and peer-to-peer communication while seeing negative behaviors decrease dramatically and creating an intrinsic capability towards learning and education however the improvements did not stop there as increased teacher to guardian communication and student to parent communication allowing for more efficient learning this was corroborated by the class dojo studies (Educ and Sci, 2021) (Hursen and Bas, 2019)( Bicen, H., & Kocakoyun, S. (2017)

### ***EFFECTS OF GAMIFICATION WITHIN ENGLISH EDUCATION:***

Papers:

- 1) Gamification in English as Second Language Learning in Secondary Education Aged Between 11-18: A Systematic Review Between 2013-202
- 2) Using gamification to support learning English as a second language

The papers look at how gamification affects learning capabilities to motivations within the English classes and whether can it be applied to all English classes this one is of particular value to SA as the top 3 languages are native and not English-based languages

- 1) The study looks at how gamification impacts the learning of English and other subjects through several means which are Kahoot and Quizizz, and the suggestion was that the students would have a positive impact if gamification was applied and only one major downfall was noted that it did not improve argumentative writing however vocabulary and grammar level were significantly affected and of all games applied MALL had the best rating at 38% compared to the other 9 and also showed improved motivation which corroborates (Rajendran et al., 2019) the above study in increased motivation and saw a rise in the self-esteem and confidence as well as let the learners understand how the learning process works and thus concluded that gamification had an on average a positive impact (Kaya and Sagnak, 2022)
- 2) The study states a systematic review is needed because gamification is indeed a promising field however does state that the main challenge is a lack of empirical studies and thus the study provided a more quantitative view while this was promising the study did state some of the statistics were self-reported, the study's done were done descriptively and as mentioned in the previous 2 sections infrastructure is still a protentional challenge to the use of gamification in English which creates the question of analog GT vs digital GT however despite all this we can conclude there is a space for gamification to be used in classrooms if we can implement it in a trial stage first (Dehghanzadeh et al., 2019)

### **SUB- CONCLUSION 1 AND ENGLISH CONCLUSION**

Gamification is a plausible methodology to be used in the education system and holds much promise which varies from motivation to actual marks and performances however there is a recurring challenge that is intrinsic to the country's economy, infrastructure, and funding thus the best solution would be a mix of analog/digital systems (Dehghanzadeh et al., 2019) (Kaya and Sagnak, 2022)

## **USAGE OF SOFTWARE AND SOFTWARE DEVELOPMENT IN GAMIFICATION:**

### **1) MINECRAFT EDU AND THE PROS AND CONS OF THE USE IN EDUCATION**

#### **WHAT IS IT?**

It is a version of the builder game Minecraft that allows for use in educational settings and for teaching as per the case in point using the in-game building to showcase history textbook information (education.minecraft.net, n.d.)

#### **Pros:**

- 1) It enhanced the education of the classroom, students who became familiar with it could see a use for it within their learning (Callaghan, 2016)
- 2) Increase in communication and collaboration (Callaghan, 2016)
- 3) Increase in cognitive development (Callaghan, 2016)
- 4) Can be applied to varying student abilities (Bar-El and E. Ringland, 2020) (Callaghan, 2016)

#### **CONS:**

- 1) As per the previous sections, teachers may not be able to grasp computer literacy well
- 2) Lack of infrastructure suggests no computer rooms in poorer countries
- 3) People tend to disregard digital education as beneficial

### **2) KAHOOT! AND THE PROS AND CONS OF THE USE IN EDUCATION**

#### **WHAT IS IT?**

This is a game-based software that allows for testing of coursework through several types of quizzes and can be used on mobile and browsers as well as can be used for remote learning and in-person learning (Wang and Tahir, 2020)

#### **THE STUDY:**

The study was done on 93 separate sources with most being positive and 12 stating no effects (Wang and Tahir, 2020)

#### **PROS: (Wang and Tahir, 2020)**

- 1) showed a drop in test anxiety, learning performance, classroom dynamics, attitudes, and general student anxiety.
- 2) Increase in interest in the subject
- 3) Increase in results

#### **CONS: (Wang and Tahir, 2020)**

- 1) Lack of infrastructure within poorer countries means a slow adoption rate
- 2) Timed questions made students feel as if they were competing adding competition stress
- 3) not all teachers are tech-literate

#### **POTENTIAL IMPROVEMENTS:**

- 1) create more than one attempts
- 2) use a mix of analog and digital testing
- 3) ensure multiple types of testing



## SUB CONCLUSION 2:

If the infrastructure can be improved then gamified software can be used to aid and improve learning capabilities in and out of the classroom allowing for a significant improvement across the board (Wang and Tahir, 2020)

## FINAL CONCLUSION:

we can conclude gamification can fix and improve the education system and has a variety of uses both within digital and analog systems and the challenges are limited to the capability of the teacher and infrastructure rather than a limit of gamification itself as we see even with those limitations a significant improvement in students

## CONCEPTUALISATION

CONCEPT	DENOTATIVE	CONNOTATIVE
Gamification	Implementation of game mechanics/techniques to motivate/aid people to learn or achieve their goals (Deterding et al.,2011)	The use of fun and meaningful game and game-like systems to teach within logical methods
Cognitive ability	The capacity needed to perform tasks that require certain capabilities such as reasoning (Indeed Career Guide, n.d.)	The skills students pride themselves in excelling at and the emotions felt
Motivation	Reason for behaviours in a particular manner (Merriam-Webster, 2019)	The feeling experienced when having the motivation to achieve

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