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Gamification for Student Motivation: A Case Study on Two Orphanage and Underprivileged Homes in Perak

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Abstract

This paper explores gamification in education to improve student engagement and motivation. We empirically investigate this by exploring the impact of gamification intervention approach towards motivation on the participants. This study has selected children from two orphanage and underprivileged centres in Perak as the participants. The gamification approach was embedded in the Science, Technology, Engineering and Mathematics (STEM) module as well as the English Language Acquisition (ELA) module to become STEM-ELA program. The STEM-ELA program aims to engage students in STEM subjects and English Language Acquisition, fostering motivation and well-being through innovative methodologies. Implemented over three days per location, the program consists of five modules emphasizing activity-based learning and character development to boost students' confidence and learning outcomes. A quantitative method using survey was used to collect data from the 60 orphaned and underprivileged children. Our results showed that the 60 students from both centres in the sample possess a high level of self-confidence and motivation after completing all our modules. Hence, it is highly recommended that teachers to further improve student engagement and motivation by embedding gamification in education. Future work is needed for a longitudinal study to observe the long-term effects of gamification on students.

Keywords: STEM, Motivation, Gamification Learning, Orphanage and Underprivileged Centres, English Language Acquisition

Introduction

Education stands out as a paramount concern for all parties, with the shared objective of nurturing an enlightened and accomplished younger generation across various domains. The diversity of teaching delivery methods is a crucial component to kindle interest and active engagement among learners. Orphans, defined as children who have lost either their father or both parents, receive attention within the Malaysian context from governmental bodies, non-governmental organizations (NGOs), and private entities, particularly in terms of specific assistance and training. Therefore, the growth and development of these orphaned children,

encompassing physical, mental, and social dimensions, necessitate meticulous attention, akin to children of similar age who experience life within their family structures.

The waning interest of students in Science, Technology, Engineering, and Mathematics (STEM) poses a significant and persistent issue for Malaysia's aspirations of becoming a developed nation. Malaysia has set ambitious targets to rank among the top 20 global nations in the fields of economy, societal well-being, creativity, and innovation by the year 2050. Achieving these objectives demands substantial transformation, preparedness, human capital development, expenditure, cultural cultivation, and a visionary spirit. One pivotal approach towards these goals is the cultivation of interest in science, technology, engineering, and mathematics (STEM) from the school level. Additionally, it has been observed that many students still struggle to communicate fluently in English beyond the confines of the classroom, and a lack of confidence has been identified as a primary contributor to this shortcoming.

Currently, gamification is a technique used to support the learning process in educational environments; this is one of the learning techniques whose use is increasing (Ana López-Martínez, 2022) . Gamification seeks to implement elements taken from games in rigid environments that are not originally playful, such as the academic context (Zichermann, 2011). Gamification is often regarded as an appealing strategy that improves motivation and engagement. However, not all studies agree with these effects, for instance, some suggest a decrease in motivation after gamification exposure (Hanus, 2015). Therefore, more research is needed to understand the motivational learning effects of gamification.

Therefore, the integration of STEM and English Language Acquisition (ELA) into a gamification program is instituted to captivate the interest of students in STEM subjects such as Mathematics and Science, alongside English. The program also aspires to enhance students' motivation and mental well-being, fostering increased interest and dedication to their learning journey. Diverging from formal learning methodologies in schools, this program adopts creative and interactive approaches aimed at transforming students' perceptions of learning and education. The implementation of this program, encompassing a total of five modules, is slated to run for three days at each location. Activity-based modules are carefully crafted to achieve the program's objectives, encompassing STEM subjects and English proficiency. Moreover, the program aims to foster character development and self-confidence among the participating students.

Negative attitudes of students towards school and teachers can undermine their interest and motivation to learn the subjects taught by teachers. Another notable study conducted by Saabran (2005) indicated that many students attend school but do not engage in meaningful learning. Typically, such students are labelled as problematic, exhibiting low academic achievement and lacking positive self-motivation. Drawing from the motivation theory motivation signifies the drive or need that leads to a specific action proposed by (Torff, 2001). Motivation also involves a process of empowerment and direction that propels an individual's behaviour. Study on adolescents aged 11 to 18 years old suggests that self-image, self-esteem, and stress related to life events are associated with adolescent gender was conducted by (Marcotte, 2002). Self-image is more symptomatic of stress in the lives of adolescent females compared to males. Meanwhile, study on adolescents residing in dormitories and those who do not, found that adolescent females in both categories exhibit higher levels of personal stress compared to adolescent males as stated by (Ainslie, 1996). Therefore, this study is aimed to explore the impact of integrating STEM and ELA towards students.

Literature Review

Gamification Learning and Motivation

As stated by Kyewski (2018), gamification involves incorporating game elements and design principles into non-game environments. Its objective is to blend intrinsic and extrinsic motivations to encourage active participation and foster engagement.

Gamified student's group intrinsic motivation increased compared to the traditional method; interest enjoyment and effort-importance dimensions were high. Students who underwent an intervention grounded in gamification demonstrated elevated levels of motivation, teamwork, and commitment compared to their counterparts who engaged in traditional instructional methods. Employing educational gamification presents an opportunity to cultivate a user-centric, autonomous, and flexible learning milieu, encouraging learners to pursue individual objectives and engage in more profound cognitive activities persistently. This approach entails integrating motivational elements intrinsic to gaming into pedagogical practices, recognizing the innate human inclination toward communication and achievement-sharing as potent drivers for student motivation and learning engagement stated by (López-Martínez, 2022). Gamified students has found to have increased their motivation compared to the traditional method as the tension-pressure reduced after the gamified learning (López-Martínez, 2022).

Gamification represents a vast concept with extensive potential. Therefore, it can be explored beyond traditional role-playing games, leveraging ICT tools and simulated practices involving multiple users. In such environments, tasks and roles are distributed equitably and interdependently, fostering autonomy and decision-making skills. Unlike conventional methodologies, collaborative gamified approaches allow students interested in specific topics to form teams, promoting inclusivity, and enhancing engagement. Additionally, teamwork facilitates interactions among students, particularly in mixed-gender and bilingual settings, further enriching the learning experience. There is a positive influence of gamification in student's self-confidence to learn (Chen, 2022). The gamified course increased student's motivation and self-confidence by (Isabelle, 2020) but has a contradicting effect on another study by Müller et al (2007) where student's motivation level decreased in the gamified group but also in the control group non-gamified.

Motivation

An environmental event enhances people's perceptions of competence that make their intrinsic motivation will increase but if it diminishes their perceptions of competence, their intrinsic motivation will decrease as stated in (Ryan, 1982). Motivation is a decisive factor when trying to determine academic success Albrecht (2017) it is known that the pace of the academic cycle decreases, for which it is necessary to implement innovative techniques that avoid this type of situation, such as gamification (Jang, 2012). Motivation involves a group of beliefs and emotions that are interrelated which guide people's behavior. In the academic context, motivation promotes the level of commitment that students present in their learning process. Behaviors driven by intrinsic motivation tend to exhibit greater flexibility, autonomy, persistence, creativity, and effectiveness.

Student's intrinsic motivation from the gamified group decreased after the exposure to badges as examined in (Facey-Shaw lshaw, 2019). In spite of gamification being aligned with learning objectives, Hanus (2015) observed a decline in student motivation levels in a gamified course compared to a non-gamified course over time. This indicates that the novelty of badges and the controlling influence of such rewards may have adversely affected

motivation. Activities leading to badge awards, such as attending classes or reading course notes, might have been perceived as behavior-controlling events, thereby failing to enhance intrinsic motivation (Deci et al., 2001). Consequently, these activities were subsequently eliminated. Badge designers should ensure that badges do not detract from student motivation. Empowering students to manage their own learning is essential in utilizing badges as a motivational tool. Further investigation is needed to explore the role of badge design in enhancing motivation, especially concerning specific gamification elements that can foster intrinsic motivation (Facey-Shaw lshaw, 2019).

Methodology

A quantitative investigation was carried out where a structured investigation that seeks to collect and analyse numerical data, with the intention of identifying averages or checking relationships to obtain and quantify results using statistical tools. This module-based program was conducted at two welfare centres in Perak. The modules are designed and structured in the form of activities and games to prevent students from feeling bored and to increase their engagement in all activities throughout the program. The students consist of 60 orphaned and underprivileged children from two welfare institutions. All of them are within the age range of 13 to 18 years old, currently attending secondary school from Form 1 to Form 6.

Analysis and Study Findings

Frequency Analysis

Table 1

Frequency Analysis

Demographic		N	%
1. Orphanage	Centre A	20	33.3%
	Centre B	40	66.7%
2. Age	7-9	7	11.7%
	10-12	22	36.7%
	13-15	25	41.7%
	16-18	6	10.0%
3. Gender	Male	51	85.0%
	Female	9	15.0%
4. School	Primary	29	48.3%
	Secondary	31	51.7%

Orphanage

Based on Table 1 above, the study involves two welfare centres: Centre A and Centre B. Centre A has 20 children (33.3%), while Centre B has 40 children (66.7%). This indicates that most students in this study are from Centre B.

Age

The age of the respondents varies from 11.7% between 7 to 9 years old, 36.7% between 10 to 12 years old, 41.7% between 13 to 15 years old, and 10% between 16 to 18 years old. It highlights that the majority of respondents are between 13 to 15 years old, indicating that students from lower forms outnumber those from upper forms.

Gender

All the responses are sorted accordingly in Table 1 above. The sample of this project consisted of 51 (85%) male and 9 (15%) female respondents (N=60). Out of this, it shows that males are dominate in this survey than females.

School

The majority of respondents involved are students from secondary school, comprising 51.7%, while primary school students make up 48.3%. STEM-ELA modules are arranged and organized to suit their age groups, allowing them to work together in mixed groups comprising both secondary and primary students. This setup facilitates mutual learning, as secondary students can share their knowledge while also learning how to lead the group effectively.

Descriptive Analysis

For this study, the focus of the analysis revolves around the interpretation of mean scores, with a mean value of 2.99 or below indicating lower self-confidence, whereas a mean value of **3.01 or above indicates higher self-confidence.** The self-confidence scores of students were derived by computing the mean score across the items in the scale, as outlined by (Wong, 2005).

English

The mean pre-test score, as indicated in Table 2, was **1.97**, suggesting that the majority of students performed at a **low self-confidence level before participating the STEM-ELA program**. The range of scores varied from a minimum of 1 to a maximum of 5.

Table 2
Descriptive Statistics of Pre-test

Descriptive Statistics – English (Pre-Test)					
	N	Minimum	Maximum	Mean	Std. Deviation
I can read English text with ease.	60	1	4	1.98	.854
I can understand most of the vocabulary in English texts.	60	1	4	2.03	.882
I am comfortable with reading long texts in English.	60	1	4	2.00	.844
I can write grammatically correct sentences in English.	60	1	3	1.80	.708
I can write coherently organized paragraphs in English.	60	1	5	1.85	.840
I can speak English fluently and confidently.	60	1	4	1.87	.724
I can participate effectively in English discussions and conversations.	60	1	4	2.12	.691
I can use appropriate grammar, vocabulary, and pronunciation in English.	60	1	4	1.98	.725
I can understand easy and complex instructions given in English.	60	1	4	2.05	.852
I can follow English conversations and class without difficulty.	60	1	5	2.08	.869
Valid N (listwise)	60				

Note: Scale: 1–5, ranging from (1) strongly disagree to (5) strongly agree. The higher the score, the higher the self-confidence level.

Based on Table 3 below, the descriptive statistics for the post-test showed an increase in the mean score from **1.97 to 3.05**, with students achieving scores ranging from 3 to 5. This increase indicates an improvement in students' performance after organizing the STEM-ELA modules for them.

Table 3
Descriptive Statistics of Post-test

Descriptive Statistics - English (Post)					
	N	Minimum	Maximum	Mean	Std. Deviation
I can read English text with ease.	60	1	5	3.47	.853
I can understand most of the vocabulary in English texts.	60	1	5	3.08	.787
I am comfortable with reading long texts in English.	60	1	5	3.07	.936
I can write grammatically correct sentences in English.	60	1	5	2.90	1.130
I can write coherently organized paragraphs in English.	60	1	5	2.98	.983
I can speak English fluently and confidently.	60	1	5	2.85	1.022
I can participate effectively in English discussions and conversations.	60	1	5	2.93	1.056
I can use appropriate grammar, vocabulary, and pronunciation in English.	60	1	5	3.02	.983
I can understand easy and complex instructions given in English.	60	1	5	3.18	1.033
I can follow English conversations and class without difficulty.	60	1	5	3.05	.999
Total mean score				3.05	.978

Note: Scale: 1–5, ranging from (1) strongly disagree to (5) strongly agree. The higher the score, the higher the self-confidence level.

With a total mean score of 3.47, the students, in general, could be considered as having considerably higher self-confidence levels regarding their ability to read text in English with ease. Looking at each item's mean score, however, seems to indicate that students have slightly higher self-confidence in their effort to use English language in their communication and writing. Students appear to believe that they do not have much problem in reading English and are highly motivated to read the text in the language. The students are higher

self-confidence in English conversations at class without difficulty. Means they are capable in understanding the easy and complex instructions given by their teachers. The mean score for the item is 3.05 and 3.18.

Science

The mean pre-test score, as indicated in Table 4, was below 2.99, suggesting that the majority of students performed at a low self-confidence level in Science. The range of scores varied from a minimum of 1 to a maximum of 5.

Table 4

Descriptive Statistics of Pre-test

Descriptive Statistics - Science (Pre-data)					
	N	Minimum	Maximum	Mean	Std. Deviation
My great learning experience at school.	60	1	5	3.27	1.039
My great daily experience.	60	1	5	3.12	.976
The concepts related to these subjects in an integrated manner.	60	1	5	2.75	1.099
My ability to solve problems.	60	1	5	2.87	.929
My ability to manage experiments in the school lab.	60	1	5	2.75	1.052
My ability to think deeply towards Science and Technology.	60	1	5	2.92	.944
I enjoy doing work in group.	60	1	5	3.50	1.033
My understanding and skills regarding science experiments.	60	1	5	3.13	.873
My ability to use laboratory equipment during experiments.	60	1	5	3.02	.983
Knowing how to use science to invent useful things.	60	1	5	2.65	.917
Valid N (listwise)	60				

Note: Scale: 1–5, ranging from (1) strongly disagree to (5) strongly agree. The higher the score, the higher the self-confidence level.

There are 5 items that achieve in range 3.00 – 3.50 in Pre-test which are 3.27 learning experience at school, 3.12 daily experience, 3.50 working in group, 3.13 science experiments skills and 3.02 ability in using laboratory equipment. As shown in Table 4, the students have higher self-confidence in group activities such as group discussions and science project . These

findings indicate that students enjoy participating in group discussions that related to sciences. However, they are low self-confidence in managing the experiments in school lab, and less explore about invention useful things. The mean score for the items is 2.75 and 2.65.

Table 5
Descriptive Statistics of Post-test

Descriptive Statistics – Science (Post)					
	N	Minimum	Maximum	Mean	Std. Deviation
My great learning experience at school.	60	1	5	3.85	1.102
My great daily experience.	60	1	5	3.73	1.133
The concepts related to these subjects in an integrated manner.	60	1	5	3.63	1.041
My ability to solve problems.	60	1	5	3.63	.974
My ability to manage experiments in the school lab.	60	2	5	3.77	.851
My ability to think deeply towards Science and Technology.	60	1	5	3.67	1.003
I enjoy doing work in group.	60	1	5	4.03	.991
My understanding and skills regarding science experiments.	60	1	5	3.87	.965
My ability to use laboratory equipment during experiments.	60	1	5	3.82	.854
Knowing how to use science to invent useful things.	60	2	5	3.92	.829
Total mean score				3.79	.974

Note: Scale: 1–5, ranging from (1) strongly disagree to (5) strongly agree. The higher the score, the higher the self-confidence level.

After Post-test, their low self-confidence in explore the invention useful things have improvement from 2.65 to 3.92 which it indicates the higher self-confidence level. All items in Science reach higher self-confidence based on post-test, Table 5. Besides, their ability to use laboratory equipment increased from 3.02 to 3.82, indicating an increase in their interest and knowledge regarding the application of laboratory equipment. As indicated in item 7, they would like to *enjoy doing their work in group*. The mean score for this item was 4.03, which also indicates very high self-confidence level. Thus, the students have achieved a significantly improved standing in basic science education and learning following their participation in the STEM program.

Mathematics

The mean pre-test score, as indicated in Table 6, was below 2.99, suggesting that the majority of students performed at a low self-confidence level in Mathematics. The range of scores varied from a minimum of 1 to a maximum of 5.

Table 6
Descriptive Statistics of Pre-test

Descriptive Statistics – Math (Pre-data)					
	N	Minimum	Maximum	Mean	Std. Deviation
Orphanage	60	1	2	1.67	.475
My great learning experience at school.	60	1	5	2.53	1.016
My great daily experience.	60	1	5	2.53	.873
The concepts related to these subjects in an integrated manner.	60	1	5	2.50	.834
My ability to solve problems.	60	1	5	2.60	.867
My ability to manage Mathematics projects.	60	1	4	2.55	.675
My ability to think mathematically.	60	1	5	2.63	1.008
I enjoy doing work in group.	60	1	5	2.83	1.060
My understanding and skills regarding calculations.	60	1	5	2.67	.951
My ability to use Mathematical tools.	60	1	5	2.65	.954
Knowing how to use mathematical methods to invent useful things.	60	1	5	2.73	.821
Valid N (listwise)	60				

Note: Scale: 1–5, ranging from (1) strongly disagree to (5) strongly agree. The higher the score, the higher the self-confidence level.

As shown in Table 6, the descriptive statistics for the pre-test revealed the lowest level of self-confidence in Mathematics, indicating a lack of understanding of integrated mathematical concepts. The mean score for this item is 2.50. Additionally, students exhibited a lack of confidence in solving mathematics problems, with a mean score of 2.67 for this item. Furthermore, they demonstrated a lack of understanding in calculations when unable to solve problems, with a mean score of 2.67 for this item. The mean score for the ability to manage the project is 2.55. These findings suggest that students from both orphanages have low self-confidence in Mathematics.

Table 7
Descriptive Statistics of Post-test

Descriptive Statistics – Math (Post)					
	N	Minimum	Maximum	Mean	Std. Deviation
My great learning experience at school.	60	2	5	4.30	.646
My great daily experience.	60	2	5	3.92	.850
The concepts related to these subjects in an integrated manner.	60	1	5	3.58	1.013
My ability to solve problems.	60	1	5	3.48	1.000
My ability to manage Mathematics projects.	60	1	5	3.42	1.062
My ability to think mathematically.	60	2	5	3.47	.965
I enjoy doing work in group.	60	2	5	4.23	.871
My understanding and skills regarding calculations.	60	1	5	3.67	.968
My ability to use Mathematical tools.	60	2	5	3.50	.930
Knowing how to use mathematical methods to invent useful things.	60	2	5	3.68	.911
Total mean score				3.73	.922

Note: Scale: 1–5, ranging from (1) strongly disagree to (5) strongly agree. The higher the score, the higher the self-confidence level.

Based on Table 7, with the total mean score of 3.73, this indicates that the students have considerably higher self-confidence levels after engaging in STEM activities. Examining each

item's mean score, students appear to believe that they have improved their calculation skills from 2.67 to 3.67 and are highly motivated to have a great learning experience at school. Furthermore, students exhibit higher self-confidence in working in groups to solve mathematics problems, indicating an improvement in basic mathematical learning and an ability to understand how to apply mathematical methods to invent useful things. The mean score for this item is 3.68. Thus, they are able to think mathematically after participating in STEM activities that require group work. By solving problems in groups, they can enhance their mathematical skills, thinking abilities, and calculation techniques. This will aid them in increasing and refining their problem-solving skills and mathematical understanding.

Discussion

In order to enhance the analytical depth of the results, the studyer opted to conduct a comparative analysis of the improvement percentages (%) for each subject. This method was chosen specifically for items that displayed notable disparities between pre- and post-data. Through this approach, the study aims to elucidate the profound impact of the STEM-ELA modules on the students over the course of the 3-day intervention period.

Table 8
Percentage of Improvement for Each Subject

Items	Pre-data	Post-data	**Improvement (%)**
English: I can read English text with ease	1.98	3.47	**29.8**
English: I can understand easy and complex instructions given in English.	2.05	3.18	**22.6**
Science: Knowing how to use science to invent useful things.	2.65	3.92	**25.4**
Science: My ability to manage experiments in the school lab.	2.75	3.77	**20.4**
Mathematics: My understanding and skills regarding calculations	2.67	3.67	**20**
Mathematics: I enjoy doing work in group	2.83	4.23	**28**

As indicated in the table above, students exhibited notably low proficiency in reading English texts during the pre-data assessment, with a score of only 1.98, suggesting a lower level of self-confidence. Following their participation in the program, their post-data score increased significantly to 3.47. This improvement highlights the effectiveness of the program in enhancing their reading skills, with a remarkable percentage improvement of 29.8%. The second item related to English proficiency assesses students' comprehension of instructions provided in English, wherein their initial score of 2.05 indicates a notably low level of self-confidence in this particular aspect. However, subsequent to their engagement in the program, their score exhibited a notable increase of 22.6%, reaching 3.18. This observed improvement underscores a significant enhancement in their ability to comprehend instructions delivered in English, thereby contributing to a discernible elevation in their overall self-confidence levels within this domain.

During the initial assessment regarding science-related items, students displayed notably inadequate proficiency in grasping how to apply scientific principles to devise

practical solutions, as evidenced by a score of merely 2.65, indicating a lesser degree of self-confidence in this realm. However, their subsequent assessment yielded a considerable increase to 3.92, highlighting the program's efficacy in bolstering their innovation-oriented cognitive abilities, with a noteworthy percentage improvement of 25.4%. The second aspect concerns their aptitude in coordinating experiments within the school laboratory, where students initially obtained a score of 2.75, denoting a persistently modest level of self-confidence. Nonetheless, following their participation in the program, their score escalated to 3.77, reflecting an enhancement of approximately 20.4%. Hence, it is evident that the STEM program has contributed significantly to fostering their capacity for creative thinking and innovation leveraging their scientific knowledge.

For Mathematics, the results indicate the students' proficiency in calculation skills. Their score of 2.67 in the pre-data assessment suggests a low level of self-confidence, which then increased to 3.67 in the post-data assessment, representing a 20% improvement. This underscores the beneficial impact of the STEM program. Additionally, the score for enjoyment in group work was initially 2.83, reflecting low self-confidence. However, it increased to 4.23, indicating a 28% improvement. Across all three subjects, students demonstrated significantly higher self-confidence following the STEM program. This serves as evidence that the STEM program effectively enhances their fundamental skills in English, Science, and Mathematics.

Limitation and Future Study

Given the limitations of the study, which focused solely on two welfare centres in Perak, namely Centre B and Centre A. Therefore, it is recommended that future study endeavours to adopt a more expansive approach. This entails including students from boarding schools and other locations across Malaysia, rather than confining the study to a specific region. By broadening the geographical scope of the study, the findings can be extrapolated to a wider context. This is imperative because orphans may vary in their educational backgrounds, experiences, and challenges encountered in learning English, Science, and Mathematics both in school and in their daily lives.

In addition to the limitations mentioned, it should be noted that this study solely focused on English, Science, and Mathematics, without delving into the realm of Technology. Future studies could address this gap by incorporating aspects of Technology, such as innovations stemming from machinery and other relevant areas. By conducting a more comprehensive study that encompasses Technology, valuable insights can be gleaned for the development of policies and strategies related to STEM education in the country. This broader approach ensures the provision of high-quality education for future generations not only in English, Science, and Mathematics, but also in Technology, thus fostering holistic learning and preparing students for the demands of the modern world. Future work is needed for a longitudinal study to observe the long-term effects of gamification on students.

Conclusion

In general, the findings of the study indicate that the 60 students from both orphanages in the sample possess a high level of self-confidence and motivation in all modules. This suggests that they exhibit confidence in their ability to read English text, handle laboratory science tasks at school, and demonstrate calculation skills, as evidenced in the post-data assessment. The assessment of the students' high self-efficacy is based on the average mean score for each item in every subject. The researcher believes that students' self-confidence levels has improved through participation in the STEM-ELA modules. These modules are designed and

tailored to suit their age range, allowing everyone to engage in problem-solving and innovation thinking within the STEM-ELA activities. Furthermore, by integrating gamification to cater to various learning styles, an inclusive and efficient learning atmosphere can be cultivated, ultimately benefiting students.

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