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The Effects of Gamification on Undergraduate Engineers' Public Speaking Anxiety and Competency

Sharifah Aida Hana Binti Syed Osman Abadi¹, Farah Shahnaz Feroz^{2*}, Teh Zanariah Mohd Raus³, S. Indra Devi⁴, S.K. Subramaniam^{5, 6}

¹ Institut Pengurusan Teknologi dan Keusahawanan (IPTK), Universiti Teknikal Malaysia Melaka (UTeM), Melaka, Malaysia

² Pervasive Computing & Educational Technology (PET), Fakulti Kejuruteraan Elektronik & Kejuruteraan Komputer (FKEKK), Universiti Teknikal Malaysia Melaka (UTeM), Melaka, Malaysia

³ Sustainable Industrial Community (S-ICOMM), Pusat Pembelajaran Bahasa (PPB), Universiti Teknikal Malaysia Melaka (UTeM), Melaka, Malaysia

⁴ Pusat Pembelajaran Bahasa (PPB), Universiti Teknikal Malaysia Melaka (UTeM), Melaka, Malaysia

⁵ Advanced Sensors and Embedded Control System (ASECS), Fakulti Kejuruteraan Elektronik & Kejuruteraan Komputer (FKEKK), Universiti Teknikal Malaysia Melaka (UTeM), Melaka, Malaysia

⁶ IIOTSME Sdn. Bhd., Melaka, Malaysia

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Abstract:

This study sought to identify whether gamification practices affect public-speaking anxiety and public speaking competency of undergraduate engineers in a technical university. This study also aimed to determine the relationship between public speaking anxiety and public speaking competency. A class of 30 undergraduate engineers answered the Personal Report of Public Speaking Anxiety (PRPSA) to identify their public speaking anxiety levels. Sixteen students with the highest anxiety levels were selected to participate in the study. The study was conducted for ten weeks. Rhetoric-The Public Speaking Game was played weekly for one hour in each group of eight students as an intervention. Evaluations were performed before and after the intervention to provide empirical evidence on whether the gamification approach affected the public speaking competency levels of the participants. The T-test showed a significant decrease in the participants' public speaking anxiety after the intervention. Meanwhile, after the intervention, the participants showed a significant increase in their public

Corresponding Author: Farah Shahnaz Feroz, Pervasive Computing & Educational Technology (PET), Fakulti Kejuruteraan Elektronik & Kejuruteraan Komputer (FKEKK), Universiti Teknikal Malaysia Melaka (UTeM), Melaka, Malaysia; email: shahnaz@utem.edu.my

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speaking competency. There was also a significant negative linear correlation between public speaking anxiety and public speaking competency pre-intervention, but the effect was diminished post-intervention. The gamification approach effectively reduced anxiety and increased the competency of the participants of this study. This study also suggested that gamification might have improved students' confidence, making it possible to manage their anxiety.

Keywords: gamification, public speaking competency, public speaking anxiety, engineers, Rhetoric: Public Speaking Game.

游戏化对本科工程师公开演讲焦虑和能力的影响

摘要:

本研究旨在确定游戏化实践是否会影响技术大学本科工程师的公开演讲焦虑和公开演讲能力。本研究还旨在确定公共演讲焦虑与公共演讲能力之间的关系。一个由 30 名本科工程师组成的班级回答了公开演讲焦虑个人报告 (PRPSA), 以确定他们的公开演讲焦虑水平。选择了 16 名焦虑程度最高的学生参加这项研究。该研究进行了十周。修辞——公开演讲游戏每周在每组八名学生中进行一小时作为干预。在干预之前和之后进行了评估, 以提供关于游戏化方法是否影响参与者的公开演讲能力水平的经验证据。吨检验显示干预后参与者的公开演讲焦虑显着降低。同时, 干预后, 参与者的公开演讲能力显着提高。干预前公开演讲焦虑与公开演讲能力之间也存在显着的负线性相关, 但干预后该影响减弱。游戏化方法有效地减少了焦虑并提高了本研究参与者的能力。这项研究还表明, 游戏化可能会提高学生的信心, 从而使他们能够管理他们的焦虑。

关键词: 游戏化, 公开演讲能力, 公开演讲焦虑, 工程师, 修辞: 公开演讲游戏。

1. Introduction

Public speaking plays a vital role for engineers. The increasing relevance of oral communication skills and competency levels for engineers in today's employment market has caused researchers and industry leaders to underline the rising value of oral communication skills and competency levels (Devi & Feroz, 2008). Effective public speaking abilities may help both the engineers and the company during work training activities, networking during ceremonial activities, job interviews, and various other commercial goals (Jackson et al., 2017). According to Bonnet et al. (2018), having strong public speaking skills may assist a person in feeling secure while communicating their knowledge and expertise. LeFebvre et al. (2016) concurred that high confidence in public speaking enables a person to perform well in any situation. Furthermore, engineers communicate their ideas via public speaking, which is one of the most effective methods for gaining buy-in and advancing their careers (Wang et al., 2020). Therefore, engineers must possess strong public speaking abilities.

These past years have seen increasingly rapid advances in the field of gamification. Once viewed as entertainment, interaction, and fun, the gamification context is now taking the lead in teaching and learning processes (Wongpinunwatana & Maneerattanasak, 2020). The gamification environment mainly uses digital devices that foster public speaking, primarily at the tertiary level, traditionally performed with relatively

high-quality tools (El-Yamri et al., 2019). Gamification increases student motivation and engagement in the learning process (Wardaszko et al., 2019). It may also be used to reengage academically uninterested students and students with introverted personalities. Evidence shows that learners with varying personality characteristics choose varying educational approaches and introverted individuals prefer online instruction over face-to-face education (Yu, 2021). Due to this medium of learning and practice, many students' behaviors change within days of using gamification (Westwick et al., 2016). According to Bonnet et al. (2018), Yang and Chen (2020), gamification improves student motivation and enthusiasm for learning and practice. Fung and Min (2016) showed that gamified education with technology enhanced students' academic scores.

Technology adoption and use are critical for nearly all sectors, from private businesses to public institutions and from health care to education (Kurt & Tingöy, 2017). Despite its effectiveness in modulating behavior, Kim and Park (2016) demonstrated that daily usage of a comparable gamification strategy would result in boredom if there were no further progress or challenge. Students get bored after the third week of adopting the same gamification strategy (Weik et al., 2017). However, Yang and Chen (2020) found that even though the same gamification technique was used every day, offering a new prize at each game would consistently enhance players' enthusiasm and spirit to

play the same game the next day. Thus, this technique was implemented in the intervention phase of this study to minimize participants' boredom.

People are not born to become public speakers, but they can become good ones. The idea of standing in front of a particular group to deliver a speech will lead most people to anxiety and fear, which may affect their public speaking competency. According to Lindner et al. (2021), anxiety is the most common mental disorder among public speakers. Likewise, LeFebvre et al. (2016) hold the view that public speaking anxiety is a mental block affecting an individual's performance. A mental block is usually related to self-deprecating negative thoughts, worry over performance, and fear of failure. Too much thinking may also cause anxiety (Lindner et al., 2021). Public Speaking anxiety may lead engineers to avoid giving presentations, thus limiting their career progression. Overall, these studies highlight the need for an intervention to reduce the debilitating impact of public speaking anxiety on engineers' career advancement.

This research examines the effectiveness of using a digital gamification application called Rhetoric: Public Speaking Game to reduce anxiety levels and increase public speaking competency in undergraduate engineers. To the researchers' knowledge, this is the first time that the public speaking application, Rhetoric: The Public Speaking Game, is being used to study the effects of gamification on engineering students' public speaking anxiety and competency levels.

2. Materials and Methods

2.1. Rhetoric: The Public Speaking Game

Rhetoric: The Public Speaking Game is the world's first board game dedicated to public speaking. Florian Mueck and John Zimmer collaborated on the app's design. It is a famous board game published in a limited edition of 1000 copies. The Rhetoric: Public Speaking Board Game is now available on the App Store and Google Play. The app retains all the board game elements and can be played online and in five other languages: English, French, German, Catalan, and Spanish. This game was chosen in the intervention phase of the study because it is the first digital board game designed exclusively for public speaking. To date, most instruments utilized in the gamification of public speaking are conventional, and there are no other digital gaming apps available.

The Public Speaking Game was intended to help users improve their public speaking abilities while having fun. The game required a minimum of two and a maximum of eight participants. The board game included five square spaces for the players, each with different colors. When a participant landed on a specific color area after rolling the dice, they were required to deliver a speech depending on the task written on the

card for one to two minutes. The colors were red, blue, yellow, white, and one of their choosing. The Blue space represented "Challenge." The participants responded to the challenge written on the card. The yellow space was about "Questions." The Red space represented "Topics." The white space was about "Reflection." Finally, the color of choice space allowed the participants to choose their own color spaces, illustrated in Figure 1.



Figure 1. Rhetoric: The Public Speaking Game (Rhetoric – The Public Speaking Game, n.d.)

The players also needed to choose their presentation technique depending on their topic, as follows: 1. Tell a story; 2. Use a quote; 3. Evoke the senses; 4. Draw an analogy; 5. Use humor; 6. Call to action.

Participants could not present the same type of speeches if they landed in the same color space for the next round. Participants answered the question shown on the card by choosing one of the six structures: 1. Good, better, best; 2. Bad, worse, worst; 3. Past, present, future; 4. One, two, three; 5. Pros and cons; 6. Choice.

2.2. Personal Report of Public Speaking Anxiety (PRPSA)

McCroskey (1970) developed the PRPSA to increase precise measurement for apprehension in communication. Thirty-six questions were presented based on a given level of communication apprehension using a Likert scale: strongly disagree, disagree, undecided, agree, and strongly agree, respectively. The

final score was divided into five anxiety levels. A 34–84 score, 85–92 score, 93–110 score, 111–119 score, and 120–170. These scores represented low anxiety, moderately low anxiety, moderate anxiety, moderately high anxiety, and high anxiety, respectively

The final score was determined by adding the scores mentioned below.

Step 1: Add scores for items 1, 2, 3, 5, 9, 10, 13, 14, 19, 20, 21, 22, 23, 25, 27, 28, 29, 30, 31, 32, 33, and 34

Step 2: Add the scores for items 4, 6, 7, 8, 11, 12, 15, 16, 17, 18, 24, and 26

Step 3: Complete the following formula:

$PRPSA = 72 - \text{Total from Step 2} + \text{Total from Step 1}$

Therefore, the students' final scores should be between 34 and 170. After finalizing, the results below determined the students' public speaking anxiety levels.

High = > 131

Low = < 98

Moderate = 98-131

2.3. Public Speaking Evaluation/Criteria

The public speaking evaluation form (The University of Vermont, 2013) and public speaking rubric (Schreiber et al., 2012) were chosen because of the criteria that could determine the public speaking competencies of the participants. It was improvised to fulfill the study focus and needs (Appendix B). The criteria included on the form were the introduction, organizational pattern, supporting details, conclusion, word choice, social expression, paralanguage, and nonverbal behaviors. The range of marks were between "Not done: 0", "Fair: 1", "Good: 2", "Very good: 3" and Excellent: 4".

Two evaluators evaluated the pre- and post-public speaking task using a modified Public Speaking Evaluation/Criteria form from the University of Vermont to score the participants. The total mean scores from the two evaluators were taken to summarize the public speaking competency of the students before and after the intervention. The results of the final scores were as follows:

Blue Ribbon (39-45 points) - Excellent

Red Ribbon (31-38 points) - Very Good

White Ribbon (1- 31 points) - Good

3. Participants

During participant selection, purposive sampling was utilized to ensure that the samples met the research's specific profile. Purposive sampling was simpler than random sampling, where volunteers who exhibit the research characteristics were chosen (Etikan, 2016). The sample used for this research included thirty third-year engineering students in the Faculty of Mechanical Engineering who enrolled for English for Professional Interaction (BLHW 3462). This was the last English course required for all undergraduate engineers at University Technical Melaka Malaysia (UTeM). The students were asked to complete the Personal Report of Public Speaking Anxiety (PRPSA)

questionnaire (Appendix A) to identify participants with high public speaking anxiety.

Sixteen students with high anxiety levels were selected for the intervention based on their PRPSA scores. This research used a small sample size because of the resource constraints where the intervention only needed a maximum of eight participants to play the game at one time (Rhetoric – The Public Speaking Game, n.d.). Studies by Lindner et al. (2021), Bartholomay and Houlihan (2018), Donovan (2016) also used a small sample size to measure the effectiveness of different interventions toward public speaking anxiety. Written informed consent was attained from all participants following the explanation of the objective and nature of the study. The game could accommodate a maximum of eight students. As a result, two groups of eight students were formed for this research. The game was played once a week through WebEx for both groups. The flow chart in Figure 2 summarizes the materials and procedures utilized in the study.

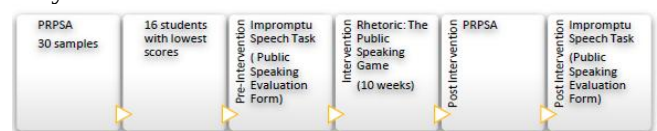


Figure 2. Material and procedure summary

4. Statistical Analysis

The statistical analyses of this study utilized the STATISTICA 8.0 and SPSS version 20 software. Moreover, all bar graphs in this paper reported the standard error.

5. Data Collection

PRPSA was used to assess the anxiety levels of thirty English for Professional Interaction students. Sixteen students with the highest level of anxiety were chosen for the intervention. Two evaluators assessed the students' public speaking competencies before the intervention using a modified public speaking evaluation form initially developed by the University of Vermont. One week of pilot research was conducted initially, followed by the actual game with the students. Each group underwent the intervention once a week for ten weeks. The students' public speaking final evaluations were completed using the same public speaking evaluation form on the eleventh week.

PRPSA scores were tallied based on the students' responses to thirty-six questions about themselves, ranging from "Strongly Disagree: 1" to "Agree: 5". The results were combined and analyzed to determine the students' overall anxiety levels. In addition, the public speaking evaluation form evaluated their introduction, organizational pattern, supporting details, conclusion, word choice, social expression, paralanguage, and nonverbal behaviors pre- and post-intervention.

6. Results and Discussion

6.1. Public Speaking Anxiety Levels before and after the Intervention

From the PRPSA result, the average pre-intervention anxiety levels of all thirty students ($M = 114.6$; $SD = 17.2$) fall in the moderate category.

T-test was used to compare undergraduate engineers' public speaking anxiety levels before and after the intervention. There was a significant decrease in post-intervention anxiety level ($M = 73.50$ (low anxiety category), $SD = 15.63$; $t(15) = 10.37451$, $p < 0.01$, $d = 3.1288$) compared to the pre-intervention anxiety level ($M = 115.06$ (moderate anxiety category), $SD = 10.42$).

The results showed that, after the students participated in the public speaking game, their anxiety levels improved. These results were consistent with those by Wati et al. (2021), that suggested the positive influence of "Public Speaking-Attractive Training," a non-digital tool in reducing public speaking anxiety. These results also matched the results of Feroz et al. (2020), who established the use of a digital gamification technique called 'Kahoot!' to enhance undergraduates' learning performance and engagement during lessons.

Rhetoric: Public Speaking Game in this study had elements similar to those of the gamification method shown by "Public Speaking-Attractive-Training" from Wati et al. (2021) and "Kahoot!" from Feroz et al. (2020), which may have boosted students' motivation and engagement during public speaking practices. (Foss & Reitzel, 1988) established a relational competence model for coping with second language anxiety and identified that motivation effectively manages communication activities shown in the intervention of their study (Foss & Reitzel, 1988). Figure 3 illustrates a bar chart that compares the value for the sixteen students' pre- and post-anxiety levels.

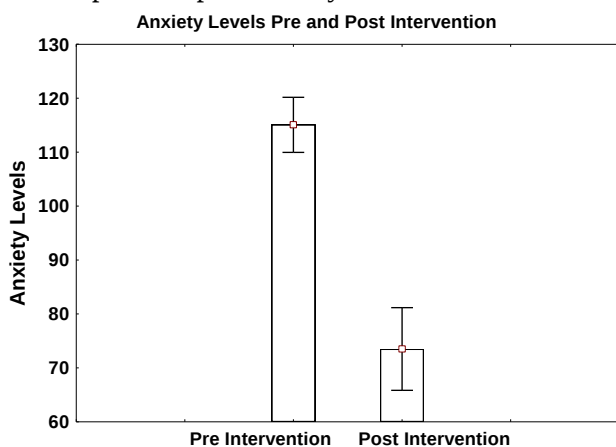


Figure 3. Bar graph of anxiety levels before and after the intervention

6.2. Public Speaking Competency Levels before and after the Intervention

T-test was used to compare the public speaking competency levels of the undergraduate engineers

before and after the intervention. There was a significant increase in the post-intervention competency level ($M = 19.69$, $SD = 2.26$; $t(15) = 13.2082$, $p < 0.01$, $d = 3.3021$) compared to the pre-intervention competency level ($M = 15.47$, $SD = 2.26$).

The findings observed in this study mirror those of LeFebvre et al. (2021), who examined the positive impact of using a virtual environment (VE) with Composition Mirror Tool (CMT) on increasing public speaking competency. These similar features, VE and CMT, were also found in the public speaking game in this study. Another possible explanation is that through the Rhetoric: Public Speaking Game, the students undergo self-perception, in which they are competing against themselves to become better at the game (LeFebvre et al., 2016). Each week, students practice to better themselves, which makes them better public speakers. Being competitive in-game is an excellent method for teaching and learning (Wati et al., 2021). Figure 4 depicts a bar chart of the sixteen students' average pre- and post-competency levels.

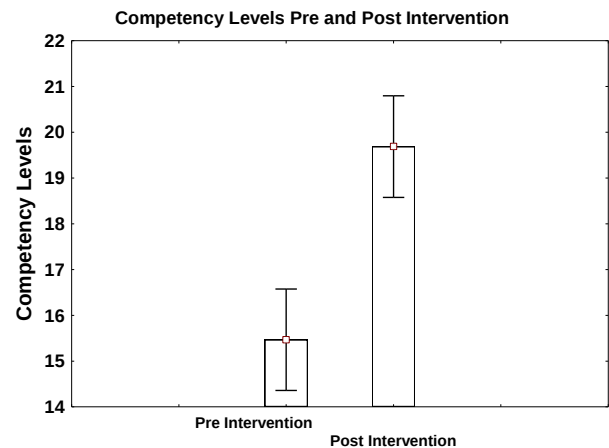


Figure 4. Bar graph of competency levels before and after the intervention

6.3. Correlation between Public Speaking Anxiety and Public Speaking Competency

6.3.1. Pre-Intervention

Pearson correlation analysis was used to determine the relationship between pre-intervention public speaking anxiety and pre-intervention public speaking competency. The most interesting finding was that there was a significant negative correlation between the pre-anxiety and pre-competency levels ($r(14) = -0.60379$, $p = 0.01326$). Increased anxiety levels were associated with decreased competency. It is encouraging to compare this finding with that found by Kelly et al. (2020), who observed that students and professionals who battled with communication anxiety possessed all the required abilities to be good communicators but could not communicate effectively due to their anxiety. The difference between pre-anxiety and pre-competency levels is illustrated in Figure 5.

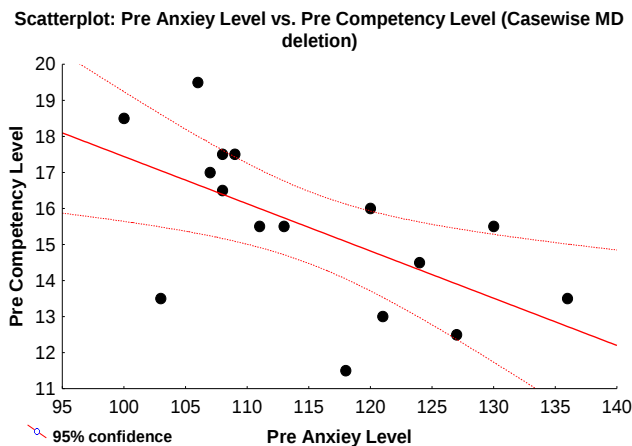


Figure 5. Scatterplot of pre-intervention anxiety level vs. pre-intervention competency level

6.3.2. Post-Intervention

Surprisingly, the correlation between post-intervention anxiety level and post-intervention competency level was not significant ($r(14) = -0.153459$, $p = 0.5704$). The results showed no significant linear relationship between anxiety and competency (post-intervention). The students scored an average of 20 in proficiency (rounded up from $M = 19.69$, $SD = 2.26$), which indicated that they managed to remain proficient at public speaking despite their anxiety levels.

These results agree with the findings of Tridinanti (2018), where speaking anxiety was found to have no statistically significant relationship with post-intervention speaking ability. The study also found that confidence positively affects speaking ability. The study separated speaking anxiety and low confidence as two different factors. We speculate that the public speaking game in this study may have improved students' confidence, making it possible for them to manage their anxiety so that it does not affect their performance. Zondag et al. (2020), in their study on foreign language learning (FLL), also agreed that self-confidence is a lack of anxiety. Anxiety can be reduced by a more relaxed environment that positively influences self-confidence in language learning (Zondag et al., 2020), such as those produced during gamification. Many researchers (Kelly et al., 2020; Palupi, 2021; Tridinanti, 2018; Wati et al., 2021) conclude that anxiety can be manageable, and it is normal to feel it.

7. Conclusion

The main findings of this study revealed that the gamification approach in public speaking practices reduced anxiety levels and increased the competency levels of the participants. Further, this study showed a significant negative correlation between public speaking anxiety and public speaking competency pre-intervention. However, there was no significant correlation between these two variables post-intervention. This study also indicated that gamification leads to increased motivation and a better learning outcome. This study also suggested that learners

improve their public speaking using the Rhetoric: Public Speaking Game because it boosted their motivation and promoted self-competition, fun, and engagement.

The non-significant correlation results post-intervention concur with the findings of Tridinanti (2018), in which it was determined that speaking anxiety had no statistically significant link with post-intervention speaking competence. In addition, the study discovered that confidence favorably influences speaking abilities. The study also distinguished public speaking anxiety and low confidence as distinct characteristics. It is speculated that the public speaking game in this study boosted students' confidence, allowing them to handle their nervousness without affecting their performance after the intervention.

From their research on foreign language learning (FLL), Zondag et al. (2020) concurred that self-assurance is the absence of worry. A more comfortable setting that favorably impacts self-confidence in language acquisition, such as those provided by gamification, can lower anxiety (Zondag et al., 2020). Numerous researchers (Kelly et al., 2020; Palupi, 2021; Tridinanti, 2018; Wati et al., 2021) find that anxiety is natural and can be controlled.

This strength of this study lies in the usage of the first online public speaking board game as the gamification instrument in this study. To the best of the authors' knowledge, this is the first time that the public speaking app, Rhetoric: The Public Speaking Game, has been used to study the effects of gamification on engineering students' public speaking anxiety and competency levels.

While acknowledging the study's outcome, its several limitations should be noted. It should be noted that larger sample sizes would afford increased power to detect effects not presented in this article. In addition, the participants' language proficiency and cultural bias may pose a barrier in this study. Students who speak English frequently may produce results different from those of students who do not use English as often. For preventing bias in the outcomes, only non-native English speakers and students of English as a second language were chosen for this case study.

The current findings add to a growing body of literature on the effects of technology and gamification on public speaking anxiety and competency. Further research might explore more applications and game devices to reduce anxiety and improve public speaking competency that will benefit the education system.

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Authors' Contributions

Sh. Aida Hana and S. Indra Devi were responsible for the study design and data collection. Sh. Aida Hana was responsible for the literature review. Sh. Aida Hana, F. S. Feroz, and S.K. Subramaniam were involved in statistical analysis and data interpretation. Sh. Aida Hana, F.S. Feroz, and T. Z. M. Raus were involved in manuscript preparation.

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