Primary Education's Stakeholders Behavioural Intention to use Prospective Game-based Learning for Waste Awareness

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Abstract: Despite some efforts to design games to raise primary school students' awareness of the waste problems, there is a lack of research studying the directly involved stakeholder's behavioural intention to use the games. Prior studies have explored the users' games acceptance of the games that have already been developed. However, we believe that understanding the user's acceptance from the beginning of the game design process is also crucial. This research investigates the factors that influence the behavioural intention to use prospective game-based learning (GBL) for waste awareness among primary school parents, teachers, and students. An online survey based on the UTAUT 2 was distributed to each stakeholder, supplemented by a video demonstrating an Augmented Reality-based mobile game interaction scenario. The sample of participants included 135 parents, 47 teachers, and 129 primary school students from Malang, Indonesia. The internal consistency of game acceptance from the surveys was evaluated through Kruskall Wallis. Results show that Effort Expectancy is the factor with the highest acceptance value while Facilitating Condition has the lowest value. The three stakeholders argued that the prospective GBL seems easy to play and learn, but in contradiction, the adults are concerned that they cannot assist in teaching how to use the game and cannot provide the necessary technology. The cultural background seems to influence user game acceptance. Indonesians are known to be quite open to new technologies like GBL, although the facilitation condition might be low. Furthermore, there are some significant differences between the student-parent and student-teacher groups, but not in the parent-teacher group. Findings indicated that Indonesian teachers are more ready to adopt GBL than students and their parents. By understanding the perceptions and attitudes of these groups, educators and researchers can develop strategies to address any concerns or doubts they may have and promote the benefits of GBL.

Keywords: UTAUT 2, Games Acceptance, Behavioural Intention, Waste Awareness.

1. Introduction

Game-Based Learning (GBL) has emerged as an innovative pedagogical approach that forces the engaging nature of games to enhance learning outcomes. Recent studies show that using GBL potentially improve student's learning outcome compared to traditional teaching learning method (Acquah and Katz, 2020; Byusa, Kampire and Mwesigye, 2022). Despite numerous studies indicating that GBL can increase learner's performance, understanding its acceptance among parents, teachers, and students as direct stakeholders, particularly in specific cultural contexts like Indonesia, remains underexplored. In Indonesia, where cultural values and school curricula somewhat different from those in other parts of the world, it becomes imperative to study the acceptance and readiness of stakeholders towards GBL. This is especially important because, based on our careful observations, studies on technological readiness and acceptance in the Indonesian context often yield uniformly positive results without offering comparative insights among different stakeholder groups. In addition, the geographical diversity of the Indonesian archipelago presents challenges, as some students have limited access to the technology and facilities necessary for effective learning.

While previous research has often examined the acceptance of GBL by students, teachers, and parents separately (Bourgonjon *et al.*, 2010, 2011, 2013), our study seeks to integrate these perspectives. By exploring the connection of these stakeholders' different perspective, we aim to provide a more comprehensive understanding of the factors that drive the acceptance of GBL in Indonesia. This research aims to investigate the factors that influence the behavioural intention to use game-based learning for improving waste awareness among these three stakeholder groups in Indonesia. Notably, we have only come across two studies in our journey to find research that compares the level of games acceptance among them. In Yong's and colleague's research from Malaysia about parents, students, and teachers views in the use of digital games in learning

mathematics (Yong, Gates and Harrison, 2016), shows that students were supportive and positive towards it but not with their teachers and parents. In their study, the students' focus their affective aspect towards learning, while the teachers and parents are concerned with the practicality and effectiveness of using Math computer games for learning, but they do not perceive learning as an activity that should be fun. Other study from China (Xie, Wang and Hooshyar, 2021) revealed that teachers' and parents' perceptions toward digital GBL were shown to be significantly correlated with each other. There is a possibility that parental pressure may contribute to the teacher's lack of empowerment in classroom, even though the students show highly optimistic perception with GBL (Xie, Wang and Hooshyar, 2021). These two studies show that students are more ready to learn using digital games compared to adults, echoing with three studies by Bourgonjon and colleagues that exploring students, parents, and teachers (Bourgonjon *et al.*, 2010, 2011, 2013) acceptance in GBL, although they did not continue their studies to correlate those three results.

This study was part of a larger project researching how games can enhance primary student's waste management awareness. This paper represents the initial phase of our primary research, focusing on understanding user's technology acceptance before moving on to game design process. Unlike most previous studies that explored stakeholder game acceptance after the development of games, our research aims to assess the readiness of parents, teachers, and students to adopt GBL from the beginning. By exploring the perspectives of these three key stakeholder groups, this research aims to provide a comprehensive understanding of the factors that may facilitate or hinder the adoption of game-based learning, in the case of Indonesia.

2. Previous Studies on GBL's Acceptance

2.1 Factors Influencing User Acceptance in Game-Based Learning

Compared to teachers and students, parents' acceptance of GBL is less studied, possibly due to underestimating the importance of their perspective in education (Hillier, Milne and Aurini, 2019). Some parents seeing GBL as an opportunity to make learning more interesting and interactive for their children (Rosyati *et al.*, 2020; Amzalag, 2021), while others may be more skeptical, concerning whether children truly acquire knowledge when playing video or have concerns about the potential negative effects of excessive game play (DeCamp, 2019; Xie, Wang and Hooshyar, 2021; Hidayat, 2022). The top three factors influencing parents' games acceptance namely learning opportunity, game experience, subjective norms, social influence, and cultural background (Nikken and Jansz, 2006; Bourgonjon *et al.*, 2011; Yong, Gates and Harrison, 2016; Lin, Li and Yang, 2018; Xie, Wang and Hooshyar, 2021). In our prior research, encompassing a sample size of 42 parents, the findings revealed that issues related to screen time management, facilitation conditions, and limited opportunities for social interaction significantly influenced their perspectives on GBL (Hidayat, 2022). When parents hold negative views or disapprove of a particular technology, it is highly probable that their children's acceptance of games will be impacted as well (DeCamp, 2019).

On the other hand, the successful implementation of GBL heavily relies on teachers' perceptions and attitudes, as they play a crucial role in executing learning games (Hanghøj and Brund, 2010; Chee, Mehrotra and Ong, 2015). Teachers serve as instructional designers when incorporating GBL into their classrooms (Pedler, Hudson and Yeigh, 2020). Their perceptions and openness of new teaching methods and technology could lead and impact to their instructional strategies (De Grove, Bourgonjon and Van Looy, 2012; Stieler-hunt and Jones, 2015; Rasmitadila *et al.*, 2020). They also need to be comfortable with the idea of giving up some control over the learning experience (Acquah and Katz, 2020; Luo, Brown and O'Steen, 2021) as GBL often involves a more student-led approach to education. Key factors influencing teachers' adoption of GBL include facilitation conditions, gaming experience, and challenges during the preparation phase (De Grove, Bourgonjon and Van Looy, 2012; Ucus, 2015; Bandara, 2018; Ibrahim, 2018; Alizadeh *et al.*, 2021; Siburian and Mahmud, 2022). Several other factors are also very important to look at, such as perceived usefulness, personal gaming mindset, parent's involvement, learning opportunity, teacher's skills, and personal positive belief in GBL (De Grove, Bourgonjon and Van Looy, 2012; Ucus, 2015; Huizenga *et al.*, 2017; Bandara, 2018; Ibrahim, 2018; Alhebshi, 2020; Alizadeh *et al.*, 2021; Siburian and Mahmud, 2022)

Furthermore, understanding students' acceptance of GBL is essential for effective implementation and maximising its potential as an educational tool (Byusa, Kampire and Mwesigye, 2022). The perception of GBL by students can significantly impact their level of engagement (Armier, Shepherd and Skrabut, 2016), motivation (Liu, Liu and Yue, 2021; Byusa, Kampire and Mwesigye, 2022), and overall learning experience (Bourgonjon *et al.*, 2010; Janakiraman *et al.*, 2021). Factors influencing students' game acceptance include perceived usefulness,

perceived ease of use, perceived enjoyment, learning opportunity, gender, and usability (Bourgonjon *et al.*, 2010; Martí-Parreño, Galbis-Córdova and Miquel-Romero, 2018; Huang, 2019; Wang, Wang and Jian, 2020; Liu, Liu and Yue, 2021; Udeozor, Russo-Abegão and Glassey, 2023). Several other factors, including learning opportunity (Bourgonjon *et al.*, 2010; Beavis, Muspratt and Thompson, 2015; Martí-Parreño, Galbis-Córdova and Miquel-Romero, 2018) and usability (Saleh, Prakash and Manton, 2014; Beavis, Muspratt and Thompson, 2015) exert an influential effect on students' acceptance of GBL. Only two studies from (Beavis, Muspratt and Thompson, 2015) and (Ninaus *et al.*, 2017) had primary school students as their research subjects. However, some students may be hesitant to embrace GBL, particularly if their parents and teachers are still unaware with the beneficial of games (Piller, 2016).

2.2 Recent Studies of Utaut 2 in Games Study

The Unified Theory of Acceptance and Use of Technology 2 (UTAUT 2), an extension of the original UTAUT model, includes additional constructs like Hedonic Motivation (HM), price value, and habit, along with the original constructs of Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Conditions (FC) (Venkatesh, Thong and Xu, 2012). It has served as a baseline model for new technologies and has been valuable in understanding technology adoption (Yein and Pal, 2021). In the case of the use in games research, Ramírez-Correa et al. (2019) argued that UTAUT 2 is better and suitable model to analyse online game use, although with certain changes, compared to Theory of Use and Gratifications or the original UTAUT. This model has been successfully used formerly in the online games sector, but we have not found in our review other works that have applied the UTAUT 2 model to GBL for primary school education. Ibrahim and colleagues' study with the utilisation of extended UTAUT for game-based learning seem to be the closest work (Ibrahim and Jaafar, 2011) even though their study occurred before the establishment of UTAUT 2. They add two new factors to the origin UTAUT with Enjoyment and Learning Opportunity but eliminate Facilitating Condition. Other recent work from Udeozor et al. (Udeozor, Russo-Abegão and Glassey, 2023) whom employed UTAUT 2 based survey and interview to investigate the factors affecting the adoption of digital games for engineering education also seem similar to our works. While the UTAUT 2 model has been widely used in various technology adoption studies, its application in the context of game-based learning, particularly among adolescents, remains relatively unexplored. To date, only one study we found that implemented UTAUT for primary school student's participant, however, this study focused on an online homework platform rather than on game-based learning. They (Chen *et al.*, 2024) extend UTAUT model by incorporating perceived playfulness, perceived interactivity, and flow experience into a theoretical framework for understanding the behavioural intention to use online homework platforms. Result shows that PE, EE, SI, and Flow Experience significantly impact elementary school students' behavioural intention toward online homework platforms. Perceived playfulness and perceived interactivity indirectly affect students' behavioural intention through the mediating effect of flow experience.

3. Methodology

This study was conducted in several phases (figure 1). The research began with the exploration of technology acceptance model that suitable most to our study. We decided to adopt UTAUT 2, but we exclude Price Value and Habit from our study since we did not evaluate user acceptance of published games; rather, we created a conceptual game from the interaction scenario video (Figure 2). After several iterative discussions about the questions with researcher's team, we got each 14 questions for students encompassing six factors, with two questions per factor except for facilitation condition and behavioural intention which include three questions, and each 12 questions for teachers and parents encompassing six factors, with two questions per factor (For a detailed breakdown of the survey results, see Appendix [https://shorturl.at/yYoGR]). This questionnaire is divided into two parts: the first section covers demographic questions, which include the participant's gaming experience and habit, while the second section focuses on game acceptance question. The survey was not formally tested for validity and reliability with the experts, due to constraints related to time and the challenging conditions imposed by the COVID-19 pandemic. However, to ensure that the child participants would understand the task, we conducted a pilot test like a trial with a sample of eight private primary school students, aged 7-12, to confirm clarity and eliminate any potential ambiguities. While we found that all students understood and easily completed the 7-point Likert scale surveys, it is acknowledged that the absence of formal validity and reliability testing represents a limitation of this study.

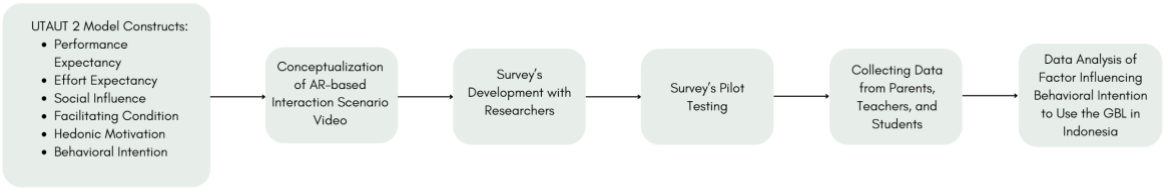

Figure 1: The data collection phases

Figure 2: The interaction scenarios video

Moreover, each group has different questions approach, in which, parents' acceptance of GBL refers to their willingness to support and engage with the use of games as a learning tool for their children, teachers' acceptance of GBL refers to their willingness to teach with the use of games as a teaching tool for them and learning tool for their students, while students GBL acceptance refers to their willingness and enthusiasm to participate in and engage with the use of games as a learning tool. Furthermore, the final phase involved analysing the collected data using Kruskall-Wallis.

4. Findings: Behavioural Intention to use the GBL

4.1 Performance Expectancy

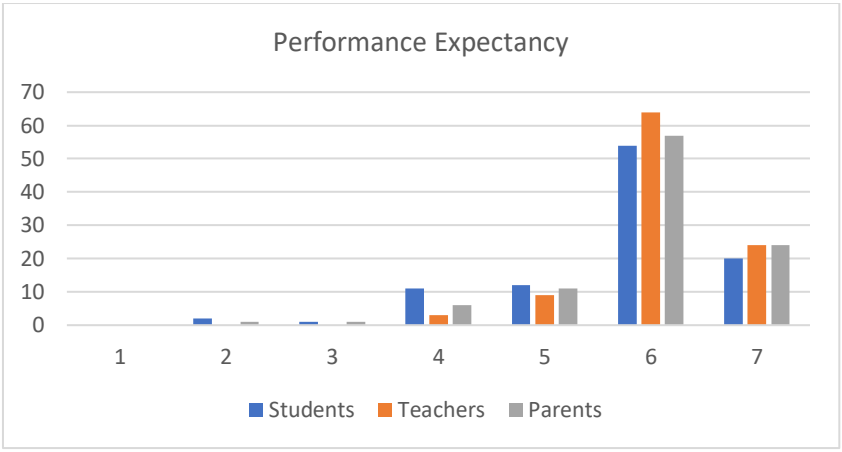

Figure 3: Frequency of responses for PE for students, teachers and parents

Figure 3 shows the frequency of response for the samples of students, teachers and parents for the variable PE. To check for differences between groups, we performed a Kruskal Wallis nonparametric test for independent samples. The test revealed statistically significant differences for PE between groups of students, teacher and parents ($H(2)=9.92$, $p=0.007$). Concerning the sample of students, they are the ones who have lower distribution values of PE, with an average of 5.4 and a standard deviation of 1.2. When we compare students with teachers

and parents, post-hoc Mann-Whitney tests using Bonferroni-adjusted alpha level of 0.17(0.05/3), showed a difference between students and teachers U(NStudents=129, NTeachers=47, z=-38.05, p=0.029) and between students and parents U(NStudents=129, NParents=135, z=-27.94, p=0.026). It is clear from Figure 3 that teachers and parents have a higher frequency of the higher scale values (6 and 7) than students. Teachers have the higher average value (6) and the lower standard deviation (0.7) followed by parents with an average of 5.7 and a standard deviation of 1.1. Between parents and teachers there was no statistically significant difference (U(Nparents=135, NTeachers=47, z=10.11, p=1)). In general, we can see that all of the groups have high values of PE, with averages above 5, however students have the more heterogeneous results, thus are the ones with more doubts about their PE.

4.2 Effort Expectancy

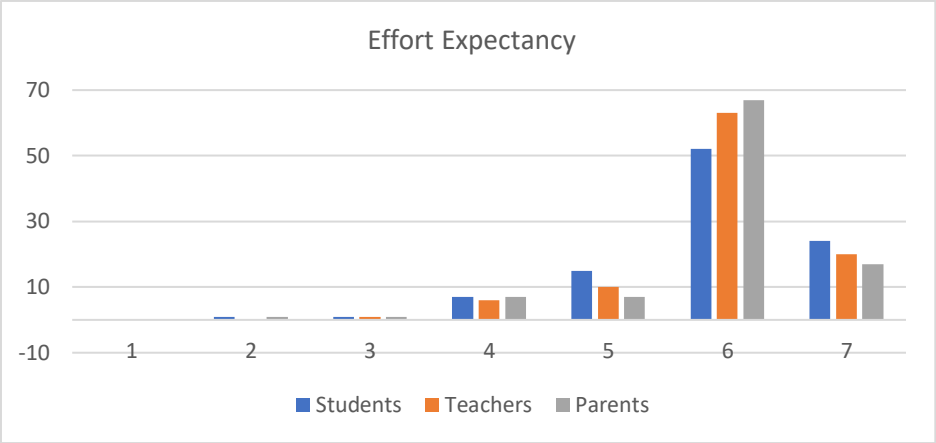

Figure 4: Frequency of responses for EE of students, teachers, and parents.

Figure 4 shows the frequency of response for the samples of students, teachers, and parents for the variable EE. The Kruskal-Wallis test showed no statistical differences in EE between student, teacher, and parent groups (H(2)=1.91, p=0.384). In this factor, students, teachers, and parents have Mean value distributions that are not too far apart, being 5.6; 5.8; and 5.7, respectively. Teachers have the lowest standard deviation (0.7) but with the highest value, followed by parents (0.9), and students (1.0). Overall, it becomes evident that all groups have high levels of EE, with average values exceeding 5. This proves that all three groups believe that the games interaction scenario video we provided, even with Augmented Reality technology, appears to be uncomplicated and easy to understand.

4.3 Social Influence

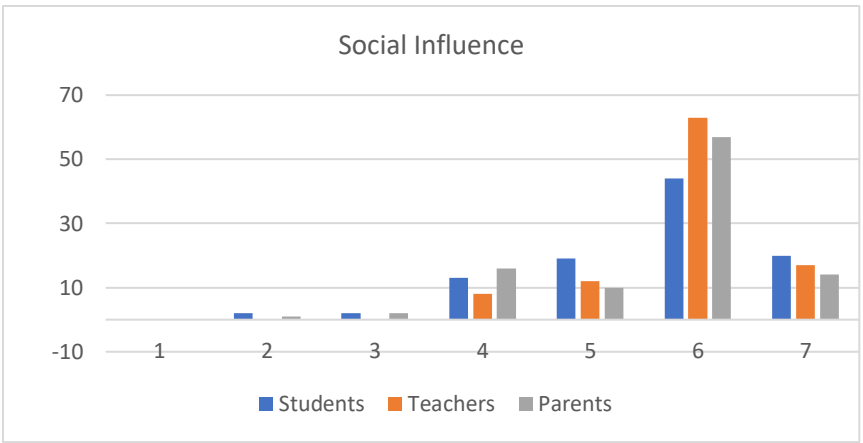

Figure 5: Frequency of responses for SI of students, teachers, and parents.

Figure 5 shows the frequency of responses for SI of students, teachers, and parents. The statistically significant differences between the groups are clear in this factor (H(2)=6.24, p=0.044). To discover the differences and comparisons among each sample, we employed the post-hoc Mann-Whitney test. There is a statistically

significant difference between students and teachers even after adjusting for multiple tests using the Bonferroni correction, the significance remains below 0.05 ($U(N_{Students}=129, N_{Teachers}=47, z=-36.23, p=0.044)$. However, in parents and teachers' comparison, the initial value is 0.032 and it indicates significance difference. But after adjusting for multiple tests using the Bonferroni correction, it increased ($U(N_{Parents}=135, N_{Teachers}=47, z=31.64, p=0.095)$. This means that, while there is some evidence of a difference in perceptions between parents and teachers, the difference might not be statistically significant when considering the multiple tests conducted. Furthermore, as shown from Figure 3, students and parents exhibit a more diverse range of values compared to teachers.

4.4 Facilitating Conditions

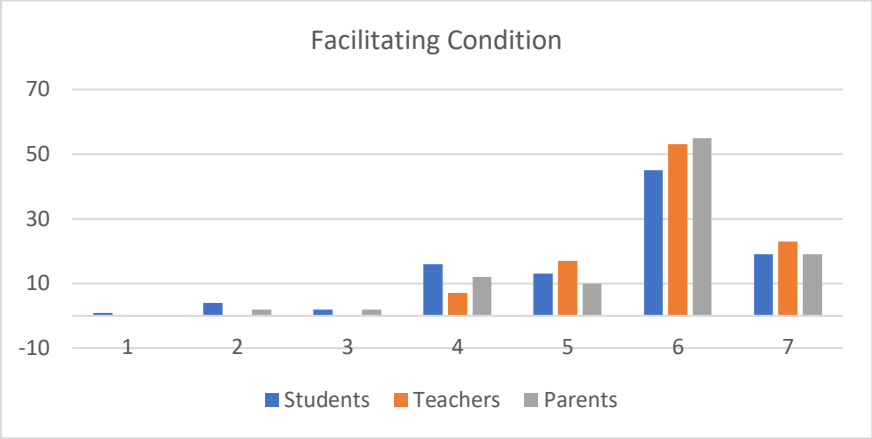

Figure 6: Frequency of responses for FC of students, teachers, and parents

In this factor, the Kruskal-Wallis non-parametric test shows that there is statistically significant difference between three groups ($H(2)=15.08, p=0.001$). The student's group has the broadest distribution of values compared to the other groups, with an average of 4.97 and standard deviation of 1.3. Consistent with the previous factors, we conducted a post-hoc Mann-Whitney test using a Bonferroni-adjusted alpha to examine the relationships. It was found that there is a statistically significant difference in the relationship between students and parents $U(N_{Students}=129, N_{Parents}=135, z=-31.91, p=0.01)$ and between students and teachers $U(NStudents=129, N_{Teachers}=47, z=-52.27, p=0.02)$ Conversely, there is no statistically significant difference in the views of parents and teachers regarding FC $U(N_{Parents}=135, N_{Teachers}=47, z=-20.36, p=0.53)$. Relatively, all groups display a positive attitude towards the FC factor with average values above 5. However, in this factor, the Mean value for students is the lowest (4.97).

4.5 Hedonic Motivations

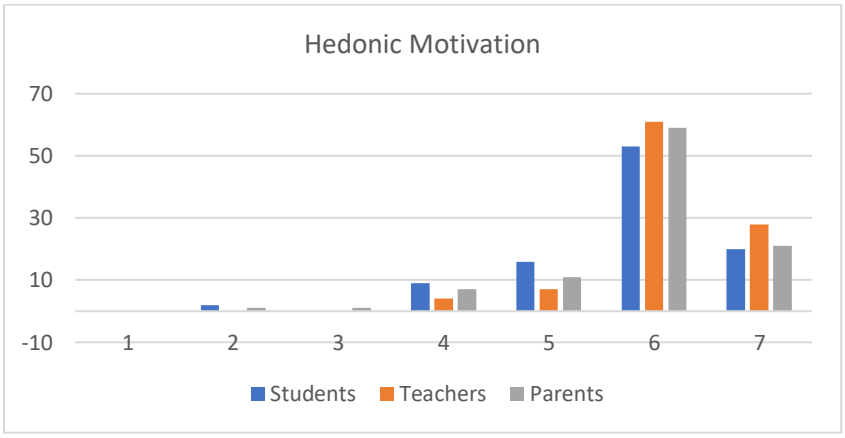

Figure 7: Frequency of responses for HMs of students, teachers, and parents

Based on the results of the Kruskal-Wallis test for the HMs factor, a statistically significant difference was identified among the three groups ($H(2)=10.78, p=0.005$). When comparing the three groups—students,

teachers, and parents—using post-hoc Mann-Whitney tests with a Bonferroni-adjusted alpha level, the p-value (Sig.) for the comparison between students and teachers was found to be 0.001. After adjustment for multiple tests, this value becomes 0.004. Both values fall below the significant level of 0.050, denoting a statistically significant difference in HM between students and teachers $U(N_{Students}=129, N_{Teachers}=47, z=-47.51, p=0.004)$. Conversely, the p-value for the comparison between parents and teachers stands at 0.040; after adjustment for multiple tests, it rises to 0.119. This adjusted value exceeds the significance level of 0.050, indicating that, when accounting for multiple tests, the difference in HM between parents and teachers is not statistically significant. Within this factor, teachers have the highest Mean value among the six factors we tested, displaying an average of 6.05 with a standard deviation of 0.69. Moreover, while teachers and parents generally expressed positive views toward HM, students appeared somewhat less enthused.

4.6 Behavioural Intention to Use GBL

Figure 8 illustrates the frequency of responses from the samples of students, teachers, and parents concerning the variable of BI. Upon examining the differences between the students, teachers, and parents groups, we found no significant differences in BI (H(2)=4.16, p=0.128). However, the mean values for BI in both the teachers' group (with an average of 5.58 and a standard deviation of 0.89) and the parents' group (with an average of 5.13 and a standard deviation of 1.2) are the lowest among the other six variables. This suggests that some parents might still be hesitant to permit their children to regularly use digital GBL (or on a daily basis), while certain teachers remain sceptical about the potential of GBL as a tool to augment learning activities and are uncertain about its implementation in schools. Nevertheless, on average, all groups displayed high values for BI, with Mean values exceeding 5. Thus, the average sample across the three groups demonstrates positive acceptance of this variable.

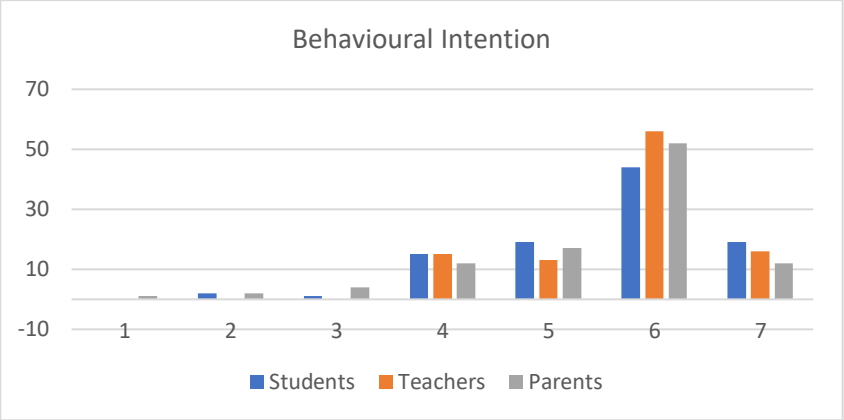

Figure 8: Frequency of responses for Behavioural Intention of students, teachers, and parents

5. Conclusions

Significant differences were found in the PE factor between student-teacher and student-parent relationships. Teachers and parents were confident in the potential of GBL to motivate and engage students, while some students were skeptical about its ability to deepen their understanding of environmental issues. This highlights the need to integrate LO into research on GBL's effectiveness. No significant differences were observed in the EE factor, as all groups found the GBL concept user-friendly. Positive perceptions from parents could ease teachers' concerns about GBL implementation. For SI, all groups generally felt supported in using GBL, although some doubts persisted due to the novelty of GBL in Indonesian schools. Some students may still feel the uncertainties about whether their parents or teachers would permit the use of GBL. Conversely, the teacher's group, which has the highest value, seems confident that both their colleagues and the students' parents would agree with the utilization of GBL in classroom. FC factor received the lowest scores, indicating doubts about having adequate tools for GBL, especially given restrictions on smartphone use in schools. Demographic data revealed that most students lacked personal mobile phones, relying on parents or siblings, which could limit parental support in resolving game-related issues. This indicates that some students may still have hesitation about whether they possess the necessary tools and if their parents or teachers can assist them when they encounter challenges with this technology. Conversely, the highest value for FC is still held by the teachers, who believe that they can support students in using GBL and that schools will provide adequate facilities for it. The

factor HM showed a significant relationship between students and teachers, with both groups finding GBL fun. However, some students found the concept less entertaining. It seems that teachers believe the game concept we introduced is highly entertaining, which would enhance their enjoyment when employing it for teaching. While for students, they might want to have more entertaining GBL. It is contrasting with findings from (Yong, Gates and Harrison, 2016; Xie, Wang and Hooshyar, 2021), where adults had lower confidence in GBL. Furthermore, factor BI showed no significant differences among groups, though parents had the lowest mean values, reflecting concerns about daily digital game use.

Remarkably, the interesting discovery in the case of Indonesian primary school was that adults showed a higher level of confidence in using games to improve students' learning experience than the students. This result could be attributed to cultural factors or their previous experiences with technology. Indonesian adults may have a greater appreciation for the potential educational benefits of GBL, viewing it as a valuable tool for enhancing learning outcomes, particularly in the context of environmental education. While the students may feel a lack of familiarity with GBL's effectiveness, or they just want a more fun games. It has come to be understood that parents and teachers never prohibit children from playing games, especially for educational purposes, but ensure that their responsibilities as students take priority overindulging in games. These insights could contribute for educational game designs area, to meet the needs and expectations of different stakeholder groups, particularly in primary school. Game designers should address the specific concerns of students perspectives, since they are the end-user of the GBL.

Furthermore, teacher's strong BI to use the game plays a crucial role in determining what kind of technology will be used in the classroom, as the teacher acts as a facilitator. Future research needs to gain a deeper about what technology that teacher's familiar with. While teachers might be confident in their abilities to use games to teach, as seen in the interaction scenario video, they might run into problems when using this strategy in the actual classroom. By understanding the perceptions and attitudes of these groups, educators and researchers can develop strategies to address any concerns or doubts they may have and promote the benefits of game-based learning.

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