Comparing the Immersive Levels of Trivia Hidden Object Game Paper-based and Game Applications

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The widespread development of the digital gaming industry in Indonesia began in 2000. The growth in interest in gaming has led to various objectives and encouraged research into several aspects and concepts of digital games. The aim of this research is to examine how significant the immersive differences are between paper-based game versions and applications/games among participants over 40 years old. The total average immersion obtained from the paper version is 4.43, while the application/game version is 5.85. For the average immersion per scale, the results of testing per scale show that the lowest average for the paper version is found in the Presence scale with 4.15, and the highest in Usability with 4.81. In the application/game version, the lowest average is found in the Focus Of Attention scale with a total of 5.55. The Usability scale scored 6.11, which is the highest result in the application/game version. The Interest scale is a category that has a significant difference between the paper and application/game versions with a margin of 1.6.

Keywords—Immersive, Trivia Hidden Object, Digital Game.

I. INTRODUCTION

The game industry entered Indonesia can be seen for the first time in the 1980s, where game products found in that year were console and arcade games. The development of the digital game industry in Indonesia began to expand in 2000. The early development of the game industry in Indonesia was centered in major cities in Indonesia, which generally were located in Java Island and its surrounding areas. The growth of the game industry in Indonesia led foreign game companies like Gameloft to open branches in Indonesia [1].

Currently, more and more people are playing digital games. The growth of interest in games has brought about diverse objectives and has spurred research into various aspects and concepts of digital games [2]. Digital games have a specific objective, which is to entertain and make players feel comfortable while playing them [3]. However, this is highly subjective as it largely depends on the characteristics of each player. Although the majority of digital game players are children and teenagers, the number of parents interested in technology and using various types of digital games is increasing [2], [4].

Besides being entertainment, games can also be beneficial in other fields such as education, business, military, medicine, and others [5]. In the field of education itself, games are intended to create a more interactive learning environment between students and teachers to make the classroom atmosphere more active, thereby enhancing students' knowledge and skills in understanding the lessons presented [5], [6]. In enhancing and evaluating learning, it can be done through various types of digital games, including one of them by using edu-games [7], [8].

Educational games, or edu-games, are terms used in the context of education that serve as one of the learning media to enhance learning motivation, engagement, and learning outcomes on specific topics [9], [10]. Edu-games can be utilized as one of the educational media that involve learning through doing. Players are required to learn in order to solve problems [11]. Features in edu-games not only create an engaging learning environment but also can present diverse and challenging materials to evaluate players' understanding [12]. To determine whether a game can be evaluated through factors such as engagement, engrossment, and depth of experience, measurements are conducted at the level of immersion.

Immersion is a concept often used in the literature of digital applications, such as video games, avatar-based virtual worlds, or virtual reality applications. One common definition of immersion is that it occurs when a player suspends disbelief and feels that they are within an enhanced digitally-mediated environment [13]. Immersion can be seen as a form of cognitive and emotional absorption, aimed at enhancing enjoyment, engagement in activities, and even learning [14]. In an immersive digital environment, players can experience sensations and perceptions that they are truly within that world [15], [16]. Because entertainment and learning regarding digital experiences depend on the depth of immersion achieved, immersion becomes a concept of high interest in certain contexts [17].

Based on the distribution of digital games in the year 2000, research was conducted on parents aged 40 and above. The reason for selecting participants aged 40 and above is that during the 2000s, the participants were already 17 years old or older, meaning they had just encountered digital games at that time. This is different from children nowadays who have been exposed to digital games since early childhood. To assess the level of immersion of digital games among participants aged 40 and above, a comparison of immersive values was made for the same game across different media.

The aim of this research is to examine the significance of the difference in immersion between the paper-based version and the application/game version of Trivia Hidden Object game among participants aged 40 and above. Trivia Hidden Object is a game where players search for an object in a picture based on a question or clue provided. This game was developed in two different media: paper-based and as a mobile application/game. The classification of participants in this study includes parents aged 40 and above who are still employed in Sidera village, near Palu city.

II. RESEARCH AND METHOD

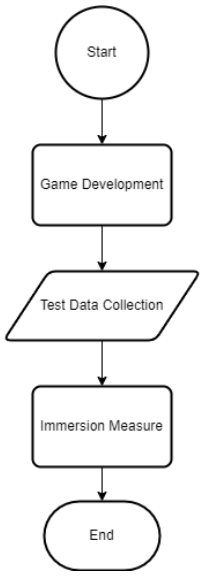

Fig. 1. Research flow

In this research, there will be three stages in its completion as shown in Figure 1, that is game development, test data collection, and immersion measure. During the game development stage, the Trivia Hidden Object game will be created in the form of a mobile application/game first, followed by converting the game into a paper-based format. Data collection and testing will occur after the game is completed, and participants will be divided into two groups: one group will play the paper-based version of the game, while the other will play the mobile application/game version. Once all data is collected, immersive testing will be conducted on both games based on participant questionnaire results.

A. Game Development

The Game Development Life Cycle (GDLC) methodology developed by Dr. Heather Chandler, as shown in Figure 2, is utilized as the game development methodology in this research. The GDLC method is chosen because game development is a central aspect of this study.

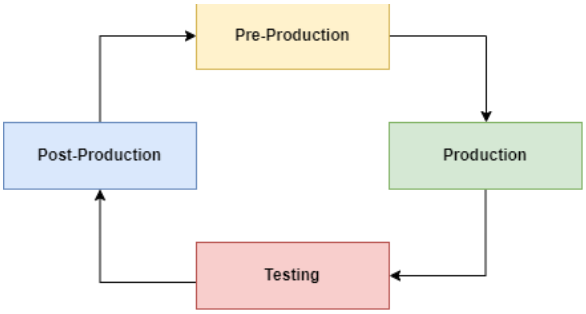

Fig. 2. Game Development Life Cycle Model

The Game Development Life Cycle process consists of four main phase as follows:

1. Pre-Production

This stage is carried out to determine the game design and project planning such as the game concept, which includes: game title, game genre, target market, gameplay, challenges, including game mechanics and game aesthetics [18], [19]. In this stage, the game title "Trivia Hidden Object" was created, combining elements of Trivia and Hidden Object game genres. The game is themed around Technology Education with a mixed gameplay of Trivia Game and Hidden Object. It consists of 5 stages; stages 1-3 have 5 questions each, while stages 4-5 have 7 questions each. Trivia Hidden Object also features a scoring system so players can see their playing abilities.

2. Production

This stage is the core of the process related to creating the technical and artistic aspects that implement the concepts, designs, and plans contained in the comprehensive Game Design Document (GDD) within the game. Asset creation, source code development, and integration of both elements are carried out at this stage [18]. This stage involves the development of the Trivia Hidden Object game, as shown in Figure 3.

Fig. 3. Gameplay from Trivia Hidden Object Game

In Figure 3, you can see the gameplay model of Trivia Hidden Object. In this game, players must search for the object mentioned by the question or clue given within a certain time limit. If they achieve a certain score, players can proceed to the next stage. If players fail to achieve the specified score, they can replay the stage with different object positions to avoid feeling repetitive. Players can also reset their scores if they wish to remove all the scores obtained from each stage, which means they have to replay from the first stage.

Fig. 4. Gallery from Trivia Hidden Object Game

In Figure 4, it show the Gallery menu of Trivia Hidden Object. This menu contains detailed information about the technological devices featured in the game. The menu is created with the aim of providing players with new knowledge or more

comprehensive information about the objects they guess while playing. Each object visible in the gallery is an object that players have already guessed during gameplay.

3. Testing

This stage is conducted when game development has been completed within one cycle. Testing in this context is carried out to assess the usability of the game and to evaluate the functionality of features and game difficulty related to game balance. Methods used to test game usability and assess feature functionality and game difficulty levels can be conducted through Playtesting along with test functions and gameflow tests. When testers encounter bugs, gaps, or games suddenly ending during Playtesting, it is important to note the causes and scenarios taken to reproduce the game [18]. In this stage, Software testing is performed using Black Box Testing. The results of the testing conducted can be seen in Table 1.

TABLE I. BLACK BOX TEXTING

No	Testing	*Test Case*	Expected Result	Test Result	Conclusion
1	When you click on the executable file	Click on the executable file	Enter the game and the main menu appears	aligns with expectations	Valid
2	Select 'play' in the menu	Click on the 'play' button	Enter stage selection	aligns with expectations	Valid
3	Opening the Information	Click on the 'info' button	Entering the stage	aligns with expectations	Valid
4	Opening the Information	Klik objek yang benar	Opening information	aligns with expectations	Valid
4	Choosing the correct object	Click on the correct object	Points add up and objects disappear	aligns with expectations	Valid
5	Choosing the wrong object	Click on the wrong object	Time decreases	aligns with expectations	Valid
6	Select the 'Retry' button	Click on the 'retry' button	*Repeating stages*	aligns with expectations	Valid
7	Select the 'Next' button	Click on the 'next' button	Entering the next stages	aligns with expectations	Valid
8	Select the 'Menu' button	Click on the 'menu' button	Return to the main menu	aligns with expectations	Valid
9	Select the 'Gallery' button	Click on the 'gallery' button	Enter the option section	aligns with expectations	Valid
10	Select the 'Option' button	Click on the 'option' button	Menghapus *Highscore*	aligns with expectations	Valid
11	Select the 'Reset Highscore' button	Click on the 'reset highscore' button	Reset the Highscore	aligns with expectations	Valid
12	Select the 'Back' button	Click on the 'back' button	Return to the main menu	aligns with expectations	Valid
13	Select the 'Exit' button	Click on the 'exit' button	Exit to the desktop	aligns with expectations	Valid

4. Post-Production

This stage is carried out to present the latest documentation and post-mortem activities. The main goal of post-production is to create closure tools and to complete the post-mortem. Post-production in this research is conducted by submitting relevant assets and the Game Design Document for the development of the next game(Husniah et al., 2018). In this stage, archiving is carried out, which includes game assets, game source code, and documentation results. The archive is stored securely so that it can be used in the future for purposes such as content updates, bug fixes, or game development.

B. Converting Game

After the entire game development is completed, the Trivia Hidden Object game is converted into a paper format that as shown in Figure 5.

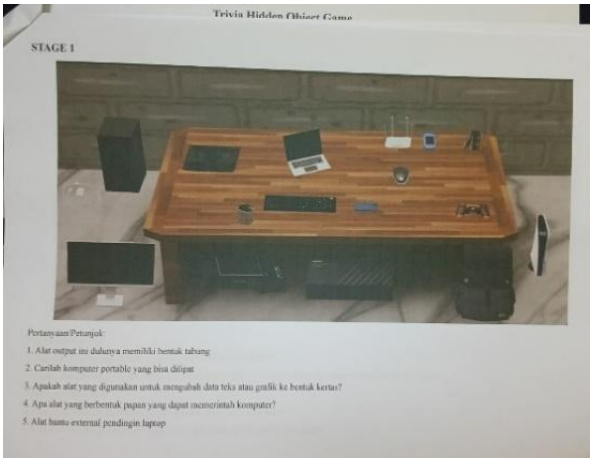

Fig. 5. Gameplay from paper based Trivia Hidden Object Game

The paper version of the game follows a gameplay similar to the application/game version, except that in the paper version, gameplay is conducted manually. When an object is found, players mark it with a pen and the corresponding

question/clue number. Due to the limitations of the paper version, scoring and timing in this game are done manually

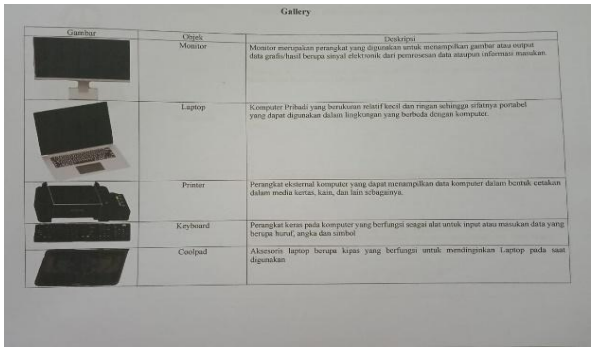

Fig. 6. Gallery from paper based Trivia Hidden Object Game

In the paper version, the game gallery can be accessed directly by players without needing to complete the game first, as shown in Figure 6. This is because the paper version differs from the application/game version, where everything is done.

C. Test Data Collection

In this stage, participants who meet the criteria of being 40 years old and above and still working are sought. A total of 40 participants are successfully obtained consisting of 18 women and 22 men. They were then divided into 2 groups: 20 participants play the paper version of Trivia Hidden Object, while the other 20 participants play the application/game version.

TABLE 2. LIST OF QUESTION

Immersion Level	**Scales**	Q	**Item Descripton**
Engagement	Interest	Q1	The game caught my attention
		Q2	I liked the game because it was novel
		Q3	I wanted to spend the time to complete the game successfully
		Q4	I liked the type of the game
	Usability	Q5	I feel that the flow of the game is easy to follow.
		Q6	I don't find any difficulty in playing this game.
		Q7	I feel that the gameplay is not too complex, making it easy to play.
		Q8	I feel like I can obtain the information/learning that I want.
Engrossment	Emotional Attachment	Q9	I feel like I want to finish this game quickly.
		Q10	I want to know how the progress of this game will be next.
		Q11	I feel excited while participating in this game.
		Q12	I sense tension in the game.
	Focus of Attention	Q13	If i get distracted, I think about returning to play the game.
		Q14	I feel more focused on the game than on other irrelevant thoughts.
		Q15	I often lose track of time while playing the game.
		Q16	Daily thoughts and worries fade away while playing the game.
		Q17	I'm more focused on the game than external distractions.
		Q18	While playing, almost nothing can distract my attention.
Total Immersion	Presence	Q19	The game feels authentic.
		Q20	The game feels like an experience, not just mere play.
		Q21	I feel so engaged in the game that I feel my actions can influence its course.
	Flow	Q22	I don't have irrelevant thoughts or external distractions while playing.
		Q23	The game becomes the sole unique thought occupying my mind.
		Q24	While playing, time seems to stand still, and the only thing on my mind is the game.

Table 2 contains a list of questions to assess the level of immersion in the Trivia Hidden Object game, both the paper version and the application/game version. There are 3 Immersion Levels, each with 2 scales, totaling 24 questions overall. For the Engagement stage, it is based on access and investment. Access refers to the player's preference for the game and control of the game being played. If players can access the game, they will invest time, effort, and participate in the game. From Engagement, players can become more involved in the game and enter the level of Engrossment, which is the next Immersion Level. During this level, attention and emotional attachment to the game are determining factors. Finally, there is Total Immersion, where players feel a sense of presence, meaning they feel immersed in the game world and are emotionally involved to the extent that the game becomes the most important thing at that moment [14].

D. Immersion Measure

To calculate the level of immersion in the Trivia Hidden Object game, both the paper and application/game versions, the Likert Scale results ranging from 1-7 are computed for each question. A 7-point rating scale (1 being "Strongly Disagree" and 7 being "Strongly Agree") is applied to each question. Each question is kept simple and directed towards positive statements to reduce confusion in answering the questions [20]. The Likert scale is then used to calculate the mean, standard deviation, and Cronbach's Alpha. The mean value serves to observe how the results differ across each level of immersion scale. The standard deviation is used to determine the variability of responses for each question. Cronbach's Alpha is used to measure consistency at each level of immersion. These three values are obtained by converting the results of the Likert scale using the Statistical Package for the Social Sciences (SPSS). The final results sought are the Mean, Standard Deviation, and Cronbach's Alpha. These results will be compared to see how immersive the game is for individuals over 40 years old.

III. RESULT

In this stage, immersive calculations are conducted for the paper and application/game versions of Trivia Hidden

Object. The Mean and Standard Deviation results are displayed for each question, while Cronbach's Alpha is categorized for each Immersion Level, as shown in Table 3.

TABLE 3. RESULTS OF IMMERSION MEASURE TRIVIA HIDDEN OBJECT

Immersion Level	Scales	Q	Paper Based			Application/Game		
			Mean	Standard Deviation	Cronbach's Alpha	Mean	Standard Deviation	Cronbach's Alpha
Engagement	Interest	Q1	4,5	1,7	0,93	6,55	0,68	0,72
		Q2	4,8	1,6		6,05	0,88	
		Q3	4,2	1,98		5,7	1,03	
		Q4	4,4	1,84		6	0,72	
	Usability	Q5	4,85	1,72		5,9	1,02	
		Q6	4,65	1,59		6,25	0,91	
		Q7	4,55	1,5		6,4	0,88	
		Q8	5,2	1,67		5,9	0,91	
Engrossment	Emotional Attachment	Q9	4,25	1,58	0,97	6,2	0,89	0,66
		Q10	4,55	1,63		5,65	0,67	
		Q11	4,4	1,72		6	0,64	
		Q12	4,25	1,61		5,6	0,88	
	Focus Of Attention	Q13	4,55	1,35		5,3	0,65	
		Q14	4,4	1,67		5,4	0,68	
		Q15	4,2	1,82		5,6	0,82	
		Q16	4,5	1,53		5,55	0,68	
		Q17	4,5	1,79		5,75	0,85	
		Q18	4,3	1,83		5,75	0,91	
Total Immersion	Presence	Q19	4,15	1,56	0,97	6,3	1,03	0,58
		Q20	4,25	1,77		5,85	0,73	
		Q21	4,05	1,84		5,7	0,73	
	Flow	Q22	4,5	1,73		5,55	0,68	
		Q23	4,35	1,75		5,65	0,81	
		Q24	4,15	1,75		5,8	0,69	

The occurrence of significant differences in the average scores is observed across almost all questions when comparing the paper and application/game versions. The total average immersion score for the paper version of the game is 4.43, which is significantly lower compared to the application/game version, which scored 5.85. The total average Standard Deviation for the application/game version is 0.81, indicating that the values for each question do not vary much. These results also affect the Cronbach's Alpha values, which are low for each Immersion Level as seen in Table 3. Although low, as long as the Cronbach's Alpha values remain above 0.4, it means that the category is still reliable. The paper version of the game shows significantly different results in Standard Deviation, with an average of 1.69. These results affect the Cronbach's Alpha values, which approach 1 for all three Immersion Levels as shown in Table 3.

The average results are relatively close in both game versions for Q8, which states "I feel like I can get the information/learning I want." The paper version scored 5.2, while the application/game version scored 5.9. On the other hand, there is a significant difference in average results between the two game versions for Q19, which states "The game feels very authentic." The average scores are quite distant, with the paper version at 4.15 and the application/game version at 6.3, indicating a difference of 2.15 in average scores.

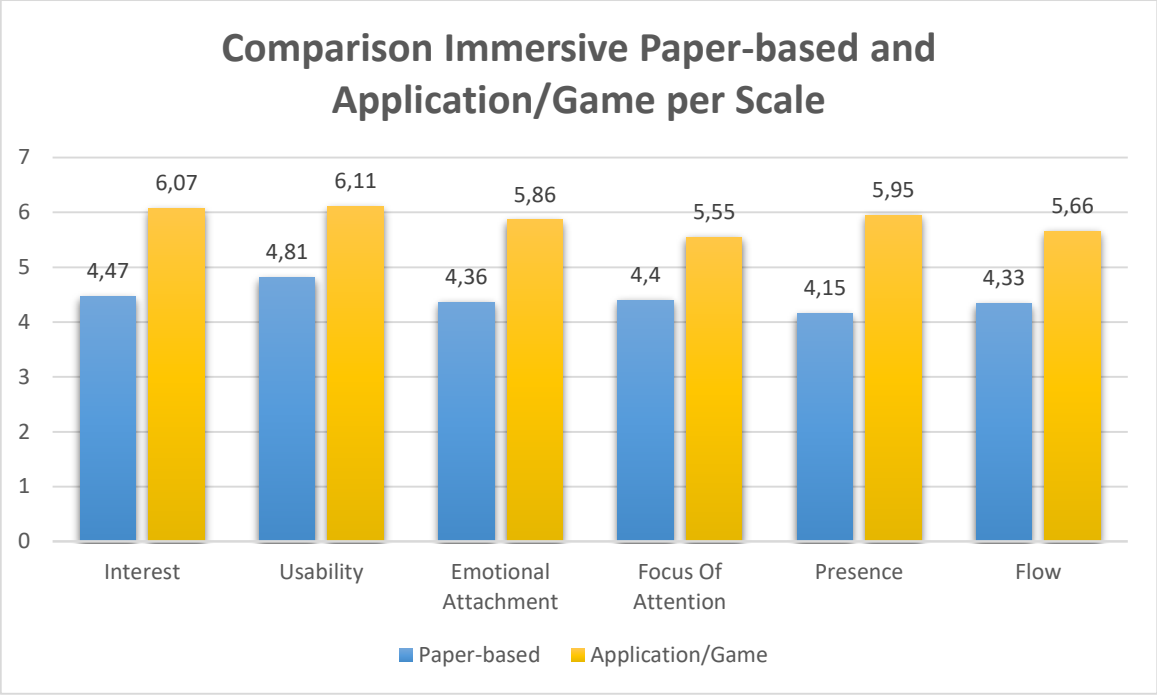

Fig. 7. Results of Immersive Measurement for Trivia and Hidden Object per Scale

For the measurement results of immersion per scale, the lowest average score in the paper version is found in the Presence scale, with 4.15, while the highest is in Usability, with 4.81, as shown in Figure 7. In the application/game version, the lowest average score is in the Focus of Attention scale, with 5.55. Meanwhile, the Usability scale obtains the highest score of 6.11 in the application/game version. The Interest scale is a category that shows a significant difference between the paper and application/game versions, with a gap of 1.6.

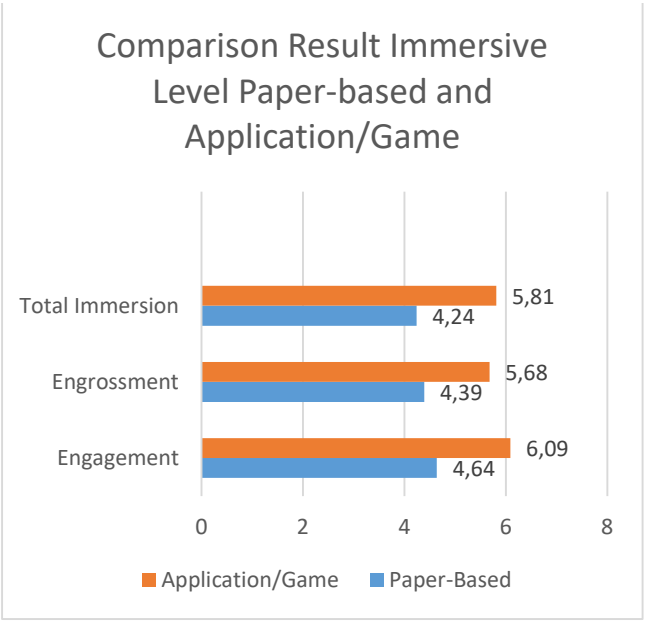

Fig. 8. Results of Immersive Measurement for Trivia and Hidden Object per Immersion Level

For the measurement results of immersion per Immersion Level, the lowest average score in paper version is found in the Total Immersion with 4.24, while the highest is in Enggrosment with 4.64 as shown in Figure 8. In the application/game version, the lowest average score is in Enggrosment with 5.68. Meanwhile, Engagement obtains the highest score of 6.09. Total Immersion is a category that shows a significant difference between the paper and application/game versions, with a gap of 1.57.

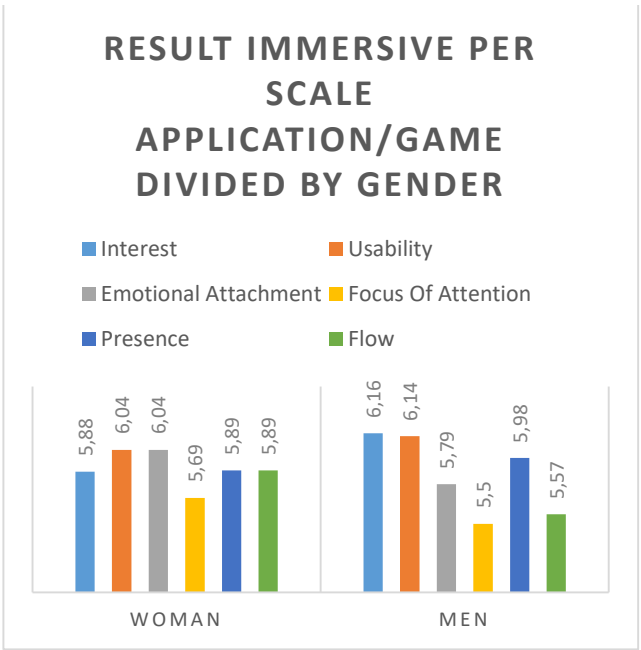

Fig. 9. Results of Immersive Measurement for Trivia and Hidden Object application/game per Scale Divided by Gender

For the immersion results per application/game scale based on gender, the Focus of Attention scale has the lowest score for both genders, with a score of 5.69 for woman and 5.5 for men as shown in Figure 9. Additionally, the Flow scale for men is the second lowest, with a score of 5.57. Meanwhile, the second lowest scale for woman is Interest,

with a score of 5.88. The highest scale for woman is Usability and Emotional Attachment, both scoring 6.04, while for men, the highest scales are Interest and Usability, both scoring 6.14.

IV. CONCLUSION

After conducting immersive measurements on both versions of Trivia Hidden Object among participants aged 40 and above, it can be observed that the application/game version outperforms the paper version across all scales in terms of average scores. There is a significant difference in the average scores between the paper and application/game versions, amounting to 1.41. Both versions have also achieved Cronbach's Alpha results of more than 0.4 for each Immersion Level, indicating that this factor is acceptable for each game version.

From these results, participant preferences lean towards the application/game version of the game, indicating that is more immersive compared to the paper version according to participants aged 40 and above making application/game version much better compared to the paper version.

The game's genre and player experience can also serve as a reference for game designers and educators in creating immersive games for older adults. Furthermore, there are several scales with values that vary according to the participant's gender. This variability can be a key consideration in designing games that are engaging for participants of all genders aged 40 and above.

Nevertheless, this study has several limitations. It only focuses on the Trivia and Hidden Object game genres. The results cannot be generalized to all other game genres. Additionally, the participants are limited to individuals aged 40 and above who are already employed. For future research, different game genres can be explored and tested for their level of immersion. Additionally, participant selection can be expanded to include various age ranges and classifications.

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