UNFOLDING EXERGAME ROLES TO IMPROVE PRE-SERVICE EDUCATION TEACHERS' PHYSICAL ACTIVITY LEVELS USING DRAWINGS ANALYTICS

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Abstract

The exergame concept allowed us to promote physical activity (PA) through games. It helps to normalise PA rather than segregate or exclusive PA to certain times or settings. Nonetheless, studies on exergames during online distance learning are currently scarce. Therefore, this study aimed to explore participants' insights and feelings towards exergame concepts to promote physical activity (PA). Specifically, aspects such as participants' understanding, knowledge, and motivation with the exergame were analysed through drawings to investigate how the exergame influences their engagement with PA and learning during online distance learning (ODL). This study adopted a qualitative research design. Drawings were utilised to explore participants' perceptions, motivation to play, and exergame as a teaching tool. The participants comprised 45 first-year undergraduate physical and health education (PHE), biology, and chemistry major students aged between 20-25 years. The Interpretive Phenomenological Analysis approach was adopted to develop the procedures while Consider.ly software [Usertime Solutions GmbH] was used to analyse data from the videos and drawings. Findings indicate that (i) emoticons were used to represent the changes in feelings among the participants throughout the intervention; (ii) the use of objects, symbols, and characters to portray the sense of protection, togetherness, and curiosities; and (iii) the combination of split drawings were used to express differences between ideas and thoughts on exergame approach among participants. Overall, the findings demonstrated the exergame potential (e.g., higher learning ownership, student-centred) and challenges (e.g., accessibilities, game-built quality) which helped inform future teaching planning and practices to promote meaningful learning experiences during distance learning.

Keywords: Characters, drawings, exergame, online learning, physical activity

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1. Introduction

Studies on the theory and practice of how people learn individually or in groups in an online environment have increased consistently in recent years (Yang et al., 2020). The recent COVID-19 pandemic has accentuated people's adoption of technology to complete their daily tasks and needs including education and physical activity (PA). The Department of Statistics Malaysia (DOSM) has reported that Malaysians spend on average 8-9 hours daily with their gadgets for many purposes (e.g., productivity, learning, socialising) (DOSM, 2019). Additionally, 100% of Internet users aged between 16 and 64 in Malaysia have utilised social networks or messaging applications as well as spend an average of 2 hours and 45 minutes on social media (Kemp, 2020). Consequently, more Malaysian university students are prone to anxiety and depression due to smartphone addiction (Ithnain et al., 2018).

The initial implementation of the movement control order by the Malaysian government in March 2020 has resulted in "online distance learning" or ODL teaching and learning mode in many universities in Malaysia. Most of the classes and assignments were modified to accommodate ODL and minimise movement during the period. The increase in sedentary lifestyles throughout the period has not only heightened anxiety and depression (Ithnain et al., 2018), cognitive impairment (Wilmer et al., 2017), lower sleep quality (Demirci et al., 2015) but also obesity among the students (Isa & Palpanadan, 2020).

1.1. Exergame and its role in the educational context

Literature in educational contexts indicates that individual and collaborative learning occurs over some time; hence it is referred to as the "learning process" (Knight et al., 2017). As with other academic content, learning with the exergame approach would take time for students to explore, experiment with, develop an interest in, and become a routine before modified behaviours can emerge. Exergame is a concept of games for health, in which the game mechanics require the players to move and be active to progress in the game (Baranowski et al., 2014). Many populations found the exergame approach to be an intriguing and enjoyable way to learn and sustain their PA levels. Previous meta-analysis studies on health and exergame between children and adolescents' population found that exergame was capable of increased PA compared to sedentary video games (Gao et al., 2015; Gao et al., 2017).

Meanwhile, a systematic review of exergame among rehabilitative seniors found that most seniors improve their balance (Zeng et al., 2017) while a study involving dance exergaming among 37 adolescent girls three times per week for 12 weeks also improved the participants' psychosocial outcomes (i.e., self-report intrinsic motivation, self-efficacy) (Staiano et al., 2017). Nonetheless, a comparison study on exergame between children with autism spectrum disorder (ASD) and children without ASD in six exergame sessions of 45 minutes for two weeks found no difference between the groups on object control and manipulation skills. Factors such as the insufficient amount of gameplay and lack of supervision were deemed as limitations which may have influenced the study outcomes (Edwards et al., 2017).

The presence of visuals, sounds, characters, narratives, and challenges in exergame also enhanced the entertainment value which motivates individuals to engage in PA (Gao & Chen, 2014; Zulkifli & Danis, 2022). Additionally, many authors suggest that exergame can be a welcoming distraction and allow for higher intensity and longer frequency of PA (Lyons et al., 2016). In their studies, the adoption of exergame was found to reduce rating perceived exertion (RPE) during moderate-to-vigorous intensity (MVPA) PA

among participants (Gao et al., 2017; Gao, 2017). Nonetheless, the type and content of the exergame would also determine physiological changes such as heart rate (HR) and energy expenditure (EE) which affect potential health benefits from engaging PA with exergame (McDonough et al., 2018).

Exergame also positively impacts individuals' cognitive and affective learning domains. Games such as Fitness RPG encourage players to plan, perform, and evaluate their PA performance (e.g., calories, distance, mission, and character levels). Therefore, each player can have different outcomes when playing the game depending on their plan, strategies, effort, and time spent engaging in PA. Being able to make their own decision empowers the individual while reducing negativity such as peer pressure, fear of failure, and dependence (Mellecker et al., 2013; Zulkifli & Danis, 2022).

1.2. Drawing analytics and physical activity behaviours

Drawing analytics are considered valuable and used by many scholars and clinicians as drawings may demonstrate an individual's feelings, ideas, and competencies both abstractly and figuratively about a specific context (Nagamey et al., 2018). Changes over time in classrooms and schools could also be monitored through students' drawings approach (Haney et al., 2004). Previous studies related to personality or emotional adjustment (MacPhail & Kinchin, 2004), sex and gender-role differences (DiCarlo et al., 2000), and human figures (Cox et al., 2001) were some examples of studies that integrated drawings analytics into their studies.

Additionally, drawing was deemed to be more exciting and less judgemental for the individual to express their thoughts and feelings on the issues and serve as complementary to written words. Drawings were capable of becoming the stimulus to motivate, present situations, and develop emotions (Vince & Broussine, 1996). Difficult or indescribable messages were easier to be conveyed via drawings rather than spoken or written words (Bulunuz, 2019). This finding may be due to a higher sense of freedom given to individuals to decide the contents and objects they wish to include in the drawings rather than prompted by researchers' frame of reference (MacPhail & Kinchin, 2004).

Furthermore, participants from various backgrounds (e.g., races, and languages) may also use drawings instead to express their thoughts and experiences about the exergame (Medina-Jerez et al., 2011). Consequently, the drawings may provide complete clarification of the mental image as well as subjective insights rather than objective on how individuals perceive the situation. The combination of both subjectivity and objectivity in collecting data would enhance the ability to infer and interpret data meaningfully (Daston & Galison, 2010).

Besides that, in the case of a traumatic event, the experience may be vague and fragmented; thus, the drawings approach with the combination of colours, shapes, and motifs would help prompt individuals to express, solidify and verbalise unconscious thoughts (Gantt & Mills, 2009; Nagamey et al., 2018). Previous studies also found that students involved in dynamic visualisation (e.g., imagining and drawing) consistently outperformed their counterparts who practice static visualisation (e.g., imagine) in describing chemical reaction processes and linking concepts with real-life examples using a visualisation tool (Chang et al., 2014).

Therefore, the main aim of this study was to explore participants' insights towards exergame concepts to promote physical activity (PA). Specifically, aspects such as participants' understanding, knowledge, and motivation with the exergame were analysed through drawings to investigate how the

exergame influences their engagement with PA and learning during ODL. To the best of our knowledge, a limited number of studies use drawing analytics among young adults to explore participants' interest in PA engagement or educational research. Considering the importance of the exergame approach for diagnosing participants' knowledge, perceptions, and motivation, this study explored the exergame roles in predicting participants' engagement in PA during ODL. Our study addressed the following research questions:

a) What are the participants' understanding towards the exergame approach?

b) How do participants' knowledge of the exergame (i.e., advantages, disadvantages, the game as a teaching tool) change over time?

c) What is the association between exergame and participants' motivation to engage in PA during ODL?

This paper employed the drawing analytics methods for the exergame approach to uncover a core focus of this study, namely, understanding how exergame impacted participants' PA engagement during the ODL semester. More specifically, this study aimed to diagnose and predict participants' engagement in PA based on their drawings related to Fitness RPG (Role Playing Games) [Shikudo Inc.] over time using drawing analytics. The participants' drawings were collected from Google Classroom [Google Inc.] and pictorial evidence such as lines and shapes were analysed at the end of the intervention.

2. Materials & Methods

2.1. Participants

The participants were recruited via students' enrolment in the individual sports subject between October – February 2021 from three departments (i.e., physical education (PE), biology, chemistry) of the Faculty of Education in a local university located in central Selangor, Malaysia. All participants aged between 20-25 years old were undergoing pre-service teachers training and would receive a degree in education after completing their four-year program at the university. As many as 45 first-year education students (13 males and 32 females; 11% (5) from East Malaysia, and 88% (40) West Malaysia students) participated in the study. Contents of the subject and assignment (e.g., rubrics, time, goals) were consistent throughout each class (e.g., PE, biology, chemistry) and the intervention was conducted from October to February 2021.

2.2. Procedures

This study adopted the phenomenological approach as the basis of this study. This qualitative approach allows the researchers to attempt to describe phenomena from the participants' perspectives. Specifically, this study seeks to understand how participants perceive the Fitness RPG, its roles in shaping an individual's experience towards PA (Neubauer et al., 2019), to explore meanings that inform or readjust our understanding of exergame concept and application among participants (Gill, 2014).

The researchers spent about two months before the beginning of the new semester devising the study design which includes a period of literature review to gain insights into the exergame approach, and meeting experts (online) to discuss appropriate aims, objectives, and methodological issues of this study. The next phase involved the researchers engaging the students to inform them about the study framework, benefits,

and potential risks (if any) associated with participation in this study. Once the students fully understood what was expected of them and all questions were satisfied, they were invited to complete the consent form. Additionally, the participants were free to withdraw from the study at any time without any consequences. Ethical approval was obtained from the university research ethics committee before the beginning of this study.

The participants were introduced to the Fitness RPG [Shikudo Inc.] game as part of their assignment for the individual sports subject. Apart from the game, the main researcher also highlighted the rubrics and goals of completing this task. There were no specific instructions on what, when, where, whom, and how they should collect the steps to convert into energy and win missions. Prompts such as reminders and ideas of activities (e.g., jogging, doing house chores) and occasional checks on participants' progress helped the participants to keep motivated and continue their PA throughout this study. Participants were also encouraged and reminded about the benefits of regular PA and their continuous assessment throughout the study.

Data were collected in week 13 of the semester which involved participants completing two drawings. Specifically, participants were given two minutes per drawing before the start of the class session to draw two drawings in separate A4 size papers based on the researcher's questions such as (1) what is your feeling, advantages, and disadvantages of playing the Fitness RPG? and (2) how do you think exergame can help you to become a better educator in future? The participants were given the freedom to reflect on their experience via drawings without any specific instruction from the researcher (e.g., shape, size, colours).

The researchers emphasised that the participants' feedback should be honest and that there were no specific correct or false answers to the questions among participants before, during, and after the drawing sessions. Additionally, prompts (e.g., verbal encouragement, and positive body gestures) were given to support participants to complete their tasks on time. Upon completion, participants were asked to show each drawing to their camera as evidence of their completing the task. Subsequently, the researchers asked the participants to scan their drawings and provide brief explanations about their drawings before sending a short video of their drawings and explanations back to the main researcher within two days via the Google Classroom platform [Google Inc.].

The final phase involved the researchers conducting the thematic content analysis; both drawings and videos were viewed and reviewed; the explanations were transcribed and analysed individually; issues related to researchers' differing opinions were resolved to ensure conformity regarding meaningful themes and sub-topics.

2.3. Instrument

2.3.1. Drawing

The participants' insights on the exercise were evaluated using two drawings on separate A4-size papers. They were required to reflect, and draw based on the questions given such as (1) what is your feeling, advantages, and disadvantages of playing Fitness RPG? and (2) how do you think exergame can help you to become a better educator in future? The drawings were especially useful to explore participants'

experiences either abstractly or figuratively. Additionally, through drawings, participants may be more encouraged and willing to share hidden or repressed thoughts and feelings (Nagamey et al., 2018).

Previous studies have used various features in drawings (e.g., shapes, motifs) to try to understand unconscious expressions which solidified the verbal contents in video reflection (Gantt & Mills, 2009; Lev-Wiesel & Liraz, 2007). This instrument is especially capable of producing valid and reliable data among the young adult and adult populations (Nagamey et al., 2018; Varea & Gonzalez-Calvo, 2020). The researchers conducted this drawing session for all participants at the beginning of the final class session in week 13 of the semester.

2.4. Data analysis

Drawings from each participant were reviewed a minimum of two times as a process of data familiarisation. The initial coding process involves the researchers identifying the common or repetitive pictorial evidence through features such as lines, shapes, images, textures, contrasts, massive area space, and the relation between each feature (Thyme et al., 2013). Each unique feature in the drawings was initially broadly identified based on its pictorial phenomena, signs in the drawings and the researchers' impression. Specifically, the repetition of objects or styles in each drawing has helped the researchers to gain an in-depth understanding of participants' experience of exergame during their ODL period (Nagamey et al., 2018).

The aggregated signs in the drawings helped the researchers to carefully assess participants' thoughts and feelings through the compositional and stylistic elements of each drawing (Huss et al., 2012). Subsequently, the related codes were grouped into categories to aid in understanding and systematically reviewing data. Objects and signs deemed to be irrelevant or providing minor contributions were excluded from the data analysis. The combination of researchers from different fields and areas of expertise comprised of physical education and primary health care also enhances the reflexive approach and transferability between researchers' perspectives, values, and beliefs which reduces the tendencies of bias and preconception. Both researchers continuously review and refine codes and categories and exchange input to ensure the credibility of the coding process (Malterud, 2001).

3. Results and Discussion

**Table 1.** The pictorial phenomenon related to ODL and exercise

Drawings Phenomenon
1. The use of emoticons to represent feelings
2. The use of objects, symbols, and characters
3. Combination of split drawings to express a sense of motivation

The drawing analytics yielded three themes. The first theme focused on the participants' use of emoticons to express their feelings and how they changed throughout the intervention. The second theme described the use of objects, symbols, and characters as tools to highlight the knowledge gained while the last theme discussed the roles of split drawings in participants' motivation to engage in PA during ODL via

the exergame approach. To ensure participants' confidentiality, pseudonyms were used throughout this study to replace the actual names of the participants.

*3.1. The use of emoticons to represent feelings*

One fundamental phenomenon of drawings that emerged from the artwork of the participants was that of emoticon drawings. It was manifested in the depiction of ever-changing emotions as the intervention progressed. These emoticons were often emphasised in their drawings with different sizes and contents. Furthermore, some drawings tend to have a limited colour scale and almost no referral to the surroundings.
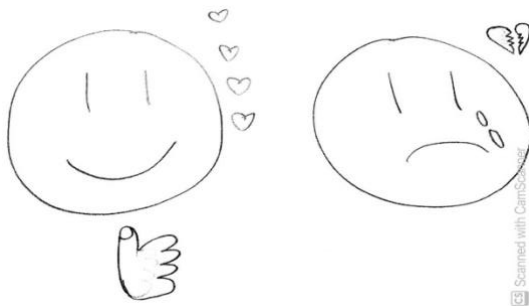
Figure 1. Emoticons depict happiness and heartbroken
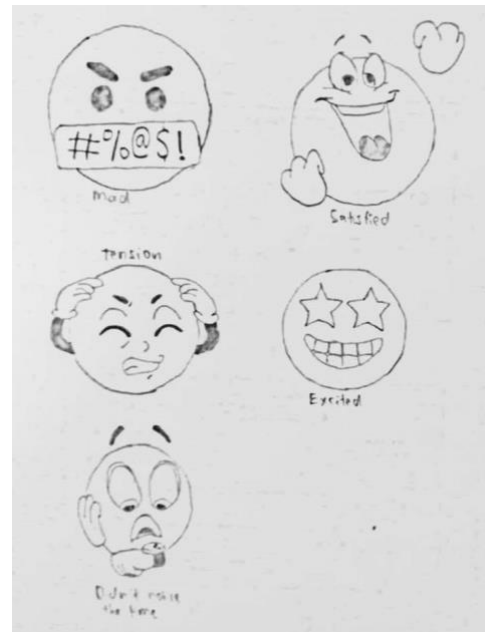
Figure 2. Drawings of many emotions throughout the intervention
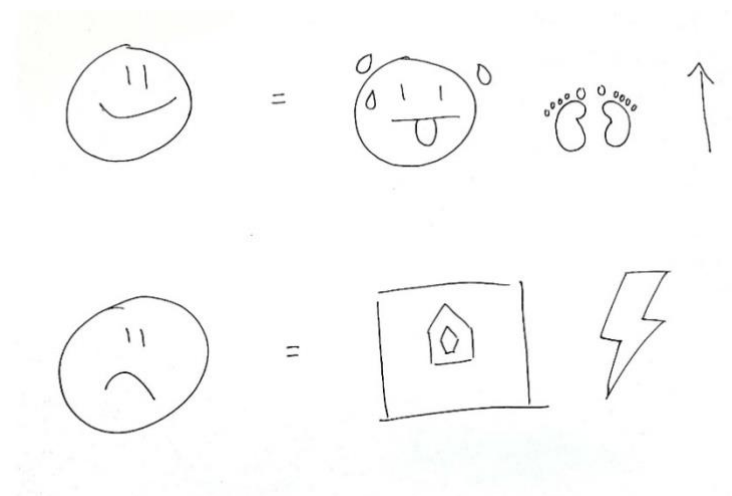
Figure 3. Emoticons demonstrate like and dislike of the exergame content and needs

The overall impression was excitement, lack of a way out, and frustrating emotions among participants throughout their Fitness RPG journey. The changes of emotion portrayed in Figure 1 were explained by the participant: "Initially, I am curious about the adventure (e.g., different levels, exploring map) but then I feel frustrated when I can't progress to the next level." (Far) The likelihood of success in each game depends on factors such as experience with the game, practice time in playing the game, and set goals when starting the game. Those who have participated in e-sports for instance might have more experience, ideas to clear obstacles set in the game, and better strategies to organise their characters, equipment, and battle against monsters compared to non-gamers. Those only started to play games might struggle to understand the exergame concept, slower development of hand-body coordination, and experience failure more frequently compared to participants who have played games before this intervention. Previous studies related to esports have also found that active mobile games could help improve sports knowledge, competitive skills, social interaction, and skill-building for problem-solving, as well as providing pleasurable stimulation (Baltezarevic & Baltezarevic, 2019; Seo, 2013).

Emotions in Figure 2 were also associated with time constraints, difficult content, and Internet limitations. For instance: "I think this game is too long to complete." (Shau) and "It is very difficult for me to balance between playing the game and other work, difficult to collect energy and clear each level as the game progressed." (Zati). Meanwhile, a few participants pointed to the game's crucial dependence on Internet connectivity. The accessibility issues which include equipment and facilities are critical as they may influence an individual's interest to continue using the exergame beyond this intervention. Previous studies have also highlighted the importance of equipment and facilities to support students' ODL teaching and learning (Alyaz & Sinem, 2016; Kilue & Muhamad, 2017).

Similarly, as shown in Figure 3, several participants have voiced their discontent about the issues: "This game is highly dependent on Wi-Fi, and if I use mobile data, it will consume a big amount of data." (Hai) Additionally, there was another complaint: "I can't connect the game data to my smartwatch, it's terrible I have to bring my phone every time I went for exercise." (Riz), while another participant pointed to the in-app purchases: "I feel discouraged when there's too much advertisement and unfair when people can take a shortcut and buy the energy instead or working-out." (Mar) Therefore, although many considered the PA elements to be fun, the game contents may be difficult for some, raising anxiety and tension as participants were required to engage with the game throughout the intervention. Over-dependence on the game or devices could also result in students' reduction in competency, autonomy, relatedness, and autonomous motivation which contradicts the aim of the exergame (Kerner & Goodyear, 2017).
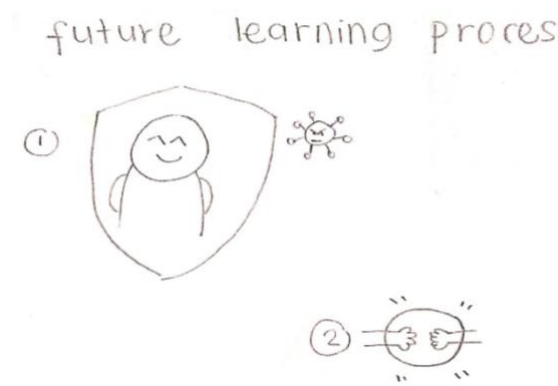
3.2. The use of objects, symbols, and characters

The second phenomenon which was revealed in the drawings, was the use of objects, symbols, and characters to depict participants' feelings on the exergame as well as teaching using technology. The combination of objects and symbols used in Figure 4 produced a sense of protection with the individual seeming to smile in a shape similar to the shield with an outlooking object portrayed as a bacterium. Another object showed two hands in a big circle accompanied by four sets of two lines around the circle indicating a sense of togetherness and importance.

In contrast, figure 5 possessed many straight lines to create a few objects (i.e., bulb, box, ribbon, pair of eyes), producing a sense of curiosity and surprise. Both figures 6 and 7 demonstrated a combination

of objects to highlight several ideas on teaching with technology. While Figure 6 focused on the independent learner (i.e., avoid boredom, PA beyond class session) figure 7 tends to highlight exergame roles in promoting higher teamwork, commitment, and "thinking" students.
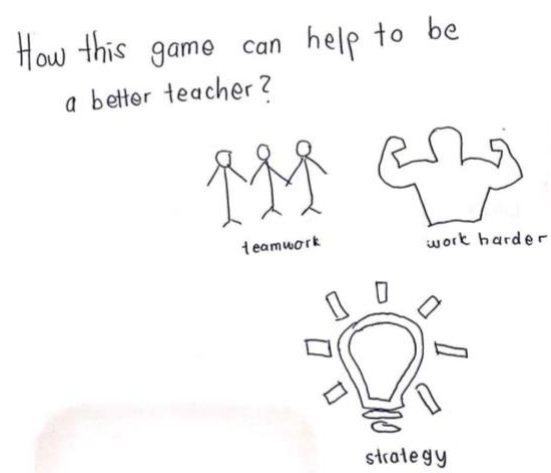

Figure 4. The combination of shield, individual, bacteria, circle, and double hands

Figure 5. Creative use of objects and symbols to demonstrate curiosity and reward
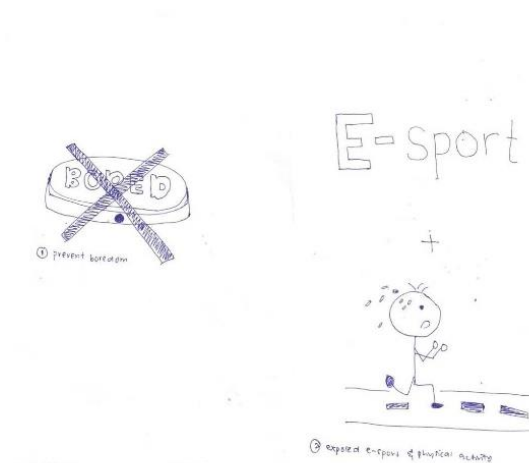
Figure 6. Combination of words, objects, symbols, and characters to portray the benefits of exergame

Figure 7. Extensive use of words, characters, and objects to depict ideas on teaching with technology

The figures above demonstrated multiple, anonymous, and small figures shaped and organised around the page which created an impression of excitement, hope, and improvement. The participants' narratives regarding their perceived teaching and learning with the exergame also seem in line with most of the drawings. A few participants from the Biology and Chemistry departments shared about how exergame motivated them to exercise: "I rarely exercise before, but Fitness RPG has encouraged me to start exercising more often in the evening, I am proud of myself." (Asm), "I am more motivated to do exercise now due to the reminders and adventures in the Fitness RPG." (Wahi), while a participant from PE department "I am happier when playing Fitness RPG as it no pressure and I can play game while

exercising." (Nas) This finding concurred with other studies which suggest that the element of entertainment, narrative, and engagement in the Fitness RPG enhance its appeal and distance participants from the concepts of repetitions, intensity, and type of training which could be daunting for some individuals (Lu et al., 2012; Lyons et al., 2016).

In terms of teaching with exergame, the participants seem to have mixed perceptions of its feasibility with concerns of disruption to their teaching and learning time with students. The majority of participants agreed on teaching content with the exergame due to its potential to help educators achieve more learning objectives in a shorter time. Several studies also have demonstrated teaching with technology would be capable of inducing positive learning effects such as the increased metabolic equivalent of task (METs) compared to sedentary video gameplay due to higher motivation and the entertaining nature of exergame (Gao et al., 2015; Gao, 2017).

Similarly, in this study, one participant highlighted the word "option" associated with technology: "I feel that Fitness RPG provide more options for students to learn content, so we become less dependent on our lecturer." (Redz) Another PE participant explained: "Fitness RPG is good because it promotes higher PA and is suitable for all students." The participants from other departments were more specific: "Exergame can help students sharpen their mind." (Athi), and "the game can inspire students to work harder, focus, and become more creative in solving issues (e.g., battling monsters, choosing different characters)." (Shau).

These findings were in line with another study which found that a combination of smart devices and mobile applications with personalised teaching and learning could improve engagement, learning retention, on-task behaviours, practice time, and learning enjoyment throughout the session (Stein et al., 2017). The added values in exergame such as self-monitoring and feedback functionalities also encourage more participants to embrace the intervention and find excitement in PA (Brannon & Cushing, 2015).

Nonetheless, a minority of participants also voiced their concerns about the potential adverse effects of exergame on students. For instance: "I am not sure; sometimes when I am stuck, I feel left behind and sad about not being able to achieve the target." (Nabil), "I feel playing exergame for too long can cause sore eye and headache due to higher screen time." (Fara). The obligation to keep playing the game might lead to higher smartphone use, which then translates to higher feelings of guilt, stress and depression (Thomee et al., 2010).

Despite all the touted benefits, Fitness RPG is still a game, therefore students might still face difficulties in managing time, feel stressed due to failure and peer pressure as well as health risks such as eye irritation due to higher screen time compared to before the intervention. These findings were consistent with several studies which associated prolonged use of smart devices with various issues such as cognitive impairment (Wilmer et al., 2017), lower sleep quality (Demirci et al., 2015), eye strain, headache, musculoskeletal issues (e.g., neck stiffness) (Loh & Redd, 2008), and depression (Geng et al., 2021).

3.3. Combination of split drawings to express a sense of motivation

The third phenomenon was the use of split drawings, in which participants manifested thoughts divided into parts in the drawings. In some drawings, the splitting line signifies the difference between ideas and perceptions of exergame both in the present and anticipated future. From a personal perspective, Figure 8 demonstrates the participant's conception of herself before the intervention, represented by an individual seen sleeping on a desk with a book and pen indicating a sense of tiredness and boredom.

Changes signified by the arrow pointed to the individual smiling, standing, and raising both hands with a thunderbolt drawn in the centre of her body to demonstrate feelings of happiness and energy.

While Figure 9 focused on ideas and perceptions of teaching contents with exergame, Figure 10 demonstrates the use of split drawings to portray the elements of physicality (e.g., footsteps, masculine figure) and critical thinking (e.g., different numbers of circles and marks in different boxes, figures standing in a separate box ready for potential battle) needed to play and excel in Fitness RPG. Fitness alone will not help the individual to win, but the combination of fitness and strategies will help the participants to win battles and move on to the final stage (i.e., Fit Castle).
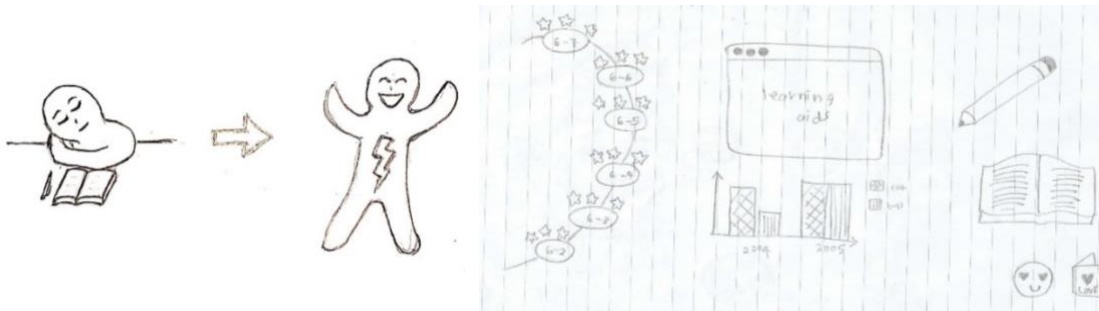
Figure 8. Conception of present and anticipated future from exergame

Figure 9. Ideas and perceptions of teaching and learning with exergame
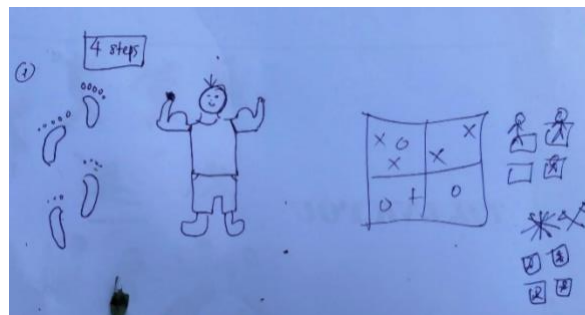
Figure 10. The use of split drawings to portray the physical and cognitive aspects involved in Fitness RPG

The split drawings may reflect participants' sense of reality and the ideal conceptions of the future which also emerged from the participants' verbal descriptions. One participant shared about changes to herself pre-and-post intervention: "This game (Fitness RPG) helps me to walk the talk and start practising a healthy lifestyle." She continued: "I used to talk a lot about exercise but most of the time I was procrastinating and doing inconsistent PA." (Fath) Similarly, a past study related to war conflict in the Middle East suggests that the use of split drawings represents the differences between the catastrophic present and the anticipated future (Nagamey et al., 2018). Depending on the context, split drawings were

commonly used to reflect participants' fragments of ideas and their coping or adaptation mechanisms from playing the exergame during their ODL (Riedel, 2017).

Additionally, exergame also supports PA maintenance among participants in this study: "I feel that this game helps me to maintain doing PA, otherwise I can't collect the energy, level up the characters and it is hard to win battles." (Ikr) Other participants viewed the Fitness RPG as their opportunity to become better and healthier individuals. For instance: "This game makes me happy and healthier." (Riz), "Playing this game also helped me to be patient and persistent, keep trying (i.e., different characters and battle strategies) until I can clear each level." (Ina), and "I am much more thrilled and motivated in doing my assignment (i.e., Fitness RPG) compared to the normal assignments (i.e., referring to essays, lab reports)." (Nis). These findings have been supported by previous studies which highlighted the combination of drawings might resulted from participants' feelings of being overwhelmed at the beginning of the study more in control of their studies and completing tasks in the exergame toward the end of the intervention (Lev-Wiesel, 2005).

Nonetheless, there were also concerns related to occasional game instability. For example, a few participants complained about the game becoming unstable leading to failure in recording steps, and moving to the next level or that the game may stop functioning altogether. For instance: "sometimes the game becomes unstable and ends abruptly, we have to restart the app, and if we're unlucky, we have to re-play the level." (Wahi), "I feel sometimes the game takes longer time to finish due to instability, maybe the game has some bugs or problems." (Shau), and "I hate it when the game become unstable, it has been a few times already I lost the progress and have to re-play the same level." (Haz)

4. Implication for Practice

The study results reflect the changes in perceptions, knowledge, and intent to adopt exergame as part of participants' learning strategies at university and future teaching at schools. Despite the potential benefits outweighing the issues, being aware of the exergame's advantages and disadvantages might help us navigate the exergame approach in a neutral way considering many factors such as game content, students' capabilities, safety, and logistics.

Therefore, we suggest, with caution, in developing lesson content around exergame, that taking into account the factors mentioned above is important. Specifically, we propose to (1) encourage discussion among students on the exergame, (2) rotate the selection of exergame after a certain period (e.g., each semester cycle), (3) set additional rules and regulations when engaging with the exercise (e.g., time limit, no in-app purchases), (4) create personalised rubrics based on students' current conditions and capabilities, and (5) emphasis on the process of increasing steps count and PA and less on achievement.

Nevertheless, several limitations of the current study should be acknowledged. First, this study is solely qualitative, which limited the triangulation process to just the drawings and literature reviews. Next, the absence of colour scale in the drawings might result in misinterpretation and reduces the drawing analysis to lines, shapes, and pattern. Besides that, solely depending on the qualitative approach may also cause conflict over biased views or personal issues which may have affected the participants' interpretation of the exergame. Individual differences in factors such as experience, mobile device specifications and Internet connectivity may have also altered their perceptions and intent to adopt and maintain learning content with exergame. To mitigate these issues, the researchers approached each of the students to inform

them about this study's purpose, objectives, benefits, and potential risks (if any) as well as provide them with the opportunities either to accept or refuse invitation to become part of this study. Providing ownership to students in making decisions helps ensure participants in this study genuinely wish to participate and willingly offer their thoughts on exergame and ODL (Shenton, 2004). Additionally, a series of debriefing sessions were conducted periodically between both researchers to check the progress and data collected; widened the vision of researchers and identified potential flaws in the course of action. Besides that, throughout this study, the main researcher occasionally shared the study progress with colleagues from the faculty to invite constructive feedback and make comparisons between their perspectives and assumptions made by the researchers. Importantly, findings from this study were compared with previous studies' findings for similarities, differences, and congruencies with past studies (Shenton, 2004).

5. Conclusion

The current study sheds light on undergraduate pre-service education students' perspectives on exergame roles to support their teaching and learning process. The analyses of the findings showed that mitigating the obstacles and overcoming the challenges of contextual interference presented by exergame will heighten the students' willingness to explore exergame and remain consistent in doing PA. It is not only about presenting the students with an exergame but rather moving with them to understand and appreciate the values of play and movement. Future studies should continue to investigate the impact of exergame on the maintenance of PA or academic performance over time. Besides that, different studies should also consider the categories of exergame available (e.g., dance and step games, strength cardio, and action-adventure) and how each category might impact the individuals' PA levels differently.

Data Availability Statement

Data is available upon request.

Declaration of Conflicts Interests

The authors declare that they have no conflict of interest to disclose. Author 1 read and prepared the literature review, constructed the framework, methodology, carried out data collection and entry as well as analysed the data, and wrote the findings of the study. Author 2 guided the selection and planning of the study, maintained the standard of study process, revise the statistical analysis and interpretation, as well as overlooks the writeup of the whole article.

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