Play4fit: Enhancing Users' Engagement With Smartphone Health And Fitness Application Using Gamification Concept.

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Abstract: This paper elaborates the design, development and evaluation of health and fitness smartphone app, Play4fit. The Play4fit app was developed using systematic approach called Mobile application Development lifecycle (MADLC). This study explores the use of gamification concept in engaging the users whilst using the smartphone app. Game experience questionnaire (GEQ) was used to measure participants' engagement with the Play4Fit app. A study in the wild was conducted with a total of 30 participants and they were assessed using seven components of GEQ, competence, sensory and imaginative immersion, flow, tension, challenge, negative affect and positive effect. Mean scores obtained in this study shows that only two components, competence (M=2.60, SD=0.62), sensory and imaginative immersion (M=2.8, SD=0.71) have the higher mean, above the median value. Results of this study suggest that the gamification app for health ad fitness, Play4Fit have an impact on users' engagement particularly sensory and imaginative immersion.

Index Terms: Smartphone app, health, fitness, Gamification, engagement.

1. INTRODUCTION

Physical exercise has been associated with a better mental and physical health. Researchers suggested that it promote a significant impact on physical and mental health [1]. Unfortunately, there are various reasons given by people why they do not engage with physical exercise such as lack of time, occupied with other work, no motivation and [2]. The prevalence of unhealthy behavior amongst teenagers have been identified such as extreme diet, binge drinking, spending significant amount of time watching television or paying games on computer or mobile devices and many others. These behaviors can lead to chronic diseases which is a major killer [3]. The overweight and obesity have become a major issue in the past decades [4] and mainly due to unhealty eating high fat and sugar food contents but did not burn off enough calories through physical activities [5]. Nowadays, people spend significant amount of their time with television, computers, smartphone and other types of technologies. Teenagers spent an average of nearly two hours online and nearly three hours in front of television [6]. In 2019, time spent on smartphone increase significantly to 2 hours and 55 minutes [7]. The importance of regular exercise is important to maintain healthy life and to have both preventive and healing effects for many disease [8]. Wang and Liu posited that physical activity helps in improvements of emotions, social psychology and cognitive skills [9]. Furthermore, it improves health related quality of life amongst postmenopausal women [10]. Physical activities also have a significant impact on children. A study on the enjoyment of school based physical activity programme shows that it decreases the risk of cardiovascular, metabolic and obesity while increasing their bone health. They highlighted that the enjoyment during school based physical activities promotion in children and supported by behavioral theory such as self-determination theory. Research has shown that technology has an impact on the people lifestyles and various technologies have been used to promote health initiative [11]. For example, computer technologies, internet, smartphone, CD-ROM amongst other. Previous studies show that mobile technologies are able to provide an individual level support for health care consumer ([12], [13]) and subsequently deliver health behavior interventions [14]. A study by de Jongh et al., shows that the communication between patients and healthcare providers plays a vital role in monitor disease and education [15]. The use of mobile related software applications in health and fitness are increasing significantly [16]. It was used to monitor and guide users' health [17], boost users' behavior towards physical activity [18]. Recently, wearable technology for health and fitness has become the fastest growing smart devices in the market [19]. Wearables such as Fitbit Flex, Fitbit Charge HR, Garmin vivo-active and apple watch plays an important role in health and fitness improvement [20]. A gamification apps on the smartphone has been on the rise in which many users spend their time for digital games and other activities [21]. Gamification apps could be used to motivate people to exercise regularly by providing an interactive feature similar to other types of digital games. Ferguson highlights the gamification' potential in health-related aspect, particularly in chronic diseases prevention [22]. In addition, it has a huge impact on availability, cost and effectiveness in both remedial and preventative healthcare. Thus, this study aims to explore the impact of gamification health app on the users' engagement by designing a Play4Fit app to motivate the users in engaging in physical activities.

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2 MOTIVATION AND RATIONALE

Research has shown that the physical activity has a great impact on people mental health [23] and has a potential to prevent against chronic diseases such as metabolic syndrome, obesity, coronary heart disease, stroke, congestive heart failure, cancers amongst others ([24], [25], [26]).

Gamification plays a significant role in enhancing users' motivation and awareness about their physical activities and progress [27]. The participants' motivations in their study significantly improved with the gamification concept. The user engagement with the fitness application can be increased if the fun elements is implemented to attract users' attention.

The gamification concept aims to provide users with game-like experience in which as a result will affect user' behaviors [28]. The game provides challenges which requires users to collect the points and received rewards after completed each level. The significant increase of gamification apps on smartphone has drawn users' attention particularly exploiting different types of technology and interaction. For example, such technologies are QR code ([29], [30]), wearable technologies [31], computer games and mobile applications ([32], [33]). Previous studies (i.e. [33], [34], [27]) addresses the different health related issues using gamification concept. Gamification element such as leaderboard was used to measure the users' physical activities before and after using the application and rank them according to their achievements. Although there are many gamification elements that can be implemented for health fitness app, the Play4Fit app only focused on the gamification elements such as trophy and badges. In addition, the QR code is implemented in Play4Fit app to enable users to read the instructions at the designated area. Furthermore, the physical activities integrated with Play4Fit are jogging, walking, stairs workout and monkey bars exercises.

3 METHODS

3.1 Design and Development of Play4fit App

Mobile Application Development Lifecycle (MADLC) was used as a framework for the development of Play4Fit app. It consists of seven main phases: (1) identification, (2) design, (3) development, (4) prototyping, (5) testing, (6) deployment and (7) maintenance phase. This lifecycle aimed to differentiate system development for mobile application [35]. In the first stage, idea and design for health and fitness related smartphone app were collected categorized. The idea from existing app were analyzed and documented particularly the information about health and fitness. Other features of the apps were identified, i.e. health and fitness activities such as jogging, walking, stairs workup. The location for the fitness activities were identified around university campus ranging from jungle park, lake side recreation facilities, kayak recreation facilities and sport complex. Target users for the Play4Fit are University students and their users' requirements were identified in this stage. The aims of this Play4Fit app is to increase users' motivation in health and fitness activities using the gamification concept. Thus, promoting healthy lifestyle. The storyboard of the play4Fit app were design based on users' requirement gathered in the first stage. Fig. 1 shows the initial storyboard design for the app. Subsequently produce the complete system flow for the app as illustrated in the Fig. 2. The important part in the design stage is creating the overall flow for the Play4Fit app.

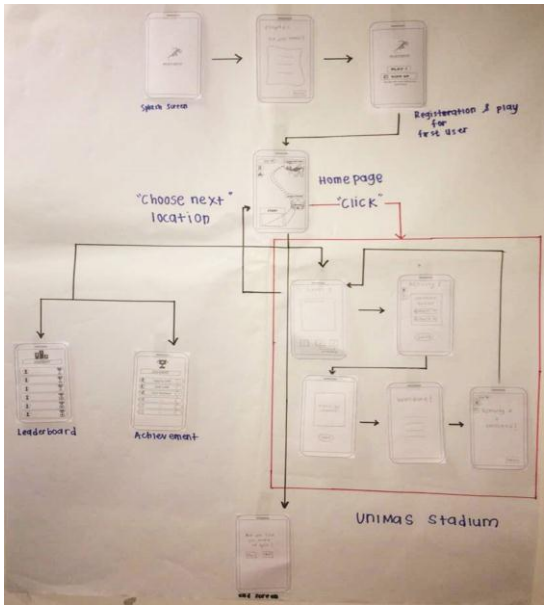


Fig. 1. *The initial storyboard of Play4Fit*

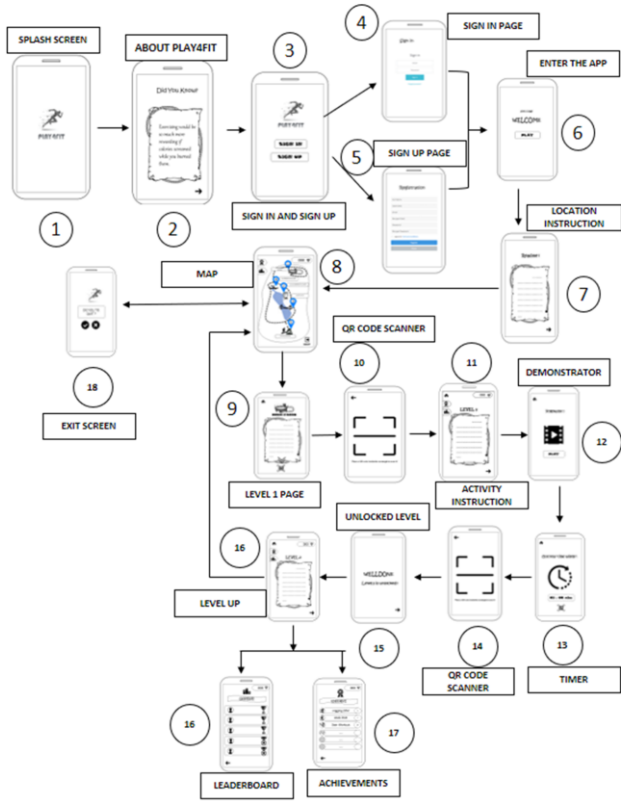


Fig. 2. *The complete storyboard and system flow for Play4Fit app*

Play4Fit app in the following stage. Subsequently, the app was evaluated with the users.

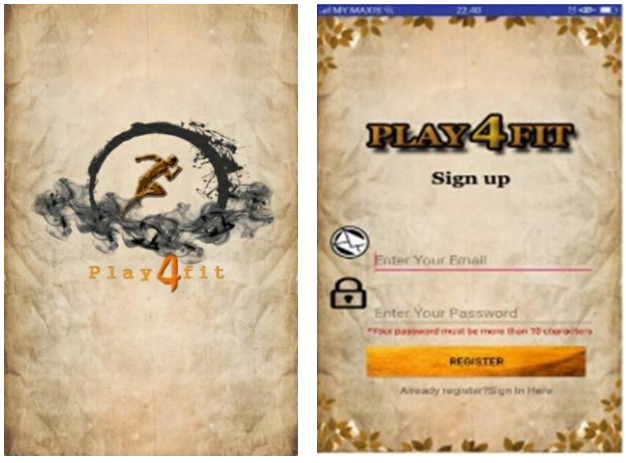
3.2 Materials

3.2.1 Play4Fit App

Fig. 3 shows an overall gameplay for Play4Fit app. When users open the Play4Fit app, a splash screen will appear and subsequently redirect them to registration interface (see Fig. 4

(a) and (b) respectively). Users are required to complete the registration process before able to sign in into the app. After the users sign in into the Play4Fit app, they were given a location map for the health and fitness activities and were asked to choose the location they would like to engage with the fitness activities (see Fig. 5). Only current location will be made available and the other locations were locked (see Fig. 5(a)) and all locations were made available once users completed current activities (see Fig 5(b)). Users will be provided with instruction and were required to follow the instruction and complete the tasks given (see Fig. 6). Users were given time (timer function) to complete the activities and will be rewarded with trophy (gamification element) when completed the activities (see Fig. 7). This process will be repeated until all levels and locations were completed.

Fig.3. *The Play4Fit gameplay*



(a) Splash Screen (b) Registration Screen

Fig. 4*. The splash screen and registration of Play4Fit*

(a) Locked Location (b) Unlocked Location

Fig. 5*. The initial storyboard of Play4Fit*

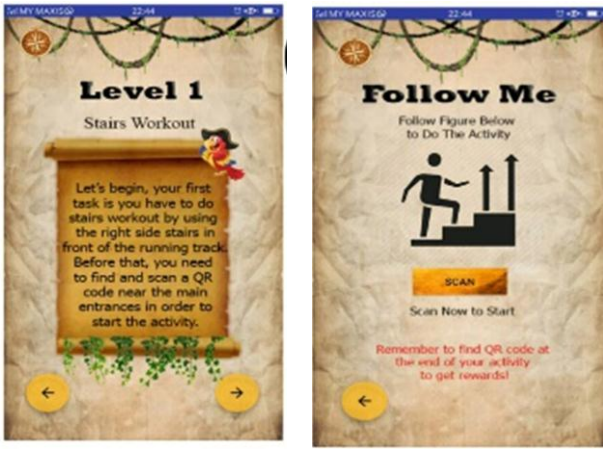


Fig. 6*. Activity Instructions*

(a) Timer (b) Trophy

Fig. 7. *Timer function and rewards for activity completion*

3.2.2 Instruments

Game experience questionnaire (GEQ) was used to measure

participants' experiences with gamification health app. GEQ are made of seven components competence, sensory and imaginative immersion, flow, tension, challenge, negative affect and positive effect. The GEQ consist of 5 points Likert-scales type, 0= not at all, 1= slightly, 2= moderately, 3= fairly and 4=extremely. Participants were asked to complete the GEQ after they participated in the study. The Play4Fit was design

3.3 Participants

30 participants aged 20-35 years old were recruited to participate in this study. They were comprised of 15 male and 15 female participants.

3.4 Procedure

A "study in the wild" was conducted in assessing the health gamification app and procedure of the study is as follow:

1. Recruitment: 30 participants were recruited during the evaluation stage. Participants used their own smartphone during the evaluation process.
2. Briefing: All participants were briefed individually about the purpose of the study and the evaluation procedures. They are allowed to ask any questions about the evaluation process.
3. Informed consent: All participants were asked to sign the informed consent form before the participated in the study. They were told that their participants in this study is in voluntary basis and will not be rewarded with any monetary. They are allowed to withdraw from the study at any stage of the evaluation process without prejudice.
4. Play4Fit evaluation: Participants were asked to download the Play4Fit .apk file from the online location given to them. They were asked to get familiarize with the functionalities of the Play4Fit app and were assisted by the researchers. Subsequently they evaluated the Play4Fit app.
5. Questionnaire: Participants were asked to complete the GEQ questionnaire after they completed the fitness activities.
6. Debriefing session: Researchers answered any queries from the participants.

4 RESULTS

4.1 Demographic background

A total of 30 participants took part in this study with equal number of male and female participants. 90 percent of participants were between 20-25 years old, 6.7 percent were between 26-30, whilst 3.3 percent between 31-35 years old. All participants have their own smartphone and with varied years of experiences. 73.3 percent have more than five years experiences with the smartphone, 16.7 percent with three to four years of experience. The remaining participants were with two years and less experiences. Participants were also asked about their experiences with fitness application and 80 percent have experience with fitness application. A total of 13 males and 11 females have previous experience with fitness app. Additionally, only 20 percent of participants have previous experience with fitness gamification app, which comprised of 5 males and 1 female participant.

4.2 Game Experience Questionnaire (GEQ)

In general, the mean scores for seven GEQ are varied as illustrated in Table 1. Only three components produced a higher mean for Play4Fit app. Mean Score for Sensory and Imaginative Experience (M=2.80, SD= 0.714) is highest followed by Competence (M=2.60, SD= 0.621) and Positive Impact (M=2.53, SD=0.681).

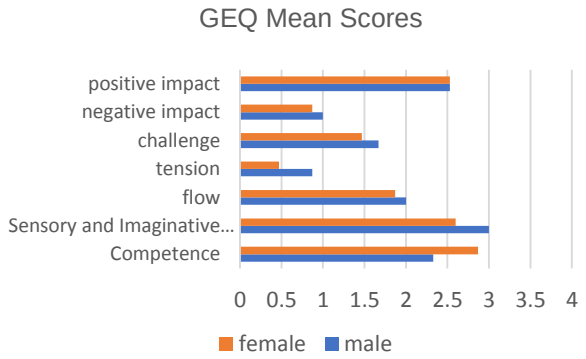


***Fig. 8**. GEQ mean scores for male and female participants*

TABLE 1

GAME EXPERIENCE MEAN SCORES

GEQ	MEAN	SD
Competence	2.60	.621
Sensory and Imaginative immersion	2.80	.714
Flow	1.93	.520
tension	0.66	.922
Challenge	1.56	.728
Negative Impact	0.93	.740
Positive Impact	2.53	.681

A further analysis was made to investigate if gender has impact on game experience for Play4Fit app. Fig. 8 shows the mean scores for male and female participants in this study. The mean scores suggested that male participants score higher for all components of GEQ except for competence component. Female participants score higher (M=2.87, SD= 0.35) than male participants (M=2.33, M=0.723) in competence component. Both male and female participant score equally for positive impact component.

5 DISCUSSION AND CONCLUSION

In this study we explore the use of gamification app for health and fitness to engage the users. The use of gamification concept on health and fitness smartphone app increased the users' engagement for Play4Fit app. Our finding from GEQ analysis shows that sensory and imaginative immersion component has the impact on users when using the Play4Fit app. The design of Play4Fit which include the gamification elements such as leaderboard, trophy, badge do increase users' engagement, motivation and immersion. O'Brien and Toms insinuate that engagement with games involved several components such as interest, motivation, affect, attention, challenge, feedback, novelty and interactivity [32]. Previous studies (i.e. [27], [36]) posited that gamification have a potential impact on fitness motivation although each individual have a difference in stamina and ability. Study by Sailer and colleagues concluded that gamification

elements such as badges, leaderboard and performance graph positively affect the users' competence satisfaction [41]. Previous studies (i.e. [37], [38]) also suggested that participants who actively engage with the game activities have a significant improvement in their eating and drinking habits among children and adults. Result also suggested that the gamification app for health and fitness, Play4Fit has a positive impact on the users. This study echoed result from previous studies which suggested that gamification has positive impact on behavior changes in physical activity exercises ([39], [40]). The use of gamification concepts in health and fitness app could be a powerful solution to address the motivational problems amongst teenagers and adults in engaging with physical activities. The different components of gamification elements should be explored individually to uncover the impact of gamification for the health and fitness app. Future study should explore different measurements for the assessment of users' game experiences to ensure all gamification components are explored.

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