การออกแบบเกม COVID-19 เพื่อวัดพฤติกรรมของผู้เล่นเกม

The Measurement of the Players Behaviors on COVID-19 Game Design

Wilawan Inchamnan[1] and Punyawee Anunpattana[2]

College of Creative Design and Entertainment Technology Dhurakij Pundit University Lak Si,

Bangkok, Thailand 10210[1]

School of Advanced Science and Technology Japan Advanced Institute of Science and Technology

1-1 Asahidai, Nomi, 923-1211 Ishikawa, Japan[2]

E-mail: wilawan.inn@dpu.ac.th[1], punyawee@jaist.ac.jp[2]

บทคัดย่อ

การศึกษานี้มีวัตถุประสงค์เพื่อออกแบบกลไกเกมในการวัดผลการปรับเปลี่ยนพฤติกรรม โดยมุ่งเน้นการปรับตัวใหม่ในช่วงสถานการณ์โรคระบาด เกม COVID-19 ออกแบบผ่านขั้นตอนของการเปลี่ยนแปลงพฤติกรรม โดยใช้กลไกต่างๆ เช่น ภารกิจและความกดดันด้านเวลา เพื่อส่งเสริมผลกระทบทางอารมณ์และประสบการณ์ระหว่างการเล่น งานวิจัยนี้ออกแบบเกมเพื่อการทดสอบพฤติกรรมผู้เล่นผ่านกลไกของเกม โดยแบ่งวิธีการวัดผลตามแนวความคิดพฤติกรรมของผู้เล่นแบ่งออกเป็นสามขั้นตอน 1)การระบุปัจจัยกระตุ้น 2)การออกแบบเกม และ3) กระบวนการวัดผลเชิงพฤติกรรม ผลการวิจัยพบว่ากิจกรรมในเกมสามารถกระตุ้นให้เกิดการเปลี่ยนแปลงพฤติกรรมได้

คำสำคัญ: เกม COVID-19, กลไกของเกม, พฤติกรรมผู้เล่น, การเปลี่ยนแปลงพฤติกรรม, วิดีโอเกม

Abstract

This study aims to design the game mechanics to describe the formatting policies for capturing behavioral changes. The behavior focuses on the new normal during a pandemic situation. The game calls a COVID-19 game designing through the stages of behavior change. The mechanics like quests and time pressure are designed to promote emotional affect during play. This study was validated through the use of a questionnaire and game mechanics notions. The method for conceptually measuring the player's behaviors is divided into three stages; stimulus factor identification, game design, and measurement process. The finding positively incentivizes the behavioral changes regarding the relevant designs.

Keywords: COVID-19 Game, Game Mechanics, Players Behaviors, Behavioral Changes, Video Game

1. Introduction

Financial video games can affect the development of certain human behaviors, whether

those behaviors are good or bad. Hence, they have been studied by many researchers in the fields of computer science, psychology, education, and adolescent studies [1]. Playing video games has shown many challenges in player behavior that are altered for better or worse. The game elements can provide the challenges for players thinking. The effects that video games may have on players' personalities can be positive, such as improving social skills, mental skills and finding solutions. It can also be negative on the players' personalities, such as violence, aggression, anxiety and stress. In following two sections we will discuss these two impacts on the players' personality. Games may have the potential to engage individuals and retain them for a longer period of time than traditional programs [2], promoting behavior change in people. These studies also examine whether video game mechanics can measure player behavior. The conceptual method is the central role that the game plays either as a medium to convey incentives for certain activities through game-like elements such as competition or rewards. The following section explores these underlying methods in more detail, examining the roles and potentials that knowledge transfer, gamification, and social learning can have as tools for capturing behavior change.

2. Background

In this study, the stage of change is examined in terms of behavior. The stage is influenced by the game mechanics. The method of conceptual measurement of the player's behavior focuses on the emotional impact due to the motivating stimulus.

2.1 Video Games

There is no doubt that video games play a major role in determining players' motivations, social impact, and emotional state. Most popular video games dynamically change the environment in the game, which means that the player's behavior in the game can change with the changes in the game itself. This causes the player to adapt to these changes, which in turn can gradually change the player's behavior. This means that the player can change their personality in real life and become more adaptable [1].

2.2 Stage of Change

The term "game" refers to a stimulation tool that can help people change their behavior. In the field of behavior change, theoretical frameworks are increasingly recognized and used by practitioners as a means to inform, develop, and evaluate interventions to influence behavior [9]. In this study, an integrated summary of

constructs, procedures, and methods for understanding behavior in relation to the stage of change is provided. Game elements may include causal pathways that influence behavior through pre-contemplation, contemplation, preparation, action, maintenance, and relapse.

1) Pre-contemplation (S1) : Pre-contemplation is the stage when there is not yet an intention to change behavior in the fore- seeable future. When pre-contemplatives seek psychotherapy, they often do so because of pressure from others. Usually they feel pressured to change by their family threatening to leave them, their employer threatening to fire them, their parents threatening to disown them, or courts threatening to punish them [10].

2) Contemplation (S2) : This step is the preparation of change. For example, in the situation of the COVID-19 pandemic, which is very close to all people. Contemplation recognizes the problem and think that we should change our own behavior self-care of disease, for example as shown in [10].

3) Preparation (S3) : Preparation is the stage of readiness for change. It is a stage that combines intention and behavioral criteria. Individuals who are in this stage have an intention to take action within the particular time and often make small behavioral changes, "baby steps" so to speak. Gamification has been applied to promote remembering through a design task. Such examples demonstrate that games can promote communication between older adults and caregivers. Similarly, various game design techniques have been applied to memory enhancement interventions to improve participants' cognitive skills and self-esteem. The example game shows the "Memory matters" that presented quiz games with pictures and music that represented participants' past [5]. The preparation the action or process of making ready or being made ready for use or consideration changing. However, there are few studies that have examined the use of games as a tool for life review and preparation. Some studies found that memory performance was significantly improved when participants understood and empathized with the meaning of the metaphors in the game. Because the Long Journey of Life metaphor game offered metaphorical elements that were connected to real life, it was able to stimulate conversations that related to personal stories [4]. Memory will promote positive future life behavior. The narrative approach is the individual's ability to remember experiences [5].

4) Action (S4) : is the phase in which individuals change their behavior, experiences, and environment in order to cope with their problems. The action requires a significant investment of time and energy, and it is the most visible and

receive the most significant external recognition. Individuals are in the action phase when they have successfully changed the dysfunctional behavior for some time. Changing the target behavior to an acceptable criterion and making apparent efforts to change are the hallmarks of the action phase [10]. Game designers manipulate a process involving an iterative sequence of modifications to the rules and subsequent behaviors within games to address the need for players to affectively work towards goals [6]. The rules specify what actions the players may take to overcome the challenges and achieve the goals of the game [7]. The complexity level of each tasks in terms of difficulty [31]. Actions are meaningful subcomponents in the larger picture of the game and answer the question. What can the players do [8].

5) Maintenance: Maintenance is the phase in which people work to prevent relapse and consolidate the gains made during the intervention. For some behaviors, such as addictions, maintenance may last a lifetime; for other behaviors, maintenance may end when patients no longer engage in the problematic behavior and/or consistently engage in a new, inconsistent behavior. Stabilization of behavior change and prevention of relapse are the hallmarks of maintenance [10].

6) Relapse (S6) : A relapse is a stage where one reverts to old behaviors and abandons the new changes. Relapse should not be interpreted as a failure of treatment or an indication that the individual has abandoned their commitment to change. With support, these experiences can provide information to facilitate continued progression through the stages of change and identify new areas where treatment and case plans can be improved [9].

2.3 Behavior Stimuli

This study ***assumes*** that aversive motivational salience is activated during motivational engagement. Engagement leads to continued behavior and assertive salience prevails when the new behavior has become habitual during the pandemic. A few theories of behavior change have been developed that aim to explain behavior change and understand the domains that make change more likely, such as health. Some studies have considered automatic, implicit, or non-cognitive aspects of behavior, including emotions and positive affect [11]. Understanding these mechanisms serves as a basis for planning future interventions aimed at lifestyle change, such as targeted (cognitive) behavior change interventions or stimulus-driven (non-cognitive) triggers. A recent systematic review of health behavior changes theories that

place a particular emphasis on the maintenance aspect of behavior change identified five common themes relevant to maintenance: Maintenance Motives, Self-Regulation, Resources, Habits, and Environmental and Social Influences [12]. This research will integrate neuroscientific advances in the role of motivational systems and game mechanisms into theories of behavior change. Stimuli are concrete physical objects, mental representations or memories of such objects, abstract concepts or possibilities anticipated for the future [13]–[15].

1) Gamification Affordances: Gamification introduces a method of incorporating game mechanics and applying them to the non-game context to elicit engagement and satisfaction. Affordance refers to points, badges, leaderboards and ranks in gamification elements [18]. Gamified element influences behavior change through motivation. Motivation and engagement refer to passion and emotional involvement in learning activities. Engagement constructs the meaningful learning that includes the quality of students' effort, interaction with students, and their immersive experiences [19]. There are some researchers who divide engagement into three dimensions, behavioral engagement, emotional engagement, and cognitive engagement [20]. Motivation is a theoretical construct used to explain behavior that represents motive of actions, desires, and needs. Gamification elements could provide a thematic evaluation of the following formulations of the term affordance. A comprehensive list of game elements and mechanics is identified in Table 1. This comprehensive selection aims to understand the basis of the elements and the affordances of the alternative. Additionally, this would be helpful to enlarge the domain of behavioral change (see Table I) [18], [22], [23], [26], [27]. The potentials of gamification were used to elaborate on behavior and engagement, where its implementation must demonstrate an improvement of incentive, as a short-term consequence, and learning outcome as a long-term consequence [26].

2) Game Mechanics and Design Principles: Game mechanics can trigger and reinforce situational awareness competencies, such as workload management and procedural application [21]. A game can provide information about the player's performance, such as reaction times, correct responses, and procedures followed during the game through points. Game points are associated with behaviors that indicate critical competencies [21]. The majority of the motivators revealed in the study were first classified as intrinsic [30].

This is especially useful in serious games that need participation and behavioral adjustments. Depending on the environment, it

can support and promote a variety of motivational outcomes. However, many game mechanics are abstract and may be challenging to implement in practice.

It is worth remarking that game design principles should be addressed in order to serve as a guideline for designers to use as appropriate for behavioral measurement game design.

Table 1 Summary of Game Elements and Mechanics Implementation

Game Mechanics	Description	Implementation & Alternatives
Call to Action	An interactive element designed to persuade users to take a specific action based on its content	Storytelling, Roles, Goals
Leaderboard	The leaderboard allows players to compare their own performance and abilities to other players. It also elevates one's competitiveness and motivation.	Ranking, Dashboard
Points	Points are a basis numerical feedback element that can be used to track progress and unlock additional features.	Experience points, Scores
Challenges	Challenges keep players motivated by allowing them to see their progress toward a goal. It is frequently composed of a series of tasks or quests.	Timer, Rules, Tasks, Quests
Badges	Badges is a form of feedback which visualize and signifies the achievements by icon, medals, and trophies.	Achievements, Trophies, Medals
Levels	Levels aid in mapping a user's development by integrating various levels of difficulty.	Progression, Scaffolding, Difficulty, Onboarding
Emotion	Physical and virtual rewards can encourage a high level of emotional motivation, as well as maintain engagement.	Rewards, Feedback, Prizes, Incentives

3. Related COVID-19 Game Designs and other perspectives

The authors have explored multiple perspectives in designing games, ranging from psychological and learning theories to game design theories basis. There are several game designs in the field of precautionary prevention measures in the COVID pandemic. There is a study attempted to develop a flash-based game to teach the children about the COVID-19 by focusing on the fundamental vocabulary and essential precautionary measures [38]. This incorporates the directions of accessibility in gaming while keeping educating and developing positive influences. The contribution of [39] is to design a biofeedback game application on smartphone devices. This game application introduces the interactive by considering optimal control of all the relevant factors for personalization and adaptation that improve and change the essence of life. Another study entirely presents a serious game design by working on the prototype of a serious game to strengthen immunity to fight against COVID-19. This aims to reflect risky behaviors to raise awareness [41]. Moreover, the game led to a significant increase in knowledge about COVID transmission, symptoms, preventive measures. Several studies mentioned the guideline by developing serious games and gamification to induce behavioral change in this characteristic. One of the studies develops the serious game to improve the employees' intentions in the long-term by participating in the trial and answering the questionnaires after playing the serious game. The objective is to observe the change in behavior and practices in care facilities after playing the proposed game [42]. Prior study has explained that persuasive games are practical tools for motivating desirable behavior change even it requires to be tailored to various individual components. Another study presents the potential of a persuasive game to promote the adoption of COVID-19 precautionary measures. In line with this, our study has been inspired by its contribution to tailoring the persuasive strategy and evaluating the overall effectiveness, which helps discuss the predominance and worthiness's to help people improve their behavior by using gamified elements approach [43]. Serious games are being widely used to achieve behavior change interventions. There are relevant studies that expose the approach through the lens of perception changes [44] and demonstrate the game-based learning for teaching hygienic best practices that were relatively regarded on behavior change [45]. Existing research, which consists of a gamification approach, also shows that the recommendations of its functional characteristics

address relations between different factors and stakeholders to identify the gamification approach in a more meaningful way, including analogical findings on game elements and mechanics to reinforce an engagement [46] and to develop a gamified module to increase knowledge acquisition [47].

4. How to Use Game Elements to Reinforce Behavior

In this sense, serious games influence human players and analyze their behavior. As such, they often seek to build on the increasingly ubiquitous role that games play as an entertainment medium to provide an engaging way to deliver educational content and thus provide an efficient way to analyze behavior [3]. Game mechanics can make games particularly appealing as a tool for analyzing and modifying affect and behavior. Subsequently, games can be adapted either to individual users or in response to a comprehensive understanding of interactive efficacy tools. The concepts of motivation and engagement should be addressed in order to understand the effects of gamification on player behavior. Players usually want to achieve motivation that refers to the individual's willingness to change the symptoms or problems they are experiencing [2]. Progressions steps provide optimal flow, whereas engagement cycles keep players motivated by constructive feedback [17]. Engagement is a vital emotional component intimately linked to motivation and flow, and it can be regarded as a negative aspect closely identified with relapse and withdrawal. This study intends to focus on the two game mechanics: Quests and Time pressure. It could indicate that players can see the clear target and achieve meaningful purposes with different actions, which may cause behavioral changes.

A. Quests

Players are encouraged via quests and challenges to complete predefined activities. They aid inexperienced users in figuring out how to proceed with the objectives and struggle in the game based on their competencies. Levels typically display progress in the game. As an essential means for conveying the game's story, quests dictate the setting and contents of levels. It provides challenges for the player to overcome in completing quests, and their structure can invite the inclusion of certain kinds of quests [16]. It could be formed as tasks that players have to complete that help them monitor performance to trigger and reinforce desired behavior. This study shows an example of the game in [16] that reinforces healthy eating behavior by rewarding points based on goal attainment. The challenges

for this game are to master the skills needed to prepare for the action corresponding to the tasks.

B. Time Pressure

Time pressure refers to the uncertainty that influences players regarding difficulty and challenges, whereas time pressure causes discomfort. There are several integration of time pressure in games, including, cycles, countdown, increasing pace, and timer. The impacts of time pressure on engagement are conjectured as involvement when time pressure is incorporated with objectives [17]. Moreover, the importance of unpredictable time pressure in which players are anticipated to behave for unexpected events (and quests) was denoted. Considering time pressure as a challenge, the balance between the amount of time pressure and the ability of players to achieve the goal under that time pressure should be well designed. Likewise, autonomy reflects the less effective in their actions under time pressure since quick responses are required. These inferences address the idea that there may be an optimal time limit in which autonomy and competence are maximized and positively correlated.

5. The Conceptual Model of the Player behavior in Game Design

This research proposes to associate the behavior stimulus factors and gamification mechanics. The experiment design aims to cluster the behavior criteria and define the relationships between the factors and the behavioral changes. The data collection method uses a behavior questionnaire to investigate mental and physical states by evaluating the activities that give satisfaction during the pandemic. Figure 1 illustrates the processes of data evaluation for behavior measurement.

A. Participants

1st Study: According to the survey, the 45 participants (N = 45) in this study were answered the questionnaire. Participants included 64.4% are females. The age average is 20-29 (42.2%), 40-49 (22.2%), 50-59 (20%), and more than 60 (13.3%). The participants are student (35.6%), employee (31.1%), business owner (13.3) and others (11.1%). They have income/months around 15,000 baht (37.8%), 15,001-30,000 (17.8%), 30,001- 50,000, (15.6%), 100,001- 200,000 (11.1%), and 50,001- 70,000 (8.9%).

2nd Study: 30 Participants in this study were 31 university students Dhurakij Pundit University, who are gamers (N = 31). The included participants are 87.1% male. The average GPA is 3.17. They have a gamer experience of more than 4 years. The results can be utilized as a guide for game design for application to outline rules, challenges, game mechanics, fun, or storylines.

This transforms players' behavior in the community according to a new fashion of digital existence and the pandemic that is essential to people's lives. The relationship between behavior change and perceived usefulness of game mechanics influence to aid individuals specifically achieve desired behaviors based on the concept of self-efficacy, leading to behavioral change.

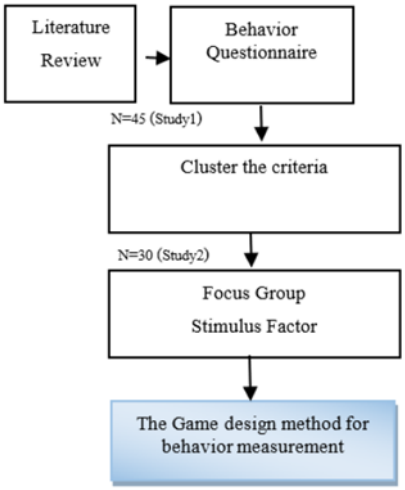

Fig. 1 The game designmethod for behavior measurement

B. Clustering the Criteria

In the clustering process, participants took a questionnaire in order to consider behaviors that lead to satisfaction. It also affords opportunities to discover the activities that people are anticipated to do during the pandemic period. Besides, further details are presented in the survey by focus- ing on the analysis of activities, including the desired and necessary activity to do which aims to consider the problem according to the stage of change theory.

C. Stimulus Factor and Game Mechanics

It is essential to acknowledge that behavior change is a dynamic process over time and is characterized by various motivational levels [28]. Besides, It depends on the individuals' behavior condition and perception with the various gamified experiences [28]. This paper presents an approach based on behavior-related and practical notion to identify elements that cater to player cognition and stimulate motivation, which is essential for successful gamification design. The stage of change model can contribute to the approach to investigate and encourage the behavior that would be enforce by stimulus factors. In terms of serious issues, It is susceptible to employ game elements to drive behavior change into desired behavior [28], then the plausible intervention of game mechanics should be addressed, which involves an in-depth analysis of its existing studies and components. The following steps will be aimed at defining the possibility of game element to influence the players' perception of the target behavior to motivate actions.

D. Measurement Process

Each element can be the indicator and motivator of behavior change according to the stage of change theory and design principle [30]. These elements can affect one or more behavior states. The observation is that those behaviors

can be measured and recognized through the available game mechanics. Therefore, the steps mentioned earlier that require the stimulus factor and suitable game mechanics are measured through a questionnaire about their target activities and situated affordances, including considering our criteria. The reliability test is conducted using the 2-sided asymptotic significance to compare the mean scores of two or more groups of significant differences. The ***p-value*** for significant test was set at 0.05.

6. Proposed Game Design Scheme

Since the objective of this game is to capture and moti- vate behavior changes regarding the state of changes, several gamification components were chosen through a user survey to get a reasonable settlement on what the users thought as the best gamification components that could encourage their changes in behavior. Besides that, the data was also considered on the stimulus factor, and participants were asked questions regarding their satisfaction and mental condition during this pandemic. The mechanics that will motivate people to use this application have been found by this direction until clustering the criteria to point out the stimulus factors. Even though numerous kinds of research on COVID-19 games have emerged lately, many directions are still lacking, such as the representation of the individual state of behavioral change, practical usefulness, multimodal perspectives, and the comprehensive effectiveness of games for the long term. Furthermore, few studies have presented the baseline to avoid bias and validate human perceptions. Therefore, the authors proposed a conceptual model that combined game mechanics and identified stimulus factors to capture and measure behavior change. Also, this study attempts to examine the baseline to tailor a self-assessment system that avoids biases. Our main intention is to design COVID-19 games that merge time and quest to emphasize the objectives and incentivize the motivation that leads to behavior change. Therefore, we proposed a game design flowchart, refer to Figure 2, that assembles quests using timer elements to put challenge and time pressure mechanics. These features would encourage and acknowledge the awareness and desired actions during gameplay. According to the proposed game design, the goal-setting system is crucial for achieving behavior first. Users have to acknowledge and be aware of their actions and strategies to achieve the goal, even good or poor results.

The next one is the player engagement, which gives the gamification itself a char- acteristic personalization. Besides that, game

design requires a progressive design, where challenge and complexity should evolve to improve their competencies while promoting new behaviors. Finally, gamification should allow for socializing between users and current situations.

The mechanics of this game design start (Game Start) with the goal of achieving the game. User will see the screen of Menu and the system will display Mission/Quests after taking action. Afterwards, using the quest mechanics can help determine the game's direction and help set game goals that will affect the player in terms of behavioral and cognitive changes to the purpose of the game. Players are required to input their actions in real-time (as shown in Input Action from User), and the objective is to finish all quests before timeout (as shown in Timer). Regarding engagement in the game, The proposed design utilizes time pressure to motivate players in the sense of challenges and set lines to achieve the desired outcome. Player behavior can be both positive and negative. Nevertheless, the timer element will help identify abilities and drive decision- making behaviors to increase the awareness and sharpness for encountering practical situations. Damage value will be randomized, and the player will deal the damage to their health points and infection rate each time the player fails the precautionary measures (as illustrated in Generate Infection Rate and Increase Infection Rate). The feedback system will automatically notify the player about the measures, which would help educate players at the same time. Also, the bonus points will redeem each time player succeeds in the task and follow the measures. The infection rate can reach the maximum point so that players' characters will get infected, which causes the draining of their health points (as illustrated in Generate Random Damage and Deal Damage). Besides that, the progression system is introduced as a challenge. This game design includes different difficulty levels (Next Stage), health points system (HP), and infection rate system (Infection Rate) to indicate notable results if the player fails the mission or does not follow the game rules.

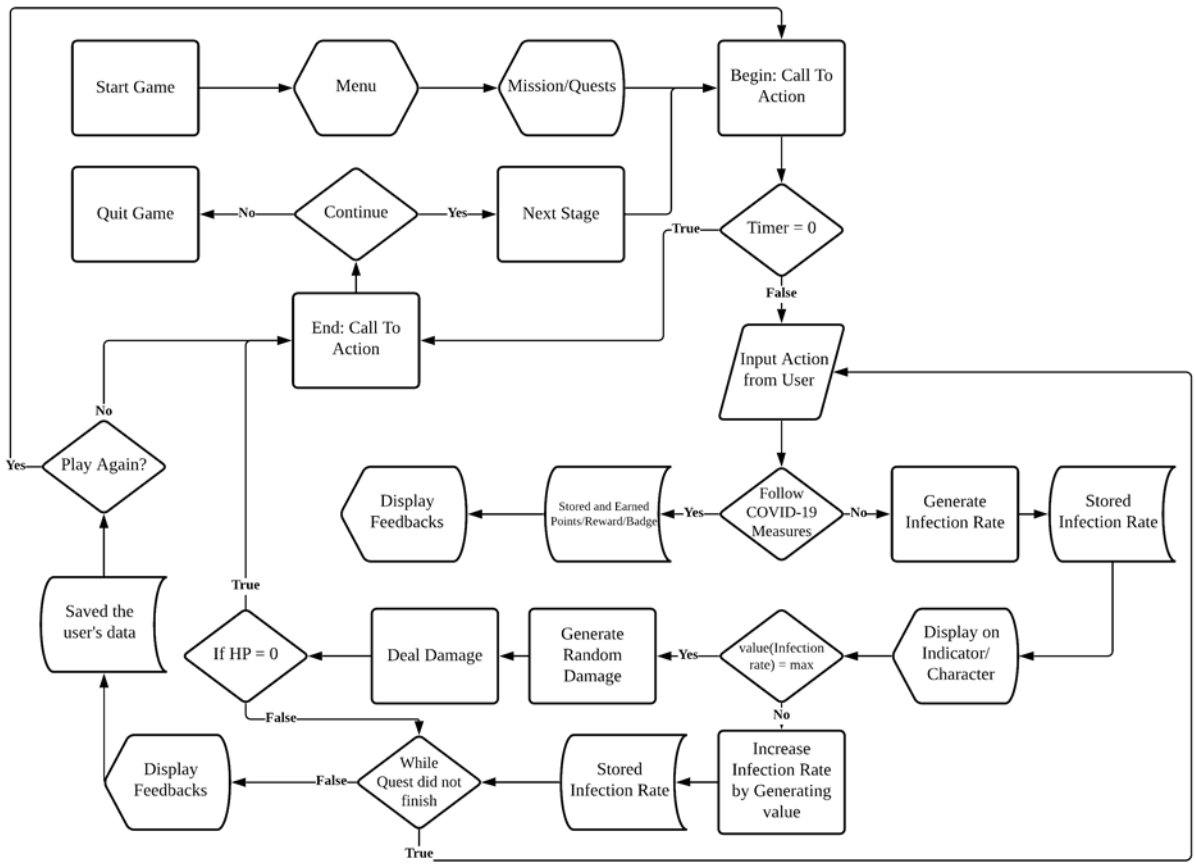

Fig. 2 A proposed COVID-19 game design flowchart

The game will constantly shift the difficulty in each quest or task, which could be represented as a variety of the design. Results and feedback are addressed in the game leaderboard element (as illustrated in Display Feedbacks), which can affect the emotion and possibly induce or reduce behavioral change. This consequence can be envisioned if the effective game design is situated and exploited for long-term use. The last part is the interaction between users and the environment. These mechanics were set by the rules and conflicts to raise awareness of the pandemic, which followed the preventive measures (as followed by Follow COVID-19 Measures. The rules can create engagement as much as possible, and the authors have designed such a mechanism to maintain positive behavior and develop optimal behavioral changes during gameplay. User can decide if While Quest did not finish returns false value, the loop will continue and request user input in decision box Play Again?. In case of continuing, user will play the same mission. Otherwise, user can decide to go for the next stage as shown in Continue. Otherwise, the user will quit the game and the game will shut itself. The game will end if the time

is up (Timer = 0 is true), a player decides not to play (Play Again is no), and the health point has become zero (If HP=0 is true). After finishing the game, the system will collect users' data (Saved user's data) and display it on the leaderboard. Badges, rewards, and points will be revealed after finishing the game so that users can notice their performance and the behavior they use at each level. All of these values are stored every decision making (as shown in Stored Points and Stored Infection Rate, and etc.).

7. Results and Discussion

A. 1st Study: Behavior Questionnaire

Based on the research by interviewing people during COVID-19 period for 4 days, respondents answered based on their mood and physical condition during that time. The percentage of participants who felt comfortable at home was 24.4%. It was found that most of the time was spent in online communities such as social games or teleconferencing. This stressful or distressing situation leads everyone to become familiar with digital technology and want to play games. It was found that most of the time was spent in online communities such as social games or teleconferencing. This stressful or straining situation leads everyone to familiarize themselves with digital technology and want to play games. During the pandemic, people prefer to exercise because circumstances prevent them from exercising and because they feel that they should exercise for their health and in their need. Behavior change is the preparation phase. Preparation is the stage when people embark on a plan. Begin working on strategies to change problematic behaviors. Point out that most of the time is spent cooking. Respondent data suggests that most people understand the situation with COVID-19, likely due to current media. 55.6% of respondents have a good understanding and 28.9% have a very good understanding. Retention is a habitual practice. and doing new behaviors until the new behavior becomes a permanent habit.

B. 2nd Study: Behavior Stimulus with Game Mechanics

The findings show that satisfaction and autonomy have taken 12 samples from the normal distribution (see Table II. There is a statistically significant relationship between the two variables satisfaction and autonomy ($0.038 < 0.05$), satisfaction and time to do quest during play ($0.035 < 0.05$). The mean of this particular distribution will be 9 that illustrates significant relationship between the satisfaction and the game quest ($0.012 < 0.05$). There is a statistically significant relationship between the two variables autonomy and time to do quest ($0.000 < 0.05$), time to do quest and during play quest ($0.009 <$

0.05). According to the findings and research background [3], [25], understanding these mechanisms serves as a basis for planning future interventions aimed at daily life change. Behavior change is influenced by game mechanics triggers. Table III depicts the design model for behavioral stimulation by game mechanics. Pre-contemplation state (S1) refers to a call to action. However, it can be situated in a contemplation state (S2) as well as level system implementation. These behavior stimuli are responded corresponding to scaffolding technique [32]. Preparation state (S3) refers to a point system that possibly aids the player in assessing their overall performance. Action state (S4) refers to challenges that specify the action throughout the various time pressure and quests. This implies the signifier that game affordances provide the initiative of behavioral changes. Badges and leaderboards incorporate the maintenance state (S5), these mechanics can track their performance and motivate users effectively in sense of effective time scale. Badges are a kind of reward representing achievements, and the leaderboards stimulate the sense of competence. Individuals in this state have consistently presented the desired behavior for a period of time. Once the behavior is maintained, the effective period would be considered as to how long the game mechanics will last before moving to the relapse state (S6). The persuasive techniques and rewards can incentivize the improvement of behaviors in several states, and its applicability can pursue the players' mastery progression by emotive and extrinsic rewards.

Table 2 Pearson's Chi Square Test χ^2

Variables	Pearson's Chi-Square Value (χ^2)	df	Asymptotic Significance (2-sided)
Satisfaction and Autonomy	21.956a	12	0.038
Satisfaction and Time for Do Quest	22.258a	12	0.035
Satisfaction and Quest	21.246a	9	0.012
Autonomy and Time for Do Quest	73.273a	16	0.000
Time for Do Quest and Quest	26.590a	12	0.009

Table 3 An Illustration of Game Mechanics and Behavior Stimuli Corredponding to the Stage of Change Model

Game Mechanics	Behavior Stimuli					
	S1	S2	S3	S4	S5	S6
Call to Action	●	●				
Levels	●	●			●	
Points	●		●			
Challenges			●	●		
Badges				●	●	
Leaderboards					●	
Emotions	●		●		●	●

●: Direct stimulus
●: Indirect stimulus

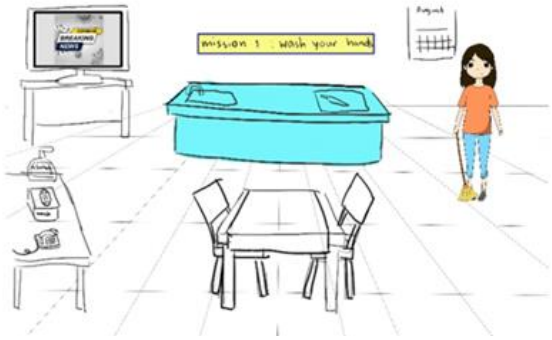

Fig. 2 An example of game design for call to action

C. 3rd Study: Measurement Process Prototype

1). Call to Action (Game Mechanic)

To measure action (S1): In making the connections between actions and goal requirements, the player must draw on knowledge about approaching a task [34], how to act, e.g., click or complete the task. Game designers use a process that involves an iterative sequence of modifications to the rules and subsequent behaviors within the game to satisfy the player's need to work toward goals effectively [6]. Actions are meaningful subcomponents in the larger picture of the game and answer the question - What can the player do [8]. The game is essentially composed of the player's allowed actions and interactions [33] to promote motivation and willingness to play. This mechanic measures the stage of pre-consideration when the player does the quest, for example. Figure 2 shows an examples of the quest for accessing the action mechanics.

2). Levels (Game Mechanic)

This step is the preparation of change (S2). Contemplation recognizes the problem and think that we should change our own behavior. Game levels design will aid in mapping a user's development by integrating various levels of difficulty. Onboarding activities that including environments' care concerned in their life.

3). Points (Game Mechanic)

Preparation (S3) is the stage of readiness for change. It is a stage that combines intention and behavioral criteria. Points are a basis numerical feedback element that can be used to track progress and unlock additional features. Point refers to the collection task that encourage continue play. The points' behavior collection infers to preparation criteria. The criteria aim to access the time to collect point or the quest success during play.

4). Challenges (Game Mechanic)

Action (S4) is the phase in which individuals change their behavior, experiences, and environment in order to their challenges in game. Challenges keep players motivated by allowing them to see their progress toward a goal. It is frequently composed of a series of tasks or quests.

5). Leaderboard and Badges (Game Mechanic)

Maintenance (S5) is the phase in which people work to prevent gain and lose that made during the intervention. Badges is a form of feedback which visualize and signifies the achievements by icon, medals, and trophies. The achievements can help people maintain their behavior. The leaderboard allows players to compare their own performance and abilities to other players (S5). It also elevates one's competitiveness and motivation. Leaderboard is a list of participants, which is ordered by the highest

to the lowest achievements. The leader board can be viewed in different ways such as weekly, daily rankings or by activities. It is used to stimulate and promote competitiveness and engagement among the players participating while assessing the capability of the participants [35]. Leader board is also known as score board [36]. The game design will collect the performance's player in terms of quest and time leaderboard such as addictions, maintenance may last a lifetime behavior.

6). Emotion (Game Mechanic)

This stage is the reverting by old behaviors and abandons the new changes (S6). Relapse should has abandoned their commitment to change. Physical and virtual rewards can foster high levels of emotional motivation and maintain engagement. Emotions help players integrate prior knowledge and organize long-term memory, focus attention, and recall information [37]. The emotion feeling will encourage people to change the bad behavior.

8. CONCLUSION REMARKS

This study incorporated the game mechanics in the COVID-19 game design for behavior measurement according to the stage of change model. As the findings, behavior stimulus factors in the design can lead to sustainable behavior change through games. The game design process encourages players to change their behavior along with the relevant design of game mechanics. Each game mechanic reflects the sense of behavioral changes in each state. Quest and time pressure were proposed to capture the effect of behavior and motivation during gameplay, this visualizes the behavioral change in the state of preparation and action. This proposes the direction on how to prevent the relapse by incorporating badges and levels. These may be involved with the emotional and extrinsic rewards that incentivize the behavior in the positive affect. This study may require extension analysis to verify the game design for behavior change. The prototyping process will be conducted to measure whether the design of the game mechanics can have a lasting impact on the behavior of players or participants. Therefore, a future study could investigate a dynamic mechanism or incorporate a specific artificial intelligence that can cope with different participants to gain additional results so that the game design is more efficient and reflects the improvement in behavior. Future work will design all stages of change using game mechanics and measure the outcome.

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