Integrating Self-Determination and Self-Efficacy in Game Design

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Abstract. Video games have been known to increase the levels of player's motivation. This initiated the emergence of serious games and gamification to exploit game elements and mechanics for increasing the motivation in non-game contexts. The research reported in this paper used psychological theories of Self-Determination Theory (SDT) and Self-Efficacy Theory (SET) to design three versions of a game. The first version was based on SDT, the second on SET and the third version was based on a combination of these two theories. The objective is to investigate the impact of each game design on the user motivation and performance. An experiment of playing the games designed with these features was conducted. Surprisingly, the results on the objective evaluation revealed that there is no significant difference among the groups in terms of engagement and performance. Furthermore, these findings were confirmed by the results on the subjective evaluation of player's perceived motivation, which showed no significant difference between the three experimental conditions.

Keywords: Self-determination · Self-efficacy · Game design · Motivation · Engagement

1 Introduction

Motivation is the driving force of all of our actions. Deficiencies to motivation can lead to undesirable consequences. In extreme cases, it can cause severe problems such as hypophagia and starving to death [1]. Finding novel and effective ways to influence and increase the motivation can help humans to overcome countless problems. Hence, there have been plenty of efforts to improve our recognition of its nature and underlying mechanisms. Psychological theories such as Self-Determination Theory (SDT) attempted at explaining the building blocks of motivation and what drives us to action [2]. SDT argues that the need for three factors of relatedness, competence and

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autonomy generates the intrinsic motivation that can push us to accomplish our goals [3]. However, SDT is a macro theory of human motivation and its three outlined components are really broad [4]. Thus, some researchers have decided to investigate the effect of integrating SDT with other psychological theories such as Self-Efficacy Theory (SET) to create a more concrete and practical theory, as well as increasing its effectiveness [5, 6].

Video games have been known for a long time to produce a surge in motivation and engagement levels [7, 8]. The motivational boost produced by video games motivated scientists and researchers to exploit game elements and mechanics for non-game purposes. This led to the emergence of fields such as gamification and serious games [9–11]. However, there exist plenty of game elements and mechanics, and it is important to recognize which game design produces the most motivation. One solution can be to test the engagement and motivation of the users with multiple game designs each based on different motivational theories.

The objective of this study is to investigate the integration of self-determination and self-efficacy theories in game design and compare the integrated design with the designs based on self-determination and self-efficacy individually. For this objective, three variations of a simple video game were developed, and each of the variations was based on one of the mentioned theories (SDT, SET and SDT+SET). Forty-six participants were involved in the experiment and they formed the three experimental groups. The data related to their performance and engagement were automatically recorded. The outcome results were analyzed to test the hypothesis of this study, which supposes that integrating self-determination, and self-efficacy theories in game design would lead to enhanced levels of motivation and performance.

The paper is organized as the following: Sect. 2 introduces SDT and SET and the related studies reported in the scientific literature. Section 3 presents the developed game and three variations of the game design based on each of the theories and the combined version integrating SDT and SET. Section 4 presents the methodology of the experiment design. In Sect. 5, the results from the analysis of the effect of each game design on the levels of engagement and performance are presented with the discussion. Finally, Sect. 6 presents the outcome of this study, its limitations and the conclusion with the future research.

2 Related Works

2.1 SDT, SET and SDT+SET

Self-Determination Theory (SDT), is a macro-theory framework for studying human motivation, it was first proposed by Deci and Ryan [2, 12, 13]. SDT defines psychological needs that need to be satisfied to foster motivation. The three psychological needs are Autonomy, Competence and Relatedness. Autonomy concerns with the sense of free will and being the agent of our own decisions. Competence is the need of being effective and competent in a task. Relatedness is the need of interacting with people, feeling attached or belonging to some groups.

Bandura [5] has defined self-efficacy as "the conviction that one can successfully execute the behavior required to produce the outcomes". Therefore, in this theory, the self-perceived judgment of one's capabilities is more relevant than the actual capability of the individual [14]. Bandura suggested four different sources for self-efficacy, which are Performance Accomplishments, Vicarious Experience, Verbal Persuasion and Emotional Arousal. Performance accomplishment is more related to the past successes and failures on a certain task and the perceived capability of accomplishing it. Vicarious experience happens when people see other people similar to them performing that specific task without too much hardship, this adds to the self-perceived capabilities. In addition, verbal persuasion from others can add to this perceived self-efficacy, although, the effect might be limited. Finally, emotional arousal relates to the emotional and physiological state of the person in face of a task, and people rely on their emotional arousal state to judge their self-efficacy.

Techatassanasoontorn and Tanvisuth [15], integrated SDT and SET to examine the influence of self-determined motivation on Information and communications technology (ICT) training outcomes and acceptance with emphasis for internet skill of a Thai community. They found that the individual with a higher self-determined motivation to participate in ICT trainings, are more predisposed to develop their Internet self-efficacy, training satisfaction and usage intention.

Sweet et al. [6], integrated and tested SDT and SET in the context of physical activity. In their work, they proposed an integration based on SDT's three psychological needs, where they replace Competence with SET and rename it as Confidence. They found that the integrated model was favorable over the individual theory models, but they warn that such conclusions warrant caution.

Sweet et al. [16], integrated SDT and SET and made a longitudinal test on post-cardiac patients for physical activity. They denote the need for physical activity for post-cardiac patients whom they present low adhesion to this activity. Hence, they proposed to fuse the two motivational theories for motivating patients to perform the necessary activities. In their experiment, they used questionnaires to assess both SDT and SET, and then they analyzed the results. Although their motivational construct was not able to predict physical activity change in a period of four months, the results suggested that it is possible to combine both theories.

2.2 SDT and SET-Based Game Mechanics in Serious Games

Peng et al. [17] presented one of the few works that actually implemented SDT through game features. In their work, they implemented autonomy and competence but not relatedness, hence implementing only two out of the three core constructs of SDT. Three features were identified and manipulated to relate them to the concept of autonomy: character customization, virtual currency to buy power-ups and freedom of dialogue interaction with non-player characters. To support competence, another three features were implemented: dynamic difficulty adaptation, progress bar and achievement in the form of badges. Although they were unable to measure the impact of each feature individually, they found evidence that both groups of autonomy-supportive and competence-supportive features led to greater game enjoyment, greater motivation for future gameplay, higher likelihood of recommending the game and greater game rating.

Francisco-Aparicio et al. [18], implemented SDT through gamification to satisfy users' three psychological needs. For Autonomy, they used profiles, task selection, configurable interface, privacy control and notification control. For competence: karma system, positive feedback, badges, real-time information, challenges and leaderboards. For Relatedness; working groups, messages, blogs and connection with social networks.

Although it was not implemented nor tested in a real system, Prouxl et al. [19] proposed to map SDT to a theoretical framework for designing serious games aimed at learning. The selected theoretical framework was the Learning Mechanics and Game Mechanics (LM-GM) [20, 21]. This work relates learning mechanics to game mechanics and classifies them according to different extrinsic and intrinsic motivation levels.

In their work, Richter et al. [22], analyzed several motivational theories and mapped them to game mechanics. Some of these theories include SDT, hierarchy of needs, SET, need achievement theory, goal setting theory, social comparison theory, Personal investment theory, expectancy value theory and skinner's principle of partial reinforcement. For SET, they proposed the following mechanics: audio/verbal/visual/music/sounds effect, progress bar, points/bonus/dividend, mini games/challenges/quests, badges, virtual goods, leaderboard, rewards-choosing colors, power, achievements and levels. However, this work lacks an experimental design to test the proposed approach.

3 Hypothesis

In the context of the research and based on the previous psychological findings, it is hypothesized that combining self-determination and self-efficacy will lead to enhanced motivation and better performance. In order to confirm this assumption, the following research question is stated: Does the integration of self-determination and self-efficacy enhance motivation and performance?

4 Developed Approach

In order to study the effect of SDT and SET on the player's in-game performance, a video-game system was developed. To keep the rules and interaction as simple as possible for the player, a platformer infinite-running type of game was developed. In this kind of game, the objective of the player is to accumulate maximum points possible by lasting as much time as possible while avoiding the obstacles. The interaction of the player is limited to pressing one button to command the in-game character to jump to avoid both the obstacles and falling.

To speed up the development, the video-game was adapted from the one presented in the tutorial "Let's Make a Game: Infinite Runner" presented at Unity Tutorials [23]. In this game, as shown in Fig. 1, a series of platforms were randomly generated in front of the player. The platforms were aligned to create three height levels, the player can jump between platforms while picking up coins and avoiding bombs. The score of the

player is increased based on how much time he keeps his character alive and the number of coins he collects. The game session lasts until a bomb is touched, or the character falls to a pit. The player controls the jump of the character and he can even perform a mid-air jump, but he cannot control the force nor modify the starting trajectory of the character. Three different levels of difficulty were presented to the player to select: easy, normal and hard. The difference between the three levels of difficulties is an increase in the speed of the game and hence faster player reactions are required at harder levels.

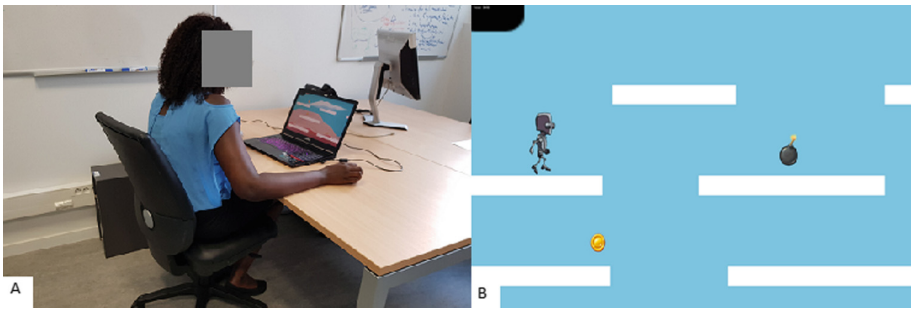

Fig. 1. **(A)** User playing the game. **(B)** Screenshot of the game containing the player's character, the three height level platforms, bonus coins and hazardous bombs

Changes to the game mechanics were made in order to implement the different features that could foster either SDT or SET. These modifications resulted in three different game modes, one mode related to each of the theories of SDT and SET and a mode for the integration of SDT and SET. This represents the three experimental conditions of this study. The implementation and the difference between the developed game mechanics are shown in Fig. 2, they are explained as follows:

- Profiles, score and levels: These three mechanics were implemented in the same way for the three game modes. To create a profile, the user has to provide his nickname, age, sex, dominant hand, whether he wears glasses and his prior experience with infinite runner type of videogames. The objective of entering the player profile is to identify and save the data of the user for further analysis. In addition, the profiles helped to implement the leaderboards mechanic. Points are constantly shown to the player as his total score while playing the game and at the end of the session. The scores increase with the time that the character is alive and by obtaining coins. Finally, three levels were implemented, easy, normal and hard. The difference between these levels is that the speed of the game is increased and hazards are spawned more often.
- Character selection and environment configuration: To fulfill the player's need for Autonomy, character selection and environment configuration mechanics were provided. At the start of the experiment and later at the in-game personalization option, the player is asked to select one of seven different characters, one of four possible backgrounds and one of two different songs. These options are presented in

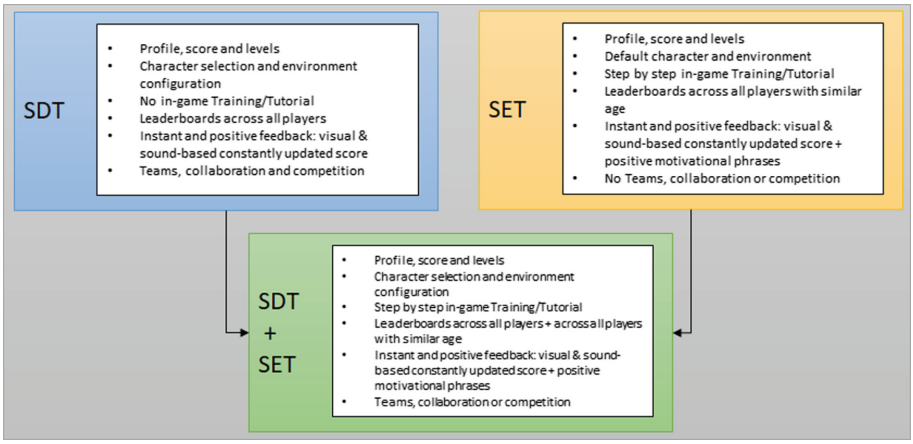

Fig. 2. Game mechanics implemented for SDT, SET and the integration of SDT+SET

the game session and can be changed at any time when desired by the player. In terms of gameplay, all the options are merely aesthetic, as they do not confer any advantage or disadvantage in the game session. These two mechanics exist in the SDT and SDT+SET game modes, but not in the SET mode where the player has to keep the default options.

- Training/Tutorials: Tutorials, particularly interactive tutorials are a very appropriate way to achieve SET's Mastery Experiences. In the SET game mode, the player is unable to play the game session in any difficulty level until he first completes the tutorial. The tutorial is divided in five successive stages; each stage aims at teaching the player a single gameplay rule of the game. Unlike the game sessions, the tutorial stages have a starting point and a goal, reaching the goal will open the access to the next tutorial. For completing the tutorial stages, the user has to understand a gameplay rule and apply it to proceed. The first tutorial stage is aimed to teach the player how to jump; simple obstacles and pits are present. To complete the stage the player has to avoid them. The second tutorial stage aims at teaching the mid-air jump, which is very similar to the first stage; but the obstacles and pits are larger, hence requiring the use of mid-air jumps to proceed. The third stage is for understanding the bonus represented by coins. By obtaining coins, the user will understand how they increase his score and why it is important to take as many as possible in order to reach higher scores. The fourth stage is about hazards, namely the bombs. If the player touches a bomb, he loses and he has to restart the tutorial. To reach the goal, the user has to avoid all the hazards. The fifth and final tutorial stage is a combination of the first four stages. By combining all the learnt lessons in a single mission, the player is requested to correctly make use of all the knowledge presented in the tutorials to reach the goal. After completing the final tutorial stage, the player is able to play the game session in easy difficulty, once he played at least one easy session, he can select normal difficulty and then, the same process is devised for hard difficulty mode. In the SDT mode, the tutorial is not present and

the player can select from the start, any preferred difficulty level, this is in order to avoid limiting his autonomy. The SDT+SET mode presents the combination of the other two game modes. The tutorial is provided, but its completion is not necessary for having access to the three difficulty levels of game sessions. Hence, the user can benefit from mastering the game experience, without limiting his autonomy in choosing to play the game sessions whenever he wants.

- Leaderboards: This mechanic was included to promote SDT's Competence and SET's Vicarious Experiences. In all the experimental conditions, the leaderboards are shown at the end of each game session. Leaderboards show the name, age, sex and score of the top players. For SDT game mode, the top ten players for each difficulty are shown, there are three leaderboards, one for each level: easy, normal and hard. For the SET condition, leaderboards are also provided for each difficulty level. However to differ from SDT condition and to trigger vicarious experiences the leaderboard shows only the high scores of people having the age close to the player's age. Vicarious experience can be triggered in people when they are informed about the people that they consider similar to them and they completed the task at hand successfully. Since the developed system does not include multiplayer capabilities, it was assumed that leaderboards defined by the age could implement this experience. The reason behind choosing this mechanic in the infinite runner game, which is mainly based on quick reaction time, is by considering that older people generally have a slower reaction time than younger players. Hence, it was decided that comparing older and younger players will not produce the feeling of having similar people achieving a task, but comparing similar-aged people could produce the feeling of vicarious experience. For creating the sense of similarity between players, a range of three years for each player was considered to identify similar-aged players. The player under this experimental condition will only see the scores of people of their age group, which is denoted inside the game as "highscores in your range of age". The SDT+SET condition shows both of the two types of leaderboards described previously.
- Instant and positive feedback: This mechanic was used to strengthen the SDT's Competence and SET's Social Verbal Persuasion. In all three game modes, instant and positive feedback is shown under two conditions: first by increasing the player's score based on how much time he/she stays active. The player can see his/her score increasing in the upper left part of the screen; the second condition is when the player picks up a coin, in this case, a number (+200) is shown in the position were the coins are displayed. A positive sound is played and the score is increased likewise. As previously stated, the developed game does not include multiplayer mode, hence, social interaction is limited. In order to implement social verbal persuasion, voices of natural spoken speech were recorded, saying positive motivational phrases such as "well done" and "perfect". These voices are randomly played when the player obtains between three and five coins.
- Teams, collaboration and competition: These mechanics were selected to fulfil the player's psychological need for Relatedness in the SDT and SDT+SET game modes. At the start of the experiment, to foster the sense of belonging, the player has to choose to be part of the yellow or the red team; this decision cannot be changed later. Belonging to a team allows collaboration with teammates and

competing against other teams. For collaboration, when the player completes a game session, his score in the specified difficulty level is added to his team's total score. Hence, there are three scores for each team; they are based on each difficulty level. The team score is shown at the end of the game session. In order to create the sense of competition, the score of the adversary team is also shown. In addition to being a member of a team, the player feels motivated to collaborate for increasing his/her teams' score in order to beat the adversary team, thus promoting competition.

It is important to note, for implementing the leaderboards and team mechanics, fictive data was included in the game. The objective is to provide a starting point for the participants to have a "fake player" to beat individually and as a team. To avoid bias in the experimentation by players trying harder to beat the latest highscore, the leaderboard data was kept the same for all players. The fictive data is excluded from the data analysis of the experimental study.

In addition to the data captured during the user's profile creation, in each of the selected game sessions, the game automatically captures the score and the time spent in the session.

5 Methods

5.1 Participants

Forty-six volunteers participated in this experiment and assigned randomly, 16 to SDT condition, 15 to SET, and 15 to SDT+SET. The subjects are researchers, personnel and students from the university community. The sample was comprised mainly of females (59%). Ages ranged between 17 and 70 years (Mean = 30.93, SD = 13.78). Forty-five subjects are right handed (98%). 28 participants wear glasses (61%). All the participants were asked to rate their prior experience with infinite runner type of video games in a scale ranging from 0 to 10 (where 0 represents no experience and 10 represents a very experienced user). The reported prior experience has a Mean = 3.22 and SD = 2.83.

5.2 Procedure

Three experimental conditions were tested: SDT, SET, SDT+SET. An infinite-runner game was created based on a tutorial and different game mechanics were devised for each experimental condition.

The experiment was conducted individually in equal set-up conditions across the three experimental conditions. All participants where positioned in front of the same laptop where the game was running. The laptop was a Lenovo B50-80, with a processor of Intel Core i5 2.20 GHz, 8 GB RAM, Intel HD Graphics 5500 graphics card, 15.6″ HD screen and integrated speaker set to a comfortable volume. All participants were sitting on the same chair at the same height (40 cm). The laptop was set on a desk

at 80 cm of height and to 15 cm from the edge of the desk. For the interaction, a mid-size mouse was set to a side of the laptop, participants were allowed to move the mouse to any position they found most comfortable for them.

A between subjects design was adopted for this experimental design. The volunteers were assigned to the experimental conditions randomly and they arrived according to their availability. In order to avoid the bias that might be caused by the intention of completing the experiment in rush, the subjects were asked to be available for 30 min, although the experimentation time for each subject was expected to be a maximum of 15 min. Each subject was assigned to one of the three experimental conditions randomly. The basic rules of the game were briefly explained to each subject prior to starting the experiment: "one click to jump, one click to perform a mid-air jump, try to collect coins, avoid bombs and pits, and the playing time is not limited". Subsequently, they were assisted to create their profiles in the game. Then, they played the game until they decided to finish the experiment.

5.3 Measures

Objective Evaluation:

- Player performance: At the end of each game session, the total score of the player was automatically saved to a file, which was eventually used for the analysis.
- Player engagement: In addition to saving the total score of the player at the end of each session, total time was also saved. Total time for each session and the number of sessions played in each difficulty level, were used to assess the player's engagement.

Subjective Evaluation:

- Player's perceived motivation: In order to capture the perceived motivation, the Situational Motivation Scale (SIMS) was applied [24]. This scale measured the player's own self-perception on Intrinsic Motivation, Identified Regulation, External Regulation and Amotivation. This test was administered in the form of pre-test post-test.
- Player's perceived system usability: The Usability of the system was assessed by applying a short version of the System Usability Scale (SUS). This test was applied in the form of post-test [25].
- Game mechanics and their impact on the player's motivation: A questionnaire was devised to assess whether each of the implemented game mechanics was perceived as motivating or demotivating.

6 Analysis of Data and Results

The 46 participants formed the three experimental groups of SDT, SET and SDT+SET with 16, 15 and 15 subjects respectively. For each subject, a set of subjective and objective data was captured. The subjective data was obtained via questionnaires, and the objective data was captured automatically from the game experience of each

participant. For each subject three main outcome of the objective data were extracted: Total Sessions (sum of the number of sessions played for each difficulty level), Total Time (sum of the duration of times spent in playing each difficulty level), and Max Score (maximum of recorded high scores throughout all the difficulty levels).

For each of these dependent variables normality test of Shapiro-Wilk was conducted. The results of this test showed that the data belonging to Total Sessions and Total Time were not normally distributed for any of the experimental groups. P-values of this test for the variable of Total Sessions were: $p = 0.0002$ for SDT group, $p = 0.001$ for SET group and $p = 0.0001$ for SDT+SET group. For Total Time, $p = 0.002$ for SDT group, $p = 0.001$ for SET group and $p = 0.001$ for SDT+SET group. However, the results of Shapiro-Wilk test for Max Score confirmed its normality throughout the experimental conditions ($p = 0.679$ for SDT, $p = 0.287$ for SET and $p = 0.263$ for SDT+SET). Additionally, Levene's test of homogeneity of variances was conducted for Max Score, and the results confirmed the homogeneity of this data across the different groups ($p = 0.433$).

The test of Shapiro-Wilk was applied to the data of these variables based on independent variables of Age Group, Gender and Experience Level. They all followed the same pattern for the normality test, in which the data groups belonging to Total Sessions and Total Time were not normal, but the data groups belonging to Max Score was normally distributed. Hence, for the normal data One-Way ANOVA, as well as Post-Hoc test of Scheffe, was conducted and for not-normally distributed data the non-parametric test of Kruskal-Wallis was applied.

The results of Kruskal-Wallis test on the variables of Total Sessions and Total Time between the three experimental groups (SDT, SET and SDT+SET) were not statistically significant ($H(2) = 0.422$, $p = 0.810$ for Total Sessions, $H(2) = 0.666$, $p = 0.717$ for Total Time). In addition, the result of One-Way ANOVA on the variable of Max Score among the three experimental conditions (SDT, SET and SDT+SET) was not statistically significant ($F(2,45) = 0.987$ and $p = 0.381$). Moreover, the same tests of One-Way ANOVA and Kruskal-Wallis were performed on the data of each variable categorized based on Age Group, Gender and Experience Level. The only statistically significant result that was found belongs to the One-Way ANOVA test on data of Max Score categorized based on Experience Level ($F(2, 45) = 8.713$ and $p = 0.001$). This indicates a logically expected positive relationship between the prior experience in this type of games and the performance. However, no significant effect of Gender and Age group was found on these three variables.

The results from pre-test post-test questionnaires were extracted for the variables of Intrinsic Motivation, Identified Regulation, External Regulation and Amotivation. The difference between pre-test and post-test was calculated and the outcome was tested for the normality and homogeneity. The variable of External Regulation did not pass the Shapiro-Wilk test for normality. Hence, One-Way ANOVA test was conducted for the other variables and the results did not indicate any significant difference among the three experimental groups: Intrinsic Motivation $F(2,45) = 0.243$ and $p = 0.785$, Identified Regulation $F(2,45) = 0.356$ and $p = 0.703$, and Amotivation $F(2,45) = 0.080$ and $p = 0.923$. Furthermore, the non-parametric test of Kruskal-Wallis was applied for the data of External Regulation. The results showed no significant difference among the three experimental groups ($H(2) = 0.716$ and $p = 0.699$). Finally, the Paired-Samples

T Test was conducted to analyze the difference in the level of intrinsic motivation before and after the experiment. This test was carried out separately for each of the experimental groups and the results showed a unique significant difference for SET ($t(14) = -2.559$ and $p = 0.023$), which was not observed in the other experimental groups. Cohen's d effect size value ($d = 0.66$) suggested a moderate to high effect size.

The usability was assessed with the short post-test of SUS. The used scale ranged from one to five. On average, when the participants were asked if they would like to use the system frequently if it is available, produced a score of 3.3. When they were asked if they think that the game was easy to use, they produced an average score of 4.39. Participants gave an average score of 4.60 when they were asked if they think that most people will learn to use the game quickly. Finally, a score of 3.86 was given when they were asked if they felt confident when using the game.

Finally, a questionnaire was included to assess which game mechanics were perceived as more motivating for the players. The scale ranged from −3 (Very demotivating) to 3 (very motivating). The game mechanics that were perceived as more motivating were: watching the highscore in the player's range of age (mean = 2.36), being able to choose between doing and not doing the tutorial (mean = 2.2) and being able to select your character (mean = 2.12). The least motivating game mechanic was: being forced to complete the tutorial before being able to play the game (mean = 0.66).

The results did not confirm the hypothesis that combining self-determination and self-efficacy in game design would lead to enhanced motivation and performance. However, this does not imply that the hypothesis is not plausible. Specific attributes of the experiment design in this research (e.g. type of game, game design, and environment of the experiment) might have contributed to the results of the experiment. Thus, additional investigation and experimentation are necessary to confirm this research outcome.

7 Conclusion and Research Perspectives

Motivation is not a simple construct and recognizing its underlying mechanisms has been the subject of a plethora of scientific research. This paper aimed at investigating the impact of combining self-determination and self-efficacy theories in game design on performance and user engagement. Three variations of a game were designed based on each of these theories and a combination of them.

The statistical analysis revealed that there is not any significant difference between the experimental groups in terms of maximum score, number of sessions and total time spent in playing the game. These results did not confirm the hypothesis considering that integrating self-determination and self-efficacy would lead to enhanced performance and engagement. Additional analysis did not show any significant difference in terms of engagement among different levels of prior experience in this type of games. However, prior experience was shown to have a significant positive impact on the performance (Max Score).

Additionally, the analysis of the user feedbacks obtained through questionnaires did not reveal any significant difference among the experimental conditions in terms of Intrinsic Motivation, Identified Regulation, External Regulation and Amotivation.

However, a significant difference was found between the pretest and posttest questionnaires of SET condition on Intrinsic Motivation. This effect was not observed in the other experimental groups. Finally, the participants perceived the developed system as easy to use. The most motivating feature was to compare highscores between players of the same range of age; the least motivating feature was being forced to complete the tutorial before being able to play the game.

More investigations are necessary to check the validity of the results obtained in this study. Future experiments should involve bigger sample size of subjects. In addition, future experiments could include multiple games and allow the participants to choose among them, in order to increase their sense of autonomy. Additional indicators, such as emotion recognition should be included to evaluate the effect of the emotional state of the user during the gameplay. This could confirm the interplay between self-determination and self-efficacy in game design.

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