

The Impact of Gamification on Student Motivation and Engagement: An Empirical Study

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5



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Abstract

Objectives: This study aims to investigate the impact of an online gamified learning environment on university students' motivation and engagement in learning a computer essentials course.

Methods: A quasi-experimental design was used on the participants of Saudi university students.

Results: The results showed statistically significant differences between the mean scores of the students in the experimental and control groups regarding their motivation and engagement towards learning, with the experimental group exhibiting higher scores.

Conclusions: The study concluded the effectiveness of using gamification in developing motivation and engagement towards learning in the field of computer sciences. The study recommends encouraging teachers to take advantage of e-platforms and applications that support gamification in teaching computer courses. It is also recommended that, when implementing a gamification strategy in education, the program should be designed in accordance with theories and principles of gamification design in education, as these have an impact on developing motivation and engagement towards learning.

Keywords: Education, gamification, motivation, engagement, higher education, online learning, self determination theory.

أثر التلعيب على تحفيز الطلاب واندماجهم في التعلم: دراسة تطبيقية

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ملخص

الأهداف: استكشاف أثر بيئة تعلم عبر الإنترنت قائمة على التلعيب على تحفيز طلاب الجامعة لتعلم مقرر أساسيات الحاسب واندماجهم في تعلم.

المنهجية: تم استخدام التصميم شبه التجريبي بتصميم الاختبار القبلي والبعدي للمجموعتين الضابطة والتجريبية وكان المشاركون من طلاب الجامعة السعودية الإلكترونية. وقد تم في هذه الدراسة تبني أداتي قياس من دراسات سابقة بعد الحصول على موافقة الباحثين لقياس متغيري التحفيز والاندماج، وتم تطبيقهما قبل البدء بالدراسة وبعدها. وقد أُستخدم تحليل مانوفا للكشف عن وجود أي فروق دالة إحصائية بين متوسطات المجموعتين.

النتائج: أظهرت النتائج أن التلعيب كان فعالاً وأن هناك فروق ذات دلالة إحصائية لصالح الطلاب الذين درسوا باستخدام التلعيب في متغيري التحفيز والاندماج.

التوصيات: أوصت الدراسة بتشجيع المعلمين على الاستفادة من المنصات الإلكترونية والتطبيقات التي تدعم استخدام الألعاب في تدريس دورات الكمبيوتر. من المستحسن أيضاً أنه عند تنفيذ استراتيجيات التلعيب في التعليم، يجب تصميم البرنامج وفقاً لنظريات ومبادئ تصميم التلعيب في التعليم، لأن هذه تؤثر على تطوير الدافع والمشاركة نحو التعلم.

الكلمات الدالة: التعليم، التلعيب، التحفيز، الاندماج، التعلم عبر الإنترنت، نظرية تقرير المصير..

1. Introduction

Gamification has recently attained a noticeable position within a variety of contexts (Buckley & Doyle, 2016). Kapp (2012, p. 10) defined gamification as using “game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems”. The application of gamification uses features related to video games, including game dynamics and game mechanics. Such features can be applied to non-game contexts as well (Simões, et al., 2013). Significantly, Squire (2003) pointed out that gamification can be differentiated from the utilization of computer games in educational contexts. It is important to note that when gamified learning is applied in classrooms, the engagement of students is potentially boosted and their learning can be dramatically enhanced (Buckley & Doyle 2016). This indicates the significance of gamification in generating a comfortable atmosphere in learning.

Within the area of simulated business games, it should be noted that commercial games such as Railroad Tycoon, World of Warcraft and Civilization have been identified as learning instruments (Buckley & Doyle, 2016). This indicates that gamification tackles the incorporation of design components or activity samples utilized in games in education. However, it is not necessary to include information technology or a real game (Buckley & Doyle, 2016).

Moreover, a definition of gamification by Deterding et al., (2011, p.1) expresses the “use of game design elements within non-game contexts”. Sailer, Hense, Mayr, and Mandl (2017) argued that the main concept is that the building blocks of games can be implemented in actual situations, adopting the aim of the motivation of particular behavior and conduct in certain gamified contexts. In addition, gamification is viewed by a number of scholars as a promising and innovative notion which can be used in several contexts (Zichermann & Linder, 2013; Zichermann & Cunningham, 2011).

To win students’ interest and attention away from video games and other social media and mobile applications, educators have a lot of difficulty finding new methods to engage and motivate their students (Dicheva et al., 2018). It is interesting to note that gamification provides an auspicious design for educational interventions and can boost learners’ engagement and motivation. Adopting game mechanics and game design components makes learning attempts more engaging, a learning experience known as gamification of learning (Dicheva et al., 2018). It dramatically captivates teachers’ attention and interest in anticipation of its encouraging behavioral changes and motivation in learning fields. However, the lack of evidence explaining the possibility of course gamification as well as the relevant tools required to encourage it have been noted (Dicheva et al., 2018).

Problem of the study

Large numbers of empirical studies show positive rather than negative impacts of gamification on motivation (Dicheva et al., 2015; Seaborn & Fels, 2015). Nevertheless, evidence is lacking on the basis of its efficacy because studies based on analysis strategies and study design are limited (Dichev & Dicheva, 2017; Hamari et al., 2014; Seaborn & Fels, 2015). Further, Seaborn and Fels (2015) pointed out that few studies have tackled the theoretical foundation to demonstrate such motivational impacts. This implies that how gamification actually motivates has not yet been tackled. Also, there is a lack of studies addressing the required support for learning activities of gamification (Dicheva et al., 2018). Hence, the aim of this paper is to investigate the various game design components to show their particular impacts on university students’ motivation and engagement.

It should be noted that the particular designs and concepts of gamification contexts can be extremely diverse. Gamification can have various forms and can join game design components in several ways. The effects of these various components within a provided environment should be given attention as well.

Study Questions

This study aims to investigate the impact of an online gamified learning environment on students’ motivation and engagement. This study was guided by the following questions:

1. Does the online gamified learning environment affect university students’ motivation to learn computer essentials course?
2. Does the online gamified learning environment affect university students’ engagement in learning computer essentials course?

Literature Review

Gamification in Education

Understanding and cultivating learners' abilities is one of the most significant aims of education. To gain such understanding and development, their strengths and weakness should be identified (Kotob & Ibrahim, 2019). Educational systems that concentrate only on teaching through traditional techniques and strategies have created passive learners. Teachers have to change from their traditional teaching strategies since social media applications and gaming tablets have become an influential component of learners' lives. For example, Kotob and Ibrahim (2019) argued that instructors encounter a considerable problem with learners' achievement and motivation inside classrooms. They added that it is easy to distract learners: interest of the lesson is lost and weak communication occurs between learner and instructor. This is why teachers or instructors need to find new methods to help learners obtain better results. Significantly, one of these teaching strategies and techniques is gamification, learning through playing (Kotob & Ibrahim, 2019).

In the real world, education includes different activities satisfied by special platforms. To serve such activities, various gamification platforms target education, including ClassDojo, ClassCraft, Seppo, Rezzly and Kahoot. However, such platforms target K-12 education and the focus is directed toward reward systems and class management (Dicheva et al., 2018). On the other hand, Aguilar, Holman, and Fishman (2018) stressed that no general gamification platforms have been provided at the university level except the Gradecraft platform. It is interesting to note that Gradecraft's focus is on grading and selection of learning tracks within a course.

In addition, famous gamification components are provided in Moodle, one of the learning management systems. In this case, Dicheva et al. (2018) stated that teachers can only choose them for use by the whole class without defining game components' behavior. The researchers added that game mechanics have been previously involved in particular improved online learning systems through changing grades to scores, offering points for certain activities encouraged by the system, and utilizing the points for rewarding certain badges. This process of gamification is often known as 'pointification' (Dicheva et al., 2018). It is important to indicate that empirical studies demonstrate that pointification does not cause learners' development of motivation (Dichev & Dicheva, 2017).

Mayer and Johnson (2010, p. 244) pointed out that a game is identified as a "rule-based environment that is responsive to the player's actions, offers an appropriate challenge to the player, and keeps a cumulative record of the player's actions", whereas in educational contexts a computer game is identified as a technology-supported game used for the sake of causing a needed change in the participants' knowledge (Mayer & Johnson, 2010). It should be noted that according to Goehle (2013) educational games have two purposes; the first, primary purpose is related to the nature of the game, while the other, secondary purpose is related to teaching any relevant area through the game.

Literature confirmed the role of games in learning. For example, games have an efficacious function in learning promotion and support (Liu et al., 2014; Moreno, 2012; Annetta et al., 2009; Papastergiou, 2009; Ke, 2009; Barab et al., 2005), and students are more motivated than are others who received non-gaming teaching approaches (Papastergiou, 2009; Batson & Feinberg, 2006; Barab et al., 2005). Van Eck (2006) argued that games proved to have a considerable effect in a learning environment "partly because learning takes place within a meaningful context" (p. 18). This indicates that practice and application have been activated. Moreover, O'Donnell, Gain, and Marais (2013) stressed that it is necessary that efficient games be "motivating, addictive, and provide encouragement through very short-term goals, so that the player can fail and try again until they succeed" (p.242).

Significantly, introduction of game mechanics for immediate feedback, incentives, and rewards to instructions in classrooms caused the first systems of the gamified learning to emerge. Gamification systems are still popularly connected with leaderboards, badges, and points (Hamari et al., 2014). Integrated game-like components such as progress bars, narratives, and choice systems have recently been implemented. Hamari et al. (2014) claimed that research asserted that the application of such game components was probably to promote needed user behavior in different environments. Some studies have warned that these components probably reduce the intrinsic interest of the users. However, other studies contended that a fully considered use of game components probably enhances intrinsic motivation through engaging users'

innate psychological demands for relatedness, competence and autonomy (Ryan & Deci, 2000). As for points, badges and leaderboard systems, they are easy to apply and use and this why they are abundant. Due to their role in enhancing motivation, there is need for support to study and create gamified learning activities. It is important to note that there are limitations in the current available support (Dicheva et al., 2018).

In education, Dicheva et al. (2018) claimed that learning via games represents a tremendous source of pleasure. It is interesting to note that the challenges in learning make games more fun. This is due to their nature of permitting players or learners to experience the ability to think and of freedom. The same researchers added that to boost engagement, useful challenges are formed to present learning in attentively planned advancement presented in educational platforms. Some popular gamification platforms exist. They include Bunchball, Badgeville, PugPharm and Hoopla. However, packing chosen gamification approaches into 'one size fits all' processes is considered the related typical method. This responds to the requirements of projects with different organizational systems (Dicheva et al., 2018).

In a critical review study, Dichev and Dicheva (2017) reviewed a number of empirical studies. The researchers' review demonstrates that the empirical studies have not been quite systematic in relation to understanding what type of game components under what conditions can provide the needed conduct. Their revision of the collected works showed that eight papers reported gamified systems utilizing two game components, 11 papers described studies on the impact of a single game component, 16 papers discussed gamified systems with three game components, and the remaining 16 papers described the findings of gamifying systems by integrating more than three components. The same researchers concluded that more studies are needed so these studies can enhance our understanding of how single game components are connected to motivational and behavioral results and how they operate in a provided educational situation. It should be noted that it is hard to recognize their assistance in studies that join various game components together without having understood the impacts of single game components.

Motivation and Engagement in Learning

Research has considered the two concepts of motivation and engagement as having similar features that often agree in the fields of cognitive engagement and intrinsic motivation (Guthrie, Wigfield, & You, 2012; Dornyei & Ushido, 2011). Although motivation and engagement share a powerful relationship, the two concepts are different terms; they are synonymous. Also, if one term exists this does not necessarily indicate that the other term has the same meaning. Brooks, Brooks, and Goldstein (2012) pointed out that motivation is connected with psychological components that generate choice-making and behavior, whereas Russell, Ainley, and Frydenberg (2005) viewed engagement as "energy" connected with various actions and tasks" (p. 1). Other research accentuates the significance of motivation and engagement together in learning, but stressed their different independent concepts (Appleton et al., 2006).

As an extensive definition of motivation, Dornyei and Otto (1998) defined it as "the dynamically changing cumulative arousal in a person that initiates, directs, coordinates, amplifies, terminates, and evaluates the cognitive and motor processes whereby initial wishes and desires are selected, prioritised, operationalised, and (successfully or unsuccessfully) acted out" (p. 64). Hsieh (2014) pointed out that some scholars divide motivation into five elements. These include ability belief, task value, expectancies for success, and intrinsic and extrinsic motivation.

It is good to start with intrinsic motivation which is driven by human requirements for overcoming challenges, mastery, and curiosity. Extrinsic motivation is quite appropriate for components not associated with task value like rewards and grades. Task value is the learners' awareness and the value of the task as well in a manner that may or may not be useful to them (Alsawaier, 2018). Wigfield, Byrnes, and Eccles (2006) claimed that the expectation of success means the way learners anticipate what to do in the future as they take part in a definite task.

On the other hand, it is interesting to note that engagement has emerged to involve the psychological internal methods, demonstrated in human behavior in the shape of efficacious, cognitive and task engagement (Griffiths et al., 2012). To introduce an operational definition for engagement, Willms (2003) accentuated the association between school participation in the form of activities and psychological behaviors. Ryan (2000) noted that research has highlighted the

noticeable levels of engagement, including the learners' aspects of participation and attendance, their attitudes, and their dedication and effort in doing the task of school activities.

Additionally, according to Skinner and Belmont (1993), engagement demonstrates the emotional participation and passion in completing and sharing learning activities. Kuh (2009) defined engagement as the effort and quality students spend in an actual activity. In his definition, Kuh highlighted the noticeable level aspect of engagement since it is demonstrated in the students' behavior towards the time and quality, they spend in the learning activities as well as the learning experience. It should be noted that engagement does not have the same meaning as the expression "time on task"; it is however "the enthusiasm and diligence" in performing the activity that causes the engagement to be authentic (Schlechty, 2001, p. 64). In another view, Csikszentmihalyi (1990) accentuated this relation between engagement in an activity and the substantial strong involvement of the students in a manner that exceeds space and time.

Alsawaier (2018) contended that motivation and engagement can often be differentiated in chronic happenings. The same researcher added that intrinsic motivation and prior behaviors in learning can be a preliminary to participation enhancement and task engagement. In addition, participation may function in a way that alters previous negative behaviors. A mixture of noticeable motivation and important task engagement has been found to simplify learning experience success (Davis & McPartland, 2012). It is important that engagement as a remarkable positive behavior that can be known as learners' involvement in school-provided activities is motivated by preceding behaviors (Alsawaier, 2018).

Gamification in Relation to Motivation and Engagement

In a number of studies, Alsawaier (2018) noted that learners' levels of engagement mushroomed dramatically after the game components were presented. Alsawaier reviewed multiple studies in reference to gamification, engagement, and motivation. The studies mentioned in his review employed only components of video games. He found that gamification boosts learners' task engagement and motivation. To be more specific, Alsawaier investigated all the studies mentioned in his study for the sake of theoretical foundations used in the gamification research, the participants' ages and number, the gamified content, and the findings. He found a clear agreement among authors who made empirical studies on the use of gamification components in relation to the positive impact on learners' motivation, engagement, and general performance by providing immediate collaboration and feedback (Koivisto, 2014; Leaning, 2015; Kingsley & Grabner, 2015; Papastergiou, 2009; Seaborn & Fels, 2015). Attali and Arieli-Attali (2015) suggested positive findings to highlight greater preference evaluations when gamification aspects are presented. However, there is no relation between learners' motivation and engagement and presenting gamification aspects to the environment of learning (Alsawaier, 2018; Hanus & Fox, 2015).

Moreover, in an empirical study on gamification Hamari, Koivisto and Sarsa (2014) examined 24 studies. They pointed out that the majority of them provided positive findings of the connection between students' engagement and gamification. Similarly, Seaborn and Fels (2015) pedagogically investigated 32 research papers concerning the use of digital gamification components. They found that among the 32 papers, 20 provided positive findings that link gamification to the higher levels of engagement and motivation. The remaining 12 studies provided negative findings that demonstrated no association between learners' engagement and the provision of game components. In other empirical studies, leaning (2015) and Berkling and Thomas (2013) provided mixed or negative findings. The researchers highlighted the limited aspects of gamification; on the other hand, they forced the learners to tackle the available game options and did not succeed in providing them with options.

Theoretical Background

The scarcity of empirical studies on gamification established relating to theoretical principles is important (Alsawaier, 2018). As mentioned above, Seaborn and Fels (2015) conducted a reviewed paper on engagement and gamification covering 32 research papers. They found that ten of these studies only dealt with theories. Moreover, there is "a gap

between theory and practice- where theory is empirically unexamined [in the context of gamification] and applied work lacks reference to theory- which serves to limit the growth of the field” (Seaborn & Fels, 2015, p. 27). This actually accentuates the demand for research on gamification with solid theoretical connections that assists in filling the gap between practice and theory. In this paper, the self-determination theory and new literacies study will be discussed thoroughly to comprehend the association between motivation, engagement and gamification.

Self-Determination Theory

The core of self-determination theory of human motivation is engagement and motivation. This theory relies on the three bases of relatedness, competence, and autonomy (Deci & Ryan, 2008; Seaborn & Fels, 2015). Baard, Deci, and Ryan (2004) contended that competence is associated with motivation to gain success as well as to overcome challenges. The same researchers noted that the demand for autonomy is linked to decision-making and determination of being responsible for one’s actions. Additionally, the demand for relatedness is concerned with social status and an association with others on the basis of mutual interdependence and respect. It is interesting to note that the three components of this theory form the psychological demands of a human being to initiate choices, to collaborate and compete with others. The whole process can be provided in the environment relating to gamification (Alsawaier, 2018).

Gee (2003) claimed that in such an environment various players have the option to pick their own avatars, and competitively have the option to play the game. Alternatively, they can work together in close similar groups. A large number of players feel satisfied since the findings are shown on leader boards of the environment of gamification in emphasizing the social components of relatedness. Research has demonstrated that the components of this theory positively influence intrinsic motivation. For example, Deci and Ryan (2008, p. 14) confirmed that “considerable research has found interpersonal contexts that facilitate satisfaction of the basic psychological needs for competence, autonomy, and relatedness to enhance autonomous motivation, which comprises intrinsic motivation and well-internalized extrinsic motivation”.

Alsawaier (2018) stressed that scholars initiated a relationship between this theory and video game components and motivation. When participants employ the gamified environment, they cheerfully merge themselves with virtual challenges for the sake of gaining play and fun. Francisco-Aparicio, Guti’errez-Vela Isla-Montes, and Sanches (2013, p. 114) argued that “Intrinsically motivated activities are those that the individual finds interesting and performs without any kind of conditioning, just by the mere pleasure of carrying them out”.

New Literacies Study

New literacies study is a development of the new literacy theory (Alsawaier, 2018). Focus has been on the digital environment in a manner that serves a semiotic area for processing and adopting meaning. In this specific theory, meaning “involve [s], as well, ways of acting, interacting, valuing, believing, and knowing as well as often using other sorts of tools and technologies” (Gee, 1997, p.10). It is important to note that Gee pointed out that this theory has been used as an umbrella term for the whole types of digital literacies involving processing and understanding meaning.

Gamification is a type of digital literacy where various levels of meaning processing and making occur. In the digital game environment, one of these forms of learning occurs via the close similar groups and the multiple modes of social interaction (Gee, 2003). In addition, it has been argued that gamification permits learning to occur individually since the students feel intrinsically and extrinsically motivated via achieving scores and gaining awards. Accordingly, the social feature of gamification via competition and collaboration has been regarded as crucial (Challco, Moreira et al., 2015).

Method

A quasi-experimental design was used in this study. It was conducted at Saudi Electronic University (SEU) during the first semester of the 2021 academic year. The participants were 97 first-year undergraduate students from two classes of a computer essentials course. In this course students are introduced to computer sciences and learn the use of the office applications. They all were male and their ages ranged for 18 to 29.

All of the participants had experience using collaborative tools in the Learning Management System (LMS) used at SEU. One class (50 students) was designated the experimental group learning with the gamification-based approach while the other class (47 students) was the control group learning with the conventional approach. The classes were taught by the researcher and learning material, content, and teaching were the same.

Experimental procedure

At the beginning of this course, the students were given a pre-test. They then were taught online for the duration of 12 weeks and the instruction was administered through the LMS. The instructor used points, leader board and badges since they are easy to implement manually in the LMS that SEU uses which does not support gamification. At the first lecture, the instructor explained the rules of the gamification strategy to be used such as when students can get points or badges. At each lecture, the instructor used the same learning activities for both groups. However, with the experimental group, a number of points were given for each student for completing each activity. Earning badges was based on specific activities such as submitting an assignment three times earlier or provided quality peer feedback. Each week, the instructor put the leader board on the main page of the course which displays each student's points, badges and the students' order on the leader board. In each group the students were divided into smaller groups through the breakout rooms feature. Each time a student joined a different group which allow exchanging ideas. A discussion board was used to provide feedback for both groups in a similar way. The only difference between the experimental group and the control group was the use of points, badges and leader board.

Developing the gamified online environment

Based on the self-determination theory (Ryan & Deci, 2000), competence, autonomy, and relatedness are three basic psychological needs. People will have high motivation when these needs are satisfied. Therefore, when developing the gamified online environment students were given access to build their capabilities while choosing from different activities provided with the autonomy. Moreover, collaborative opportunities to work with their peers were provided to enhance students' relatedness to a social community. The GAFCC model proposed by Huang and Hew (2018) was adopted when developing the gamified online environment. This model indicates that five elements (goal, access, feedback, challenges, and collaboration) are essential in designing a motivating environment. Thus, the goal of the learning activities was set clearly for students as was how they were rewarded for finishing these activities. Students were provided the option to select from a number of activities so the access element was achieved. A student could get peer feedback as well as instructor feedback. A student would earn a badge for providing peers with quality feedback. Some activities were challenging and earned more points than others. The use of group activities satisfied the collaboration element.

Instrument

After obtaining permission from researchers, the motivation instrument adopted from Tuan, Chin & Shieh (2005) and the engagement instrument was adopted from Lin and Huang (2018).

Data collection and analysis

At the beginning of the course, the instrument was administered to assess the motivation and engagement variables of the experimental and control groups and to ensure that there was significant difference between them. At the end of the semester, the same instrument was administered again. MANOVA test was used to analyze the data.

Results

Table 1: Summary Statistics Table for Interval and Ratio Variables

| Variable | <i>M</i> | <i>SD</i> |
|------------|----------|-----------|
| Motivation | 3.75 | 0.89 |
| Engagement | 3.85 | 0.99 |

Table 2: MANOVA Results for Motivation and Engagement by Groups

| Variable | Pillai | <i>F</i> | <i>df</i> | <i>p</i> | η_p^2 |
|----------|--------|----------|-----------|----------|------------|
| Groups | 0.25 | 15.46 | 2 | < .001 | 0.25 |

To further examine the effects of gamification on motivation and engagement, an analysis of variance (ANOVA) was conducted for each dependent variable. The ANOVA was examined based on an alpha value of 0.05. The results were significant: $F(1, 92) = 25.53$, $p < .001$, indicating there were significant differences in students' motivation between the two groups (Table 3). The eta squared was 0.22, indicating the gamification approach explains approximately 22% of the variance in students' motivation. The means and standard deviations are presented in Table 4.

Table 3: Analysis of Variance Table for Motivation

| Term | <i>SS</i> | <i>df</i> | <i>F</i> | <i>p</i> | η_p^2 |
|-----------|-----------|-----------|----------|----------|------------|
| Groups | 16.13 | 1 | 25.53 | < .001 | 0.22 |
| Residuals | 58.11 | 95 | | | |

Table 4: Mean, Standard Deviation, and Sample Size for students' motivation

| Combination | <i>M</i> | <i>SD</i> |
|---------------------|----------|-----------|
| Control group | 3.31 | 0.96 |
| Experiential groups | 4.14 | 0.58 |

Moreover, the ANOVA was examined based on an alpha value of 0.05. The results were significant, $F(1, 92) = 28.20$, $p < .001$, indicating there were significant differences in students' engagement between the two groups (Table 5). The eta squared was 0.23 indicating that the gamification approach explains approximately 23% of the variance in students' engagement. The means and standard deviations are presented in Table 6.

Table 5: Analysis of Variance Table for students' engagement

| Term | <i>SS</i> | <i>df</i> | <i>F</i> | <i>p</i> | η_p^2 |
|-----------|-----------|-----------|----------|----------|------------|
| Groups | 21.75 | 1 | 28.20 | < .001 | 0.23 |
| Residuals | 70.96 | 95 | | | |

Table 6: Mean, Standard Deviation, and Sample Size for students' engagement

| Combination | <i>M</i> | <i>SD</i> |
|---------------------|----------|-----------|
| Control group | 3.35 | 1.10 |
| Experiential groups | 4.32 | 0.58 |

Discussion and Conclusion

To examine the impact of the gamification-based online learning on university students' motivation and engagement, a MANOVA test was conducted. The result showed statistically significant differences between the mean scores of the students of the two groups (experimental and control) in their motivation and engagement towards learning in favor of the experimental group. This result is consistent with the results of a number of previous studies that showed the effectiveness of using gamification in developing motivation and engagement towards learning in the field of computer sciences (Gafni et al., 2018; Rojas-López et al., 2019) and in general (Hamari et al, 2014; similarly, et al., 2015). This result is due to the

use of gamification elements in the e-learning environment, which attracted students' attention and encouraged them to learn and participate. It also facilitated difficult topics due to the accompanying positive reinforcement with points, badges, and leader boards (Elshehy, 2017). This result may also be attributed to the role of gamification elements in meeting basic psychological needs such as relatedness, competence, and autonomy. If these needs are met according to the self-determination theory, this will positively affect motivation and thus the person will work more efficiently (Dichev et al., 2015; Rojas-López et al., 2019). This was taken into account by designing the learning environment in a way that the student could feel his or her competence and ability to understand and master computer skills, by presenting the educational goals the student seeks to achieve by the end of the unit and linking that to the corresponding points and badges. The learning environment was also designed in such a way that would student feel connected while communicating with the teacher and colleagues in the discussion space. The student was thus given confidence and a sense of independence by having a personal account through which to be responsible for learning and performing his or her tasks. The student was provided with a guide for the educational environment to see the rules of gamification, how to get points, badges, the leader board, and to navigate between learning levels.

Recommendation

Given the effectiveness of the e-learning environment based on gamification in developing motivation and engagement towards learning, the study recommends encouraging teachers to take advantage of e-platforms and applications that support gamification in teaching computer courses. It is also, recommended that when implementing gamification strategy in education the program should be designed in accordance with theories and principles of gamification design in education, as these impacts developing motivation and engagement towards learning.

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