The Effectiveness of a Platform based on Gamification in developing Creative thinking among Middle School Students

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ABSTRACT

Gamifications are currently one of the key instruments for educational platforms as they can be used to encourage students to achieve learning goals and develop their thinking skills. One of the key skills needed in the modern educational setting is the ability to think creatively, and students in the creative education stages must cultivate this skill. Therefore, the goal of the current research is to determine whether a platform that uses Gamification can assist middle school students to improve their creative thinking. Using the quasi-experimental method, the first experimental group, which used the educational platform based on Gamification, was compared to the second experimental group, which used the same platform but without any Gamification. The research sample consisted of 60 ninth graders from Jeddah, kingdom of Saudi Arabia who were divided into two research groups randomly. In the computer and information technology learning material, a creative thinking skills measurement scale was developed. Three fundamental skills were measured on the scale: fluency, originality, and flexibility. The findings indicated that, the general creative thinking skills, as well as sub-cognitive thinking skills: the fluency, originality, and flexibility are best developed using an educational tool built on Gamification.

Keywords: platform, gamification, creative thinking**.**

Introduction

In recent years, researchers in educational technology have paid close attention to gamification (Sailer & Homner, 2020). Gamification is one of the most recent educational innovations, and it refers to the use of some digital incentives such as points, badges, leaderboards, and other elements in educational settings for the purpose of motivating and arousing (Alzahrani & Alhalafawy, 2022) individuals to complete tasks. (Leclercq, Poncin, & Hammedi, 2020). Therefore, gamification is the use of game mechanics in non-game situations (Kapp, 2012). According to Kim (2015) gamification is the use of game elements to motivate learners to learn and make the learning process more enjoyable. As defined by (Huotari & Hamari, 2012), gmafication is the reinforcement of behavior using game-related elements and game-related methods of thinking in settings outside of the game, and It is described by Nicholson (2015) as the use of grading components from video games, such as points, achievements, and levels, in an educational setting. The gamification of educational environments involves challenges within the learning environment and tasks that the learner must complete. Based on the way learner completes these tasks, the learner earns points and badges and advances through stages. Furthermore, the learners are arranged in accordance with their success rates. (Alhalafawy & Zaki, 2019).

The spread of gamification in education has been helped by the emergence of a variety of digital platforms. These platforms enable educational programs to be managed in accordance with motivational procedures, allowing teachers to track students' performance and provide digital rewards based on their performance through the platform. (Alhalafawy & Zaki, 2022) Additionally, some platforms automatically manage stimuli based on students' implementation of specific conditions via the platform, so they are automatically given points, badges, and other incentive elements. (Alzahrani & Alhalafawy, 2022). Through the variety of stimulus elements that these platforms include, digital platforms provide an ideal environment for presenting content in special circumstances. A student can earn points or badges and appear on leaderboards by using digital networks. (Alhalafawy & Zaki, 2019).

Educators have been interested in measuring the effect of digital stimuli and gamification tools on a variety of educational and psychological variables. Including the learner's participation in the learning process. (Halliday et al., 2018) improve learning motivation and cognitive success (Restivo & Van De Rijt, 2012). Gamification adds to a positive change in learners' behavior and attitudes toward learning, as well as improving their motivation, resulting in positive outcomes for learners' achievement. (Urh et al., 2015). Gamification also helps to develop and strengthen processes of cooperation and communication among learners. This enables learners to discuss educational problems and tasks, which improves cognitive awareness and increases achievement rates. (Kingsley & Grabner-Hagen, 2015).

Creative thinking skills are among the critical skills emphasized in the educational sphere. and it is of the essential skills for the twenty-first century is creative thinking. (Ritter et al., 2020). Creativity and innovative thinking are not desirable qualities in twenty-first-century workers. Rather, it is one of the requirements for employees in this age. Many public and private sector employees (75%) affirmed that they wished

they had more creative thinking abilities, and they affirmed that their dissatisfaction with their ability to think creatively was due to a lack of exposure to creative thinking skills during their time in school. (Ritter et al., 2020). Many employers have stated that creative thinking skills are among the most difficult to discover in job applications. ("These Are the Skills You Need If You Want to Be Headhunted," 2015). Academics, business leaders, and lawmakers all over the world have emphasized the importance of encouraging creative thinking in all populations. (Scholte, 2008).

The research gap in this research is based on the urgent need for new and modern teaching methods that are consistent with the features of this era and its technological advancement to teach and enhance creative thinking skills among school students in the early stages of their lives. This necessarily means searching, studying, and testing modern technical tools in different contexts, with different contents, and on different samples to enhance the creative thinking skills among students.

Accordingly, the current research attempts to answer the following question:

(RQ1): What is the effectiveness of the proposed design of a platform based on Gamifications in developing creative thinking among middle school students?

The current research also attempts to validate the following hypothesis:

(H1) There is no statistically significant difference at level 0.05 between the mean scores of the first experimental group that uses a platform based on Gamifications and the second experimental group that uses a regular platform that is not based on game stimuli in the post-measurement of creative thinking.

Literature Review
Digital educational platforms

Digital Educational platforms are regarded as one of the most crucial and effective instruments in contemporary e-learning systems and among the most well-known and prominent products that support the teaching and learning processes. They represent a significant advancement in the field of educational technologies. This is because it offers so many educational features as a communication, educational, and remote learning tool. Due to its widespread adoption by educational institutions and the high number of students enrolling in electronic classes and programs, it is noteworthy that it is practiced globally. Educational platforms are electronic cloud-based computer applications that offer the technical framework through which e-learning activities can be conducted. (Piotrowski, 2010).

Digital educational platforms are defined as one of the e-learning management systems that provide interactive learning environments through virtual classrooms and various tools and media through artificial intelligence technologies. It is also known as websites that aim to provide educational opportunities through many virtual courses of an educational nature that include content, activities, and evaluation methods. Educational platforms are defined as one of the e-learning management systems that provide interactive learning environments through virtual classrooms and various tools and media using artificial intelligence technologies. It is also known as

websites that provide educational opportunities through many virtual courses that include content, activities, and evaluation methods. This environment is rich in applications based on computer technology, networks, and multimedia, which enables the learner to achieve the goals of the educational process (Alanzi & Alhalafawy, 2022a, 2022b; Alhalafawy, Najmi, Zaki, & Alharthi, 2021; Alhalafawy & Tawfiq, 2014; Alhalafawy & Zaki, 2019, 2022; Alshammary & Alhalafawy, 2022, 2023; Alzahrani & Alhalafawy, 2023; Alzahrani & Alhalafawy, 2022; Alzahrani, Alshammary, & Alhalafawy, 2022; Najmi, Alhalafawy, & Zaki, 2023; Zeidan, Alhalafawy, & Tawfiq, 2017; Zeidan, Alhalafawy, Tawfiq, & Abdelhameed, 2015). Educational platforms are online educational systems that provide learners, instructors, and administrators access to education-related services such as access control, learning content delivery, and communication and assessment tools. (Tabakova, 2020). Educational platforms also provide a social interactive environment for users, which promotes the exchange of opinions and free expression, as well as discussion, analysis, and recording of data, as well as sharing of photos, videos, and files of various types. (Kumar & Sharma, 2016). A variety of experiences and interactive services are given via the Internet by educational platforms; courses are provided electronically; curriculum planning, class management, and student assessment are also offered. Educational platforms also enable the exchange of ideas and the sharing of educational material between teachers and students, as well as between students.

The educational platforms are designed to facilitate electronic contact between instructors and students by exchanging educational experiences, opinions, meaningful discussions, and dialogues. All of this is accomplished using synchronous and asynchronous engagement and communication tools. Furthermore, educational platforms strive to provide students with a variety of educational encounters and circumstances that are rich in audiovisual and electronic stimuli. Another goal of educational platforms is to broaden students' Internet contacts, not only to teachers as a source of information, but also to overcome the space and time constraints that both students and teachers experience. (Kumar & Bhardwaj, 2020).

Ouadoud et al. (2016) noted some of the characteristics of educational digital platforms, such as content management, where it is possible to create dynamic and interactive content as well as provide a richer educational experience through electronic educational platforms. E-learning platforms are eager to evaluate learning activities by taking into consideration students' response and feedback speeds. Interaction: This refers to the meeting of a teacher, students, and technology to facilitate the process of teaching and learning, which requires interactions between the teacher, students, and technology more than the transfer of knowledge from the teacher or technology to the learner, requiring a high level of interactivity. Management: The system of electronic educational platforms includes a teaching and learning management system that tracks the success of students, users, and trainees through evaluation tests. It is also feasible to learn certain details about students, such as their attendance, absence, and task completion schedule.

Gamification

Gamification is one of the most recent educational trends, and it refers to the use of game features and elements in educational settings that are not primarily focused on play. With the goal of stimulating, increasing motivation, and enjoyment in traditional educational settings, and introducing some of them to the concept of enjoying different learning events and circumstances, (Alzahrani & Alhalafawy, 2023). The word gamification is more closely related to the term games than to the term play."This is because playing means more freedom and fewer restrictions, as opposed to games, which mean restrictions, challenges, competition, and goals that must be pursued." (Barr, 2008; Deterding et al., 2011).

Gamification is the use of game components to motivate students and make the learning process more enjoyable. (Kim, 2015). Gamification is defined by (Huotari & Hamari, 2012) as the use of game elements and methods of thinking about the game in environments beyond the game to enhance behavior. Gamification can also be defined as the use of game mechanics, design elements, and thought processes that occur during these games to attract people, inspire actions, improve learning, and solve problems. (Kapp, 2012, p. 10). Gamification is unlike play-based learning. Play-based learning accomplishes its educational content and goals using a main game or a series of games that serve as the primary focus of the educational situation. Unlike gamification, which does not rely on a particular game but uses game elements or principles such as badges, points, gifts, leaderboards, and so on. Within the learning activities and missions, with the goal of motivating and rewarding learners in a way that guarantees a high and continuous level of motivation and attractiveness (Alhalafawy & Zaki, 2019; De-Marcos et al., 2016),

Many studies have emphasized the need to employ digital stimuli in educational environments due to the positive results of these studies, including the study by Lisa et al. (2020), which targeted 617 male and female students. The study concluded that digital stimuli aid students in paying attention to the content and increase students' retention rates. The qualitative study conducted by Bai and his colleagues (Bai et al., 2020), which analyzed 32 qualitative studies that focused on digital stimuli, discovered that one of the most important reasons for students' happiness is digital stimulation because it is one of the most effective tools for encouraging students' enthusiasm, and providing immediate feedback. A study by Sanchez and his colleagues (Sanchez et al., 2020) confirmed that digital stimuli help facilitate learning, improve students' participation and interaction with the content, and that motivation leads students to expand their knowledge and develop their thinking.

Creative thinking

Higher-order thinking skills such as creative thinking, critical thinking, problem-solving, communication, cooperation, innovation, and information literacy are among the skills of the twenty-first century or the skills of the digital age that must be taught and included in learning activities in the early stages of education. (Wijayanti et al., n.d.). Many subjects, including mathematics, science, engineering, and algebra, can

help students improve their creative thinking skills. Creative thinking is the mental processes that individual performer to come up with new ideas, insights, methods, and perspectives for understanding different things (Eragamreddy, 2013). Creative thinking can be defined as the entire set of cognitive activities performed by individuals in specific situations. It is also can be defined as a type of effort directed toward a specific event in which individuals attempt to use their imagination, intelligence, insight, and ideas to generate new ideas, suggestions, designs, and hypotheses that contribute to the resolution of an existing problem. (Birgili, 2015).

In general, creative thinking is associated with critical thinking and problem-solving skills. There are three dimensions to problem-solving skills: synthesis, expression, and imagination (Sternberg et al., 2009). Synthesis: This dimension includes various activities such as making use of similar thinking, drawing real results creatively and decisively through partial thinking, and presenting new and real proposals to solve the problem. Expression: It includes creating or expanding new knowledge based on old knowledge, building non-traditional relationships between variables to produce non-traditional solutions, and making ideas tangible using imagination and creativity. Imagination: This dimension includes building relationships between valid and reliable ideas and using imagination to display flexible ways of thinking during the process of generating ideas.

Theoretical Framework

According to the Motivation Theory, individuals are more involved in tasks when it stems from their intrinsic motivations, therefore they enjoy everything they do. Some consider gamification and digital stimuli to be a type of external motivation which does not have the same effect as internal motivation. However, the Basic Psychological Needs Theory (BPNT) suggested that there is a group of factors that make any action enjoyable and stimulating for internal motives; among these factors are autonomy, competence, and relatedness. All of these elements are accessible in a gamification system by providing the learner with a sense of autonomy and freedom in completing tasks. It also increases efficiency by providing the learner a feeling of accomplishment when completing tasks. Finally, it promotes the connection created by the learner's social relationships with his peers within the learning environment, in addition, it increases his feeling of belonging to the groups established during task implementation. (Ryan & Deci, 2000b; Sailer, Hense, Mayr, & Mandl, 2017; Suh, Wagner, & Liu, 2015). There is no doubt that increasing students' motivation to learn increases their eagerness to obtain more digital incentives. which significantly enhances the attempt to think in various ways in order to obtain the greatest number of incentives, so it may be possible to find an initial relationship between game stimuli and creative thinking.

The game stimuli, according to Skinner, behavior is the result of reinforcement; learning occurs when the correct responses are reinforced in the sense that if the response to a particular stimulus is reinforced in some way, then this response will be strengthened, reinforced, and repeated again in the presence of the stimulus, which indicates the importance of directing incentives to the student upon completion of the learning tasks (Almalki & Elfeky, 2022; Hew, Huang, Chu, & Chiu, 2016; Huang, Chu, & Chiu, 2016; Huang, Chu, & Chiu, 2016; Almalki, et al). This may encourage students to make greater attempts to obtain digital stimuli that support their continuity, implying that there are signs for the development of thinking by using non-stereotypical approaches to ensure stimulation of gaming stimuli.

Flow theory (FT) is one of the theories that supports the employment of game motivators, although it is mostly concerned with intrinsic motivation as the basis for the flow state. However, associating stimuli with flow processes leads to greater engagement with the environment and greater motivation for continuity, as it indicates to the learner that he is on the correct track, allowing him to follow the flow processes to achieve the desired objective. (Groh, 2012; Nakamura & Csikszentmihalyi, 2009). This can be predicated on viewing the flow as one of the fundamental markers that ensures pupils use a variety of methods of thinking in order to continue harvesting digital stimuli.

Methods

1. Design:
A quasi-experimental method was implemented in the experimental design, which was based on two experimental groups. As indicated in Figure 1, the first experimental group used the platform based on gamification, while the second experimental group used the same platform without any gamification.

2. Sample:
The sample of the participating students consisted of 60 middle school students in the city of Jeddah in the first semester of 2022–2023. The sample members were randomly divided into two groups, each consisting of thirty students, where the first group is the group that studies using the TalentLMs LMs platform that uses gamification, while the second group studies through the same platform but without any activation of the gamification.

3. Measurements:
Creative thinking Indicators within this research are related to indicators of creativity related to fluency, originality, and flexibility that occur because of learning through educational platforms. The current research scale has been prepared to measure the creative thinking associated with the computer and information technology course for third-grade students in the middle school. To prepare the scale in study, a variety of creative thinking scales were reviewed (Akpur, 2020; Doppelt, 2009; Kozikoğlu & Küçük, 2020; Long & Plucker, 2015). The scale consisted of 10 questions, each of

which aimed to measure the three abilities: fluency, originality, and flexibility. The scale was presented to a group of experts to ensure the validity and reliability. The scale showed it was reliable for application from the expert's point of view, as it reached a Cronbach's alpha of 0.81.

4. Procedures:

The platform used in the current research is (TalentLMs), and the platform allows gamification options to be enabled or disabled. The first experimental group uses the platform after activating the gamification, while the second experimental group uses the same platform, but without activating the game stimulus system. Four (4) digital incentives have been activated: points, badges, levels, and leaderboards.

The following gamification elements have been established:

- Points: The student is awarded (10) points upon entering the platform and completing any educational unit. (50) points are awarded for each certificate obtained by the student. And (10) points for each exam or (assignment), provided that the number of points is multiplied by the grades obtained by the student. And (20) points for each participation in a discussion. And (10) points for each vote.
- Badges: Each student is awarded badges according to a successive number of activities related to the student entering the platform, completing modules, answering test questions, doing assignments, making comments, getting certificates, making connections, and participating in surveys.
- Levels: If the student obtains (2000) points, he moves to the higher level, and if he obtains (5) badges.
- Leaderboards: A leaderboard has been activated for points, another for badges, and another for levels, as the leaderboard system includes three sub-boards.

Three topics from the computer and information technology course are included in the content. For each subject, three (3) tasks have been identified, for a total of nine (9) tasks. Each assignment was assigned a time frame and was linked to the gamification. Students were instructed to create cross-platform educational discussions, answer quizzes, write reports on each learning topic, upload student-generated multimedia, and participate in polls.

The learning process was activated via the platform according to two experimental treatments; the first treatment included platforms based on gamification, while the second treatment used the platform without activating the gamification Table 1 shows the mechanisms of action of the experimental groups during the implementation of the experiment.

| The first group based on gamification	The second group without gamification
All students navigate and study the topics that are presented through the TalentLMs LMs platform, activating the gamification. All educational tasks are carried out	Students study all topics offered through the TalentLMs lent platform. The gamification are not activated. Students studied the same educational contents,

according to plan, integrating them with gamification and in the context of a specific schedule. The gamification used are based on points, badges, levels, and leaderboards.	but without any gamification system. Students carry out all tasks on the same schedule as the first group.

Results

In order to answer the main question of the research and validate the hypothesis of comparison between the first experimental group that used the digital platform based on gamification and the second experimental group that used the platform without gamification, the "T" test was used to identify the significance of the differences between the two experimental groups, and a table (2) shows the results of the "T" test for the members of the two research groups.

in terms of creative thinking abilities, data analysis from Table (2) demonstrates that, the first experimental group, which used the platform based on gamification, outperformed the second experimental group, which used the platform without gamification, Figure (1) illustrates the average total creative thinking capacities of the two experimental groups.
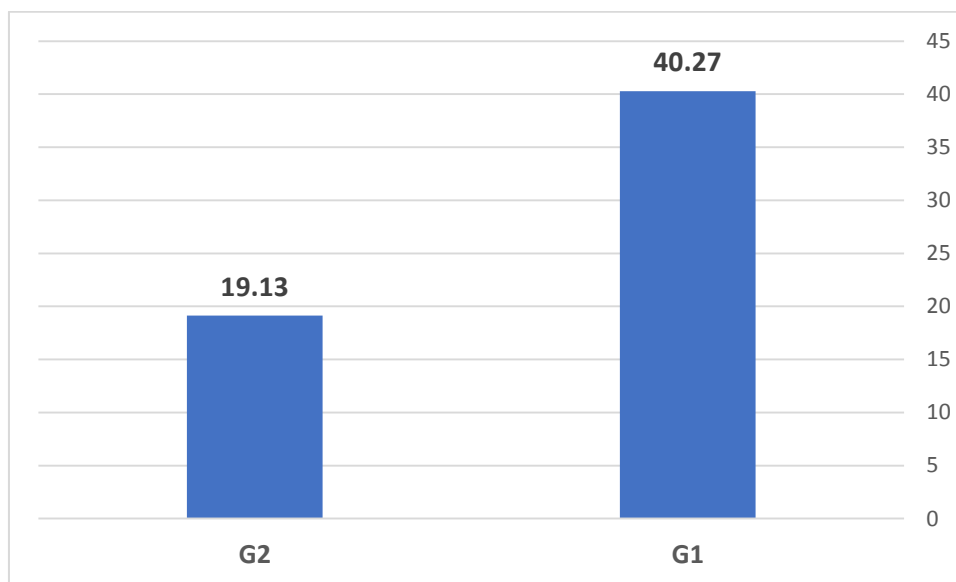
Figure (1). The difference between the experimental groups in the sum of the total abilities of creative thinking

The significance of the differences between the two experimental groups was also investigated regarding the sub-abilities that make up creative thinking, which are fluency, originality, and flexibility, as shown in Table 3.

Table (3). The mean, standard deviation, and "T" value for the creative thinking sub-abilities

Creative thinking abilities	group	N	Mean	SD	T	DF	sig
Fluency	G1	30	21.70	3.21	14.28	58	0.000
	G2	30	12.20	1.73			
Originality	G1	30	11.67	1.45	25.14	58	0.000
	G2	30	4.43	0.65			
Flexibility	G1	30	7.90	0.71	26.83	58	0.000
	G2	30	2.50	0.57			

Table (3) reveals that there are statistically significant differences in the three sub-abilities of creative thinking: fluency, originality, and flexibility between the first experimental group that used platforms based on gamification and the second experimental group that used platforms without gamification in favor of the first experimental group.

Figure (2) shows the comparison between the two experimental groups in each of the creative thinking sub-abilities.
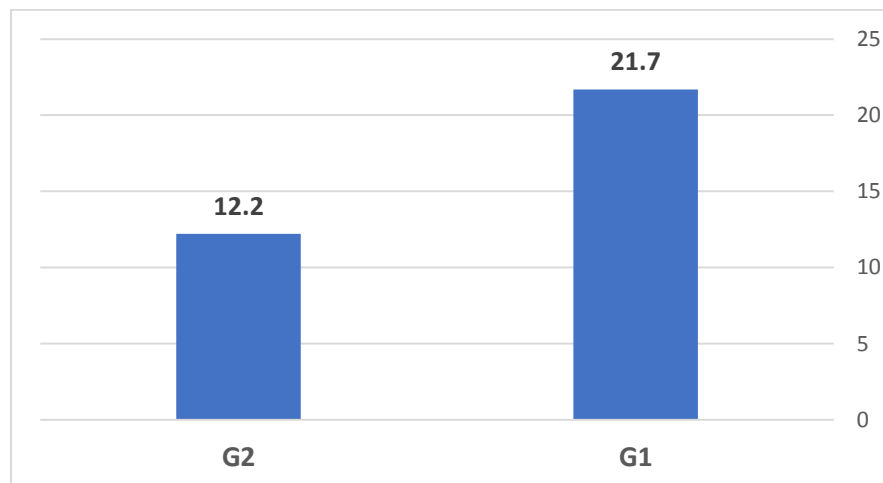
Figure (2-A). The difference between the experimental groups in fluency.
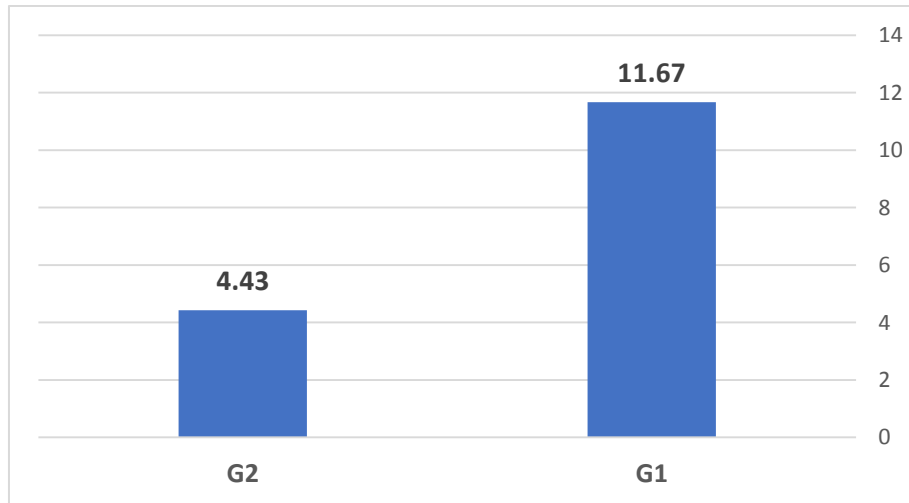
Figure (2-B). The difference between the experimental groups in Originality
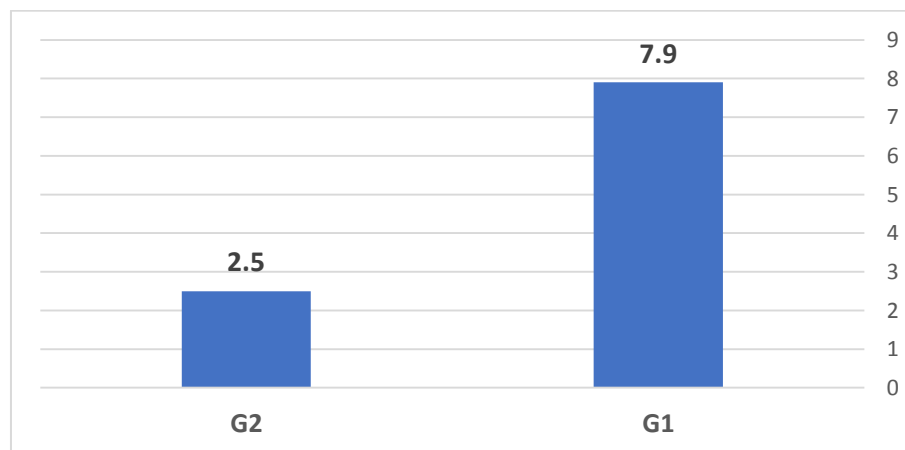

Figure (2-C). The difference between the experimental groups in flexibility.

Discussion

The results of the current research showed the effectiveness of gamification in developing creative thinking and its three sub-abilities: fluency, originality, and flexibility. This can be supported by gamification ability to generate a new educational setting that places student in a motivated framework that causes him to be attentive and involved in all learning processes and tasks. (Almarzooq, Lopes, & Kochar, 2020). Motivational platforms increase students' cognitive growth rates while also improving their organizational skills. (De Notaris, Canazza, Mariconda, & Paulon, 2021). Motivational elements also aid in the development of thinking and the discovery of new approaches to attain the best learning, which is reflected positively in creative thinking abilities. (Sanchez, Langer, & Kaur, 2020). Similarly, the digital incentives on which motivational platforms rely heavily contribute to elevating students' interest in activities and, as a result, focusing on and planning all the needs

of the task and thinking as much as possible to achieve the intended goals. (Ferro, 2021).

The current result is consistent with some theoretical trends. According to the theory of expected values, the student continuously develops his performance until he gets the incentives he expects because of his performance, which motivates him towards practicing thinking skills (Richter, Raban, & Rafaeli, 2015; Vansteenkiste, Lens, Witte, & Feather, 2005). In this context, it can be inferred from the theory of cognitive evaluation that the student's practice of thinking skills comes from the fact that he will receive digital incentives that represent an informational result about his success in carrying out educational tasks (Ryan & Deci, 2000a; Vansteenkiste, Niemiec, & Soenens, 2010). According to social comparisons theory, the student's practice of upward comparison processes pushes him continuously towards reviewing his performance, working on continuous improvement, and reaching higher levels of performance through practicing various creative thinking processes (Hanus & Fox, 2015; Hew et al., 2016).

The usage of motivational platforms improves social interactions significantly. (Chen, Li, & Chen, 2020; Hassan, Dias, & Hamari, 2019). Because humans are by nature proactive and have a strong internal desire for growth, which influences the choices they make, if the environment supports these motives, that he resorts to utilizing all available means to enhance his motives through various processes of social interaction. (Seaborn & Fels, 2015). The system, which includes a variety of communication tools, improves students' capacity to engage with one another and participate in discussions that meet their cognitive needs. Communication, interaction, and discussion tools are foundations of creative thinking and authentic enhancers of fluency, originality, and flexibility (Zeidan, Alhalafawy, Tawfiq, & Abdelhameed, 2015), particularly when combined to a motivational framework (Alhalafawy & Zaki, 2019).

The results of the current research are consistent with the results of many studies that confirmed the effectiveness of gamification in developing learning outcomes and many psychological variables. The results of a post-analysis research which was conducted for (101) studies confirmed that, motivational platforms Play an active role in increasing participation rates and motivating students to complete activities. There is little doubt that participation rates influence creative thinking. Furthermore, it was discovered that the reasons for students' well-being and happiness with gamification are because gamification are one of the most powerful tools to encourage students' enthusiasm and provide immediate feedback in addition to meeting the cognitive needs of students (Bai, Hew, & Huang, 2020).

In addition, the results of long-term study conducted by Putz et al. (Putz, Hofbauer, & Treiblmaier, 2020), which was carried out on 617 students for two years, showed that digital incentives stimulate attention to content and increase student retention rates which can support creative thinking. Also, the study of Cheng et al. (Cheng, Davenport, Johnson, Vella, & Hickie, 2019) examined 70 research papers through

which products based on digital incentives were developed. The results of the study showed that 59% of the research papers indicated that digital incentives have played a role in improving mental health and well-being as well as the active participation of users of these products, which leads to the need to pay attention to digital incentives when designing digital platforms.

Limitation

The context of creative thinking in the current research is related to the scale that was developed according to the content of the computer and information technology course, and therefore the results of the current research cannot be generalized to creative thinking abilities in general. Generalizing the results of the research requires preparing a general measure of creative thinking, conducting factorial analysis of the scale, and then measuring the impact of gamification on creative thinking abilities, which can be measured through other studies that have a large sample.

Conclusion

Current research contributes to the development of the structure of educational platforms based on gamification that may encourage creative thinking. The current research proposes a vision for utilizing gamification such as points, badges, levels, and leaderboards as some of the most crucial factors in the development of creative thinking. In future papers, the impact of different game stimulus elements on the development of creative thinking and other learning outcomes can be discussed. Also conducting other studies for the effect of other gamification that are not used in the current research on creative thinking.

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