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THE EFFICIENCY OF INSTRUCTIONAL GAMING PROGRAMS IN STIMULATING CREATIVE THINKING

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ABSTRACT

The current study attempts to investigate how well educational gaming applications foster original thought. The research sample consisted of two groups: an experimental group that used instructional gaming programs to study an interactive multimedia course, and a control group that used the conventional approach. Each group had 33 students in it. The test of creative thinking was a method employed to accomplish the research's goal. The study found that students in the experimental group (learning using instructional gaming applications) outperformed those in the control group (conventional learning) in terms of creative thinking (total score), as well as in terms of fluency, flexibility, and originality.

Keywords: Instructional gaming programs; face-to-face learning; interactive multimedia; e-learning; creative thinking

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INTRODUCTION

In a time of unprecedented technological advancement and an explosion of knowledge, the subject of improving education has emerged as a national imperative to keep pace with advancement. In addition, the rigidity of the prevalent educational practices connected to the techniques, means, and strategies of education prevents the university education system from adequately meeting the needs of the increasing number of students Ahmed, Alharbi [1]. Researchers in the human sciences have been looking for the best strategies for dealing with this development and these challenges as a result. Because of this, new educational approaches have emerged, including e-learning, which helps students learn more effectively using multimedia components like texts, photos, static and animated graphics, audio, and sound effects [2, 3]. In order to give the student knowledge and the ability to apply it, e-learning permits the delivery of information to the learner through any electronic media, including the Internet and satellites. [4, 5].

There are advantages to learning in the conventional way that e-learning could not attain, even though the e-learning environment has addressed many of the drawbacks of traditional learning environments, such as the restrictions of location and time [6, 7]. The process of social interaction is hampered by e-learning, which also lessens the appeal of traditional learning environments, the motivation that comes from interacting with others and competing against them, the loss of the teacher's direct support, and the reduction of his role and creativity [8, 9]. This is due to the fact that the teacher and the students do not already know one another, as well as the fact that e-learning emphasizes the cognitive rather than the skill sides of learning [10, 11]. While the traditional learning environment places limitations on time and location, the e-learning environment contributes to part of the harm those results in communication process restrictions [12-14]. The need for a new educational setting that included ideas like instructional gaming programs was prompted by these kinds of harms.

Digital games have also become more and more popular, which has had an impact on the study of computer science and information technology. Several programs to improve education have included the use of digital games as a popular strategy [15, 16]. The process of combining the best elements of e-learning to create educational courses is known as instructional gaming [17, 18]. As a result, learning becomes more productive for students. In order to find the right combination of learning components, the term "integration of learning" should be used to describe more than just the variety of training in learning methods (as it is frequently known). It should also refer to the systematic application and integration of learning, tools, performance support, collaboration, practice, and assessment [19, 20]. There are many benefits to employing educational gaming systems, including improved pedagogical methods, simple knowledge access, increased learner

participation, a more individualized experience, and ease of content revision. There have been numerous studies looking into educational gaming platforms, including one by Zhan, He [21].

Additionally, Kaldarova, Omarov [22] findings demonstrated that instructional gaming programs strengthened students' sense of community more than the conventional approach. Additionally, a study by Kaplan [23] to gauge students' perceptions of the environment of instructional gaming programs produced some key findings, one of which was an improvement in students' success, engagement, and enjoyment in the environment. Students that participated in instructional gaming programs expressed general satisfaction with the course and a strong desire to apply it in their learning, according to the study of Pásztor, Magyar [24]. They expressed a wish to use this strategy to study another course. The students who participated in the instructional gaming programs, on the other hand, felt that they had a solid comprehension of the course concepts. In comparison to students in the typical group, they also said that this training increased their analytical skills.

In order to be creative, one must first be able to detect issues and deficiencies, knowledge gaps, missing pieces, and inconsistent elements. Next, one must identify difficulties and look for solutions, make educated guesses and form hypotheses about these difficulties, test these hypothese, modify them, then retest them to arrive at the final results [25, 26]. The highest level of creative thinking demands novelty in production and unity of process, and it falls under a specific category of problem-solving behavior [27, 28]. Numerous studies, such as the one by von Thienen, Kolodny [25], focused on creative thinking. One of the study's most significant findings was that students with (medium and low) levels of creative thinking profited more from the high-tech media environment than students with high levels, as seen by the rising levels of innovation. Researchers typically approach the question of what constitutes innovation from four different perspectives: the traits of the creative individual, the traits of the creative process, the requirements of the creative output, and finally a description of the educational environment that fosters innovation [29, 30]. The authors virtually all agree that the creative person enjoys exploring the mystery and the unknown, even if he finds a ray of hope, confronting the challenging and complex without becoming bored, and enjoying adventure without worrying about the hurdles he may face [31, 32]. All of these traits combine to make the creative person characterized by the capacity to generate a very large number of concepts or solutions to a particular issue. His perspective on the issue has various facets, making these concepts diverse and all-inclusive for all facets of the circumstance [33-35]. The creative individual frequently comes up with novel and unusual solutions or ideas that set him apart from his contemporaries [31, 36]. In terms of the creative process, a mental process is meditating or seriously considering a challenge or circumstance. Additionally, it is characterized by divergent thinking, in which the individual connects the most number of fresh associations to the situation's specifics in his thinking [37]. The creative mind is open, independent, flexible, curious, and intelligent as well. It is not attached to conventional ways of thinking but instead tends to break them, and it guides him in unconscious processes that are controlled by the demands of the situation. This frequently results in unusual ideas or solutions. The creative product itself must be current, uncommon, rare, precious, lovely, and usable [38]. Regarding the innovation environment, it should be flexible to allow students to select and discover alternative methods of problem solving, high-energy and motivation to encourage students to try without fear of failure, and opportunities for interaction with the teacher and other students. The ability to generate the greatest number of options, solutions, or ideas is a refined process that is characterized by originality, flexibility, sensitivity to problems, reorganization, a sense of difference, calibration, rebellion against the established order, and embracing positive values [39].

Similar to the previous point, creative thinking requires rethinking how knowledge is presented to students because it cannot develop in a learning environment built on memory, memorization, and indoctrination [40, 41]. In order to achieve this goal, the developed educational process in all of its forms—including classrooms, libraries, teaching aids, information networks, and non-stereotypical learning environments—has been developed [39, 42]. Therefore, it is crucial to reevaluate the process of distributing educational content. The usefulness of educational gaming programs in fostering creativity is the subject of the current study.

This study was conducted in light of the emphasis placed on the need to adequately prepare students for careers in educational technology through the ongoing development of curricula and programs that are in keeping with the roles and responsibilities that have been given to it in light of the rapid advancement of science and technology. The researchers discovered the low level of students' creative thinking in the interactive multimedia course through their teaching of the course to fifth-level students, evaluation of the students' work, and surveys of comments from students and professionals. Where students took this course in the conventional manner. The researchers felt it was necessary to include instructional gaming programs in the current course in light of the findings of earlier studies that showed how well instructional gaming programs worked to generate various learning outcomes. This is done to make use of instructional gaming systems' capacities to provide

course material in a way that fosters students' creative thinking and increases their capacity to create interactive multimedia applications.

METHODOLOGY

The experimental technique with semi-experimental designs, which necessitated the employment of a pre-post design with two equal (control and experimental) groups, served as the foundation for the current study.

Table 1: Research experimental design

	Pre-test	**Treatment**	**Post-test**
Control group	Creative thinking test	traditional learning	Creative thinking test
Experimental group		Instructional gaming programs	

Research Tool (Creative Thinking Test)

After analyzing a large amount of female literature and studies that dealt with developing creative thinking tests related to certain subjects, the test's substance was challenged. The Williams test for creative thinking, the Torrance test for creative thinking, image (a), and image (b), among other general worldwide tests for creative thinking, were also covered in his briefing to the researchers. When creating the creative thinking test for the interactive multimedia course, the researchers considered these tests. The test consisted of eight items, each measuring one of the three creative thinking skills (originality, flexibility, and fluency) that together make up an individual's capacity for creative thought. It was designed to be verbal in nature and open-ended. The researchers presented the test to a panel of arbitrators to get their feedback on the test's clarity and suitability for the intended purpose in order to confirm the validity of the instrument. As the researchers implemented the changes recommended by the arbitrators, which included reformulating some of the test items, the arbitration findings reaffirmed the relevance of the test questions to its aim. By assessing the correlation between the outcomes of the application of the test created by the researchers and the outcomes of the application of the "Williams" test for creative thinking through the exploratory experiment, the validity of the creative thinking test was also established. The test's stability coefficient was (0.88), which is a strong stability coefficient and verified the test's applicability for the current study. The amount of time it took each student in the survey sample to complete the test was also noted, and the average amount of time was then determined. Wherein the (72) minutes total time was divided by (9) minutes for each of the exam items. Following the completion of the earlier phases, the test took on its final shape, consisting of eight tasks meant to assess the students' capacity for original thought regarding the interactive multimedia course's material.

Ensure the Homogeneity of the two Groups in Creative Thinking

The pre-test measurement was used to confirm the homogeneity between the two groups (control and experimental) in the creative thinking test of the interactive multimedia course material, as shown in the following table:

Table 2: The importance of the variations between the two groups on the creative thinking test's preliminary measurement

	Sum of Squares	**DF**	**Mean of Square**	**F. ratio**	**Sig.**
Between Groups	31.2	1	31.2	0.71	0.429
Within Groups	12554.6	64	219.4		
Total	12585.8	65			

According to the statistical analysis's findings, which are displayed in the preceding table, the percentile obtained a value of (0.71), which is not statistically significant at the level of (0.05). This indicates that there were no statistically significant differences in the pre-measurement between the two groups. This demonstrates the uniformity of the students' scores on the test of creative thinking prior to exposure to the experimental procedure.

Experimental Processing Material

The experimental group to study the interactive multimedia course in instructional gaming programs uses the following steps:

- The purpose of the first meeting with the students is to describe the nature of the course, its significance, objectives, evaluation, and tests. In addition, how to provide each student their own unique Username and Password to access the website. As well as to decide on the weekly study schedule, the communication method, and the division of students into teams of five to carry out the weekly tasks.
- Within a 24-hour period, the instructor responds to all queries and questions submitted by students through the forum.

- Each work team's students work together to complete the weekly assignment due to them and submit it electronically to the lecturer.
- At the conclusion of each unit of instruction, students complete a formative assessment individually. Each student is allowed three attempts, which are electronically corrected and yield an average grade. Each attempt lasts five minutes.
- The final assessment given to students in person at the end of the semester.

The control group, on the other hand, follows the timetable indicated in the application and learns the content of the interactive multimedia course conventionally in the classroom and computer lab. The researcher meets with the students once a week for four hours.

RESULTS

After outlining the study's methods, finishing the fundamental experiment, and keeping track of the experimental and control group students' results on the pre- and post-tests of creative thinking related to the interactive multimedia course's material. The adjusted earning percentage for the students' scores in creative thinking (fluency, originality, flexibility, and the total score) in relation to the subject matter of the interactive multimedia course were compared between the two groups using the T-test, which the researchers used to assess their significance. The outcomes depicted in Table (3) have been achieved:

Table 3: The adjusted earning percentage for the students' results in the two groups on the creative thinking test (total score) is significant at the t-test level

Group	M	SD	Mean Difference	T. Ratio	Sig.
Control group	31.1	5.32	15.4	7.27	0.031
Experimental group	46.5	4.91			

The T value for the difference between the adjusted earning percentages for the students' scores in the two groups on the creative thinking test as a whole was 7.27, as can be seen in the previous table. Students in the experimental group had an average grade of 46.5. The pupils in the control group received an average score of 31.1. We conclude that T's value is statistically significant as a result. The experimental group is the group with the highest average; therefore statistical significance is biased in its favor. The researchers also conducted a statistical analysis for each of the individual creative thinking talents in addition to the statistical analysis of the overall level of creativity:

FLUENCY RESULTS

The significance of the differences between the adjusted earning percentages for the scores of students in the two groups on the fluency axis was calculated to confirm the influence of educational gaming programs on developing fluency. The outcomes depicted in Table (4) have been attained:

Table 4: Significance of "T" for the variation in the adjusted earning percentages for the students' fluency scores in the two groups

Group	M	SD	Mean Difference	T. Ratio	Sig.
Control group	18.2	4.77	5.7	4.2	0.041
Experimental group	23.9	3.95			

It is evident from the previous table that the adjusted earning percentage difference for the grades of students in the two groups in the area of fluency had a T value of (4.2). Students in the experimental group received an average grade of 23.9. The students in the control group received an average score of (18.2). We conclude that T's value is statistically significant as a result. Additionally, the experimental group, which has the highest average, benefits from statistical significance.

Flexibility results

The significance of the variations between the adjusted earning percentages of the scores of the two groups of students on the flexibility axis was determined to confirm the influence of instructional gaming programs on enhancing flexibility ability. The outcomes depicted in Table (5) have been attained:

Table 5: Relevance of "T" for the variation in the modified earning percentages for the students' results in the two groups on the flexibility field

Group	M	SD	Mean Difference	T. Ratio	Sig.
Control group	8.8	4.2	4.6	3.11	0.044
Experimental group	13.6	3.9			

It is evident from the previous table that the adjusted earning percentage difference for the grades of students in the two groups on the flexibility axis had a T value of (3.11), which was significant. Students in the experimental group received an average grade of 13.6. The children in the control group received an average score of 8.8, however. We conclude that T's value is statistically significant as a result. The upper group, which is also the experimental group, is favored by the statistical significance on average.

ORIGINALITY RESULTS

The significance of the variations between the adjusted earning percentages of the scores of the students of the two groups in the originality axis were determined to confirm the influence of instructional gaming programs on enhancing the ability of originality. The outcomes depicted in Table (6) have been attained:

Table 6: Relevance of "T" for the variation in the adjusted earning percentages for the students' scores in the two groups in the originality field

Group	M	SD	Mean Difference	T. Ratio	Sig.
Control group	4.1	2.9	4.5	2.21	0.033
Experimental group	8.6	1.7			

The T value of the difference between the adjusted earning percentages for the grades of students in the two groups on the originality axis was (2.21), as can be seen from the previous table. The experimental group's students received an average grade of 8.6. While the students in the control group received an average score of (4.1), we discover that the T value is statistically significant. The group with the highest average, which is also the experimental group, is the group for which statistical significance is strongest.

DISCUSSION

According to the findings presented in Table 3, there was a statistically significant difference at the level of (0.05) between the adjusted earning percentage for the scores of the experimental group's students who were taught using instructional gaming programs and the control group's students who were taught using the conventional method of creative thinking (total score). Which supports the finding that exposure to educational gaming systems improves creative thinking compared to the conventional approach. This reliable indication highlights the value of adopting educational gaming applications. Which would encourage pupils to think more creatively. According to the researchers, the following information can explain this result:

- The variety of interaction styles found in the setting of educational video games.
- Students' ability to think creatively was likely aided by the use of a range of media in the presentation of information (text, images, still and animated graphics, sound, and sound effects).
- In addition to the educational activities that are completed in groups, the content offered through the instructional gaming programs also contained individual tasks for each course. This always forced the student into a state of action so that he could learn material in a group or on his own, which drove him to do numerous tasks that assisted him in growing as a thinker through the realization of his mind.
- The visual and auditory stimulation found in educational gaming programs significantly contributed to the growth of creative thinking. One of the most crucial components that instructional gaming programs rely on is visual expressiveness.

The researchers concluded from the above that the entire level of creative thinking expressed the high levels of combined fluency, flexibility, and originality. The results of each creative thinking skill were examined independently of the others by the researchers. According to the findings analysis, there is statistically significant difference between the experimental group, which used instructional gaming programs to learn, and the control group, which received traditional instruction, for each of the three abilities. Following is how the researchers analyzed the findings for each skill:

Fluency

According to the findings in Table (4), there was a statistically significant difference in favor of the experimental group between the two groups' students' modified earning percentages in the fluency field at the level of (0.05). Which supports the improvement in fluency skills following exposure to educational gaming systems against the conventional approach. This reliable indication highlights the value of adopting educational gaming applications. It would result in a rise in the master of vocational education technologies students' intellectual fluency.

Additionally, since fluency describes someone who generates a l0ot of ideas in a short period of time. He can think and perceive in record time for others as a result. The difference between the experimental group—taught using instructional gaming programs—and the control group—taught using the conventional method—was

attributed by the researcher to the variety of interaction patterns present in the instructional gaming programs environment. This encouraged the students to participate in several learning activities where they could openly share their opinions and ideas. Additionally, the reliance of educational gaming programs on a variety of presentation techniques contributed to the enrichment of educational attitudes and the resulting development of fluency in the experimental group's students.

Flexibility

According to the findings in Table 5, there was a statistically significant difference in favor of the experimental group between the modified earning percentages for the students' grades in the two groups along the flexibility axis at the level of (0.05). This demonstrates how learning flexibility improves following exposure to educational gaming systems as opposed to the conventional approach.

Additionally, flexibility is the capacity to modify the direction of thought in response to a change in the stimuli or the demands of the circumstance. Which is the antithesis of mental inertia, or the genuine capacity of the individual to switch between multiple modes of thought and not to become stuck in one mode or to insist on it, which results in the generation of responses that are distinctive for their diversity and typicality. The flexibility increases as the number of novel, original responses increases. The researcher attributed the difference between the experimental group, which was taught using instructional gaming programs, and the control group, which was taught using the conventional method, to the completion of educational activities presented collaboratively with peers in addition to individual activities. As a result, diverse learning environments and a variety of learning resources were developed, each of which serves as a complementary source for the learning process. This helped to differentiate the educational gaming programs' atmosphere and add a lot of versatility. Due to the diversity of interaction patterns within the instructional gaming programs environment, which required students to have different responses in various situations, which was reflected in the presence of a certain degree of flexibility among the experimental group's students as well as the development of their ability to be flexible.

Originality

According to the findings in Table (6), there was a statistically significant difference in favor of the experimental group between the adjusted earning percentages of the students' scores from the two groups on the originality axis at the level of (0.05). This demonstrates how exposure to educational gaming systems improves originality skills in comparison to the conventional approach.

Additionally, originality is thought to be the aspect that best reflects creative thinking, and the more original an idea is, the less common it is. Originality is defined as the capacity to generate responses that are not general, distant, unusual, or have unconventional associations. The difference between the experimental group—taught using instructional gaming programs—and the control group—taught using the conventional method—was attributed by the researcher to the environment's design, which gave students a lot of freedom to express their thoughts. As a result, each student's thoughts were set apart from those of his classmates.

RECOMMENDATIONS

- In place of traditional education, educational institutions use gaming-based instructional applications to teach pupils.
- In order to motivate students to learn, instructors must involve students in creating the environments for instructional games by learning about their preferences for the learning environment and emphasizing the value of their contributions to the course material.

SUGGESTED RESEARCH

- Secondary school students' development of critical thinking skills in a learning environment based on instructional gaming systems, which was not included in the research.
- Conducting comparable research on courses in other majors.
- How pupils' ability to think creatively is affected by an atmosphere in which artificial intelligence technology is used in teaching.

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