Develop A PLE Based on Gamification in The Development of Educational Infographic Skills and Visual Thinking

Ghada Mawad

Assistant Professor of Educational Technology and Information, Prince Sattam bin Abdulaziz University, Saudi Arabia and KSA Lecturer in Educational Technology and Information, Ain Shams University, Egypt

ORCID iD

https://orcid.org/0000-0001-8287-1173 Dr_ghadarm@yahoo.com

ABSTRACT

The current research aims to develop a personal learning environment based on Gamification, to develop in fographic design and visual thinking skills. The descriptive curriculum was used to prepare the theoretical framework and tools, and the experimental method of conducting the field experiment, the research sample consisted of (50) female students in the Faculty of Education at Prince Sattam Bin Abdulaziz University who were divided into two controlled and experimental groups of (25) students per group, who studied the experimental group using a gamification-based personal learning environment, while the group controlled by blackboard learning management system studied. The following research tools (collectible test - note card, Product evaluation card, visual thinking test) were applied Pre-test and post-test, the results of the research achieved the superiority of the experimental group, and the effect of Gamification's use in developing infographic design and visual thinking skills.

Keywords

Gamification - Infographic- Infographic Skills- Personalized Learning - Visual Thinking

Introduction

The technological scientific revolution forces us to develop curricula, teaching strategies, and the development of the skill of scientific thinking among learners, how to address problems that the technological innovation revolution may cause, and the most difficult question remains: What do we learn? How do we learn? These learners develop the ability to accept rapid and varied scientific changes, and to cope with the huge explosion of knowledge and information technology. (jameia, 2013), (Van Harmelen, 2006) that using the personal noted learning environment (PLE) in training will give the trainees more control over their learning, increase their experience in managing their tools, and produce the activities they participate in.(Al-Shatti, 2007) as the free use of a range of social services, tools, technologies and software by the learner, which enables them to manage their learning process and build their knowledge in a social context by providing means of communicating with other personal spaces for the exchange of effective knowledge.

Shaban & Qawi (2020) refers that the personal learning environment is: Systems that help learners control and manage their learning,

which include providing support to learners in setting their learning goals, managing learning in both content and mechanisms, and communicating with others during the learning process. But, with these distinct possibilities for personal learning environments, female students sometimes find it difficult to access some content, so the researcher saw the need to employ educational stimulation techniques for these students, and one of the techniques used and available to be employed within personal learning environments is the technology (Gamification).

Gamification provides an opportunity to address motivational issues, engage students in education, increase the learners' level of interest and motivation, and engage in learning environments where they lead to osmotic learning where learning leaks in the student's mind through experience in a non-poetic way. This learning needs awareness to be made aware through the process of critical thinking, which is permanent because it is unforgettable.

The studies of (Fassett & Warren, 2004). (Joey J. Lee, 2011) defined it from Education side as integrating elements and principles of games into

an educational activity to reach educational goals, achieve fun, and engage learners with the subject.

With a significant decrease in the learning cognitive and motivational learning research sample due to the apparent limitations of the traditional method, the researcher identified the following digital game catalysts for use and application within the personal learning environment (leaderboard, points) to be relevant to the affiliated research variables.

The visual element is one of the most important factors for the learner in the education process, since the visual information has been kept in the mind of the learner and is longer in memory; the current research seeks to train the female students at Prince Sattam Bin Abdul Aziz University in producing visual information through the Infographic technology. Infographic is one of the most important electronic teaching tools that rely on vision,(Smiciklas, 2012) defines infographic as visual imagery that expresses information, data, or knowledge through graphic and line drawings.

Shaltout (2016) defined it as: The visual embodiment of information or ideas in an effort to convey complex information to an audience in a way that they can quickly understand and understand, where UNMOVIC blends data with designs to help with visual learning. (Dalton & Design, 2014) point to as a visual representation of data and information designed to allow readers to understand and understand information and knowledge clearly and quickly. There are many types of infographic that are used in the educational process depending on the nature of the learning situation and from the view: (Fixed mobile infographic, infographic, interactive infographic), and each of these types has its own design skills, which must be considered when converting any verbal information into visual (Shaltout, 2016).

Sheta(2020) referred to its development which aims to provide a changing interface based on adaptive learning to develop the skills of consistent infographic design in the Education Technology Division's students, emphasized that these skills should be developed among current teachers and future teachers, because all studies use them as an independent variable. Visual thinking is one of the mental activities and skills, that help the learner to obtain represent, interpret, recognize, save, and then express information, ideas about visual and verbal (Matar, 2018)

The relationship between sensationalized thinking and images at different levels, from visual and verbal that it is possible to think without this sensationalized perception. And a study (Al-Asi, 2016) It recommended that the organizational entry should be introduced as an educational portal as an effective way of developing concepts and developing the abilities of pupils in visual thinking as important goals for teaching mathematics.

Based on the foregoing, the current research stems from a problem and goal, a problem that enables the lack of educational infographic design skills among students of the College of Education, Prince Sattam bin Abdulaziz University, and a goal that seeks to develop new learning environments that depend personal learning environments on and gamification within the educational process This can be addressed by developing a personal learning environment based on the gamification in developing the skills of educational infographic design and visual thinking among the students of the Education at Prince Sattam Bin Abdulaziz University.

Method :

2.1 Background to the Study

The sensation of the current search problem stems from several sources that can be explained as follows:

2.1.1 Experience

As a faculty member in the College of Education at Prince Sattam bin Abdulaziz University, the author noticed students' poor achievement in production of visual materials (infographic) on Educational Technology and Communication Course, which is taught in the traditional way and affects their skills.

2.1. 2 Interviews

Interviews were conducted with five of the students on the availability of training in visual materials (infographic) skills and achievement. The findings revealed not only the poor achievement of these five students (90%) but also a wish to acquire these skills, but through anontraditional approach. Consequently, having identified the lack of infographic design skills and achievement visual thinking among the students at the College of Education, the following question emerged: The effectiveness of the development of a personal learning environment based on gamification in the development of design skills infographic educational and visual thinking? "

The effectiveness of the development of a personal learning environment based on gamification in the development of design skills infographic educational and visual thinking?

This was further deconstructed into the following questions:

- Q1: What is *the* effectiveness of developing a personal learning environment based on the stimuli of digital games in developing the cognitive aspect of educational infographic design skills?
- Q2: What is the effectiveness of developing a personal learning environment based on gamification in developing the performance side of educational infographic design skills?
- Q3: What is the effectiveness of developing a personal learning environment based on digital game stimuli in developing the quality of the final product of educational infographic design skills?
- Q4: What is the effectiveness of developing a personal learning environment based on the stimuli of digital games in developing visual thinking skills?

1.2 Objectives

This study therefore aims to:

- Determine the effectiveness of the development of a personal learning environment based on gamification, on the cognitive aspect of learning design skills infographic
- Determine the effectiveness of the development of a personal learning environment based on gamification, on the performance aspect of learning design skills infographic
- Determine the effectiveness of the development of a personal learning environment based on gamification, on the quality of the end product

• Determine the effectiveness of the development of a personal learning environment based on gamification, on the visual thinking skills

2.3. Significance

The following points highlight the importance of this study:

- It reflects recent pedagogical trends that emphasize the use and application of e-learning techniques to improve learning.
- Draws the attention of educators in education technology to the importance of using gamification in the educational process.
- Helps educational designers develop personal learning environments based on gamification motivations.
- Provides instructional designers with a set of guidance on appropriate gamification motivations, to improve their performance, and their learning outcomes.

2.4. Hypotheses

This study intends to verify the following hypotheses:

- H1: There is no statistical significance, at a≤0.05 level, in the mean difference between the control and experimental groups in the post-achievement test.
- H2: There is no statistical significance, at a≤0.05 level, in the mean difference between the control and experimental groups in the observation card posttest.
- H3: There is no statistical significance, at a≤0.05 level, in the mean difference between the control and experimental groups in the evaluation card posttest.
- H4: There is no statistical significance, at a≤0.05 level, in the mean difference between the control and experimental groups in visual thinking posttest.

2.5. Limitations

There are limitations to this study, as follows:

- Human: Students at the College of Education of Prince Sattam bin Abdulaziz University
- Objective: course of educational technology, educational technology, and communication
 - ✓ Items of gamification: Leader- board and points.

- ✓ Website easily to design the infographic.
- Temporal: The first semester of the2020/2021 academic year.
- Spatial: The College of Education in Dalam.

2.6. Methodology

- Analytical descriptive approach: which describes the research problem and the data associated with it. This approach has been used in the current research to describe and analyze previous research and studies. To list the literature, research, and previous studies on the theoretical side of the research, which are concerned with the research variables.
 - The quasi-experimental approach: which is used to know the effect of the independent variable on the dependent variables and is based on studying the effect of the independent variable, represented by (developing a personal learning environment based on Gamification) on the dependent variables represented in (educational infographic design skills visual thinking skills.

2.7. Population and Sampling

The population comprised all the students at tending the College of Education in Dalam during the 2020/2021 academic year, from which as ample of 50 fourth- five level students selected and allocated to groups:

•The experimental group (25) student from level 5 was taught using personal learning environment based on gamification.

•The control group (25) student from level 4 was taught using traditional method that is based on blackboard (LMS)

2.8. Design

In the light of the separate variable of the study, the semi-experimental design of this study is two control and experimental groups, which includes:

- Control group: A group that teaches using the traditional method based on blackboard (LMS), and search tools (achievement test - observation card – evaluation card- visual test) will be applied before and after processing
- Experimental group: It is the group that studies using the personal learning

environment based on gamification, and the search tools (achievement testobservation card –evaluation card- visual test) will be applied before and after processing.

2.9. Definition of Terms

2.9.1 Personal learning environment

The researcher defines it as: An interactive educational environment in which social networks are employed, and the integration of digital game catalysts (leaderboards, scores, badges, rewards) into her, to motivate learners to accomplish their tasks.

2.9.2 Gamification

The researcher procedurally defines them as: a set of digital gaming catalysts (leaderboards, badges, bonuses, points), which are used within the personal learning environment based on those stimuli and are applied traditionally and electronically together.

- ✓ The leaderboard can be procedurally defined as: a panel that shows the names of competitors in a personal learning environment based on on-site digital gaming catalysts to know their position among their other peer rivals.
- ✓ The points can be procedurally defined as: the grades the learner receives in exchange for completing the task on which it is arranged within the leaderboard, calculated electronically, and given the rest of the catalysts based on it.

2.9.3 Infographic:

The researcher knows it procedural an innovative design science that enables the teacher to transform the data and information within students' curricula at different levels into images, drawings, and shapes, helping students to understand smoothly and quickly, making the content of the learning remain in the student's mind for a long time.

2.9.4 Visual Thinking skills

The researcher defines the ability of students to the visual perception, discrimination, and awareness of what it contains information, and measured by student's degree in visual thinking test.

3- THEORETICAL FRAMEWORK: 3.1 personal learning environment

The concept of personal learning environments has spread widely after the widespread use of e-learning methods in educational communities. And explained (Shaheeni, 2015) that it is the best use of different applications, services, and sources on the Internet, by the learner to serve and achieve the goals of his learning, and to content the educational customize in accordance with his needs and needs and to suit his wishes under the support and guidance of his teacher. (Downes, 2010) pointed that based on the formation of a set of links between users, through which several educational resources traded. and the environment used to learn within several principles. Namely independence, openness, diversity, and therefore each environment learns personal, what distinguishes it from others through the different perception of each learner individually, through the diversity of experiences, interdependence, and the sharing of learners and teachers. In addition, R showed (r. A.-A. Ahmed, 2017) is a site that provides students with a range of second-generation web applications, used by students according to their educational needs, and allows the student to provide appropriate feedback to support and clarify the learning process and help them accomplish learning tasks and achieve efficiently their goals and interactively.

3.1.1 Characteristics of the personal learning environment

There are several characteristics of personal learning environments including (Al-Enzi, 2017; Downes, 2010; Mohammed, 2012): Personal, social construction, integration of formal and informal learning, free or low costs, collective intelligence, decentralization, interactive, participation, flexibility, open source, independence, diversity, openness, sailing, standard.

In this regard, the study (Abdullah, 2017a) which aimed to present a proposed vision of a training program for the use of mobile personal learning environments, due to its effectiveness and unique characteristics compared to other e-learning environments, confirmed.

The researcher believes that personal learning environments add a special elegance in the learning process, they allow the learner to learn in an environment as if he were presented to him personally, so he can put in them what he cares about and needs and meet his needs through the services, applications, resources, elements, and sources of learning

- 3.1.2 Importance of personal learning environments Both (Dabbagh Kitsantas, & 2012; García-Peñalvo, Humanante-Ramos, & 2015; Conde-González, Kenning, 2010: Martindale & Dowdy, 2010; Wali, 2020; Wilson, 2008) The importance of employing personal learning environments in the educational process:
- The need for lifelong learning has increased as result of technological and social development.
 - Transform the role of teacher into a mentor, facilitator, mentor and learning resource pool.
 - Provide a personal environment for a variety of learning sources to make the learning environment enjoyable and increase students' motivation for learning.
- Increased access to information and the desire to communicate with other students for work and learning.
 - Depends on the uniqueness of the learning process, which contributes to helping the learner to build, organize and control his learning.
 - Changes in educational methods of learning that focused on the fact that e-learning systems are under the control of the learner.
 - Helps integrate formal learning within the educational institution with informal learning outside it.
 - Service for students who use other means of learning such as mobile phones and other mobile devices

This underscores the importance of personal learning environments and the need to develop a trend towards learning through them, as confirmed by the results of the Hamdi, (2011) study which aimed to study the attitudes of computer teachers towards personal learning environments, and the results of which have found positive trends towards learning through personal learning environments. The researcher believes that the educational importance of the personal learning environment allows personal and self-learning of the learner in a way that integrated with formal learning. so that the learner becomes in an internal and external environment, rich in sources of information from which he draws information that is appropriate to his abilities and abilities, and his educational needs.

3.1.3 Goals and functions of personal learning environments

It was identified (Khamis, 2018) in the following:

Meet learners' individual needs, set their learning goals, plan, and create personal learning, helping the learner make decisions about their personal learning, creating the right environment for them, and searching, classifying, and revising information.

- Build and represent information.
- Managing learners for educational content.
- Manage the personal learning process.
- Communicate, share, share and communicate with others during the learning process.
- Storage and retrieval of information.

From of the studies that emphasized the importance and functions of personal learning environments is a study. (Ali, 2016) which aimed to measure the effectiveness of a personal learning environment, to develop some of the technological concepts of female teachers in the kindergarten division, and the results of the study concluded that the personal learning environment has a positive impact on the development of these concepts. Al-malhm (2017) which emphasized the effectiveness of personal learning environments and the provision of appropriate support tools through which to develop many different technological skills

The researcher adds a range of functions and, the objectives are that these environments. Provide content to each learner. As if provided to him selfin order, in addition to that the learner builds his own knowledge, helps him to achieve his personality in the learning process, chooses his sources from among the many available sources, manages the process of learning appropriately for him, and acquires content, skills and experiences in the way that suits him.

3.2 Gamification

M.M. H. Ahmed (2019) noted that gamification mean moving game elements and mechanisms to other non-recreational fields with the aim of improving the level or solving specific problems, relying on understanding the mechanisms and characteristics of games and applying them in activities outside the scope of games to make them more interesting and stimulating such as games.

Noir (2020) emphasized that it is a learning curve that employs the elements of games from mechanisms, techniques, stimuli, and aesthetics in a virtual learning environment, considering meaningful scientific content in an integrated manner in the classroom learning environment, to motivate students to continue learning and achieve specific educational goals considering providing immediate feedback supported by stimuli to improve Cognitive level

El-Najjar (2019) identified using gaming techniques and elements, and integrate them into educational activities, to develop web design skills, Visual thinking skills of middle school students, by engaging them and motivating them to learn, through activities that reflect on the behavior of the learners in the affirmative and then achieve their goals.

Through the previous set of definitions, the researcher considers that gamification have the following characteristics:

• Game mechanics used for nongaming activities.

• Increases learners' learning ability.

• Saturate the competitive instinct within the pupils, which increases their involvement in the educational process.

• Break the barrier of boredom and immobility in school activities

3.2.1 Types of Gamifications

Gamification design into two types: structural gamification and content gamification both of which used together or separately and will be more influential together. (Khaleel, 2016; Marin, 2019; Marti-Parreno J., 2018)

• **Structural gamification**: The application of game elements means to drive the learner to content, but without a change

in content. The content structure employs digital game catalysts, the Items include (rewards, progress bar, real-time feedback, and time).

- **Content gamification:** Game items applied to change content. For example: Add story elements to the content to make it more fun. Some of the elements that can be added to this genre are (story, challenge, curiosity, personality)
- The researcher relied on the first type of structural gamification.

3.2. 2 Characteristics of Gamification.

Lister(2017;) Robson (2018) summarizes it in five characteristics:

- Assembly
- Score points.
- Introducing a feedback mechanism.
- Encourage communication between players.
- Allow Individualize services.

3.3 infographic

Infographic is a modern terminology in the world of technical innovations, Bicen, (2017) the term infographic refers to the combination of graphic and information to refer to the representation of different information, data, and knowledge in graphic forms with a view to clearly displaying complex information that is easy to read quickly.

Dalton, (2014) Is a visual representation of data and information designed to allow the reader to understand and understand information and knowledge clearly and quickly.

Yildrim, (2016) indicated the display of information within a particular flow, so that it contains many images, graphs, shapes, symbols, and texts in a logical sequence by setting them up Damayanov, (2018) decided that it is a visual representation of information, data and knowledge and allows this representation to display information in a practical and rapid manner, and this representation employs many textual elements such as technical or professional information and graphics such as maps, special signs, logos, symbols, images, and drawings.

It is clear from the above that all definitions of infographics are consistent with the following:

• Based on the visual representation of data or information.

- Depends on the blending of texts and drawings through programs to appear in an all-integrated form.
- The goal is to communicate information easily and effectively.

3.3.1 Characteristics of infographic:

Infographic has many characteristics that earn it the ability to attract the learner's attention, including those as noted (Ozdamli, 2018):

- The organization of information.
- Creativity in displaying content.
- Simplicity.
- Add links between design elements.
- Clarify cause-and-effect relationships.
- Integration of all elements in the design.

The researcher has benefited from these characteristics when designing static infographics, to provide courses in an attractive and enjoyable way for learners.

3.3.2 Types of infographics

(Darwish & Al-Khakhni, 2015; Ismail, 2016; Shaltout, 2016) Illustrated types of Infographics:

- 1- Static infographic: A graphic that consistently explains certain things without any interaction with the reader and includes:
 - ✓ The Visual Article: such as newspapers, magazines, cultural publications, and awareness
 - ✓ The Flow chart: It is expressed about statistics, or prophetic expectations to solve a particular problem
 - ✓ Useful Bait: How to perform a particular skill
 - ✓ Number Porn: A series of statistics with large numbers presented and simplified through the design.
 - ✓ The Timeline: Imagine my drawings to describe a timeline for a project
 - ✓ Data Visualization: The structures and tools are displayed in a visual way
 - ✓ The Vs Infographic: Focusing on the destination of the young or the difference between two elements
 - ✓ The Photo Infographic: Use real images to express a description of the data

2- Animated, Interactive Infographics: It is a moving diagram with which the reader interacts, and this depends on part of the concept of animation, and we may see it in some web sites, that have become adapted to this science. Using different web techniques such as HTML5 and CSS3 to explain something specific, some of which appear on a video that uses infographics to represent information.

From the above, there are (3) main patterns of infographics: Infographic. Static Motion Infographic, and Interactive Infographic. Each of these patterns has a distinct characteristic. Static Infographic The most widespread and easiest design and used to display ideas that contain a lot of data and information, While the Motion Infographic Used to display information that needs to be clarified to show a transaction, As for Interactive Infographic The user can handle and interact with its content. There is no preference for one type over the other; each type has the kind of information we want to represent, and the way the user deals with it.

3.3.4 The relationship of infographics to visual thinking

Infographic is one of the techniques that depends on the sense of sight in the process of reading, producing, and communicating through it. The goal is to produce a visual medium that easily and smoothly explain verbal texts to learners so that they do not get bored of the many verbal slurs and their hypertrophy in the study contents.

In this regard, the results of the study (Al-Jarwi, 2014) indicated that the proposed program has contributed for improving the level of knowledge of visual culture skills and the skills of infographic designs in designing electronic mind maps. This relationship was also explained by a study (Zeid, 2016), which concluded and concluded that the effectiveness of infographics in teaching. Among the studies that confirmed the relationship of text and images, a study (Rahman, Sayed, & Akka, 2015) concluded: The strength of the relationship between text and images, and that the language of the image is a comprehensive language. Also, a study (Ibrahim, 2016), whose results found the effectiveness of infographics in developing scientific concepts and visual thinking skills.

3.4 visual thinking:

Considering the explosion of knowledge and technological development increased the need to learn thinking where it helps students to examine alternatives and compare them and adapt them, interpret events, and predict events in the future, as the thinking of educational requirements that the courses seek to develop. Shafa, (2018) that when students think visually it has an effective effect on learning and increased motivation, in addition to the visual representation of information helps to interpret, understand, remember, and survive after learning.

Younis, (2020) I knew the visual perception of objects and shapes of different situations that enable students to recognize the visual, perceive spatial relationships, interpret, and analyze information, and deduce the meaning of it.

Shafa, (2018) I identified it as a group of processes that translate and explain the student's ability to observe what is observed in the visual form and analyze it into elements and inference of information and relationships during learning.

There are a set of common elements of visual thinking in definitions:

- Mental capacity.
- A system of operations.
- Linked to the sensory and visual aspects.
- Based on the translation of the visual form.

3.4.3 - The importance of visual thinking:

Matar, (2018) To illustrate the importance of visual thinking in the educational process:

- Developing the visual language skills of the student
- Increasing the ability to understand and understand the visual message of the student
- The ability to find solutions to educational problems by identifying visual concepts.
- Helping the student to organize information in the courses.
- Developing the ability to innovate and thus innovate
- A way to understand the abstracts and all the associated processes
- Visual forms and symbols connect objects and ideas to each other to make it easier to understand
- Visual thinking brings communication between members of the team

4. Methodology

4.1. Tools

4.1.1Achievement test of infographic skills

a. objective:

This test aimed to evaluate the cognitive aspect of infographic skills in the Educational

Technology and Communication Course. It comprised (45) items; (20) true and false and (25) multiple choice. Appendix (1): Test of infographic skills

b. control:

- Validity: Verification was conducted by submitting the test to the opinions and modifications of a group of educational and information technology specialists.
- Reliability: Reliability was checked by using SPSS to calculate Cronbach's alpha coefficient. After the 45-item achievement test was piloted among a sample of 50 participants, a value of (0.668) was calculated, which approved the test.

4.1.2 Visual Thinking Test

a. objective:

This test aimed to evaluate the cognitive aspect of Standards for the design of educational materials in the Educational Technology and Communication Course. It comprised (20) items multiple choice. Appendix (2): Visual Thinking Test

b. control:

- -Validity: Verification was conducted by submitting the test to the opinions and modifications of a group of educational and information technology specialists.
- -Reliability: Reliability was checked by using SPSS to calculate Cronbach's alpha coefficient. After the 45-item achievement test was piloted among a sample of 50 participants, a value of (0.713) was calculated, which approved the test.

4.1.3 Observation Card

An observation card comprising 19 basic skills and 87 sub-skills was produced. One mark was awarded to a skill that was performed and zero for any not performed; a group of curriculum and instructional educational and technology specialists in terms of formulation, clarity, and accuracy reviewed a total score of 87 was recorded. The card. After incorporating their recommended modifications, validity was confirmed.

Once the card's reliability was also verified, the final version of the observation card was decided.

This enabled the performance of fourth and fifth level students in implementing the skills learned to be evaluated. (Appendix (3): Observation card). **4.1.4 Evaluation Card**

An evaluation card was prepared to assess the Standards for the design of educational materials of students at the College of Education in Dalam and its validity and reliability checked. Comprising 47 items, with a possible total score of 94, each was scored as either above average (2marks), below average (1marks), or very poor (0 marks)

4.2. Instructional Design of a personalized learning environment based on Gamification and developing infographic skills and visual thinking

- Several instructional design models were reviewed (Aldesouki, 2015; Alhadedy, 2012) and certain common features identified in the general framework, which comprised analysis, design, production, testing, and evaluation stages. A model with the following stages was then developed for this study:
- a. Analysis: The overall objective of the learning environment, students' characteristics, and needs, as well as educational resources were examined.
- b. Design:

Personal learning environment:

- Video: A series showing the infographic and Standards for the design of educational materials
- **Interactive activities**: Tasks in which students interact actively with the content and receive feedback.
- Website: Provision of scientific material to study students' cognitive abilities and skills for infographic and proficiency (e.g.easly.com, igoogle).

Gamification:

- Via Google Sites, (e.g., ClassDojo) each group of students (Leaderboards, points) opened the educational to access the materials and play the videos.
- The students learn the information required and necessary worksheets to accomplish the tasks.
- The students submitted their answers to their teacher to reorder the students or take a point

• Each group collaborated on the activities.

c. Production:

Personal learning environment

- Video: A series of YouTube clips explaining the Standards for the design of educational materials and its integration into the content.
- Interactive activities: To enable collaboration, interactive activities were designed using MS PowerPoint 2010 and Microsoft Mouse Mischief, which allowed several mice to be connected to a single computer
- Website: The pages of educational content were created using Google Sites (e.g., esaly.com and ClassDojo).
- A **link** was provided from the course home page on Blackboard to the educational content and assignments.
- d. Evaluation: The learning environment was initially adjusted following a review by a group of specialists and experts in educational technology. It was then piloted with a sample of students at the College of Education to not only assess whether the modules were appropriate for their characteristics and needs but also to garner their opinions. The learning environment was modified accordingly, and the final version developed.
- e. Publication and use: Students were allowed access to the website and testing started: its impact on the acquisition of the required skills was identified. Students clicked on a link to visit the website, entered their username and password, and then worked through the content of each module form any location

f. Testing:

Pretest: Cognitive achievement in infographic skills, Visual Thinking, the

observation card, and the Evaluation Card were pretested as follows, and the results were statistically analyzed:

- Participants were introduced to the nature and objectives of the study and the learning environment explained.
- Students were asked whether they were familiar with chat rooms and forums, with instructions given to those who were not.
- The computers and Internet connection at the College of Education were checked, as was whether participants possessed such devices personal electronic as computers, mobile phones, or laptops connected to the Internet.
- Each student entered their Blackboard username and password to access and interact with the educational content.
- The students studied the required modules, taking notes and raising questions about the difficult concepts. They were monitored and support provided
- **Posttest**: The evaluation card in addition to cognitive achievement in infographic skills, Visual Thinking, the observation card, and the Evaluation Card scale were post tested, and again, the results were statistically analyzed

3- Results:

1. Q1 and H1 were answered and verified, respectively, by the statistical analysis, using SPSS, of the post-achievement test results from experimental and control groups.

Table-1. T-values and statistical significance of the post-achievement test mean scores for each experimental and control group

Statistical	Number	Arithmetic	Standard	Calculated	Degrees	Significance	Effect
Data Test		mean	deviation	(T) value	of	level	Size(η)
					freedom		

Experimental	25	32.84	5.99	4.39	48	0.00	0.78
group							
Control group	25	26.76	3.44				

Source: This data was extracted and analyzed using SPSS

Source: This data was extracted and analyzed using SPSS significant difference between the mean scores in favor of the experimental group. H1is thus disproved. Algorithm the control group (26.76). the calculated (T) value (4.39) of 0.05 level which along with the high values for degrees of freedom (48) and effect size (0.78). Suggests a statistically SPSS significant difference between the mean scores in favor of the experimental group. H1is thus disproved. Q2 and H2 were answered and verified, respectively, by the statistical analysis, using SPSS, of the observation card posttest results from both experimental and control groups

 Table-2. T -values and statistical significance of the observation card post-test mean scores for experimental and control groups.

Statistical	Number	Arithmetic	Standard	Calculated	Degrees	Significance	Effect
Data Test		mean	deviation	(T) value	of	level	Size(η)
					freedom		
Experimental	25	79.52	5.92.609	41.04	48	0.00	0.97
group							
Control group	25	41.32	3.85				

Source: This data was extracted and analyzed using SPSS

As can be seen from Table 1 the arithmetic average of the experimental group (32.84) that is higher than the control group (26.76). the calculated (T) value (4.39) of 0.05 level which along with the high values for degrees of freedom (48) and effect size (0.78). Suggests a statistically significant difference between the mean scores in favor of the experimental group. H1is thus disproved.

2. Q2 and H2 were answered and verified, respectively, by the statistical analysis, using SPSS, of the observation card posttest results from both experimental and control groups.

Table-3. T-values and statistical significance of the observation card posttest mean scores for experimental and control groups.

Statistical	Number	Arithmetic	Standard	Calculated	Degrees	Significance	Effect
Data Test		mean	deviation	(T) value	of	level	Size(η)
					freedom		
Experimental	25	79.52	5.92.609	41.04	48	0.00	0.97
group							
Control group	25	41.32	3.85				

Source: This data was extracted and analyzed using SPSS.

Table: 2. T-values and statistical significance of the observation card posttest. mean scores for experimental group (79.52) that is higher than control group. the calculated (T) value (41.04) at 0.05 level in freedom (48) and effect size (0.97) is higher. suggests a statistically significant difference between the mean scores in favor of the experimental group. H2 is thus disproved.

3. Q3 and H3 were answered and verified, respectively, by the statistical analysis, using SPSS, of the evaluation card posttest results from both experimental and control groups.

Table-4. T-values and statistical significance of the evaluation card posttest mean scores for experimental and control groups.

Statistical	Number	Arithmetic	Standard	Calculated	Degrees	Significance	Effect
Data Test		mean	deviation	(T) value	of	level	Size(η)
					freedom		
Experimental	25	88.36	4.27	14.99	48	0.00	0.84
group							
Control group	25	51.84	11.40				

Source: This data was extracted and analyzed using SPSS.

Table: 3. T-values and statistical significance of the evaluation card posttest. mean scores for experimental group (i.e,88.36) that is higher than control group. the calculated (T) value (14.99) at 0.05 level in freedom (48) and effect size (0.84) is higher. Suggests a statistically significant difference between the mean scores in favor of the experimental group. H2 is thus disproved 4. Q4 and H4 were answered and verified, respectively, by the statistical analysis, using SPSS, of the Visual Thinking *post* test results from both experimental and control groups.

Table-5. T-values and statistical significance of the evaluation card posttest mean scores for experimental and control groups.

Statistical	Number	Arithmetic	Standard	Calculated	Degrees	Significance	Effect
Data Test		mean	deviation	(T) value	of	level	Size(η)
					freedom		
Experimental	25	88.36	4.27	14.99	48	0.00	0.84
group							
Control group	25	51.84	11.40				

Source: This data was extracted and analyzed using SPSS

As shown in Table 4, the posttest means scores exceeded those of the pretest (i.e., 88.36). the calculated (T) value (14.99) of 0.05 level which along with the high values for degrees of freedom (48) and effect size (0.84). Suggests a statistically significant difference between the mean scores in favor of the experimental group. H4 is thus disproved.

5. DISCUSSION

The results revealed that a personal learning environment based on gamification was effective in developing infographic skills and virtual thinking among students at the College of Education of Prince Sattam bin Abdulaziz University. Furthermore, by adapting modern technology to education, interaction patterns can be combined, and special tools and different functions offered in accordance with a variety of students' needs. By considering specific needs and capabilities, learning can be improved. These findings agree with those of other studies, including (Flores, 2015), (Ali, 2016), (Lister, 2017). This study suggests that tools interaction greatly benefited the experimental group. In addition, despite students' individual differences, all were able to select an appropriate interactive tool and actively participate. The following points proved helpful:

- Gamifications develop students' desires and inclinations in dealing with e-games
- Interactive patterns appropriate for all students.
- Personal learning environment facilitate the simple presentation of educational content

4- Conclusion(s) and Recommendations

Based on these findings, it is recommended that:

- Training teachers in the design and production of infographic and its integration into educational curricula
- Using gamification environments to develop student thinking
- Training teachers in the design of personal learning environments
- Effective instructional methods and strategies for developing skills should be investigated.

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