The impact of using Edge Computing on Developin Sskills Producing Electronic Tests for Students in the Department of Educational Technology

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The impact of using Edge Computing on Developin Sskills Producing E-Tests for Students in the Department of Educational Technology

Abstract:

The current research aimed to reveal the effect of using edge computing on developing the skills of producing e- tests among students of the Department of Educational Technology. The research sample consisted of (60) male and female students from the fourth year of the Department of Educational Technology, Faculty of Specific Education, South Valley University. The research used the descriptive analytical approach in analyzing the literature, studies and previous research with the aim of describing the research problem, preparing the theoretical framework for the research and determining the skills that must be developed for students to develop the skills of producing e- tests. The experimental approach was used in the evaluation phase, as the research tools consisted of the achievement test to measure the cognitive aspect and the observation card to measure the performance aspect, by applying the research tools before and after on the students. The model of Muhammad Attia Khamis was used in designing the learning environment. The experimental treatment materials were represented in designing a learning environment with two patterns: the first is an advanced learning environment based on edge computing, and the second is a traditional learning environment based on the e- cloud. The research results showed a statistically significant difference between the average scores of students in the two experimental groups of the research in the achievement test and the observation card in favor of the experimental group that studied using an advanced learning environment based on edge computing to develop production skills. e-Testing

Keywords: Edge Computing - e-Testing - Cloud Computing - Educational Technology Department Students

Introduction:

The tremendous technological and scientific progress of the information and communications technology revolution has led to the emergence of many scientific and technological innovations that have revolutionized the educational process. These innovations have impacted the elements of the education system, and therefore it has become imperative for us to employ these innovations in the educational process efficiently and effectively. The role of the teacher and trainer has changed from a transmitter of information to a guide and designer of educational materials. Likewise, the role of the student has changed from a recipient of information to an active participant in the educational process. Therefore, those responsible for developing the educational process have taken care to provide the appropriate educational environment to keep pace with this development. Among the important innovations is edge computing.

I have She called necessity salt to employment Computing cloud in Positions learning, increasing Motivation learners about Participation in Use Techniques Computing cloud, why? Presented by from Motivation Subjective For the learner and development His skills and his abilities, and why Presented by

from tools communication and sharing between Users from during Use Mail e- and lists communication, and applications Library like storage Documents And share it with Others (Siham bint Salman, 2018, 57).

Computing cloud technique You do on transfer Treatment And space Storage and data Private By computer to device servant It is done Access To him on road Internet, and technology Enable Users from to request Software that They work On it and data that They need it from during Services the introduction from Presenters service Computing cloud Which Availability Cost And for less efforts administrative For users Service (Amal Ibrahim, 2017, 551).

Marwa Zaki's study (2012) demonstrated the importance of cloud computing applications in developing innovative thinking and the effectiveness of e-learning environments.

The interest in e- tests began with the Egyptian state's interest in the digital transformation of the educational process system and the necessity of conducting e- tests that are characterized by fairness and objectivity, as well as the necessity of offering courses remotely using educational platforms to teach students and provide e- tests.

It sought to build curricula and produce e- tests using available tools, programs and mechanisms, especially since students need to employ these technologies in serving the educational process and benefit from them, starting from the design processes and identifying e- learning resources, and ending with student evaluation, where the teacher uses e- evaluation programs to evaluate the end of the educational situation and transform evaluation methods in objective tests from the traditional performance method to an e- system that measures the extent of students' progress in their studies without the need for correction effort or the presence of errors (Mohamed El-Dessouki et al., 2020).

E-tests save time and effort associated with constructing, delivering, and correcting them, in addition to the enormous economic value they provide in terms of preparation costs that require great efforts to collect the exams in their traditional form based on paper and pen, in addition to correcting, analyzing, and saving them, and publishing their results in a timely manner, and obtaining feedback that helps in modifying the educational and training performance of all elements of the educational process (Jalal al-Din Omar, Muhammad Antar, 2017, p. 132).

Given the importance and advantages of e- tests, many studies have emphasized the importance of developing e- test production skills depending on the target group, such as the study (Mohamed Badawi, 2014), which aimed to study the effectiveness of a proposed program in e-learning to develop e- test production skills and the trend towards e- assessment among graduate students, and the study (Mohamed Khalaf Allah, 2017), which aimed to demonstrate the effectiveness of different sizes of synchronous groups in virtual classrooms in developing e- test production and technical trends among faculty members, and the study (Mohamed Abdel Badie, 2017), which aimed to identify the effectiveness of a web-based program to acquire skills in producing interactive e-

tests for students of the Faculty of Specific Education, Tanta University, and the study (Sahar El-Sayed, 2022), which aimed to identify the skills of producing e-tests for students of the Faculty of Specific Education.

Research problem:

First: The need to develop the skills of producing e- tests for educational technology students.

1- The researcher's experience in implementing practical exercises:

The researcher noticed through his training, as he works as a trainer at the Professional Academy for Teachers, for the practical aspect of the training package for producing e- tests (for teachers who are formerly students of educational technology), that there is a problem in the cognitive achievement and skill performance of producing and developing e- tests among trainees, as a result of the weakness of the educational environment and reliance on the traditional method of education, and individual differences between students, as learning these skills requires more time for practical application, training and activities to enhance their understanding and mastery of the steps of performing these skills. Also, each learner has characteristics and features that differ from the other, and traditional learning is presented in a single way and style for all learners, which caused a deficiency in these skills among them.

2- Exploratory study:

The researcher confirmed the research problem by conducting an exploratory study based on an opinion poll, as the exploratory study was applied to fourth-year students in the Technology Department, Faculty of Specific Education, South Valley University, for the academic year 2024/2025. The number of the exploratory sample was (30) male and female students, for the purpose of collecting information and observations about their level of achievement in e- test production skills, and identifying the most important problems and the extent of their needs

The exploratory study showed that 87% of educational technology students suffer from weakness in e- test production skills, affecting their future professional capabilities. Therefore, this study aims to measure the effect of using edge computing-based learning environment compared to traditional cloud computing environment in developing e- test production skills.

Many studies have confirmed the importance and effectiveness of producing e- tests and their role in evaluating the educational process, including the study by Hanan Khalil (2012), which aimed to build a learning units repository to develop the skills of producing and preparing e- tests and question banks among students of the Faculty of Education at Mansoura University. The study also aimed to find the effectiveness of interaction tools in the e-learning environment in developing the skills of producing and publishing e- courses among graduate students at the Faculty of Education.

Second: The need to reveal the impact of edge computing on developing e-test production skills.

The study showed that (Masud & Huang, 2011) suggestion environment

Technology Modern For systems education e- the leader on Systems clouds cloud, resulted Results Necessity Use technique cloud Computing in Systems education e-, why Presented by from possibilities and advantages big Support practical education and learning.

The study showed that (Naveen & Mishra, 2014 Jaiswal, Singh,) which Proven Its results possibility overcome on problems learning and training Using possibilities Computing cloud, to be Available For everyone in any time and any place, and without Cost or Cost cheap for those interested with development Self Professional

I recommend the conference National For computing Cloud (2013) Beijing in China in period From June 5-7, which I recommend Importantly Use Techniques Computing Cloud and its employment in Teaching, and Many from Studies Using Techniques Computing cloud in area Education, which I confirmed Its results on Help on education students in ways new help them on administration Their projects and their duties.

The researcher summarizes the research problem as follows:

The research problem is represented by the deficiency and weakness in the skills of producing e- tests among educational technology students, which requires developing these skills because they are among the basic professional competencies necessary for their preparation, through the effectiveness of edge computing in developing the skills of producing and producing e- tests among educational technology students.

Research questions:

- What is the appropriate educational design for the effectiveness of edge computing in developing the skills of producing e- tests among educational technology students?
- What is the impact of the development of edge computing on developing the cognitive aspects of e- test production skills?
- What is the impact of the development of edge computing on developing the performance aspects of e- test production skills?

Research objectives:

- Developing the skills of producing and producing e- tests among educational technology students.
- Determine the criteria that must be met in an edge computing system to develop the skills of producing e- tests among educational technology students.
- Designing an educational system for the edge computing environment to develop the skills of producing e- tests among educational technology students, helping them memorize and master all the information contained in the content.
- Exploring the impact of using edge computing on developing the cognitive aspect of e- test design skills among educational technology students.
- Exploring the impact of using edge computing on developing the performance aspect of e- test design skills among educational technology students.

Research Significance:

- Directing educators to develop an e-learning environment based on edge computing in general for educational technology students.
- Leveraging the effectiveness of edge computing in various educational platforms, especially those affiliated with the Ministry of Education or universities.
- Empowering students with e-Testing design skills, which may contribute to their professional preparation and help them keep pace with modern developments in the educational field.
- Moving educational content from rigidity and boredom to flexibility and application to keep pace with modern technological development.
- Use the developed system to teach the practical side of the course on e- test design.

Research Delimitations:

- **Human limit**: The research sample consisted of 60 students from the fourth year of Educational Technology Department, Faculty of Specific Education, South Valley University for 2024/2025. They were randomly selected and divided into two equal groups (30 students each). Homogeneity of both groups was verified in basic variables before starting the experiment.
- **Subject matter:** Training content for e- test production skills (prepared by the researcher)
- **Time limit:** The research experiment was implemented in the second semester of the academic year 2024/2025.

Research tools:

"A comprehensive e- achievement test consisting of 70 items distributed into three types: 25 true/false items to measure the level of recall and understanding, 25 multiple-choice items to measure the level of application and analysis, and 20 sequencing items to measure the level of synthesis and evaluation. Test time: 45 minutes, reliability coefficient: 0.968." (prepared by the researcher).

Observation card to measure the performance aspect of e- test design skills (prepared by the researcher).

Research methodology:

Since the research is developmental research in educational technology, the researcher used the following three methods in succession as defined by Abdul Latif Al-Jazzar (2014):

1- **The descriptive approach**: The researcher used it to analyze the literature, previous studies, and research with the aim of describing the research problem, preparing the theoretical framework for the research, and collecting and classifying data to achieve the research objective.

2- **Educational Systems Development (ISD) approach** : The researcher used it to design a learning system based on the effectiveness of edge computing using Muhammad Attia Khamis' model for designing and developing e- content (2015, pp. 144-149).

3- **Experimental approach**: to study the impact of edge computing.

Research variables:

•**Independent variable**: Edge computing.

•**Dependent variable**: The cognitive and performance aspects of e- test production skills among educational technology students.

Experimental design of the research:

Pre-application of search tools	Experimental treatment of research groups	Post-application of research tools
Achievement Test Observation Card	Experimental group (1) is applied to an advanced edge computing-based e-environment.	Achievement Test Observation Card
Achievement Test Observation Card	Experimental group (2) to which a traditional e-learning environment is applied.	Achievement Test Observation Card

Research sample:

The research sample consisted of 60 male and female students from the fourth year of the Department of Educational Technology, Faculty of Specific Education, South Valley University for the academic year 2024/2025. They were selected using a simple random method and divided into two equal groups (30 students per group). The homogeneity of the two groups was confirmed in the basic variables before the experiment.

Experimental treatment of the research:

An interactive e-learning environment designed according to the model of Muhammad Attia Khamis (2015), which includes:

* **Educational content**: 6 educational units on e- test production skills

* **Edge computing technology**: Processing data locally to reduce response time and improve performance.

*** Interactive activities**: Interactive videos with built-in questions

* **Duration:** 4 weeks, 3 sessions per week (2 hours per session)

Research hypotheses:

The research seeks to verify the following hypotheses:

- There is a statistically significant difference between the average scores of students in the first experimental group (advanced) and the second experimental group (traditional) in the achievement test of the cognitive aspect of e- test design skills.
- There is a statistically significant difference between the average scores of students in the first experimental group (advanced) and the second experimental group (traditional) in the observation card for the performance aspect of e- test design skills.

Research Terminology: In light of the researcher's knowledge of the definitions contained in many educational literatures related to the research variables, the research terms were defined procedurally as follows:

- **Edge computing:** He knows her researcher Procedurally It is defined as: “a technology that enables users to have permanent and convenient access to the Internet anytime, anywhere, and to share a pool of computing resources that can be deployed and made available quickly with minimal effort.”

- **E- tests:** One of the most effective e- assessment tools is designed with a high degree of precision and mastery. Digital devices such as computers or smart phones are used to design and construct questions digitally, determine the correction method, test grade, start and end times, and test duration, all through the Microsoft Azure platform and its add-ons.

Theoretical framework of the research:

The current research aims to identify the effectiveness of edge computing in developing the skills of producing e- tests among students of the Educational Technology Department. Therefore, the theoretical framework of the research addresses a number of axes, which are: Edge computing, e- test design, and the following are the topics:

First axis: Edge computing:

Edge computing is a new computing paradigm in which computing takes place close to the physical location of data. It is a modern technology that has emerged in the world of computing, processing, and storing data. Large computing and storage resources are placed at the edge of the Internet, close to mobile devices, sensors, end users, and Internet of Things devices that process data at the edge of the network. This advanced computing brings computing resources, data storage, and enterprise applications closer to where people actually consume information, by collecting and analyzing data close to users. The researcher found that there are several synonyms and Arabic translations for the term (Edge Computing), and their names varied, such as: (Advanced Computing, End Computing, Distributed Computing, Edge Computing, Edge Coputing), and through searching in search engines on the Internet, the researcher found that the most common synonym or term is the term Edge Computing. Therefore, the researcher decided to choose Edge Computing to refer to the term (Edge Computing) in this research.

First: The concept of Edge Computing:

Known as: (Shorouk Zayed, 2023), (Taha Muhammad, 2023), (Zeinab Muhammad, Iman Salah, 2022)
(Iftikhar, S.et al, 2022), (Sahni, Y. et al, 2022), (Khan, L. et al, 2020), (Shi, W., et al, 2020), (Xiao, Y., et al, 2019).

Edge computing as:

1. A special technology used to transfer, store, and process data in storage and processing centers located close to the request centers or parties benefiting from the data, called “Swihat.” This is a principle similar to the principle of cloud computing, but differs from it in the aspect of data storage and processing locations.
2. The process of approximating the storage information and computing capabilities of the device that produces that data and the users who deal with it.
3. A new computing model that enables its users to transfer the central control of cloud computing services and applications to the network edges in order to avoid the disadvantages of cloud computing.
4. A technology that analyzes and processes data instantly at the edge of the

network where the data is collected. The data is analyzed and processed within an end device in real time at physically close edges to support data flow acceleration, which significantly reduces data access time and allows users to provide faster service.

Second: Characteristics of edge computing:

Both pointed out:

(Liang B, Gregory M and Li S., 2022), (Firouzi F, Farahani B and Marinšek A., 2022), (Sahni, Y., 2022), (Krishnasamy, et al, 2020), (Khan et al., 2020), (Xiao, Y., et al, 2019), (Al- Turjman, 2019), (Huh, & Seo, 2019), Premsankar, et al., 2018)

Edge computing has the following characteristics: speed Response, reduce burden on Networks, Security, Efficiency Private With energy, Costs, Reduce time Access, Storage, Availability For expansion.

Third: Edge computing versus cloud computing:

Edge computing is closely related to the concepts of Cloud computing Although there is some overlap between these concepts, they are not the same thing, and many studies have demonstrated this relationship, such as the study:
(Ahmad S, Shakeel I, Mehfuz S and Ahmad J,2023), (Nair M, Mishra A and Tyagi A.,2023), (Firouzi F, Farahani B and Marinšek A.,2022), (Iftikhar, S., et al, 2022)

Which showed the differences Between Edge Computing, and cloud computing, all concepts relate to distributed computing and focus on the actual deployment of computing and storage resources in relation to the data being produced., The difference is a matter of where those resources are located.

Edge computing: is the deployment of computing and storage resources at the location where data is produced, this ideally places compute and storage at the same point as the data source at the edge. The network.

Cloud computing: Cloud computing is a massive, highly scalable deployment of computing and storage resources in a distributed global location, Cloud providers also integrate a variety of pre-built services for IoT operations, making the cloud a preferred central platform for IoT deployments. However, while cloud computing provides more than enough resources and services to handle complex analytics, the nearest regional cloud facility can still be hundreds of miles away from the data collection point, and communications rely on the same volatile internet connection that supports traditional data. In practice, cloud computing is an alternative - or sometimes a complement - to traditional data centers. where the cloud can bring central computing much closer to the data source, but not to the edge of the network.

The second axis: E- tests:

Hassan Al-Aref and Tafeeda Ghanem (2016, p. 5) define it as one of the computer applications used to overcome the problems found in traditional tests to increase students' academic achievement and develop the skill of self-learning.

Ayat Fawzy (2022, p. 1192) defines it as all the processes related to the test, from designing, producing, using, managing, correcting, and displaying the

results e-ally instead of the traditional paper method, in its various types and patterns, to evaluate the student's performance and achieve the various evaluation objectives.

The importance of using e- tests in the educational process is evident as an effective means of measuring various learning outcomes. This was confirmed by several studies that addressed the use of e- tests, including the study by Rafiq Saeed Ismail (2020), which aimed to study the effect of the two types of fixed and variable-length adaptive e- test design on reducing test anxiety and developing attitudes towards e- tests among students of the College of Education. The results showed that the variable-length e- test design was superior in reducing test anxiety, while the fixed-length e- test design was superior in developing positive attitudes among students towards e- tests. The study by Muhammad Abdel-Halim Muhammad (2018) also confirmed the effectiveness of using e- formative tests and the accompanying feedback in student teachers' mastery of statistical concepts.

Stages of designing and producing e- tests:

Ghada Shahata Moawad (2020, pp. 533-535); Enas Al-Husseini (2013, p. 410) explained that the process of designing and producing e- tests goes through six stages: analysis, design, test production, publication and distribution, application, and evaluation.

1. Analysis stage: This stage determines the general objective of producing the test, the educational, mental, physical and technological characteristics of the students are determined, the general and behavioural objectives of the test are analysed, the educational material is analysed into small elements and focused on the basics for formulating the content, the technological reality of the educational institution is analysed and the requirements for designing and implementing the test are determined in terms of network communication devices and programmes and technical support.
2. Design phase: In this phase, behavioral objectives are formulated and their relative weights are determined, tables of specifications and relative weights for learning topic questions are prepared, test questions are formulated and written, test instructions are determined, test question formats are chosen, response patterns that the learner will use are chosen, types of multimedia that will be included in the test are chosen, feedback methods are determined, whether immediate or delayed, interaction tools are chosen, the test flowchart, test scenario, interaction interface screen and links for moving between test parts are chosen.
3. Test production stage: In this stage, the test programming authoring programs are selected, the role of each individual involved in test production is determined, the test design programming is implemented, the test is initially tested, the test elements are judged in their software form, modifications are made to the test, and the e- test software is documented.
4. Publishing and distribution stage: In this stage, the test is published on computers, uploaded to the Internet and integrated with one of the e- learning

management systems (LMS), or placed on CDs to be distributed among several learners.

5. Application stage: In this stage, the test is applied to an original sample, the data obtained when conducting the test trial is collected, and the grades obtained are recorded in a record representing the previous data, i.e. (the learner's name, the class, the section, ...) and the grade he obtained.
6. The e- test evaluation stage: This stage includes collecting application information, a test validity report, a report on the validity of the e-environment containing the test, whether on the Internet or within educational computer labs, a report on the validity of transferring and delivering the test, and securing the test and maintaining its confidentiality.

Search procedures:

Instructional design for the learning environment E- according to the model of Muhammad Khamis (2015), and the procedures for designing the e-learning environment in the current research went through the stages of the model as follows:

- The pre-planning and preparation stage includes: Forming a work team to design and produce the e-learning environment, represented by the researcher with the assistance of one of the specialized programmers. Determine the responsibilities and tasks necessary to design and produce the e-learning environment, allocate financial resources and support methods, and assign the researcher alone the responsibility of providing financial resources and support and bearing all material costs. The analysis phase includes: analyzing the general needs and goals. This step includes determining the general purpose of the current research. This was represented by the lack of skills among educational technology students in designing e- tests and identifying the characteristics of learners on the basis of which the e- learning environment is designed and produced. And analyzing the general goals or objectives into their main and subsidiary components, analyzing the available resources and capabilities. Among the most important available capabilities that helped in completing the research is a computer lab in the Department of Educational Technology at the College of Specific Education, and all the devices and their accessories are usable and connected to the Internet, which contributed significantly to completing the tasks required for the research.
- E- content design phase: This phase includes determining the general objectives of the content. These are the objectives that are hoped to be achieved upon completion of the study of e- content in the e- learning environment. The objectives were formulated in specific behavioral terms. The researcher relied on Bloom's digital taxonomy, which suits the nature of the current research. The researcher must formulate the objectives accurately. And that they be observable and measurable objectively, and that the goals do not conflict with each other.

Test and Measurement Design: The researcher designed research tools appropriate to the objectives and content of the e- learning environment that are applied to students before and after completing the study within the e-learning environment.

These tools are as follows:

1- Achievement test: Its aim is to measure the cognitive aspects related to developing the skills of producing e- tests. The test items were formulated in three patterns: (true or false - multiple choice - order). The test was prepared e-ally and the test settings were adjusted to display the questions sequentially. After completing all the test questions, the student's score in the test appears.

Standardization and control of the cognitive aspect's measurement test: A sample of (30) fourth -year students from the Department of Educational Technology were selected to conduct a pilot test with the aim of:

• Calculating the reliability coefficient of the achievement test.
• Test validity calculation.
• Calculate test time.

Calculating the reliability coefficient of an achievement test: Reliability refers to the degree to which a test yields the same results when administered to the same individuals under the same conditions. The goal of measuring test reliability is to determine the extent to which it is free of errors that might alter an individual's performance on the same test from time to time.

The researcher calculated the stability coefficient on the exploratory sample, which numbered (30) students, and recorded their results. The researcher used the Cronbach's alpha method and the split-half method for both Spearman and Guttman using the (SPSS18) program.

a) Cronbach's alpha method: The researcher calculated the reliability coefficient for the achievement test using the (SSPS) program, and obtained a reliability coefficient of (0.968), which indicates that the test has a high degree of reliability.

b) Split-half method: This method calculates the correlation coefficient between the scores of the two halves of the test. The test is divided into two equal halves. The first part includes the students' scores on the individual questions, and the second part includes the students' scores on the paired questions. Then the correlation coefficient between them is calculated. The researcher reached the following results.

Table (1) The reliability of the achievement test using split-half

Vocabulary	number	Correlation coefficient	Spearman-Brown reliability coefficient	Guttman's reliability coefficient
Part one	35	0.950	0.974	0.974
Part Two	35			

It is clear from the previous table that the test's reliability coefficient is equal to (97.4%), which is a reliability coefficient that indicates that the test has a very high degree of reliability. It gives a degree of confidence when using the test as a measuring tool in the current research, and is an indication that the test can give the same results if it is reapplied to the sample and under the same application conditions.

Calculate the validity of the achievement test: The researcher calculated the validity of the survey sample, which numbered (30) students, and recorded their results. The researcher used the method of internal consistency validity and predictive validity using the program (SPSS18).

 Internal validity: Internal validity is calculated by the square root of the reliability coefficient, and thus the internal validity of the test is (9 8.39 %), which is a high percentage that makes the achievement test valid for measuring what it was designed to measure.

a) Validity using internal consistency of achievement test items:

Table (2 Internal consistency between achievement test questions

Vocabulary	Correlation coefficient	Vocabulary	Correlation coefficient	Vocabulary	Correlation coefficient	Vocabulary	Correlation coefficient
1	0.765 **	19	0.608 **	37	0.451 * *	55	0.779
2	0.522 **	20	0.474 **	38	0.423 * *	56	0.552
3	0.599 **	21	0.431 **	39	0.487 **	57	0.564
4	0.493 **	22	0.789 **	40	0.394 * *	58	0.455 *
5	0.641 **	23	0.501 **	41	0.670 **	59	0.662
6	0.451 * *	24	0.457 * *	42	0.419 **	60	0.481 *
7	0.378 * *	25	0.622 **	43	0.617 **	61	0.470
8	0.553 **	26	0.564 **	44	0.567 **	62	0.637
9	0.621 **	27	0.608 **	45	0.588 **	63	0.485
10	0.756 **	28	0.804 **	46	0.423 * *	64	0.457 *
11	0.426 * *	29	0.434 **	47	0.440 * *	65	0.703
12	0.738 **	30	0.673 **	48	0.466 **	66	0.522
13	0.445 **	31	0.423 **	49	0.677 **	67	0.686
14	0.422 **	32	0.601 **	50	0.606 **	68	0.644
15	0.774 **	33	0.652 **	51	0.397 * *	69	0.515
16	0.443 **	34	0.543 **	52	0.750 **	70	0.512
17	0.571 **	35	0.695 **	53	0.459 *		
18	0.614 **	36	0.374 **	54	0.637 **		

It is clear from the table that the correlation coefficients between the vocabulary and the total achievement test are all significant, as there are (50) significant phrases at the (0.01) level, and (20) significant phrases at the (0.05) level, which indicates the presence of high internal consistency between the vocabulary and the total achievement test, and thus the achievement test has a high degree of validity.

Determine the time required to answer the test items: The researcher calculated the test time by calculating the time taken by the first student to answer the test and the last student to finish answering it, and calculating the average between them . The test time was (45) minutes, and thus the test was in its final form, ready to be applied to the research sample.

2- Note card: Its aim is to measure the skill performance associated with developing the skills of producing e- tests.

was adjusted and standardized as follows: A sample of fourth-year students in the Educational Technology Department, numbering (30) students, was tested to try out the card as a pilot, with the following aim:

- Calculate the stability of the observation card.
- Account for the validity of the observation.

1- Stability of the observation card:

Consistency means that the observation card gives the same results, if it is

reapplied to the same individuals in the same conditions. The goal of measuring the consistency of the observation card is to know the extent to which it is free of errors that may change the individual's performance from time to time on the same card. The researcher calculated the consistency coefficient on the exploratory sample, which numbered (30) students, where their results were recorded. The researcher used:

- Cronbach's alpha method: The stability coefficient of the observation card was calculated using the (SSPS) program, and a stability coefficient of (0.874) was obtained, which indicates that the observation card has a high degree of stability.
- Split-half method: This method calculates the correlation coefficient between the scores of the two halves of the observation card. The card is divided into two equal halves. The first part includes the students' scores on the individual questions, and the second part includes the students' scores on the paired questions. Then the correlation coefficient between them is calculated. The researcher reached the following results:

Table (3) Observation card stability using split-half

Vocabulary	number	Correlation coefficient	Spearman-Brown reliability coefficient	Guttman's reliability coefficient
Part one	85	0.625	0.769	0.793
Part Two	85			

It is clear from the previous table that the stability coefficient of the observation card is equal to (76.3%), which is a stability coefficient that indicates that the observation card has a high degree of stability, and it gives a degree of confidence when using the observation card as a measuring tool in the current research, and it is an indicator that the observation card can give the same results if it is reapplied to the sample and under the same application conditions.

2- Validate the observation card.

Validity means "the extent to which the tool or measurement procedures can measure what is required to be measured." The researcher calculated validity on the survey sample, which numbered (30) students, and recorded their results. The researcher used the method of internal consistency validity and predictive validity using the program (SPSS18).

A- Internal consistency validity:

Internal validity is calculated by the square root of the reliability coefficient, and thus the internal validity of the observation card is (93.4 9 %), which is a high percentage that makes the observation card valid for measuring what it was designed to measure.

- **E- content development stage:**

E- content evaluation and improvement stage:

survey study was conducted on a sample of students, in order to test the content. In the e- learning environment, ensuring the integrity of the content, and making all necessary modifications to make it suitable for the final experiment, where the survey sample consisted of (30) students from the fourth year students of the Department of Educational Technology, and they were chosen randomly and from

those who do not have previous experience with the educational content provided through the e- environment, and the basic objectives of the study were represented in the following: Ensuring the validity of the content in the e- learning environment and its suitability to the learners' characteristics and learning style, identifying the difficulties that students and researchers may encounter during the implementation of the research and trying to avoid or address them, ensuring the validity of the e- test provided to students, allowing the researcher to gain experience in implementing the research, and identifying students' opinions, suggestions, and observations regarding the e- environment and the content as well.

The e- content publishing stage: In this stage, the following was done: The e-content was uploaded with its final processing through the environment's control panel. The intellectual property rights of the e- learning environment were determined, and access to the content was controlled, as the researcher has all the powers to control access to the e- content in the e- learning environment, in terms of the ability to show or hide it. The content is not visible to the learner until he registers in the environment, and he has the right to register for the environment only once and is not permitted to register again except after the researcher's approval. The content is maintained and updated to monitor users' reactions to it and to update the adaptive content from time to time.

The third axis: conducting the pilot experiment:

In this step, a survey study was conducted on a sample of students, in order to experiment with the e- content in the e- learning environment, and to ensure the integrity of the content, and to make all necessary modifications to make it suitable for the final experiment, as the survey sample consisted of (30) students from the fourth year students of the Department of Educational Technology, and they were chosen randomly and from those who do not have previous experience with the educational content provided through the e- environment, and the survey experiment was conducted for research in several steps, which are:

• Obtaining the approval of the research supervisors.

• pilot experiment, which is the computer lab at the Faculty of Specific Education, South Valley University, where all computers have been updated and connected to the Internet.

• The researcher met with the survey sample students to explain to them how to deal with the environment and register in it.

• Applying the cognitive test of e- test design skills in advance.

• Allow students to record their observations on the e- environment and e- content.

• Applying the research tools remotely, which are (achievement test, observation card) On the survey sample.

Axis Four: Conducting the basic research experiment

The research sample for the basic experiment consisted of (60) male and female students from the fourth year of the Department of Educational Technology at the Faculty of Specific Education, South Valley University. The researcher randomly divided them into two experimental groups, each group consisting of (30)

students, according to the experimental design of the research.

Research results, interpretation and recommendations:

First: Testing the validity of the hypotheses:

First assumption:

The first hypothesis states that "there is no statistically significant difference between the average scores of the two groups." Control (traditional training environment) and experimental group (Advanced training environment) in post-application to test the achievement in developing the skills of producing e- tests among educational technology students.

To verify the validity of this hypothesis, the researcher applied the achievement test. On the research sample, and after monitoring and analyzing the results using the (Independent-Samples t-Test) as a parametric method (in accordance with the number of sample members equal to or greater than 20 individuals), via the (SPSS) program, the researcher reached:

Table (4) Significance of the difference between the control group and the experimental group in the post-measurement in the achievement test

Groups	number	Average	Standard deviation	d.g	T value	pampering	Significance level
control group	30	53.10	3,155	58	18,844	0,000	Function at the level 0.01
experimental group	30	67.03	2,539				

It is clear from the previous table that the significance level is equal to (0.00), and this indicates the presence of a statistically significant difference between the average scores of the control group (traditional training environment) and the experimental group (advanced training environment) in the post-achievement test in favor of the experimental group (in an advanced training environment), as the average scores of the control group reached (53.10) while the average scores of the experimental group reached (67.03).

From the previous results, the first hypothesis was rejected due to the presence of a statistically significant difference between the average scores of the group. Control (traditional training environment) and experimental group (Advanced training environment) in post- application to test the achievement in developing the skills of producing e- tests among educational technology students for the benefit of the experimental group.

As for the effectiveness of the environment in developing the cognitive aspects in developing the skills of producing e- tests among educational technology students, the researcher calculated the effectiveness in light of Black 's gain rate equation for each of the two groups. Control (traditional training environment) and experimental group (Advanced training environment) as follows:

Control group (traditional training environment) experimental group (environment Training (advanced)

M	Statement	Value	M	Statement	value

1	The Great End (P)	70
2	Average pre-application (M1)	16.90
3	Average post-application (M2)	53.10
4	Average Gain Ratio (MG)	1,2

1	The Great End (P)	70
2	Average pre-application (M1)	17,13
3	Average post-application (M2)	67.03
4	Average Gain Ratio (MG)	1.65

By reading the two previous tables, it becomes clear that the rate of adjusted gain of knowledge related to the skills of designing e- tests among educational technology students indicates the effectiveness of the environment in the control group and the experimental group because they achieved effectiveness equal to or higher than the criterion proposed by Black for the effectiveness of programs (1,2), but the effectiveness of the environment in the experimental group with an environment Training Advanced (1.65) is greater than and is higher than the effectiveness of the environment in the control group with an environment Training Traditional (1,2).

second assumption:

The second hypothesis states that "there is no statistically significant difference between the average scores of the two groups." Control (traditional training environment) and experimental group (Advanced training environment) in post-application Observation card for developing e- test production skills among educational technology students.

To verify the validity of this hypothesis, the researcher applied the observation card. On the research sample, and after monitoring and analyzing the results using the (Independent-Samples t-Test) as a parametric method (in accordance with the number of sample members equal to or greater than 20 individuals), via the (SPSS) program, the researcher reached:

Table (5) Significance of the difference between the control group and the experimental **group in the post-measurement in the observation card**

Groups	NO.	Average	Standard deviation	d.g	T value	pampering	Significance level
control group	30	412.70	4,786	58	58,263	0,000	Function at the level 0.01
experimental group	30	496.90	6,305				

It is clear from the previous table that the significance level is equal to (0.00), and this indicates the presence of a statistically significant difference between the average scores of the control group (traditional training environment) and the experimental group (advanced training environment) in the post-observation card in favor of the experimental group (advanced training environment), as the average scores of the control group reached (412.70) while the average scores of the experimental group reached (496.90).

From the previous results, the first hypothesis was rejected due to the presence of a statistically significant difference between the average scores of the group. Control (traditional training environment) and experimental group (Advanced training environment) in post- application Observation card for developing the skills of producing e- tests among educational technology students for the experimental group.

As for the effectiveness of the environment in developing the performance aspects in developing the skills of producing e- tests among educational

technology students, the researcher calculated the effectiveness in light of Black 's gain rate equation for each of the groups. Control group (traditional training environment) and experimental group (Advanced training environment) as follows:

control group

M	Statement	Value
1	The Great End (P)	510
2	Average pre-application (M1)	82.33
3	Average post-application (M2)	412.70
4	Average Gain Ratio (MG)	1.42

experimental group

M	Statement	value
1	The Great End (P)	510
2	Average pre-application (M1)	82.07
3	Average post-application (M2)	496.90
4	Average Gain Ratio (MG)	1.78

By reading the two previous tables, it becomes clear that the rate of adjusted gain of knowledge related to the skills of designing e- tests among students of the computer teacher department indicates the effectiveness of the environment in the control group and the experimental group because they achieved effectiveness equal to or higher than the criterion proposed by Black for the effectiveness of programs (1,2), but the effectiveness of the environment in the experimental group with an advanced training environment (1.78) is greater than and is higher than the effectiveness of the environment in the control group with a traditional training environment. (1,42).

Interpretation and discussion of research results:

The results related to the first hypothesis of the current research showed that there is a statistically significant difference between the average scores of the group. Officer (Environment Training (traditional) and the experimental group (environment Training Advanced) in post -application to test the achievement in developing the skills of producing e- tests among educational technology students for the benefit of the experimental group.

As for the effectiveness of the environment in developing the cognitive aspects in developing the skills of producing e- tests among educational technology students, the effectiveness of the environment in the experimental group has an environment Training More developed than and higher than the effectiveness of the environment in the control group with an environment Training Traditional.

The results related to the second hypothesis of the current research showed that there is a statistically significant difference between the average scores of the group. Officer (Environment Training (traditional) and the experimental group (environment Training Advanced) in post -application Observation card for developing the skills of producing e- tests among educational technology students for the experimental group.

As for the effectiveness of the environment in developing the performance aspects in developing the skills of producing e- tests among educational technology students, the effectiveness of the environment in the experimental group with an environment Training More developed than and higher than the effectiveness of the environment in the control group with an environment Training Traditional.

The results showed a statistically significant difference at the level ($\alpha \leq$

0.05) between the average scores of the experimental group (67.03) and the control group (53.10) in the post-application of the achievement test in favor of the experimental group. The adjusted gain rate for the experimental group was (1.65) compared to (1.2) for the control group, which indicates the high effectiveness of edge computing.

Results showed a statistically significant difference at ($\alpha \leq 0.05$) between experimental group mean (67.03) and control group mean (53.10) in the post-application of the achievement test in favor of the experimental group. Black's adjusted gain ratio for the experimental group (1.65) versus (1.2) for the control group indicates high effectiveness of edge computing."

The researcher attributes these results to several reasons, the most important of which are:

- Edge computing environment the environment provided a suitable environment. From a procedural standpoint, the environment provided a specific, systematic method with clear objectives supported by interactions that made students interact with the environment. From a technical standpoint, it provided an environment of a suitable nature by presenting the educational content in the form of modules. At the beginning of each module, the general objective of studying the module was presented, followed by the educational objectives to be achieved from it. The objectives were formulated in a behavioral and clear manner, using phrases that are easy for students to understand, and clarify what is expected of them after studying each module, while presenting interactive questions to ensure that students have understood the concepts and information.
- Edge computing capabilities The environment is based on the fact that the skill is divided into educational modules presented through an interactive video clip with a set of interactive questions that the student answers while watching the video, as the student is not allowed to move to the next module until he has finished watching the entire module and answered the questions inside the module correctly, which made the learner engaged and active in the learning process .
- The effectiveness of edge computing has had a better positive impact. This superiority is due to the fact that the use of edge computing helps track learners' performance as they interact with interactive video. Through it, the student's level and learning behavior are determined, their learning problems are identified, appropriate solutions are provided, and the necessary educational assistance is provided.

Research recommendations:

In light of the findings of the current research, the researcher recommends the following:

- Benefiting from the results of the current research at the applied level, i.e. in designing an e-learning environment based on the effectiveness of edge computing, especially if the targeted learning outcome is cognitive achievement and the development of scientific skills, especially if future research supports

these results.

- The need to take into account individual differences among students in terms of their preferences, needs, learning styles, and level of knowledge.
- It is necessary to take into account the standards for designing an e-learning environment that is compatible with learning styles to increase students' cognitive achievement and skill performance.

Suggested research:

1. The current study was limited to examining the impact of its independent variables at the university level. Therefore, future studies may examine these variables within other educational stages, as the results may differ due to differences in age and level of experience.
2. Study of the independent and dependent variables of the research on a sample of people with special needs.
3. Conduct a descriptive study to establish foundations and criteria for designing the effectiveness of edge computing in e- environments.
4. The current research was limited to examining the effectiveness of edge computing as an independent variable, so future research could examine the same independent variable in terms of its interaction with learners' readiness.

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