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The Impact of Designing a Virtual Training Environment on Developing Research Skills for Postgraduate Female Students at Najran University

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ABSTRACT

It is important to provide graduate students with the necessary research skills to ensure the quality of the information they use in their scientific research therefore, the current research aims to measure the effect of designing a virtual training environment on developing digital research skills among graduate students at Najran University. The experimental method was used by employing the quasi-experimental design to conduct the research. The sample consisted of 34 students. An achievement test was designed to measure the cognitive aspects and an observation card was prepared to measure the research performance skills in the digital environment. The results revealed the existence of statistically significant differences at the significance level of ($\alpha \leq 0.01$) between the mean scores of the pre and post-application for the achievement test and the observation card as a result of using the virtual training environment. The results also showed that the virtual training environment had a significant impact, according to the application of Blake's modified gain ratio, on developing digital research skills, and that the impact size of the virtual environment on developing students' digital research skills was more than (0.97).

Keywords
Virtual environment; Virtual training; Instructional design; Research skills

Introduction

The current era is witnessing many changes in various aspects of life. The rapid technological development and the advancement of means of communication and information technology have played major roles in these changes. This calls for the need to shift from traditional learning methods to modern techniques represented in e-learning environments that depend on learners' interaction with content and with each other. In light of technological developments and digital transformation, it is necessary to reconsider the training mechanisms used and focus on converting them from traditional methods to digital means. Virtual training is one of the most important modern training methods in the field of skills development.

Anand (2021) notes that the emergence of e-learning environments and web-based training courses has greatly contributed to the realization of our need for a better understanding of the conditions and means to achieve more effective learning and that digital education gives learning a new significance in contemporary society and professional practice. Khasanah et al. (2020) confirmed that virtual training can provide a solution to raise the level of knowledge during the pandemic using technology based on the assumption that; education must continue even if it is only from home where participants from different places can gather in a virtual class and meet online using digital aids.

In light of the competition towards building knowledge societies and raising the level of qualification of scientific and research cadres in universities in all fields, these universities pay great attention to scientific research to generate knowledge that can be used for building competitive knowledge societies (Alfar, 2012, 3). Hoymel (2018) added that competition in building knowledge societies has become a necessity at local, regional, and international levels to achieve the vision, mission and objectives of the programs offered by educational institutions and universities in accordance with the policies and programs of scientific research in those institutions.

On the other hand, Al-Deek (2009) believes that scientific research is an organized process that cannot be conducted halfheartedly, as the researcher follows specific scientific methods and approaches. This requires the researcher should have varied research skills that help him to apply the appropriate research tools to find out knowledge and effectively use it to solve problems. Therefore, researchers need to have the research skills that can help them to raise the level of the quality of scientific research.

The most prominent developments that have taken place and are still in continuous development are the use of distance education with its various types, whether at the educational or training levels. E-training programs have become a tangible reality and the focus of attention of practitioners and stakeholders in various fields. Training programs are no longer testable methods, especially after the development of communication and information technologies wherever they become the focus of attention among various educational and training institutions.

Educational and training institutions are looking for ways and means to help them contribute learning and training in different styles and forms to meet the growing and renewable needs to overcome some of the obstacles they face, and to keep pace with various aspects of development (Abdul Karim & Hashim, 2004). The accumulated experiences in some countries and institutions concerned with electronic training have proven that "traditional training" is no longer sufficient or rewarding to achieve the desired goals considering the actual renewed needs of the trainees who feel bored with the repetitive training programs that have stereotyped steps. Therefore, there must be a method synonymous with traditional training that meets the actual needs, which helps the emergence of some concepts, including "digital training", "online training" or "distance training" (Saleh, 2018).

Many justifications contribute to the emergence of the urgent need for postgraduate students to acquire research skills in the digital environment including the huge content that is published in the digital environment, the diversity of sources and their different forms, and the different ways of searching for information in the digital environment than in the traditional environment as well as the renewal of information and the speed of its dissemination in digital repositories. Al-Sharqawi (2014), El-Sayed (2016) and Nasr El-Din (2019) confirm that the information structure of educational curricula must be reviewed, and digital learning environments must be developed to provide students with skills that enable them to search for information in electronic and digital environments.

Because of the importance of conducting scientific research for postgraduate students and accessing the information upon which their researches are based to ensure the quality of their scientific output, and taking into account that the researchers rely more on information sources and digital search engines now adays compared to their reliance on traditional information sources; it is necessary to provide them with the necessary research skills that they need to ensure the quality of the information they use in their scientific research. All these efforts are exerted to shorten time and effort, which will be positively reflected in the quality of scientific research. As virtual learning and training environments have several characteristics and features that fit the purposes of interactive virtual training, the researcher aimed to conduct this research by designing an interactive virtual training environment to develop research skills among postgraduate female students at Najran University; where they can attend the training program at flexible times that do not conflict with their official study times.

Literature Review

This part will be discussed from two aspects. The first aspect is related to the sources of information in the digital environment, its techniques, tools, and search strategies. The second aspect is dedicated to digital learning and training environments.

Preface: The digital environment is famous with the availability and diversity of digital resources in many forms, and this diversity has made it very rich in information, with researchers needing many skills and digital research strategies. This

has prompted researchers to develop their digital research skills and strategies. Al-Naqeeb (2008, 10) believes that the expression "scientific research" is associated with commitment to specific scientific rules. However, scientific research has no limits, and therefore it is not possible to make a definitive determination of the quality of the information required without conscious knowledge of the subject of research, ways and methods of accessing information from various channels and sources, and the optimal method for dealing with these resources in the digital environment.

Worthy here to mention that the rapid growth in the number and forms of information sources via the Internet, their diversity, and ease of access has made the information network the largest source of information in the current era. This is accompanied by a multiplicity of methods for retrieving information available through them; these methods have been determined by Al-Suwait (2018) in navigation, which depends on direct access through well-known browsing tools such as (Google, Internet Explorer, Netscape, etc…), and browsing through web pages that lead to each other through an interconnected series of hyperlinks.

Web searching and retrieval tools can be divided into three types represented in:

- **Search engines:** It mainly works on building indices for intertwined sources of information by deriving words or phrases from the texts themselves to build files that allow searching for these derivatives based on well-known search and retrieval methods such as Boolean logic, skipping terms, truncating, rooting, and others.
- **Meta Search Engines:** It is one of the most important tools for searching and retrieving information sources available on the Internet, as it receives beneficiaries' inquiries and sends them to a selected group of independent search engines, then it receives the results from these engines and merges, processes and sorts them into an arranged list according to the merging and sorting algorithms, in addition to analyzing and translating queries to match the different search capabilities of the engines in the system.
- **Web Portals:** They have many names, including Internet Portals, Portals, Subject Portals, etc.). All these terms refer to the information sources available through comprehensive thematic divisions that include all types of sources and services that users of Internet services need (mail, chat, news items, weather conditions, etc.).
- **Meta Searchers:** They allow a single search process to be generalized in different search engines simultaneously, where the results are published either based on the type of search engine or merged into one list. Their roles are confined to be intermediaries that pass the search request to more than one engine and list the results after they are arranged in a specific style for the user (Omar, 2016).

Digital information sources are characterized by many advantages such as speed of retrieval, circulation and transfer, huge storage capacity, space-saving, searching in large amounts of information, multiple access points to information within documents, ease of use, and copying and pasting. They also have advantages that are not available in traditional sources such as (Boolean operators, post coordination, truncations, etc.); which made them popular destinations for researchers. For the search for information in digital information sources to be accurate, Samer (2014) believes that a strategy must be developed based on the following steps: First: accurately defining the goal. Second: the expectation of the presence of information. Third: thinking of alternatives. Fourth, knowledge of the skills of using assistive technologies. Fifth: identification of the capabilities of the search engine. Sixth: determination of the research method (free, objective, simple, complex or advanced).

Digital research tools: Abdel-Samie & Shami (2017, 47) and Al-Sharqawi (2014) define them in three main tools:

1) **The automated program**: It is a program that captures everything modern and new on the Internet; these things are determined by the program designer.
2) **Indexer:** A program that indexes all documents retrieved by the automatic program by making a comprehensive survey of all document contents, especially the terms used in their main and sub-headings.

Search interface: It is an interface that allows users to enter the main search terms directly into the search engine and the engine searches for them and displays the obtained results.

The search engines provide many services that may use similar techniques despite the different search tools used, these services include:

The ability to use natural language to facilitate the search process.

The use of Boolean logic with its tools (AND, OR, NOT).

The ability to allocate a specific category for research that goes in harmony with each other or has the same goal.

The possibility of using more than one term for one meaning and the use of precise terms.

The probability of adding a list of similar or close websites in the same field that may contain recent information.

To search effectively, researchers must be familiar with the abbreviations within the database to save search time, which includes how to search by phrases, and the use of Boolean operators. Even though the search methods differ from one database to another, most of them have some functions, including the basic search function and the advanced search function. All databases have unique characteristics to practice the typical search process as well as unique operations such as (search within results - analysis of results - search history - search by categorical data - related articles and links).

Searching methods in search engines are multiple, but Hefni (2012) summarizes them as follows:

Natural Query Language;
Boolean Operators;
Proximity Operators;
Phrase Searching;
Concept Searching;
Thesaurus;
Truncation;
Exact Match;
Fuzzy Match;
Numeric Operators

Hence, the researchers' knowledge of the strategies and skills of searching for information within the search tools on the Internet, and their knowledge of the advantages and disadvantages of each tool in terms of coverage, speed and accuracy, leads them to access information that may be diverse according to its sources.

Several studies dealt with the importance of scientific research and acquiring its skills among postgraduate students in different universities, including Almaghrabi (2012) who depends on students in field research at Umm Al-Qura University, and concludes that students face several problems of varying degrees, including low field research skills, difficulty in researching foreign periodicals and magazines, and weak research skills in electronic sources. Asiri (2012) confirms that there are many scientific and technical difficulties facing master and doctoral postgraduate students at Umm Al-Qura University. Prereira (2013) conducts a study on a sample of students from Gao University in Mali and confirms that students do not have the skills required to search the digital environment, and they must be provided with the skills necessary to carry out research on the Internet in an effective manner using various search techniques to access the required information.

The results of these studies indicate that there are obstacles that face postgraduate students in various aspects, some of which are technical difficulties and some of them are related to retrieving information from electronic sources and scientific periodicals. In addition to other difficulties related to searching on the Internet. This is considered a justification for acquiring various research skills, especially digital skills in light of digital learning.

Virtual learning and training environments: Digital learning environments are among the environments that may not require high skills to use them, and they may not need specialists with high skills in the fields of computers, the Internet, or programming, but rather they require skilful use of a set of competencies that they can acquire easily.

Electronic learning and training environments provide several tools and means that allow their users to carry out the tasks they need. These environments are characterized by ease of development and modernization that can be carried out directly and at the lowest cost and effort. They also allow the learner to choose the level of learning that is commensurate with his

capabilities and competencies, which makes it easier for him to learn (Dron & Bhathacharay, 2007, 14-16).

Although it is easy for learners or trainees to use these environments, attaining the desired goals can only be achieved through good planning and design. Khamis (2011, 45) believes that when establishing a virtual learning environment, it must be based on clear and consistent educational theories; as the clear and stable theoretical foundations ensure the survival, development, and continuity of learning even with the shift in the accelerating technical and technological practices.

Alfar (2012, 437) indicates that the educational approach in the virtual learning environment is a theoretical scheme that lies between the scientific approach and the philosophical vision related to the nature of the educational content provided in the educational environment, its characteristics, the traits and needs of students, and the goals to be achieved. Therefore, all the above mentioned issues must be taken into consideration while designing the virtual learning environment. Training in virtual learning environments is one of the least expensive types of training because it can provide training large numbers of trainees without the need to travel to attend courses in remote places; as the virtual training environment enables the trainee and the trainer to be together at the same time from different places and interact with each other.

Virtual learning environments have many characteristics and advantages identified by Abdullah (2017) in the following:

It is a system of several programs and tools that work over virtual networks.

It is controlled by the teacher who manages the educational process; the learner is also governed in these environments. The focus and the center of interaction between the teacher and the learner is the electronic content.

They include many systems such as (e-content management systems - e-learning management systems - interactive learning networks - special applications for storage and evaluation).

Some studies emphasized the importance of using virtual learning environments. Hou (2010) shows that digital learning environments are effective, which leads to the presence of statistically significant differences between the experimental and control groups in favour of the experimental group which use the digital environment to acquire knowledge and skills. Abdul Muti and Zeraa (2012) find that e-training has an important and effective role in achieving professional development for the social studies teachers in the field of self-development, professional and educational growth, and the academic and technological fields.

Saleh (2018) confirms the effectiveness of the e-training environment in developing the cognitive and performance aspects of electronic management skills and improving the job performance among workers in educational institutions at Mansoura University. Belhaj and Boghazi (2018), conduct a study in two banking institutions in Skikda, they conclude the presence of a significant effect of digital technology on electronic training activity. Nasr El-Din (2019) emphasizes the effective impact of the virtual learning environment based on cloud computing applications on developing the skills of designing and producing educational websites for Al-Azhar primary school students and recommends the need to take advantage of virtual learning environments because of their characteristics that are not available in traditional environments.

Al-Dahshani (2019) concludes the necessity of introducing electronic training in all institutions and providing all the requirements for its implementation. The researcher also recommends the need to replace traditional training with advanced techniques through electronic training programs. Daw and Al-Misrati (2020) reach a set of results that include: e-training is an advanced method that seeks to achieve a set of goals such as raising and building capacities and developing applied skills, which will have positive effects on the development of the educational process.

If we follow the studies that were discussed above, it can be noted that some of them emphasize the importance of using virtual learning and training environments and their effect on developing skills and knowledge for different groups, whether for learners in general education or at higher levels. In addition, they are effective and important for employees in educational institutions such as staff and faculty

members. While others believe that they are indispensable means of training, especially during the pandemic, they are also techniques to keep pace with the requirements of the current era with the flexibility and interaction options they provide to overcome the problems of traditional training, especially while taking into account that the current time requires the exploitation of everything available and keeping pace with the rapid technological developments.

Therefore, specialists had to keep in line with these developments and use them optimally in education and training contexts to bring out a generation who can coexist and deal with the abundance of information flow and integrate with it.

Statement of the Problem

While teaching some master's-level courses, the researcher became aware of the weak digital research skills of female students, and this fact is matching with the results of some previous studies in the field, such as Al-Jarf (2010), Al-Habes (2010), Pererira (2013), Hoymel (2018), and Al-Suwait (2018). All these studies confirm the weakness of research skills among postgraduate students. Some studies have recommended the necessity of adopting a clear strategy to shift from traditional training to electronic training, such as Daw and Al-Misrati (2020). The recommendations of some scientific conferences in the field also emphasize the importance of virtual learning and the necessity of shifting from traditional learning and training to digital tools, including the Conference of E-Learning Technology and Techniques (2019), Al-Sharjah, Conference of Digital Transformation in Saudi Universities towards the Kingdom's Vision 20-30 (2019), The Conference of Digital Transformation in the Age of Globalization (2020), the Conference on the Future of E-Learning in the Kingdom of Saudi Arabia according to Vision 20-30 (2021), the International Virtual Conference for E-Learning (2020), … etc. All these arguments emphasize the urgent need to conduct such research.

To verify the existence of the problem, some postgraduate students at the Faculty of Education were surveyed by conducting unstructured interviews to identify the problem, to identify the extent to which they possess digital research skills and how well they can employ them, and whether they need training in these skills or not. Their answers revealed that they do not have such skills and that they need to know about them as basic research needs that means a lot to them. As a result of the importance of virtual digital learning and its contributions to providing information in a manner that suits students at the specified time, and the importance of students' acquisition of research skills in the digital environment; the researcher confirms the necessity of training postgraduate students at the Faculty of Education on digital skills by designing an interactive virtual training environment that provides the opportunity to participate and exchange opinions, information, and files easily.

On that basis the problem of the research can be formulated in the following main question: What is the effect of designing a virtual training environment on the development of digital research skills among postgraduate female students at the Faculty of Education at Najran University? Under this main question, many sub-questions can be formulated as follows:

- What are the digital research skills required to be acquired by postgraduate female students at Najran University?
- What is the educational design needed for an interactive virtual training environment to develop digital research skills for postgraduate female students at Najran University?
- What is the impact of designing an interactive virtual training environment on developing the cognitive aspects of digital research skills for postgraduate female students at Najran University?
- What is the effect of designing an interactive virtual training environment on the development of the performance aspects of digital research skills for postgraduate female students at Najran University?

Research objectives

- Identifying the digital research skills required for postgraduate female students at Najran University.
- Designing an interactive virtual training environment to develop digital research skills

for postgraduate female students at Najran University.

- Determining the impact of designing an interactive virtual training environment on developing the cognitive aspects of digital research skills for postgraduate female students at Najran University.
- Defining the effect of designing an interactive virtual training environment on the development of the performance aspects of digital research skills for postgraduate female students at Najran University.

Research Significance

The research derives its significance from the importance of interactive virtual learning and training environments, especially in light of the current situation of education, and the novelty of the concept of virtual training as one of the concepts that keep pace with technological development to promote and improve various online skills and to enrich contemporary literature. It will also be useful in guiding those who are responsible for postgraduate programs at the Faculty of Education to pay attention to the training programs offered to postgraduate students. It can also be useful for faculty members in guiding their students to use research skills and techniques in the digital environment while conducting their scientific research.

Research limitations

Objective limitation: It was represented in the research skills in the digital environment that postgraduate students must be familiar with, and the design of an interactive virtual training environment that allowed them to acquire digital research skills interactively and enabled them to use the skills to search for information in the digital environment properly.

Time limitation: The current study was applied to the chosen sample during the first semester of the year 2020/2021.

Place limitation: The research was applied to postgraduate female students at the Faculty of Education at Najran University.

Research methodology

The descriptive approach was used in reviewing the research literature and related previous studies. It was also used to build and process the measurement tools.

The experimental method was used by employing the quasi-experimental design with a single group in the experimental treatment to measure the impact of the virtual environment on the development of research skills among postgraduate students.

Research Variables

a. The independent variable: The virtual training environment.

b. The dependent variables:

The cognitive aspect of digital research skills among postgraduate female students at Najran University.

The performance aspect of digital research skills among postgraduate female students at Najran University.

Research Hypotheses

1) There are statistically significant differences between the mean scores of the pre and post-application of the achievement test related to measuring cognitive aspects in favour of the post-application of digital research skills at the significance level ($\alpha \leq 0.01$).

2). There are statistically significant differences between the mean scores of the pre and post-application of the observation card related to measuring the performance aspects in favour of the post-application of digital research skills at the significance level ($\alpha \leq 0.01$).

Tools

- An achievement test to measure the cognitive aspects of digital research skills among female postgraduate students at the Faculty of Education.
- An observation card to measure the performance skills of digital research skills among postgraduate female students at the Faculty of Education.

Population and Sample

The research community was postgraduate students at Najran University, and the sample was a randomly selected group of female postgraduate students at the Faculty of Education in Najran University.

Research Terminologies

Skill:It is defined procedurally as the student's ability to perform the basics of research in

digital resources on the website of the digital library easily, quickly and accurately. It is measured by the score obtained in the observation card that has been prepared for this purpose.

Digital research skills: It is defined procedurally in the current research as the researcher's ability to search in various digital sources quickly and accurately.

Virtual Training Environment: The researcher defines it procedurally as a training environment designed by the researcher using free interactive software to train the research sample on the skills required synchronously and asynchronously.

Postgraduate female students: These students are defined procedurally as female students who are systematically registered in the academic and professional Master's programs at the Faculty of Education in the disciplines of (curricula and teaching methods - special education - kindergarten - educational technologies), at Najran University

Research Procedures:

First: Preparing a list of digital research skills needed for postgraduate female students at the Faculty of Education at Najran University according to the following steps:

- Digital research skills were determined by reviewing the literature and previous studies in the field of e-learning and training techniques that dealt with research skills in the digital environment. Accordingly - the list of skills was prepared in its initial form and presented to a group of arbitrators to express their opinions on its suitability to measure what it was developed for. This tool was modified according to what all arbitrators agreed upon, including deletion, addition, and paraphrasing of some items, then it was prepared in its final form.
- The reliability of the list was estimated by measuring the coefficient of agreement between the arbitrators on the items of the list, and the percentage of the agreement reached (91%).

Second: Preparing the research tools

a) **Achievement Test**: The objective of the achievement test is to measure the cognitive aspects of digital research skills. *Type of test, is objective, and it was designed according to the standards of this type of test.* The test specification table was determined according to the first four levels of Bloom's classification for the cognitive domain (remembering, understanding, application, and analysis). The test instructions were placed on the virtual platform and then presented to a group of specialists to express their opinions about it before the actual application to know its apparent validity. Everyone confirmed that it is of a high degree of validity. Reliability and validity coefficients were calculated through Cronbach's alpha equation, which was estimated by (0.88), this means trusting the results that will be reached through it.

Test score estimation: A score was assigned to each question and the total scores were (60) distributed over the questions according to the relative weight of each topic of the training content, the type of questions are true and false and multiple-choice questions. The test was applied to an exploratory sample that consisted of (6) students, and the test time was determined by calculating the average time of the exploratory sample performance.

b) **Observation Card**: Its main objective was determined, which included measuring the performance of postgraduate female students at the Faculty of Education for digital research skills before and after training in the virtual environment. The observation card was prepared in its initial form in light of the list of skills to be developed and trained on by converting them in a form of performance indicators formulated to be clear, simple, short, accurate and representative for the required skill and can be observed and measured easily. Then they were presented to a group of arbitrators to check the apparent validity regarding them. The performance indicators were modified according to what all arbitrators agreed on by deleting some skills and reformulating others, and then it was prepared in its final image.

To measure the validity and reliability of the observation card, Cooper's equation was used by

the multiplicity of observers and their agreement upon the performance of the same student, and the agreement coefficient was 88%. It was a percentage that fulfilled the purpose and confirmed the reliability and validity of the tool to measure the required skills.

Third: Designing the virtual training environment

The researcher relied on Al-Jazzar model (2014) to build and design the interactive training environment. This model was chosen due to its characteristics in terms of flexibility and ease of application of its steps. The model was analyzed, and some steps were modified, and some others were deleted according to what the current research environment required based on the following steps and phases.

1. The analysis phase

- Preparing a list of standards for designing the virtual training environment by reviewing the literature related to the design of virtual electronic environments.
- Defining the general and procedural goals for designing the virtual training environment.
- The list was presented to a group of specialists in the field of educational technology and educational design to express their opinions about its relevance and the linkage of standards with performance indicators and goals to be achieved, and it was modified according to what everyone agreed on.
- Analysis of the characteristics of learners who are Master's students at the Faculty of Education in different programs (curricula and teaching methods - special education - kindergarten - educational technologies). They must have the ability to use computers and the Internet for training purposes, and they must have the desire to learn and acquire the skills of searching for information in the digital environment.
- Determining the training needs of the students and defining the skills to be trained (previously mentioned while presenting the research problem by conducting unstructured interviews).
- Analysis of the available digital resources: Edmodo platform had been identified as a system for managing the virtual learning environment since the platform is free and requires only registration to be able to join the classroom. This platform also allows the possibility of tracking trainees, creating online content and uploading all content forms (texts, photos, and videos). It also allows creating files to save and organize content to enable the trainees to easily retrieve it. In addition, it contains a set of synchronous and asynchronous communication tools and allows creating electronic tests and activities, monitoring and analysis of grades, adding comments, and answering trainees' questions and inquiries.
- Requirements Determination: Training in the virtual environment requires personal computers for all students and the availability of Internet service which facilitates the attendance and follow-up of the content explanation to perform the required digital research skills and communicate and interact with the content.

2. The design phase

In this phase, the virtual training environment was clarified and how to use it through:

- Formulating procedural training objectives in a virtual training environment based on training needs and content.
- Determining the content elements to be trained and gathering them in learning units, where four units were identified as the following:
  A. Basic information about digital information sources and the basics for searching within them.
  B. Basic information on how to search in digital information sources.
  C. Research techniques in digital information sources.
  D. Research skills in digital library & databases such as (Google scholar, Research Gate, and Eric).
- Selecting the educational media that was related to the content (photos, videos, and various files).
- Assessment methods design: they included measurement tools design (achievement test

and observation card) whose design procedures were clarified in the research tools.

- Determining the trainees' roles and allowing interaction between them and the trainer through participatory and individual activities.
- Determining the navigation, surfing, and interactive interfaces.
- Determining the method that can be used by trainees to join the learning system and supporting them by sending the virtual class code of the training program and allowing them to join the class.
- Identifying tools for synchronous and asynchronous communication with trainees within the learning management system (Edmodo) inside and outside chat rooms through WhatsApp groups and e-mail to provide immediate support to all trainees.

3. The production and construction phase

- Converting the learning media elements into digital forms using special programs and uploading them to the virtual training environment, storing, and organizing them in the form of sequential units, and linking the platform's services to Google accounts for easy access to content and uploading it from Google Drive.
- Registering the trainees: registration required creating an account for each trainee and keeping the login data on the platform and this had been clarified to them.
- Availability of discussion forums and the creation of interactive groups.
- Determining feedback methods to ensure that the virtual environment was suitable for acquiring the required skills.
- Determining the final form of the virtual environment and presenting it to a group of colleagues and specialists. All the needed steps to finish the modification process was done, then it was initially tested, and the students were trained on how to use it before the actual application.

4. The evaluation phase:

This phase included the following:

- Conducting the formative assessment and evaluating the virtual training environment by specialists to determine the components of the training environment and ensure its readiness. The initial form was tested by an exploratory sample of users to adjust the research tools and ensure clarity of the objectives and content of the virtual training environment in preparation for their application.
- Final evaluation: to evaluate the effectiveness of the virtual training environment design after its application to the research sample to obtain and analyze the results.

5. The usage phase:

- Actual use and full implementation of training within the virtual environment after ensuring that all elements of the virtual environment were controlled and ready to be used.
- Continuous follow-up and support for trainees during the entire training period, and continuous development of the training environment.

Experimentation Procedures:

After the virtual training environment had been prepared according to the previous steps. The pre-application of measurement tools (achievement test & observation card) was conducted. The application was implemented on postgraduate female students at the Faculty of Education in the first semester of the academic year 2020/2021. During the training period, all trainees showed great interest in the training program because they realize its importance to them. They also showed great interaction with the content and the virtual environment, and they were cooperative and supportive to each other in the applications and activities required from them during the training.

Statistical Methods:

The Statistical Package for Educational and Psychological Sciences (SPSS) program was used to process the data and verify the validity of hypotheses. T. test was used for correlated samples and the one sample. Blake's Modified Gain Ratio Equation was used to calculate the effect of the independent variable (virtual training environment) on the dependent variables (the cognitive and performance aspects of digital research skills).

Results

After completing the training program application and collecting the required data, then it was analyzed using the statistical methods specified in the SPSS program to verify the following hypotheses:

First: The results of the achievement test to measure the development of the cognitive aspects of digital research skills to verify the first hypothesis "There are statistically significant differences between the mean scores of the pre and post-application of achievement test in favour of the post-application of digital research skills at the significance level ($\alpha \leq 0.01$)". T-test of the correlated samples was used to find out the significance of differences between the average gains of the sample members in the two applications to find out the effect size.

Table (1): T. test of the research sample in the pre and post-application of the achievement test

Application	N	Mean	Std.	Free	T	Sig.
Pre	34	13.43	1.17	33	41.15	0.00
Post		55.80	3.00			

Table (1) showed that the mean in the pre-measurement of the experimental group was (13.43) out of the total score (60) degrees, and after they were subjected to skills training in the virtual environment, the (T) value was (41.15) and the significance value was estimated by (0.00). These values indicated that the differences were statistically significant in favour of the post-test, and this confirmed the acceptance of the first research hypothesis. Blake equation was used to calculate the modified gain ratio as shown in the following table.

Table (2): The averages of the pre-and post-achievement test and the degree of Blake's modified gain ratio:

Application	Test degree	Mean	Modified Gain Ratio
Pre	60	13.43	1.62
Post		55.80	

Table (2) showed that the modified gain ratio for achievement in the cognitive aspects of digital research skills was (1.62), which was greater than the ratio set by Blake (1966.99) with a value of (1.2) as a minimum. He explained that this ratio ranged between (1.2 - 2). The previous ratios indicated the effectiveness of virtual training environment design in acquiring digital research skills among postgraduate female students at the Faculty of Education.

To identify the effect size of the virtual environment on the acquisition of cognitive aspects of digital research skills, the Eta-squared ($\eta 2$) was calculated as shown in the following table:

Table (3): The effect size ($\eta 2$) of the virtual environment on the development of the cognitive aspects of digital research skills

Total degree	T	Free	($\eta 2$) Effect Size
80	41.15	33	0.971

Table (3) showed that the Eta-squared ($\eta 2$) achieved a value of effect size estimated by (0.97.2) which was greater than the value determined as the minimum significant effect (0.80). The achieved value indicated that 97% of the participants who attended the training were able to achieve the desired effect. This can be attributed to the influence of the independent variable on the dependent variable, which means the superiority of the performance of the experimental group and the effectiveness of using the virtual training environment on developing digital research skills.

Second: To verify the validity of the second hypothesis that stated, "There are statistically significant differences between the mean scores of the pre and post-application of the observation card in favour of the post-application of digital research skills at the significance level ($\alpha \leq 0.01$)". T-test of the correlated samples was used to find out the significance of the differences between the averages of observation card application to measure the performance aspects of digital research skills, as shown in the following table:

Table (4): T. test of the research sample in the pre and post-application of the observation test

Application	N	Mean	Std.	Free	T	Sig.
Pre	34	15.4	7.19	33	51.8	0.003
Post		75.6	10.6			

Table (4) showed that the mean in the pre-measurement of the experimental group was (7.19) out of the total score of (80) degrees. After students had been subjected to skills training in the virtual environment, the (t) value reached (51.8) and the significance value was estimated by

(0.003). These values indicate that the differences are statistically significant in favour of the post-application of digital research skills, and this confirmed the acceptance of the second research hypothesis. Blake equation was used to calculate the modified gain ratio as shown in the following table:

Table (5): The averages of the pre and post-application of the observation card and the degree of Blake's modified gain ratio

Application	Test degree	Mean	Modified Gain Ratio
Pre	80	15.4	1.69
Post		75.6	

Table (5) showed that the modified gain ratio for achievement in the cognitive aspects of digital research skills was (1.69), which was greater than the ratio set by Blake (1966.99) with a value estimated by (1.2) as a minimum. He explained that this ratio ranged between (1.2-2). The previous ratios indicate the effectiveness of the design of the virtual training environment in helping postgraduate female students at the Faculty of Education acquire digital research skills.

To identify the effect size of the virtual environment on the acquisition of cognitive aspects of digital research skills, Eta-squared (η2) was calculated as shown in the following table:

Table (6): The effect size (η2) of the virtual environment on the development of the cognitive aspects of digital research skills

Total Degree	T	Free	(η2) Effect Size
80	51.8	33	0.976

Table (6) showed that the Eta-squared (η2) achieved a value of (0.976). This value indicated that 97.5 % of the participants who attended the training were able to achieve the desired effect; this can be attributed to the influence of the independent variable on the dependent variable, which means the superiority of the performance of the experimental group and the effectiveness of using the virtual training environment on developing digital research skills.

Discussion

The previous results have shown that designing a virtual training environment according to online educational design standards for virtual environments and its use in online training has an effective impact on developing digital research skills. This result goes in harmony with the results of previous studies represented in Abu El-Ezz (2016), Daw & Al-Musrati (2020), Hung (2004), Khasana (2021), Nasr Eldin (2019) and Al-Najdi & Al-Qarani (2018). All these studies confirmed the effectiveness of various online training environments in helping students acquire the necessary skills and knowledge.

This might be attributed to the adoption of a flexible virtual training environment with clear steps and stages. Moreover, the training environment enjoyed high levels of coordination, organization, and interdependence among its elements. In addition to organizing the content in the form of flexible models that facilitate the transition within them, as well as facilitating the transition from one unit to another, which helped familiarize students with the cognitive aspects and facilitated the practice of the performance aspects of the required skills.

The training environment was designed according to the actual needs and characteristics of the trainees. The content was diverse and was designed using attractive forms, including different media (images, texts, videos, graphics, etc.) to match the individual differences among the trainees, which had an impact on the interaction of the trainees with the content, attracting their attention and increasing their motivation to learn.

In addition, the electronic activities accompanying the training had a role in the interaction of the trainees, as they were designed in flexible ways based on self, cooperative, and participatory learning approaches, which had a great impact on motivating the trainees to learn and benefit from each other's experiences in acquiring performance skills. The immediate and subsequent feedback that was provided throughout the training period in general and during the performance of activities and assignments particularly had a significant impact on aquiring digital research skills and practicing them in a better way, as it was noticed that performance was improved each time, which increased their self-confidence.

Recommendations:

Based on the results reached, the researcher recommended the following:

- Adopting virtual training as one of the training methods in the current digitization age among postgraduate students to acquire other skills.
- Designing a virtual learning environment according to the necessary standards and students' needs.
- Using digital environments in the required research processes to conduct various scientific researches.

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