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RESEARCH ARTICLE

IMPACT OF BLENDED LEARNING IN DEVELOPING THE SKILLS OF USING VIRTUAL MATH LABS AMONG POSTGRADUATE FEMALE STUDENTS AT THE COLLEGE OF EDUCATION IN RIYADH.

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Abstract

The current research aimed at investigating the impact of blended learning on developing the skills of using virtual math labs among postgraduate female students at the College of Education, King Saud University, Riyadh. The researchers used the quasi-experimental design, and the research sample consisted of (16) female postgraduate (MA and Ph.D.) students specializing in curriculum and teaching methods of mathematics. The research followed the experimental and descriptive methods. The research tool and measure consisted of a performance test and a note card (prepared by the researchers). The results of the study showed that there are statistically significant differences between the pre and post test scores of experimental group in favor of the post test scores. The study concluded with some recommendations and suggestions in the light of the study results.

Introduction:-

The educational process has been influenced by the rapid changes in technology that have made a significant shift in it and have made it acquire many of the advanced advantages regarding the offering and giving process by teacher and learner. The National Commission for Excellence in Education (NCEE) has raised the need to enhance curriculum content starting from the classroom teacher. The National Council of Teachers of Mathematics (NCTM, 2000) also focused on mathematics concepts rather than practice by heart and encouraged the teacher to acquire modern strategies that indicate giving students real opportunities to solve mathematics problems through situations from real life.

By the 21st century, educators began to search for suitable digital applications and they sought to provide it for students at all levels, especially postgraduate students at collage of education and inform them of the technological innovation and preparing them for the future teaching profession, which made them face a great challenge which is to search for everything related to the specialty and the exact field and serves the benefit of everyone involved in the educational process. The radical change in the role of the teacher in this age requires him to perform many tasks of a supervisory, consultative, and cooperative style, as he is the planner and designer of the educational situations and the lessons (electronic and traditional).

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The concept of blended learning emerged as an evolution of e-learning as it combines e-learning and traditional classroom learning, as well as linking the practical and theoretical aspects through an interactive learning environment based on lectures and scientific attitudes, as it takes several forms and patterns of learning ranging between synchronous e-learning (direct live e-learning such as virtual classes and electronic exercises) and asynchronous e-learning, which allows the learner to control the speed of learning such as electronic pages, educational training modules, tests, and simulation (Lin, Tseng & Chiang, 2016) and this blending received great satisfaction from the university students because of the flexibility and interaction in learning. Gray (2006) emphasized that blended learning represents a realistic scientific solution. Alsaai, Alkaabi, and Almuftah (2011) conducted a study aimed at revealing the impact of an e-learning environment based on blended learning on the achievement of Qatar University students and their attitudes towards the use of e-learning. The study concluded many results including the existence of a difference in the attitude scale for the blended e-learning. Linn, Tseng, and Chiang (2016) study aimed at identifying the effect of blended learning on mathematics teaching and it concluded that with the result that blended learning had a positive effect on students' attitudes toward learning through the Model Mathematics Platform after the blended learning experience.

The virtual labs are one of the tools that make the practical aspects taught by students in science, chemistry, and mathematics more enjoyable and stimulating and they reduce learning time because it contains tools to support the experiment such as graphs, and analysis in the movement of the learner on the form or on the experiment and they have an important benefit in science as it eliminated inadequate laboratory equipment, especially precious or unavailable ones (Alqadri, 2018).

The most scientific material related to technology, whether it is cognitive or skillful is mathematics, as it is considered the language of the universe and the second national language. Many students in various educational stages as referred by Stotz (2018) and Korenova (2014) that many students face problems in accepting them, either because of the lack of understanding of its laws or sense of its importance or is dominated by abstraction or perhaps the prevailing belief since childhood that it is characterized by difficulty and rigidity, therefore, the researcher found that those who work to change these misconceptions in students is the teacher by possessing various means and his learning about the modern strategies that make the teaching and learning process characterized by the nature of participation and testing to know the changes that can be made to the geometric shapes according to a certain number of steps.

The Research Problem and Questions

The problem of the current research came from the experience of the researcher in teaching the course "Computer Applications", which she gives in the beginning of each semester each year, as she found that students do not have the skill to use a lot of electronic programs, especially those that relate to mathematics, as most of them rely on PowerPoint presentations and some applications that run quizzes after completing the lesson. A number of previous studies have also emphasized the necessity of activating the virtual labs in mathematics, such as the studies of (Omar, 2013) and (Cheong & Koh, 2018). In addition to the recommendations of the conferences that focus on activating the virtual labs especially in science and mathematics, which is one of the objectives of the project of developing mathematics and natural sciences in the Kingdom of Saudi Arabia in activating the school laboratories and linking them to technology (Alshaya'a and Abdul Hamid, 2011).

The search problem can be answered through the following questions:

1. What are the needed skills to activate the virtual math labs among postgraduate female students?
2. What is the proposed model for the blended learning-based training program in the development of virtual math lab skills among postgraduate female students at the college of education?
3. What is the effect of the blended learning-based training program in the development of virtual math lab skills among postgraduate female students at the college of education?

Research Importance: It is hoped that the current research will benefit the following categories:

Female Teachers:

in reliance on technological innovations in the educational process within the classroom, which works to attract the learner and make him/her active and effective while acquiring concepts and mathematical skills.

People in charge of the educational process:

in providing training programs and raising the digital competence of the teacher.

Faculty Member:
in searching for the needs of the student to serve the educational field and achieve the goal of professional development after graduating from the university.

Programmers:
in the development and improvement of software by contracting with companies interested in education and seeking services that will contribute to raising the technical product to achieve the educational benefit for both teacher and student.

Research Objectives:-

The current research aimed at identifying the skills needed to activate the virtual math labs among postgraduate female students and presenting a proposed model for the training program based on the blended learning in the development of virtual math lab skills among the postgraduate students in the college of education, which will be used to detect the impact of this program in development of virtual math labs skills among postgraduate female students.

Research delimitations:
The search was carried out within the following delimitations:

1. **Objective delimitations:** Current research is delimited to the skills of using virtual math labs "Crocodile Mathematics".
2. **Time delimitations:** The research was applied in the second semester of the academic year 1439-1440H.
3. **Place delimitations:** The research was applied at King Saud University in Riyadh.
4. **Human delimitations:** Postgraduate female students in the Masters and PhD degrees.

Definition of the important terms:
Blended Learning:
is defined as "the use of technological innovations in the training of postgraduate female students by combining the traditional and modern methods to suit the educational situation and meet the needs of the program content and activities to create interaction and exchange of views between the faculty member and student at the actual meeting time in the classroom."

Virtual Math Labs:
are interactive interface that allows the user the freedom to add many mathematical ready models and be able to create new models and control them through the control circuits provided by the program to see the changes they have made, which contributes to the development of thinking skills and access to mathematical conclusions through the activities available in the program."

Theoretical Framework and Previous Studies:
It is divided into two axes as follows:

The first axis: Blended Learning
Blended Learning Concept:
The term "blended learning" emerged in the first half of the last century, as it was seen as "old concept with a new name" depending on the nature of the blending or integrating. Gecer (2014) stated that it is a flexible approach that helps in the development of instructional technology both in classroom environments and in virtual classrooms on the Web (synchronously or asynchronously). Guido (2019) stated that it is a term used to describe everyone's process between online learning tools and the traditional way. It is more than just adding computers or tablets to the classroom, but changing the way teachers and students interact with the learning process. Hassan (2010), also, stated that it is a way to help the learner achieve the desired learning outcomes. (Bottge, et al., 2014) stated that it is an educational shift that makes learning more productive by providing teachers with a variety of tools contribute to the time and effort in addition to taking into account the individual differences between learners so that they have the opportunity to learn according to its ability and capabilities and meet their needs. Abdul Maqsoud (2017) pointed out that blended learning can include the following elements: traditional classes, virtualization, e-mail, interactive video, and conversations electronically outside or inside the classroom to include guidance from the teacher.

Blended Learning Forms and Strategies:
in the light of the previous literature and studies on the importance of blended learning in educational process, especially in the field of providing the learner with various skills, the blended learning took several forms, as reported by Abdul Basset (2007), Tankha (2011), Denisco (2014), Javed, Deepak & Dhiraj (2016) as follows:

1. Integration of networked learning (open) through internet technologies and non-networked learning (closed) through traditional classroom attitudes.
2. Individualized blended learning in which the learner is the dominant and controller based on his speed, and it corresponds to collaborative learning, which contains a number of trainees in which they share the varied knowledge and experience among them.
3. Integration of unregulated learning (without an educational program that is no longer organized or planned in a sequential and interrelated manner) and regulated learning (It appears in the modules and is designed and implemented in a specific style).
4. Integration of special content (prepared as needed) with ready-made content. This is provided by organizations where training is done on demand and software is provided with a number of live experiences in the classroom via the Internet or integrated with created educational content to achieve greater flexibility in developing existing content and improving it at the lowest cost.
5. Integration of work and learning: This is reflected in the training institutions whose work is related to the quality of the courses offered and the quality and accessibility of the educational content of the largest segment of learners and researchers in various fields of education and training.

Blended Learning Challenges: Despite the unique advantages of blended learning, it has faced many obstacles in application for many reasons (Selim, 2010), (Marunic, 2015): lack of computer experience that should be possessed by both teacher and learner, the need of computer for periodic maintenance both at home or in schools and universities, the availability of high-speed internet access allows the learner to download multimedia or access to virtual halls, lack of feedback needed by the learner while learning through the electronic part, difficulties with the evaluation and the monitoring system by the instructor or teacher, and the focus on the cognitive and skill aspect and the neglect of the emotional aspect of the learner's face-to-face contact will reduce the level of student participation in the training activities offered to them through the electronic medium.

The second axis: Virtual Math Labs
Role of teacher and learner in virtual math labs:
The teacher takes an important role in the virtual math lab whether it is employed by the production of an international company or he built it according to the needs with his students. Tuysuz (2010) and Tatli & Ayas (2012) stated that the teacher should be a researcher in network programming languages and web design with the ability to search e-bookstores. He has to have a strong background in Internet use skills, be a coordinator for collaborative learning among learners, be a mentor and facilitator of the education process and create a safe and attractive learning environment that contributes to communicating the concepts and skills of the learner, and be a good manager of online sessions, making it easier for students to communicate with each other. The role of the learner is to take responsibility for learning and interacting with what he learns and to do self-assessment through self-tests, as he must be a participant, innovative, creative, and able to communicate and speak proving his point of view, argument, and logical evidence.

Theoretical frameworks for research:
The constructivist theory is based on learners' knowledge and self-evaluation as Kdivis pointed out that the researcher and learner need a coherent, realistic, and structural thinking based on good educational practices (Gordon, 2009) as the educational activities given by the teacher within or outside the classroom make the constructional thought of the learner composed in a sequential and organized manner as a result of the connection between theory and practice (Widodo, Maria, & Fitriani, 2017).

Research Hypothesis:
"There are no statistically significant differences ($\alpha \leq 0.05$) between the scores of pre and post tests of the experimental group after using a training program based on the blended learning in developing the virtual math lab skills."

Methodology and procedures:-

Research Design:
According to the nature of the present research, experimental method is considered as the appropriate method to accomplish the objectives of the research. Therefore, a single group- pre and post test quasi-experimental design was used to investigate the effectiveness of the independent variable (blended learning) on the dependent variable (Virtual Math Lab skills).

Research Community:
The research community is composed of all postgraduate female students at the college of education at King Saud University in Riyadh, Saudi Arabia.

Research Sample:
Purposive sampling technique was adopted to select sample for the present research. The sample consisted of (16) postgraduate female students selected from the department of curriculum and teaching methods of mathematics, college of education at King Saud University in Riyadh, Saudi Arabia. The sample selected was grouped into (12) MA students and (4) Ph.D. students.

Intervention Program:
In order to obtain the objective of the present research, a blended learning-based training program was prepared. After reviewing the literature and previous studies related to the subject of the research, the researchers followed the model of educational design (ADDIE) because of its simplicity, flexibility, and interaction between the five elements and they are as follows:

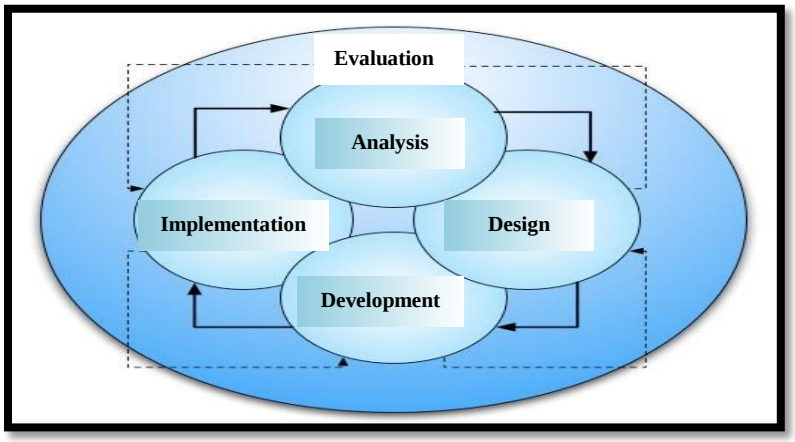

Figure 1:-General Model of Educational Design (ADDIE)

Analysis Stage:
Identifying the characteristics of learners:
convergence in the age of female students and their possessing the minimum skills of using the computer.

Identifying educational needs:
in employing the virtual math labs well and effectively.

List of skills:
The researcher conducted a unstructured interview with some of the supervisors and teachers of mathematics in different educational stages about the recognition from their point of view of what skills should be provided in the mathematical virtual labs. Also, after reviewing the literature and previous studies that dealt with the virtual math labs, the researchers prepared the list of skills (14) master skill, each containing a set of sub-skills, and was presented in its initial form to the arbitrators in order to express opinion and the necessary amendments were made in the light of the opinion of the arbitrators (Appendix 1). Thus, the first question of the research questions was answered: "What are the needed skills to activate the virtual math labs among postgraduate female students"?

Analysis of resources and potentials:
studying the reality of resources and educational resources available and limiting the obstacles to be overcome (in computer lab, a computer is allocated to each student separately).

Design Stage:
setting educational objectives (program's public and private)**,** the organization of elements of educational content in a sequential and interrelated manner, the design of educational activities and the feedback strategy, the building of the teacher's guide and the learner's guide, and finally the actual design of the interactive medium to be presented to the learner or trainee.

Development Stage:
at this stage, the materials and educational media that have been identified and selected will be acquired through the acquisition of the available, modifying the available, or new production**.**

Implementation Stage:
ensuring that all sources used in the application process are available.

Evaluation Stage:
During the development of multimedia (educational videos), the researcher conducted the experiment and editing process to ensure the integrity of the sequence of information and its interconnection during the presentation of the slides through the video as well as clarity of sound, and after the completion, it was presented to a group of arbitrators in the field of education techniques and computer systems Appendix (4) to arbitrate it and show their observations. The arbitrators pointed to some observations and the amendments were made in terms of the modification in some colors of the screensavers and the size of the font size, and the researcher adjusted the required according to the views of the arbitrators.

Thus, the second question of the research questions was answered:
What is the proposed model for the blended learning-based training program in the development of virtual math lab skills among postgraduate female students at the college of education?

Research instrument:
The instrument of the present research is a note card prepared by the researchers to measure female postgraduate students' skills of using virtual math labs at the college of education. The phrases of the instrument were prepared in accordance with the usage of Likert scale, considering how easy and common it is to apply it on respondents. The researchers used the triple scale which encompasses three responses as follows: Mastered, which means that: the respondent was capable of performing the skill without getting help, and then the respondent is given three scores. Quite mastered, which means that: the respondent was capable of performing the skill using some help, and then the respondent is given two scores. Did not master, which means that: the respondent wasn't capable of performing the skill, and then the respondent is given one score. The instrument was prepared in accordance with the following steps:

Identifying the objective of the note card:
The note card aimed to measure how well female postgraduate students at the college of education performed virtual math lab skills after applying empirical therapy on the research population, the scale included (14) major skills.

Note card scoring:
The note card aims to identify how well female postgraduate students at the college of education performed virtual math lab skills, therefore quantification is required to outline nominal weight for each level of response to the phrases of the note card.

Based on the foregoing, levels of response were distributed on the phrases of the note card and its corresponding weights in accordance with table (1) which was outlined below:
Table 1:-the distribution of levels of response on the skills of the note card and its corresponding weights

Weight according to performance	Three levels of performance

	Mastered	Quite mastered	Not-mastered
	3	2	1

According to both the previous three variable Gradient and the number of phrases of each axis of the fourteen mentioned note card axes, maximum and minimum possible score for all respondents ranged between (70-210) degrees, and table (2) outlines both maximum and minimum score for each axis of the note card axes:

Table 2:-the distribution of the note card axes according to maximum and minimum score for each axis

Sr.	Axis	Axis Skills No.	Maximum score	Minimum score
1	Virtual math lab installing and operating skills	3	9	3
2	Main menu components recognizing skills	5	15	5
3	Mathematical sections menu opening skills	9	27	9
4	Mathematical model (angles) creating skills	5	15	5
5	Mathematical model (area) creating skills	6	18	6
6	Mathematical model (circles) creating skills	4	12	4
7	Mathematical model (diagrams and coordinates) creating skills	9	27	9
8	Mathematical model (numbers) creating skills	2	6	2
9	Mathematical model (similar shapes) creating skills	2	6	2
10	Mathematical model (asymmetry) creating skills	3	9	3
11	Mathematical model (conversions) creating skills	4	12	4
12	Mathematical model (triangle) creating skills	8	24	8
13	Mathematical model (vectors) creating skills	5	15	5
14	Mathematical area controlling skills	5	15	5
Total		70	210	70

Validity and reliability of the note card:

Validity of the note card:

The note card was presented in its initial form to a group of mathematic teaching specialists –appendix (1) - in order to verify its validity, so that these specialists can manage to give their opinions toward the following:

1. The compatibility of the phrases to measure virtual math lab skills of the female postgraduate students at the college of education.
2. Modeling of language and the clarity of the phrases.
3. Validity of the phrases to measure virtual math lab skills of the female postgraduate students at the college of education.

In the light of the arbitrator's instructions, the researchers have re-modeled the language of some phrases that the arbitrators agreed on the necessity of them being re-modeled, and the fact that the arbitrators approved the validity of the phrases after modification is considered as face validity of the scale.

After conducting the modifications proposed by the arbitrators, the note card was applied in its initial form on a sample that included (10) female students who belong to the same research population. The current sample is different from the sample that the experiment was applied on.

Inter-correlation validity:

inter-correlation validity of the note card was examined through the calculation of Pearson correlation coefficient for each degree of every axis of the scale with total score, and the results were as follows:

Table 3:-Pearson correlation coefficients between the degrees of each axis and total score of the note card

Axis	Correlation coefficient
Virtual math lab installing and operating skills	**0.874
Main menu components recognizing skills	**0.933
Mathematical sections menu opening skills	**0.895
Mathematical model (angles) creating skills	**0.898

Mathematical model (area) creating skills	**0.903
Mathematical model (circles) creating skills	**0.919
Mathematical model (diagrams and coordinates) creating skills	**0.913
Mathematical model (numbers) creating skills	**0.856
Mathematical model (similar shapes) creating skills	**0.835
Mathematical model (asymmetry) creating skills	**0.878
Mathematical model (conversions) creating skills	**0.841
Mathematical model (triangle) creating skills	**0.722
Mathematical model (vectors) creating skills	**0.891
Mathematical area controlling skills	**0.879

** statistically significant at level 0.01

As outline in table (2) it's apparent that the values of correlation coefficients for all fourteen axes of the note card with total score were high and ranged between (0.933 – 0.722). The values were all statistically significant at level (0.01) which details high degree of inter-correlation validity of the note card.

Internal Consistency Reliability:
internal consistency of the note card was examined using the methods of Alpha Cronbach's coefficient and Split-half coefficient to verify the reliability of the note card.

Table 4:-values of reliability coefficients of the note card using Alpha Cronbach's and Split-half reliability methods

Values of reliability coefficient		
Alpha Cronbach's	Split-half reliability	
0.947	First half coefficient	0.897
	Second half coefficient	0.917
	Spearman-brown	0.877
	Gettman	0.875

As outlined in table (4) it's apparent that the value of reliability coefficient using Alpha Cronbach's method was (0.947), and the values of first half reliability and second half reliability using split-half reliability method were (0.897) and (0.917) respectively, whereas the values of reliability using Spearman-Brown and Gettman methods were (0.877) and (0.875) respectively. In accordance with what has been proposed of psychometric measures of the note card after conducting the exploratory experiment it becomes apparent that the note card has a high degree of validity and reliability, which qualifies the note card to be used for the research purposes.

Statistical methods used in the research:
(Excel) spreadsheet software program has been used in order to meet the research goals and objectives, and also to dump and analyze all collected data, the validity of data was then verified and the data itself was reviewed, then data was entered and analyzed using Statistical Package for Social Sciences (SPSS) software program, and the following statistical methods were used:

Wilcoxon signed rank test to identify whether there were any statistically significant differences between the scores of the experimental group within both prior and post applications or not.

Presentation and discussion of research results
Testing the hypothesis stating that "There are no statistically significant differences ($\alpha \leq 0.05$) between the scores of pre and post tests of the experimental group after using a training program based on blended learning in developing the virtual math lab skills".

In order to test this hypothesis, Wilcoxon signed-rank test was used to find out if there are any statistical significant differences between the scores of pre and post tests of the experimental group. Table (5) clarifies the Wilcoxon values and level of significance of Pre and Post test for each domain.

Table 5:-Wilcoxon –values and level of significance of Pre and Post test scores

Axis	Variable	N	Mean rank	Sum of ranks	(Z) value	Sig.
Virtual math lab installing and operating skills	Negative ranks	-	0.00	0.00	0.00	1.00
	Positive ranks	16	0.00	0.00		
Main menu components recognizing skills	Negative ranks	-	0.00	0.00	-3.530	*0.000
	Positive ranks	16	8.50	136.00		
Mathematical sections menu opening skills	Negative ranks	-	0.00	0.00	-3.528	*0.000
	Positive ranks	16	8.50	136.00		
Mathematical model (angles) creating skills	Negative ranks	-	0.00	0.00	-3.544	*0.000
	Positive ranks	16	8.50	136.00		
Mathematical model (area) creating skills	Negative ranks	-	0.00	0.00	-4.537	*0.000
	Positive ranks	16	8.50	136.00		
Mathematical model (circles) creating skills	Negative ranks	-	0.00	0.00	-4.548	*0.000
	Positive ranks	16	8.50	136.00		
Mathematical model (diagrams and coordinates) creating skills	Negative ranks	-	0.00	0.00	-4.553	*0.000
	Positive ranks	16	8.50	136.00		
Mathematical model (numbers) creating skills	Negative ranks	-	0.00	0.00	-4.581	*0.000
	Positive ranks	16	8.50	136.00		
Mathematical model (similar shapes) creating skills	Negative ranks	-	0.00	0.00	-4.536	*0.000
	Positive ranks	16	8.50	136.00		
Mathematical model (asymmetry) creating skills	Negative ranks	-	0.00	0.00	-4.574	*0.000
	Positive ranks	16	8.50	136.00		
Mathematical model (conversions) creating skills	Negative ranks	-	0.00	0.00	-4.588	*0.000
	Positive ranks	16	8.50	136.00		
Mathematical model (triangle) creating skills	Negative ranks	-	0.00	0.00	-4.533	*0.000
	Positive ranks	16	8.50	136.00		
Mathematical model (vectors) creating skills	Negative ranks	-	0.00	0.00	-4.532	*0.000
	Positive ranks	16	8.50	136.00		
Mathematical area controlling skills	Negative ranks	-	0.00	0.00	-4.537	*0.000
	Positive ranks	16	8.50	136.00		
Virtual math lab skills in total	Negative ranks	-	0.00	0.00	-4.520	*0.000
	Positive ranks	16	8.50	136.00		

*Statistically significance at level 0.05

Table (5) outlines the following results:

In the first domain "**virtual math lab installing and operating skills",** the Wilcoxon values (Z-value) is (0.00), and this Z-value is significant at (1.00), which is greater than the significance level of (0.05). Therefore, it is inferred that there is no significant difference in the virtual math lab skills between the pre and post test scores of the experimental group in the domain of virtual math lab installing and operating skills. Hence the stated alternative hypothesis is rejected and the null hypothesis is accepted for this domain.

In the other 13 domains, the values of Wilcoxon test (Z-values) ranges between (-4.588 to -3.528), and all of these Z-value are significant at (0.000), which is considered to be a significant value at level ($\alpha \leq 0.05$). Therefore, it is inferred that there are significant differences in the virtual math labs skills between the pre and post test scores of the experimental group in all these 13 domains. Hence the null hypothesis is rejected and the stated alternative hypothesis is accepted for these 13 domains.

In total **"Virtual math lab skills"**, the Wilcoxon values (Z-value) is (-4.520), and this Z-value is significant at (0.000), which is considered to be a significant value at level ($\alpha \leq 0.05$). Therefore, it is inferred that there are significant differences in the virtual math labs skills between the pre and post test scores of the experimental group in total. Hence, in general, the null hypothesis is rejected and the stated alternative hypothesis is accepted.

This result reveals that the training program based on blended learning has significant effect in developing the skills of using virtual math labs among postgraduate female students at the College of Education, King Saud University, Riyadh.

Discussion:-

Technology has a grand role in presenting any form of scientific content, and using it within the educational process whether inside or outside the classroom, as it simplifies information and smoothly transmit mathematical concepts with ease, and also helps the teacher gain both the character of computational designer and thinker, given the fact that the teacher exerts tireless efforts in creating methods and strategies that contribute to the clarification of concept in such a realistic and tangible manner. Blended learning technology has helped female teachers with the preparation of lessons and courses using virtual math laboratories such as "Crocodile" which is a virtual lab produced and powered by the British company, these virtual math labs have several advantages such as: developing self-learning and innovative thinking principles, as it enables student to design experiments that doesn't exist within the educational curriculum, along with other experiments that surpasses his educational stage, these virtual math labs also present such a distinct pattern regarding assessing the student's level, which encouraged female teachers (female postgraduate students) to both pursue the conduction of lessons and courses in different educational stages and apply these lessons and courses as subject to arbitrage by specialists so that they can check their level of mastering the usage and activation of virtual math labs with their female students.

The results that have been attained in the current research are compatible with both Selim (2010) and ALsaai, ALkaabi, & ALmuftah (2011) studies as they both addressed higher education stage. However, the same results were different from Abdul Maqsoud (2017), Stotz (2018), and Korenova (2014) studies as the three of them addressed the objectives of using blended learning in general education, the researchers further explain that the high attained results after applying the training program are attributed to the blended learning technology and also to the fact that both the development and enhancement of all female students' classroom practices were well received and accepted by them.

The researchers recommend to conduct further experiments that are similar to the current experiment, which should minimize the effort and cost of having meetings between the trainer and trainee as these new experiments would reach a broader base of female teachers as much as possible in different areas, on condition that all courses shall be conducted and prepared by those who possess enough experience and former knowledge regarding how to activate, use, and design different forms of technological innovations.

References:-

1. Abdul Basset, H. (2007): Multidisciplinary Learning: A new strategy for the use of information technology in pre-university education, First International Conference on the Use of Communication Technology for the Development of Pre-University Education Mubarak Education City, 22-24 April.
2. Abdul Maqsoud, H. (2017): Effectiveness of a program based on blended learning using electronic tables in the development of the skills of statistical thinking among students in the preparatory stage, Journal of the Faculty of Education, Port Said University, Issue. 22.
3. Alqadri, Z. (2018): Using Virtual Laboratory in Direct Instruction to Enhance Students" Achievement, International E-Journal of Advances in Education, Vol. IV, Issue 10.
4. ALsaai, A., ALkaabi & AL muftah (2011): Effect of a Blended e-Learning Environment on Students' Achievement and Attitudes toward Using E-Learning in Teaching and Learning at the University Level, International Journal for Research in Education (IJRE) No. 29.
5. Alshaya'a F. & Abdel-Hamid, AN. (2011): Project of Developing Math and Natural Sciences Curricula in Saudi Arabia and Saudi Arabia: Hopes and Challenges, Paper presented to the Fifteenth Scientific Conference (Scientific Education: New Thought for a New Reality), Egypt.
6. Bottge ,B., MA, X,. Gassaway, L., Toland, M. & Butler (2014): Effects of Blended Instructional Models on Math Performance, University of Kentuck, Peabody college of Vanderbilt, Vol. 80, No. 4, pp. 423-437.
7. Cheong, K.H. & Koh, JM. (2018): Integrated Virtual Laboratory in Engineering Mathematics Education: Fourier Theory, Engineering Cluster, Singapore Institute of Technology, Singapore, USA: IEEE
8. Denisco, A. (2014): The Different Faces of Blended Learning, Retrieved 2/4/2019 from: www.DistrictAdministration.com

9. Gecer, A. (2014): Lecturer-Student Communication in Blended Learning Environments, Educational Sciences: Theory & Practice, 13(1) : 362-367.
10. Gordon, M. (2009): Toward a pragmatic discourse of constructivism: Reflections on lessons from practice. Educational studies, 45(1), 39-58
11. Guido, M. (2019): How to Put the Six Blended Learning Models into Action" Examples & Download", Retrieved 12/4/2019 from: https://www.prodigygame.com/blog/six-blended-learning-models-examples-download/
12. Hassan, I. (2010): Blended Learning, Journal of e-Learning, Mansoura University: Issue (5).
13. Javed, Y., Deepak, P. & Dhiraj, B. (2016): The Integration of Multimedia for Online and Blended Learning at the University of the South Pacific, Retrieved 11/4/2019 from: http://oasis.col.org/handle/11599/2499.
14. Korenova, L. (2014): Blended learning in teaching mathematics at primary and secondary school, Conference Paper, this publication at: https://www.researchgate.net/publication/317851421
15. Lin, Ya., Tseng, C. & Chiang, P. (2016): The Effect of Blended Learning in Mathematics Course, EURASIA Journal of Mathematics Science and Technology Education, 13(3):741-770.
16. Marunic, M. Sc. (2015): Challenges of Blended Learning, SCIENTIFIC PROCEEDINGS XXIII INTERNATIONAL SCIENTIFIC-TECHNICAL CONFERENCE "trans & MOTAUTO '15".
17. Omar, D. (2013): The Effect of Using the Virtual Math Teacher in Developing Mathematical Interconnectivity Skills among Fourth Year Elementary School Students in Makkah Al Mukarramah, Master Thesis, Curriculum and Methods of Teaching Mathematics, Faculty of Education, Umm Al Qura University.
18. Selim, T. (2010): Quality Assurance Standards for Education in University Teaching, Arab International Conference for Quality Assurance of Higher Education, Zarqa University.
19. Stotz, M. (2018): Creature Counting: The Effects of Augmented Reality on Perseverance and Early Numeracy Skills Learning Sciences and Technology, Research PhD, Lehigh University.
20. Tankha, P. (2011): Blended Learning Approach in Learning Mathematics, Gyanodaya: The Journal of Progressive Education, Vol 4 No 1.
21. Tatli, Z. & Ayas, A. (2012): Virtual Chemistry Laboratory: Effect of Constructivist Learning Environment, Turkish Online Journal of Distance Education, Volume: 13 Number: 1 Article 12.
22. Tuysuz, C. (2010): The Effect of the Virtual Laboratory on Students' Achievement and Attitude in Chemistry, International Online Journal of Educational Sciences, 2 (1), 37-53.
23. Widodo, A., Maria, R. A. & Fitriani, A. (2017): Constructivist Learning Environment During Virtual and Real Laboratory Activities. Biosaintifika: Journal of Biology & Biology Education, 9(1), 11-18.