International Journal of Instructional Technology and Educational Studies (IJITES)
ISSN (Print): 2682-3918 - ISSN (online): 2682-3926
Volume6 / Issue1, January, 2025
DOI: 10.21608/IHITES.2025.356735.1225

Designing an Electronic Micro-learning Environment to Develop the Skills of Designing and Producing Interactive Websites for Middle School Students

Article History
Receive Date: 2024/11/1
Revise Date: 202٠/1/10
Accept Date: 2025/1/15
Publish Date: 2025/1/15

Ihab Al-Aqwar,

PhD. Instructional Technology,
Educational technology expert at the Ministry of Education,
, Gharbia Governorate, Egypt
Ihab.Al-Aqwar80@gmail.com

Abstract

This research aims at designing an electronic micro-learning environment to develop the skills of designing and producing interactive websites for middle school students. The research sample consisted of (20) students of the middle school at Sejeen New Preparatory School for Boys. The research tools were an achievement test for the cognitive aspect and an observation card for the skill performance of designing and producing interactive websites. The research results concluded that there were statistically significant differences between the average scores of the research sample group in the pre- and post- tests in favor of the post-application, the matter which indicates the development of cognitive achievement and skill performance among the research group members. In light of the research results, the research recommended the need to pay attention to using electronic micro-learning environments in the educational process due to its positive impact on achievement and skill performance among middle school students, as well as other recommendations. Besides, a set of proposals related to the results of the research were presented.

Keywords: *electronic micro-learning environments - interactive websites.*

Introduction

Educational technology has been interested in research and development in various electronic learning environments, including micro-learning environments, to suit the needs of different learners and to suit their different capabilities. Rapid development in educational tools has recently appeared in a diverse and effective manner until we reached creativity and innovation in delivering information to the learner in various ways and different tools, until we used electronic micro-learning methods that suit and take into account the individual differences of the learner.

Micro-learning is also a new educational approach that depends on dividing the educational content into very small and multiple educational units which present a single concept or skill in a short period of time, as this micro-learning ensures the presentation of precise educational content in which the student takes sequential steps that enable him to deal with all concepts and skills. (Bekmurza, A. & et, Al., 2012)

International Journal of Instructional Technology and Educational Studies (IJITES)
ISSN (Print): 2682-3918 - ISSN (online): 2682-3926
Volume6 / Issue1, January, 2025
DOI: 10.21608/IHITES.2025.356735.1225

Patten (2016) explained that micro-learning is short training courses that focus on small amounts of information to make trainees more able to do their work effectively through mastering specific implementable goals. Micro-learning is also used to prepare trainees quickly for specific performances that increases the productivity of the institutions in which trainees work.

Spanjers & Van (2010) believe that fragmenting the educational content helps reduce the cognitive load of the learner, and gives him the time needed for the necessary cognitive activities after each unit of information.

Wang, Q. (2009) explains that educational websites differ from each other in terms of their components and method of their operation, and they depend on the coding language Html in addition to other languages.

Feeling the problem:

There are several sources that contributed to reaching the research problem, including the following:

1- The researcher's experience: through the researcher's work as a supervisor of the computer subject for the preparatory stage, he noticed that there is a clear shortage in the skills of designing and producing interactive websites and among preparatory stage students.

2- Unstructured interviews with some supervisors and teachers in education in Gharbia Governorate who all stressed the need for students to acquire skills in designing and producing interactive websites.

3- Previous studies including Ibrahim Youssef's study (2016), Ihab Hassib's study (2020), Manar Hamed Abdullah's study (2021), Jihad Ali Sufi Qutb's study (2018), and Rania Hussein's study (2020) whose results reached the necessity of benefiting from developing skills of electronic webpages designing such as well as taking into account of skills of educational environment designing.

4- A survey study on a sample of (10) students of preparatory stage to identify their programming skills, and it that there is a weakness among middle school students in designing and producing interactive websites.

Research problem:

In light of the results of previous studies, the survey study, and the recommendations of international and regional conferences, the problem of the current research can be identified in that there is a weakness among middle school students in the skills of designing and producing interactive websites as well as their relying on traditional methods of memorization and indoctrination of skills, in addition as the absence of practical application.

The problem can be formulated through the following main question:

- How can we design and produce interactive websites for middle school students by designing an electronic micro-learning environment?

The following questions branch out from the main question:

1- What is the effectiveness of designing an electronic micro-learning environment in developing the cognitive aspect of designing and producing interactive websites for middle school students?

2- What is the effectiveness of designing an electronic micro-learning environment in developing the skill performance of designing and producing interactive websites for middle school students?

Research hypotheses:

1. There are statistically significant differences at a significance level of (0.05) between the averages of the pre- and post- test to measure the cognitive achievement test for the research group in favor of the post-test.

2. There are statistically significant differences at a level of (0.05) between the averages of the observation card scores (for the skill of designing and producing interactive websites) pre-/post- for the research group in favor of the post-application.

Research methodology:

The current research followed the following two approaches:

- The descriptive approach: this is to determine the basic skills necessary for designing and producing interactive websites, as the descriptive approach is concerned with describing what exists, interpreting it, and determining the conditions and relationships between variables.

- Quasi-experimental approach: this is to measure the effectiveness of an electronic micro-learning environment in developing the cognitive achievement and practical skill performance of the skill of designing and producing interactive websites for the research group.

Experimental design of the research:

The current research relied on the design known as “one experimental group” with pre-/post- test measurement. (One Group Pre- /Post-test Design)

Research tools:

1. A questionnaire to assess the training needs in designing and producing interactive websites for middle school students.
2. Cognitive achievement test in designing and producing interactive websites for middle school students.

International Journal of Instructional Technology and Educational Studies (IJITES)
ISSN (Print): 2682-3918 - ISSN (online): 2682-3926
Volume6 / Issue1, January, 2025
DOI: 10.21608/IHITES.2025.356735.1225

3. Observation card to measure the skill of designing and producing interactive websites for middle school students.

Research limits:

1. The research sample was limited to 20 middle school students from Sejeen Preparatory School for Boys, Qutur Administration, Gharbia Governorate.
2. The limits of the topic were limited to designing and producing websites through training on basic skills in designing simple web pages and websites in addition to training on the general model of educational design (ADDIE).
3. Designing an electronic micro-learning environment and electronic tests on the Moodle website, and the training environment was linked to a collaborative work group on the WhatsApp application.

Terms:

1- **Electronic micro-learning**: this means learning through small units that focus on a specific cognitive skill or competence, which makes it consistent with the approach that calls for lifelong learning (Friedler, 2018).

The researcher defines electronic micro-learning procedurally as the division of content into small and multiple educational units that provides a skill or concept in a short period of time, in which the student takes sequential steps through which the student can deal with all the units and concepts related to the content.

2- Website Designing Skills:

Dedeke (2016, 542) defined it as the process of planning and implementing the structure of the contents of multimedia web pages and links through using appropriate programming languages and technologies.

The researcher defines them procedurally as a group of procedures steps that students do to design interactive webpages are and these skills are also designed to achieve specific educational goals.

Theoretical Framework

First: Electronic Micro-Learning Environment:

The concept of the electronic micro-learning environment and its origins:

Micro-learning is one of the types of electronic learning and means learning through small units that focus on a specific cognitive skill or competence, which makes it consistent with the trend that calls for lifelong learning (Friedler, 2018; Fadl, N., & Youssef, W. 2020.).

Objectives of micro-learning units:

Torgerson & Cole (2017) explain that the main objective of micro-learning units is to be able to deliver short information in a concise manner that learners can easily control and circulate, which will enable them to engage in acquiring that information and the possibility of reusing it in similar educational situations.

Advantages of electronic micro-learning:

Micro-learning is a form of learning that can be considered particularly useful in the context of lifelong learning due to its ability to support learning flexibly. Friedler (2018) believes that it is easy to prepare and integrate into the learner's daily life.

Justifications for using electronic micro-learning:

Zhang, Zhang, Jia, and Zhang (2016) indicate there are some justifications for using electronic micro-learning including:

1) The urgent need to obtain and acquire knowledge in light of the crowding of connections and preoccupation with job tasks.
2) The urgent need for continuous learning and lifelong learning.
3) Interest in types of learning that meet the requirements of the knowledge society such as work-based learning, lifelong learning, and personal learning.

Limits of electronic micro-learning:

Micro-learning is one of the innovative and good solutions that can be employed alongside other e-learning methods and its various applications, and it comes as one of the alternatives that can be used, especially in some situations that take into account the student's time, and it also comes as a solution in case that the teacher does not have enough time in the lecture to provide more knowledge and practical applications.

Challenges and Obstacles to Applying Micro-Learning

Despite the aforementioned advantages of micro-learning that have led to an increase in the effectiveness of its use in the educational environment, those interested in this method of learning have pointed out some disadvantages that may hinder its widespread use in the educational field. One of these drawbacks is that micro-learning derives its strength from its independence and its ability to deliver focused and complete information to the learner about a specific topic, but at the same time this educational unit must be linked to other educational units in order to form the final picture of what knowledge or skills should be possessed about a specific topic (Major & Calandrino, 2018).

Theories on which micro-learning is based.

Micro-learning is based on the principles of information processing theory, which is the concept of hoarding and its relationship to the capacity of short-term memory. Hoarding is the process of designing content in the form of small meaningful units and. This short-term memory

International Journal of Instructional Technology and Educational Studies (IJITES)
ISSN (Print): 2682-3918 - ISSN (online): 2682-3926
Volume6 / Issue1, January, 2025
DOI: 10.21608/IHITES.2025.356735.1225

has a limited capacity as it can only hold a number of (5-9) information treasures. (Mohamed Attia Khamis 206, 2015; darwesh, D., & fayed, S. 2024.).

The idea of micro-learning can also be linked to the constructivist theory which views learning as an active process closely linked to learning through the Internet, as it provides tools that achieve learner's interaction and make the educational process active (Nidal Abdel Ghafour, 2012).

Foundations for building and designing the micro-electronic learning environment

Ibrahim Al-Far (2012, 438) indicates that the educational approach in the micro-electronic learning environment is a theoretical plan that lies in the middle between a scientific and philosophical vision for each of: the nature of the educational content provided in the educational environment, its characteristics, the needs of the students, and the goals sought to be achieved.

Second: Skills for designing and producing interactive websites:

Kwak et al., (2018) defined designing and producing educational website skills as "the process of planning and implementing webpages to achieve general or specialized purposes using multimedia elements and programming languages to make them available for publication over the Internet".

Dedeke (2016, 542) defined them as the process of planning and implementing the structure of multimedia webpages and links using appropriate programming languages and technologies that make them ready for display on Internet browsers.

Features of websites:

According to Wu, et al., (2018) and Salgadoet, et al., (2019) these features are:

A- Flexibility in time and place.

B- The ability to reach a larger number of audiences and followers around the world.

C- Not considering the necessity of matching the computers and operating systems used by viewers with the devices used in transmission.

- The main foundations on which websites are based:

Gutierrez, (2018) indicated that there is a set of foundations on which any website is based, and these foundations are:

1- Design.
2- Content
3- Links
4- Navigating the Web Tools

Website Characteristics:

Several studies, such as Ali Al-Ahmari, (2018), Abdullah Al-Hassan and Abdul Rahman Al-Zahrani, (2018), have stated that educational websites have several characteristics that must be taken into account when designing and building them. These characteristics can be summarized as follows:

1. Integration: this means the integration of the elements of the educational website to achieve the desired goals.

2- Interactivity: This allows the user to control the display method using different interaction patterns according to his ability and desire to learn.

The current study benefits from the theoretical framework:

- Clarifying and confirming the study problem.
- Organizing the theoretical framework for electronic micro-learning and designing interactive websites.
- Preparing the electronic micro-learning environment.
- Building a list of electronic micro-learning environment criteria.
- Descriptive, analytical and experimental research methodology with a quasi-experimental design.
- Choosing appropriate statistical methods.

procedures:

Reviewing the literature, research and previous studies related to the research variables; for the purpose of preparing the theoretical framework for the research, related to the following axes:

Electronic micro-learning.

Interactive websites.

- Preparing a list of skills required in designing and producing interactive websites that were reached and arbitrating the list of skills by specialists.
- Preparing research tools including testing the cognitive aspect of skills, observation cards, and presenting them to a group of arbitrators and making adjustments in light of the arbitrators' opinions.
- Designing an electronic micro-learning environment to design and produce interactive websites.
- Surveying the opinions of the arbitrators about it in terms of its suitability for application.
- Making modifications in light of the opinions of the arbitrators.
- Applying the research tools in advance.

International Journal of Instructional Technology and Educational Studies (IJITES)
ISSN (Print): 2682-3918 - ISSN (online): 2682-3926
Volume6 / Issue1, January, 2025
DOI: 10.21608/IHITES.2025.356735.1225

- Applying the electronic micro-learning environment in the appropriate manner on the research sample.
- Applying the research tools in a post-application.
- Conducting statistical processing, then reaching the results, discussing and interpreting them.
- Providing recommendations and proposed research in light of the research results.

Results:

This section is concerned with answering the research questions, which are:

The first question: What is the effectiveness of an electronic micro-learning environment in developing the cognitive aspect of the skills of designing and producing interactive websites for middle school students?

The answer to the first question of the research questions was through testing the validity of the first hypothesis, which was as follows:

There are statistically significant differences at a significance level of (0.05) between the averages of the pre- and post- test to measure the cognitive achievement test of the research group in favor of the post-test.

The conditions of the normal distribution were verified before conducting the "T. Test" test, and the averages and standard deviations for each test were calculated through the statistical package of the "Spss" program.

• To test the validity of this hypothesis, the research used the average performance scores in the cognitive achievement test (pre- /post-) as well as the standard deviation of the experimental group in the cognitive achievement test for designing and producing interactive websites.

Table (1) shows the results of the significance of the difference between the average and standard deviation of the experimental group's scores in both the pre- and post-applications in the cognitive achievement test for designing web pages.

Table (1) The mean, standard deviation, and number of members of the experimental group in the cognitive achievement test of interactive web page design and production skills

Group name	Application	Total	Mean	SD
Experimental	Pre-experimental	20	9.40	5.515
	Post-experimental		33.40	2.137

It is clear from the previous table that the average scores of students' performance in the cognitive achievement test for web page design vary, as the lowest average performance in the achievement test was for the pre-application of the experimental group, and the average was (9.40) degrees, while the largest average was for performance in the cognitive achievement test for web page design was for the post-application of the experimental group, and it was (33.40). It is also clear that the lowest standard deviation was in favor of the post-application of the experimental group, which is equal to (2.137), while the largest standard deviation was in favor of the pre-application of the experimental group, which is equal to (5.515).

Also, to test the validity of this hypothesis, the average performance scores in the pre-post cognitive achievement test were used, as well as the standard deviation for the experimental group in the cognitive achievement test for designing web pages.

Table (2) shows the results of the "T. Test" to indicate the difference between the mean and the standard deviation of the scores of the experimental group in both the pre- and post- applications of the achievement test in designing web pages.

Table (2) Statistical Significance of the Differences between the average performance scores in the cognitive achievement test for designing and producing interactive web pages between the pre-application and the post-application for the experimental group

Group Name	M	SD	DF	T	Sig
Pre-experimental	9.5	5.5	19	69.8	0.05
Post-experimental	33.4	2.1			

It is clear from the previous table that there is a discrepancy between the post-application and the pre-application for the experimental group in favor of the post-application, where the average score for the pre-application is (9.500) degrees, which is a lower average compared to the average score for the post-application, which is equal to (33.400) degrees. This difference between the two averages is statistically significant because the calculated "T. Test" value is equal to (69.884), which is greater than the tabulated "T" value at a significance level of 0.05. This indicates acceptance of the hypothesis and rejection of the alternative hypothesis.

The second question: What is the effectiveness of an electronic micro-learning environment in developing the skill performance of designing and producing interactive websites for middle school students?

The answer to the second question of the research questions was ciear through testing the validity of the

International Journal of Instructional Technology and Educational Studies (IJITES)
ISSN (Print): 2682-3918 - ISSN (online): 2682-3926
Volume6 / Issue1, January, 2025
DOI: 10.21608/IHITES.2025.356735.1225

second hypothesis of the research hypotheses, which was as follows:

There are statistically significant differences at the level (0.05) between the average scores of the observation card (for the skill of designing and producing interactive websites) concerning pre-/post- applications for the research group in favor of the post- application.

The conditions of the normal distribution were confirmed before conducting the "T" test, and the averages and standard deviations for each test were calculated through the statistical package of the "Spss" program.

• To test the validity of this hypothesis, the researcher used the averages of the performance scores in the observation card for the skill of designing and producing interactive websites (pre-/post-) as well as the standard deviation of the experimental group in the observation card for the skill of designing and producing interactive websites.

Table (3) shows the results of the significance of the differences between the average scores of the experimental group in each of the pre- and post-applications.

Table (3) The mean, standard deviation, and number of group members Experimental observation card on web page design and production skill

Group Name	Application	N	M	SD
experimental	Pre	20	33.50	7.60
	Post		83.85	9.229

It is clear from the previous table that the average scores of students' performance in the web page design skill observation card varied. The lowest average performance score in the observation card was for the pre-application of the experimental group, and the average was (33.50) degrees, while the largest average was for performance in the design skill observation card of the web page was for the post-application of the experimental group, the average score for the post-application for the experimental group was (83.85). It is also clear that the least standard deviation was in favor of the pre-application for the experimental group, which is equal to (7.60), while the largest standard deviation was in favor of the post-application for the experimental group, which is equal to (9.229). .

To test the validity of this hypothesis, the researcher used the average performance scores on the web page design and production skill observation card "pre-/post-" as well as the standard deviation of the experimental group in the performance scores on the web page design skill observation card.

Table (4) shows the results of the "T. Test" to indicate the differences between the mean and standard deviation of the experimental group's scores in both the pre- and post-applications in the performance scores on the web page design and production skill observation card.

Table (4) Statistical significance of the differences between the average performance scores on the web page design and production skill observation card between the pre- and post-applications of the experimental group

Group Name	M	SD	DF	(T)	Sig
Pre-experimental	33.50	7.60	19	40.62	Sig 0.05
Post-experimental	83.85	9.23			

It is clear from the previous table that there is a discrepancy between the post-application and the pre-application for the experimental group, as the average score for the post-application for the experimental group was (33.50) degrees, which is greater compared to the average score for the pre-application for the group, which is equal to (83.85) degrees. This difference between the two averages is statistically significant because the calculated "T" value is equal to (40.629), which is greater than the tabulated "T" value at a significance level of 0.05, and this indicates acceptance of the hypothesis and rejection of the alternative hypothesis.

Discussion :

The results of the cognitive achievement test and the skill performance observation card of the research group in designing and producing interactive websites can be attributed to several reasons, including:

-The electronic micro-learning environment provided broader powers for the learner to study the educational materials presented in the basic training environment, and also, giving the opportunity for time intervals to think before applying new information and participation, as these results agreed with the study of both Marwa Rabie (2022) and Ihab Hassib (2021) and proved the role of electronic micro-learning in the success of the educational process.

-The electronic micro-learning environment also provided a wide range of possibilities for continuous modification and display of skills and improving performance in designing web pages, which led to reaching a higher degree of mastery and greater participation among group members, as the performance steps were divided into

International Journal of Instructional Technology and Educational Studies (IJITES)
ISSN (Print): 2682-3918 - ISSN (online): 2682-3926
Volume 6 / Issue 1, January, 2025
DOI: 10.21608/IHITES.2025.356735.1225

simple, precise and organized steps, which provided a greater opportunity to hone skills and improve performance in delivering information faster and solving the obstacles facing the learner in designing the web page, which was confirmed by the studies of both Hasnaa Al-Tabbakh (2020) and Amal Hamid (2016) in developing web page design through e-learning.

Recommendations:

In light of the results of the current research, future studies and research can be suggested:

-Conducting studies that address different types of support and interaction in a mini electronic learning environment, and their impact on different dependent variables.

-Conducting training workshops for teachers on the technology of the mini electronic learning environment to employ it in areas of specialization.

- Focusing on the skill and technological aspect of middle school students.

- Benefiting from technological innovations to serve education and stimulate students' motivation to learn through electronic learning environments.

Suggestions for future research:

In light of the results of the current research, some proposed research can be conducted as follows:

-Measuring the impact of the difference in some support pattern tools in electronic micro-learning environment applications on different learning outcomes.

-Measuring the impact of the difference in electronic micro-learning environment applications on the learners' evaluation process

Conclusion:

Electronic micro-learning is the optimal method for delivering information to the learner, taking into account individual differences, and reaching the design and production of interactive websites in an easy and fast way, so we must use it in different branches of learning.

Ethical Approval Declaration

"All procedures involving human participants in this study were conducted in accordance with the ethical standards set by applicable research guidelines and the principles of the 1964 Declaration of Helsinki and its subsequent amendments. Ethical approval was secured before the commencement of data collection."

Funding: -

This study did not receive any external funding.

Data availability:-

The datasets generated and analysed during the current study will be available from the author upon reasonable request.

Consent for publication:-

I hereby provide consent for the publication of the manuscript detailed above.

Competing interests:-

The authors declare no competing interests.

References

[1] Abdel Aziz Abdel Hamid Tolbah. (2011) "E-learning Strategies Series", E-learning Magazine, Issue Six, August; 2010 and Educational Technology Developments. Mansoura: Modern Library for Publishing and Distribution.

[2] Abdel Raouf Mohamed Ismail (2023): The effect of employing micro-learning in an electronic learning environment on correcting spelling errors among middle school students. (2023). Journal of Curricula and Teaching Methods, 2(4), 62-85.

[3] Abdel-Raouf Ismail (2019): Designing (Internal - Incidental – External) Electronic Performance Support Systems Patterns in an Electronic Learning Environment and the Effect of Their Interaction with the Level of Mental Capacity (High – Low) on the Development of Search Skills in Information Sources and Cognitive Load among First-Year Secondary School Female Students and the Quality of their attraction to these patterns. Journal of Educational Technology, Egyptian Society for Educational Technology, Faculty of Specific Education, Qena, South Valley University

[4] Aya Ahmed Hussein (2020): The interaction between the level and type of electronic infographic support in an electronic learning environment and its impact on the development of graphics design skills among educational technology students.

[5] Badr Ahmed Fahim (2014): The interaction between the learning strategy (individual/group) using digital learning objects and mental capacity (high/low) and its effect on immediate and delayed achievement among middle school students, Journal of the Egyptian Society for Educational Technology, Vol. 24, No. 1, January.

[6] darwesh, D., & fayed, S. (2024). Combining virtual learning stations with gamification and its impact on developing positive thinking in history among secondary school students. International Journal of Instructional Technology and Educational Studies, 5(4), 1-13. doi: 10.21608/ihites.2024.287331.1185

[7] Dedeke, A. N. (2016). Travel web-site design: Information,

[8] Doyle, J. C., Francis, B. A., & Tannenbaum, A R. (2013). *Feedback control theory*. Courier Corporation.

International Journal of Instructional Technology and Educational Studies (IJITES)
ISSN (Print): 2682-3918 - ISSN (online): 2682-3926
Volume 6 / Issue 1, January, 2025
DOI: 10.21608/IHITES.2025.356735.1225

[9] Edge, et al, (2012, September). Memo Reflex: adaptive flashcards for mobile micro-learning. In *Proceedings of the 14th international conference on Human-computer interaction with mobile devices and services* (pp. 431-440). ACM.

[10] Ehab Gouda, Ahmed Talaba. (1998). The effectiveness of using a proposed strategy in developing some of the abilities needed to solve physical problems and reduce the resulting anxiety and its relationship to mental capacity among secondary school students. PhD thesis. Faculty of Education. Tanta University.

[11] Ehab Hassib (2020): The effect of different support patterns in an adaptive learning environment on the development of the performance aspect of programming skills among secondary school students, PhD thesis, Faculty of Education, Kafr El-Sheikh University.

[12] Fadl, N., & Youssef, W. (2020). Science Learning in Augmented Reality Context: An Exploration of Learners' Cognitive Load and Attitudes. International Journal of Instructional Technology and Educational Studies, 1(2), 10-14. doi: 10.21608/ihites.2020.29304.1019

[13] Friedler, A. (2018, September). Teachers Training Micro-Learning Innovative Model: Opportunities and Challenges. In *2018 Learning With MOOCS (LWMOOCS)* (pp. 63-65). IEEE

[14] Ghassan Youssef Qutit (2015): Modern Learning and Teaching Technologies, Dar Al-Thaqafa for Publishing and Distribution, Amman.

[15] Hind Salama (2022): Designing an electronic environment based on the interaction between the micro-learning presentation style and the cognitive style to develop the skills of employing flipped learning among kindergarten students, PhD thesis, Faculty of Specific Education, Zagazig University.

[16] Huang, W., Alem, L., & Livingston, M. (2012). Human factors in augmented reality environments. New York: Springer Science & Business Media.

[17] Ibrahim Abdel Wakil Al-Far (2012): "Educational Technology of the Twenty-First Century Web Technology (0.2), (Cairo: Dar Al-Fikr Al-Arabi).

[18] Ibrahim Attia (2010): The effect of the interaction between the open-ended problem-solving strategy and mental capacity on innovative solutions to educational programming problems among professional diploma students, Journal of the Faculty of Education, Zagazig University. Issue 68, July.

[19] Ibrahim Youssef (2016): The effect of the interaction between the size of micro-learning content (small - medium - large) and the level of mental capacity (low - high) on the development of the achievement of students of the immediate and deferred educational technology department for information technology concepts, Journal of Arab Studies in Education and Psychology, Arab Educators Association, Issue 2, Vol. 70

[20] Iman Abdel-Ati Al-Taran (2012): "The difference in the patterns of designing electronic performance support systems "internal - transverse - external" based on the web and their impact on the achievement and acquisition of skills among students of the Faculty of Education. The Thirteenth Conference of the Egyptian Society for Educational Technology "E-learning Technology: Contemporary Trends and Issues". The Egyptian Society for Curricula and Teaching Methods. Ain Shams University. Cairo

[21] Jihad Ali Sufi Qutb (2018). The interaction between difficulty levels and electronic support patterns and its impact on the development of photographic production skills and visual perception among educational technology students. Unpublished master's thesis. Faculty of Education. Fayoum University.

[22] Jomah, O, & et. al . (2016). Micro learning: A modernized education system. Broad Research in Artificial Intelligence and Nero science, 7(1), 103–110,

[23] Kamilali, D., & Sofianopoulou, C. (2015). *Micro-learning as Innovative Pedagogy for Mobile Learning in MOOCs.* International Association for the Development of the Information Society. e-mail: secretariat@iadis.org; Web site: http://www.iadisportal.org.

[24] Maher Sabry, Howayda Abdel Hamid and Dalia Al-Ashqar (2020): The pattern of providing educational support in the flipped learning environment and its impact on developing the skills of designing and creating websites among middle school students. Journal of Arab Research in the Fields of Specific Education, Arab Educators Association.

[25] Major, A., & Calandrino, T. (2018). Beyond chunking: Micro-learning secrets for effective online design. *FDLA Journal(3)*13. https://nsuworks.nova.edu/fdla-journal/vol3/iss1/13

[26] Manar Hamed Abdullah (2021): The effectiveness of micro-learning based on game stimuli in developing some programming skills among deaf university students, International Journal of E-Learning, Volume 3, Issue 3.

[27] Mohamed Abdel Razek Shama (2023): The interaction between note-taking (free/directed) in a high-quality video environment and the cognitive style (focus/examination) and its impact on developing educational computer network design skills and levels of engagement in learning among students of the Educational Technology Department, International Journal of E-Learning,

[28] Mohamed Attia Khamis (2003b): Educational Technology Operations, (1st ed.). Cairo: Dar Al-Hikma.

International Journal of Instructional Technology and Educational Studies (IJITES)
ISSN (Print): 2682-3918 - ISSN (online): 2682-3926
Volume6 / Issue1, January, 2025
DOI: 10.21608/IHITES.2025.356735.1225

[29] Mohamed Attia Khamis (2015): E-learning resources. Part One, Dar Al-Sahab for Publishing and Distribution, Cairo.

[30] Nabil Azmy, and Mohamed Al-Mardani (2010): The effect of the interaction between different types of constructive learning supports within the electronic book on achievement and learning efficiency among postgraduate students at the Faculty of Education, Educational and Social Studies, Faculty of Education, Ain Shams University.

[31] Nidal Abdel Ghafour (2012) Educational frameworks for designing electronic learning, Al-Aqsa University Journal, Deanship of Scientific Research, Al-Aqsa University, Jerusalem, 16 (1), 63-86.

[32] Patten, B.(2016). CONTENT DEVELOPMENT. How Micro-learning Improves Corporate Training, Available at: https:\\www.trainingindustry.com\articles\content-development\how micro-learning improves corporate training.

[33] Raja Ali Abdel-Alim Ahmed, Helmy Mustafa and Abu Mota (2020). The interaction between two learning patterns in the augmented reality environment "distributed/dense" and the level of mental capacity "high/low" and its impact on the development of digital scientific research skills and mental flexibility among graduate students, Educational Technology Journal: Studies and Research Series, Egyptian Society for Educational Technology, 30(6), 155 - 245.

[34] Rania Ragab Hussein (2020): The effect of the performance support method in virtual tours on the development of health awareness for kindergarten children, Arab Educators Journal, No. 17

[35] Sayed Shaaban Abdel-Alim Younis (2022): The Effect of the Interaction between the Two Patterns of Interactive Info graphics and the Level of Mental Capacity on the Development of Digital Video Production Skills for Secondary School Teachers, Journal of the Faculty of Education, Al-Azhar University, Issue: (193), Part (1), January 2022

[36] Spanjers, I., & Van Merrienboer, J. (2010). A Theoretical analysis of how segmentation of dynamic visualizations optimizes students' learning. Educational Psychology Review, 22(4), 411-423.

[37] Torgerson, C Lannone, S(2019). 5 Effective Formats for Micro-learning and When to use each.

[38] Vodeclic.(2015). Micro-learning: when less is more, Vodeclic, Paris

[39] Wang, Q. (2009). Designing a web-based constructivist learning environment. Interactive Learning Environments, 17(1), 1-13.

[40] Wei, S., Ren, G., O'Neill, E.:(2014) Haptic and audio displays for augmented reality tourism applications. In: 2014 IEEE on Haptics Symposium (HAPTICS), pp. 485–488. IEEE

[41] Zainab Yassin Ibrahim (2021): The effect of the interaction between two patterns of an electronic learning environment based on the theory of brain-based learning (right/left) and the level of mental capacity (High/Low) in Developing Mathematical Problem Solving Skills for Fifth Grade Primary School Students, Journal of the Faculty of Education, Ain Shams University, Issue 45, Part Two,

[42] Zhang, J., Zhang Y., Jia, Y., & Zhang, Z. (2016). The study of internet plus continuing education pattern based on micro-learning. International Conference on Information Technology in Medicine and Education (ITME) Qingdao University, Qingdao, 826-829.