ORIGINAL RESEARCH ARTICLE

Cloud computing practice activities and mental capacity on developing reproductive health and cognitive absorption

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Usama M. Ibrahem[1,2], Munthir A. Alblaihed[1], Ahmed B. Altamimi[1], Hind R. Alqirnas[1], Shawky M. Mahmoud[2], Magdy I. Salem[2] and Mohamed Alsaadany[4]*

Ha'il University, Kingdom of Saudi Arabia[1]; Suez Canal University, Egypt[2]; Matrouh University, Egypt[3]; Port Said University, Egypt[4].

***For Correspondence:** Email: *u.abdelsalam@uoh.edu.sa*

Abstract

The current study aims to determine how the interactions between practice (distributed/focused) and mental capacity (high/low) in the cloud-computing environment (CCE) affect the development of reproductive health skills and cognitive absorption. The study employed an experimental design, and it included a categorical variable for mental capacity (low/high) and an independent variable with two types of activities (distributed/focused). The research sample consisted of 240 students from the College of Science and College of Applied Medical Sciences at the University of Hail's. The sample was divided into four experimental groups. The study's most significant findings were the CCE's apparent favoritism of the group that studied using focused practice style and high mental capacity in the reproductive health skills test, as opposed to distributed practice style and low mental capacity in cognitive absorption. The findings will add to the ongoing debate over which of the two distributed/focused practice activity models is more effective in achieving desired educational results. *(Afr J Reprod Health 2024; 28 [28 [12]: 186-200).*

Keywords: Cloud-Computing Environment (CCE); Mental Capacity (MC); Reproductive Health Skills; Cognitive Absorption; Practicing Activities

Résumé

L'étude visait à étudier les attentes de performance dans les tâches futures basées sur la gestion de l'apprentissage personnel pendant l'épidémie de Corona. Un échantillon aléatoire de 871 étudiants de l'Université de Hail a été sélectionné. Les échantillons de l'étude provenaient de facultés de sciences humaines, d'ingénierie et de médecine. L'étude était basée sur une conception d'étude transversale. L'étude a préparé une mesure des attentes futures en matière de performance pour les tâches. L'échelle est de 28 items. L'analyse factorielle a été utilisée pour vérifier la validité de l'échelle, et celle-ci a atteint des indicateurs acceptables de bon ajustement. L'échelle a atteint une stabilité acceptable en utilisant le coefficient alpha de Cronbach pour le facteur émotionnel de 0,57, le facteur cognitif de 0,94 et le facteur comportemental de 0,90. Les résultats ont révélé qu'il existe des différences dans les attentes futures en matière de performance en raison du sexe et du type d'université. Les résultats ont révélé qu'il existe des corrélations positives entre les attentes futures en matière de performances cognitives et émotionnelles, ainsi qu'une relation positive entre les performances émotionnelles et comportementales. Il existe également une relation négative entre les performances comportementales et cognitives. *(Afr J Reprod Health 2024; 28 [28 [12]: 186-200).*

Mots-clés: Environnement personnel d'apprentissage en ligne (PLE); Enseignement à distance (DL); Tâches futures ; Attente; Performanc

Introduction

Educational technology is utilizing cloud computing to enhance teaching and learning, with technology companies investing in this sector and offering free software for web storage, content management, and access to vast knowledge[1]. Cloud computing allows academic institutions to concentrate on teaching and research, eliminating the need for complex IT setups and software systems[2].

The research on Cloud-Computing Environment CCE employed varied methods and demonstrated their effectiveness in providing courses[3,4]. It can enhance collaborative learning skills for cloud computing applications, regardless of the session management style[5]. Regardless of session management style, the study assesses how well CCE enhances collaborative learning skills for cloud computing applications.

The research on CCE has shown its effectiveness in providing educational and training courses and programs[6]. The study reveals that cloud-based lab technologies like Xen and KVM Cloud Platform provide a controlled experimental environment, significantly enhancing hands-on learning compared to traditional computer learning methods[7]. The study explores the effectiveness of enhancing teaching performance and fostering collaborative learning skills for cloud-computing applications[4]. Students require access to information and resources to achieve their educational goals[8,9]. Cognitive Absorption, a concept in CCE and applications, involves users immersing themselves in knowledge through content-sharing networks[10]. The use of technology in teaching practices significantly influences student engagement and motivation during educational processes[11].

Cloud computing empowers students to perform experiments with structured guidance and specific constraints, facilitating remote access to physical resources when real laboratories are unavailable or resources are limited[12,13]. The Cloud Computing Environment (CCE) operates as a network-based technology that shifts processing and storage from local computers to the Internet, offering services, support, and shared applications through a centralized server[14]. Cloud computing, as a cutting-edge technology, is transforming the educational landscape by accelerating innovations in online education and enhancing e-learning. It provides high-performance solutions that are both cost-effective and scalable[17], making it an attractive option for organizations aiming to reduce infrastructure and maintenance expenses[5,15]. Cloud-based e-learning offers unparalleled flexibility and accessibility, allowing learners to access educational resources on-demand from any location at any anytime[16,18]. Moreover, it facilitates online interactions among learners, promoting a collaborative learning experience[19].

A cognitive psychology study examines the impact of practice style on long-term retention within cloud-computing environments. Distributed practice has been shown to enhance retention and memory by increasing cognitive load, thus improving long-term memory[20-22]. While focused practice tends to be more effective in the short term, distributed practice yields better results over the long term[23-25]. However, the study found no significant differences between the two styles, suggesting no clear preference for one over the other[20,26]. Repeating and reviewing tasks strengthens memory regardless of practice style or time intervals, although the effectiveness of focused practice can vary depending on the nature of the task and the type of training. Cognitive load theory supports the idea of minimizing unnecessary cognitive load, maximizing relevant cognitive load, and advocating for distributed practice[27]. Educational theories influence practice styles, emphasizing feedback, memory retention, spacing, and interdependence between units, highlighting the importance of these theories in shaping learning outcomes.

Research indicates that long-term memories are more easily recallable than short-term memories or focused presentations[28]. Distributed practice is influenced by cognitive load theory, active learning theory, and the theory of learning, with Osbel's meaning-based learning theory contributing to its complexity[27]. Studies show no consensus on the preference for focused or distributed activities for learning outcomes, but long-term memory retention is easier with experiences distributed over extended periods[29].

Distributed practice, influenced by cognitive load, active learning, and learning theory, enables deeper learning by allowing learners to focus on a specific task without interference. Focused practice is better for using the product, mastering task transfer, experimental and verbal learning, and forming positive perceptions of the product, while distributed practice is better for verbal learning[30]. Cognitive learning theories emphasize the importance of self-awareness and information-processing abilities in human skill development.

Mental Capacity (MC) is crucial for information processing, and individual differences can impact performance failure and skill development among trainees. Research emphasizes understanding how learners acquire knowledge and skills related to technological innovation, focusing on cognitive structure and efficient processing of short-term memory to improve performance.

Diversifying practice styles based on learners' cognitive load ensures compatibility and efficient goal achievement, while identifying different mental capacities is crucial for performing practical skills[31]. The study found that the MC variable significantly impacts student performance, with high-capacity students outperforming low-capacity students in terms of achievement[32,33]. A study on the impact of MC on students' immediate and delayed achievement revealed that high MC groups performed better, while Fahim's study showed no significant differences[34]. The studies highlight the importance of studying the MC variable in educational technology research because of the diverse skills, practices, and activities required for memory retention.

Virtual laboratories can enhance students' reproductive health skills by overcoming the limitations of traditional laboratories. Hamed & Aljanazrah highlight that students utilize these tools for educational experiments, overcoming funding constraints and providing visual representation of data and phenomena unattainable through traditional methods. Their study assesses the efficacy of virtual laboratories in reproductive health courses and proposes a model for integrating real and virtual laboratories[35]. Rouis (2012) reveals that students experience cognitive absorption when using e-platforms, especially social networks, which involves tasks and activities, requiring concentration on interactive relationships and interactions[36]. Research on mental capacity highlights individual differences in learning abilities and cognitive load within cloud computing environments, impacting both short-term memory processing and long-term memory transfer, which in turn may affect overall performance[37,38]. Mental capacity plays a significant role in e-learning achievement, although a lower mental capacity does not necessarily hinder cloud computing skills. Distributed and focused instructional styles have been found to enhance practical skill acquisition, information retrieval, and working memory efficiency, depending on the learner's mental capacity.

Cognitive absorption, a concept rooted in psychological flow theory, describes a deep level of engagement with programs and applications, often resulting in successful e-learning experiences through simulations[39]. The Cognitive Absorption (CA) model suggests that when users enter a flow state, they experience heightened motivation and engagement, which enhances their retention of e-learning materials."

Theoretical framework

Cognitive absorption, a learning method based on active learning theory, enhances student abilities through interaction, decision-making, responsibility, and innovative problem-solving, enhancing the overall learning experience. Flow theory suggests that frequent website usage, increased content interaction, and activities increase cognitive engagement, indicating a positive correlation between website usage and learning[36]. Regardless of the importance of determining MC, the most pressing issue is the extent to which students differ in terms of MC level (high/ low) based on their interaction with the style of practicing activities. Thus, when learning a skill, does a university student with a high MC rely on the focused style of practice, or does a student with a low MC rely on the distributed style of practicing activities? The study explores the impact of two teaching styles on students' learning outcomes, examining if they

improve knowledge, reproductive health skills, and cognitive absorption in CCE.

Research questions and hypotheses

The current research attempts to answer the following questions:

1. What is the appropriate instructional design for a cloud-based learning environment, through which reproductive health skills and cognitive absorption can be developed?
2. What is the effect of using activities (distributed/focused) in CCE on developing reproductive health skills and cognitive absorption?
3. What is the effect of the level of mental capacity (high/low) on the development of reproductive health skills and cognitive absorption?
4. What is the effect of the interaction between the style of practicing activities (distributed/focused) in the CCE and the level of MC (high/low) on the development of reproductive health skills and cognitive absorption?

Hence, the research hypotheses were formulated:

H1: There is no statistically significant difference at the level (0.05) between the mean scores of those who studied using (distributed) activities and those who studied using (focused) activities in the CCE .

H2: There is no statistically significant difference at the level (0.05) between the mean scores of the participants with (high) MC and the mean scores of individuals with (low) MC in the CCE in the post-application of the observation card associated with reproductive health skills.

H3: There are no statistically significant differences in the mean scores of the experimental groups after applying the observation card, as a result of the interaction between the style of practicing activities (distributed/focused) in the CCE and the level of MC (high/low) for the participants.

H4: There is no statistically significant difference at the level (0.05) between the mean scores of the participants who studied using (distributed) activities and the mean scores of those who studied using focused activities in the CCE in the post-application of the cognitive absorption scale.

H5: There is no statistically significant difference at the level (0.05) between the mean scores of the participants with (high) MC and the mean scores of individuals with (low) MC in the CCE in the post-application of the cognitive absorption scale.

H6: There are no statistically significant differences between the mean scores of the four experimental groups in the post-application of the cognitive absorption scale, because of the effect of the interaction between the style of practicing activities (distributed-focused) in the CCE and the level of MC (high- low).

Methods

The research employs a descriptive-analytical approach and a quasi-experimental approach to identify the

impact of independent and categorical variables on dependent variables.

Procedures

The procedures were conducted as follows:

Determining reproductive health skills

The study aimed to improve reproductive health education in medical education by identifying the most crucial skills for students in the College of Science and Applied Medical Sciences. Establishing a minimal standard for RH skills simulation SL can enhance learning, and facilitate competency-based teaching, practice, and evaluation of clinical skills, improving cognitive, psychomotor, and affective dimensions. The study categorized faculty members' skills into basic and sub-skills, with the main skills being (4) and the sub-skills being 25. The list of procedural skills was verified for comprehensiveness and scientific accuracy.

Development of experimental treatments

Figer 1 Instructional design model

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Figer 1: Instructional design model

In the **Analysis Stage**, the research team identified the problem and assessed the needs based on previous research, focusing on enhancing reproductive health skills among UOH students. To address these needs, a cloud computing learning environment was developed to support students in the Colleges of Science and Applied Medical Sciences. The primary objectives included the development of reproductive health skills and cognitive absorption.

In the **Teaching Lab**, learners were expected to achieve competencies that would enable them to assess clients with reproductive health (RH) issues, formulate differential diagnoses, and manage health promotion and disease prevention. The **Medical Expert** aspect of the lab required students to apply their knowledge of normal and abnormal structures and functions of the human body system. Additionally, the **Scholar** component guided learners to develop, implement, monitor, and revise a personal learning plan aimed at enhancing professional practice, identifying areas for improvement, and engaging in collaborative learning for continuous personal development. Emphasis was also placed on ensuring patient safety, providing effective feedback, analyzing maternal morbidity and mortality trends, and identifying credible scholarly sources to interpret study findings and assess bias. The **Communicator** aspect trained learners to communicate effectively with clients seeking gynecologic and obstetric care using a patient-centered approach, optimizing the physical environment for such care. The **Collaborator** element encouraged students to work willingly with other healthcare professionals and establish healthy relationships with colleagues, including physicians. Meanwhile, the **Leader** component aimed to foster leadership skills in professional practice, where students were taught to manage themselves and support staff effectively, demonstrating an ability to plan and oversee activities.

In the **Design Stage**, multimedia components were created to deliver the training program via the CCE. This involved designing activities within the CCE, with components such as a cloud computing login page for learners to register, a course content page featuring lessons and interaction tools, an email page for sending and receiving messages, and a members page to connect all students. The design also included two practice styles: **Distributed Practice** and **Focused Practice**. For Distributed Practice, the research team developed educational units covering twelve reproductive health skills over a semester. These were divided into three 20-minute sessions, with mini-sessions spaced 24 hours apart to maintain engagement. This style comprised two main stages: **Mastering Stage**, where students identified and mastered content, unit, and knowledge tasks in phases; and the **Retrieval Stage**, where students retrieved previously learned information from memory during new practice sessions, with content repeated over multiple sessions.

In the Focused Practice approach, twelve topics related to reproductive health skills were organized into logical sequences over twenty sessions. This approach emphasized repetition to reinforce learning and retention, all within a structured **Learning Strategy in the CCE**.

During the **Development Stage**, training content was created using specialized software, observing curricula guidelines, and incorporating educational technology evaluations from expert arbitrators. This process culminated in a final, well-rounded educational task design. Finally, in the **Publication, Usage, and Follow-up Stage**, the research team prepared the completed training program for presentation and deployment, ready to be implemented and monitored for effectiveness.

Participants

The study consists of 240 second-year students at the College of Science and College of Applied Medical Sciences at the UOH, who were divided into four experimental groups based on their MC (high/low) according to Table 1.

The study used a graduated multivariate analysis of variance test to compare cognitive absorption pre-measurement between four groups, with the results presented in Table 2:

The study found that the four dimensions of cognitive absorption were not affected by the type of practice and the nature of the MC. The four groups were compared using a graduated multivariate analysis of variance test to ensure equivalence in the pre-measurement of the observation card. Tab. The study found no effect on the four dimensions of the observation card because of the influence of practice type and MC level.

Research tools

Crossover test (High Vs Low MC)

It represents the intersecting shapes test by Jean Pascaglioni, which was prepared and translated by Al-Banna & Al-Banna[41]. The test, consisting of 36 items and geometric shapes, has a stability coefficient of 0.721 and an overall coefficient of 0.842, indicating acceptable stability.

Reproductive health skills observation

The research team utilized the performance observation method, involving the learner observing their actual practice.

The observation scale assesses students' engagement in reproductive health skills and behavior styles, with validity and reliability confirmed by a panel of arbitrators. Cooper's equation was used to calculate the scale note's agreement coefficient, achieving a high stability coefficient of 0.838, which included 54 practical laboratory performance skills.

The correlation coefficient between card skills and the total score for each major in the scale was calculated separately, with coefficients ranging between 0.330 and 0.852. The study found a strong correlation between the dimensions of a note card and its overall score, indicating the interdependence and coherence of skills and dimensions.

Cognitive absorption scale

The research team utilized a scale to evaluate students' self-absorption in learning, analyzing terature from[42-44] identifying interrelated items and subjects for student selection. The scale's axes were determined using previous studies, focusing on immersion-focused, enjoyment and satisfaction, curiosity, and ignoring time. It included 20 statements and its validity was assessed by calculating the correlation coefficient between each item's total score and each member's score. The correlation equations showed a range of 0.020-0.060, with a stability coefficient of 0.79, higher than the mean, calculated by Alfa Cronbach.

Results

To examine whether there was a statistically significant difference at the 0.05 level between the mean scores of participants who engaged in distributed activities versus those involved in focused activities within the CCE, an independent samples t-test was conducted. The results, as shown in Table 4, were analyzed to determine the validity of this hypothesis. The study indicates a preference for focused reproductive health skills activities over distributed ones, with a higher mean of focused activities (6.82) compared to distributed activities (6.43).

The study revealed that focused activities are preferred over distributed ones, with a mean of 5.93, highlighting the preference for focused activities. From Table 4, the first statistical hypothesis was rejected, and the alternative hypothesis was accepted, which states that:

1. There is a statistically significant difference at the level (0.05) between the mean scores of participants who studied using the (distributed) activities and the mean scores of those who studied using the (focused) activities in the CCE in the post application on the dimension of extracting tools and devices for the observation card related to reproductive health skills in favor of the focused practice.
2. There is a statistically significant difference at the level (0.05) between the mean scores of the participants who studied using the (distributed) activities and the mean scores of those who studied using the (focused) activities in the CCE in the dimensional application on the dimension of the procedures for implementing the steps of the observation card related to the reproductive health skills in favor of focused practice.

Table1: Experimental groups pre-test / post-test design 2×2 factors

MC level	Pre-Test	activity style		Post-Test
		Distributed	focused	
High	reproductive health Skills test	group 1 (distributed/high)	group 2 (focused/ high)	Reproductive Health Skills Test
low	Cognitive Absorption Skills test	group 3 (distributed/ Low)	group 4 (focused/ Low)	Cognitive Absorption Skills test

Table 2: Graduated multiple variance analysis in the pre-measurement of cognitive absorption

Source	Hoteling t. value	F value	DF	Error DF	Sig
distributed	0.19	0.66	4	113	0.000
focused	0.16	0.41	4	113	0.987
MC	0.02	0.59	4	113	0.671

Table 3: Graduated multiple variance analysis in the pre-measurement of the Lab skills note card

Source	Hoteling t. value	F value	DF	EDF	Sig
distributed	0.91	30.62	3	114	0.000
focused	0.05	2.11	3	114	0.103
MC	0.031	1.23	3	114	0.304

Table 4: T-test for independent samples

The dimension	Type	N	Mean	Std. Deviation	T	Df	F-value	Effect size
Extracting tools and equipment	distributed	60	6.43	1.27	1.73	118	0.043	1.21
	focused	60	6.82	1.16			Sig.	High
Procedures for implementing the steps	distributed	60	5.08	4!.1	3.57	118	001.>	1.30
	focused	60	5.93	1.45			Sig.	High
Result extraction	distributed	60	5.68	1.41	1.64	118	0.050	1.57
	focused	60	5.21	1.70			Sig.	High

Table 5: T-test for independent samples

The dimension	MC type	N	Mean	Std. Deviation	T	Df	F-value	Effect size
Extracting tools and equipment	Low	60	6.38	1.21	2.20	118	0.015	1.21
	High	60	6.87	1.20			Sig.	High
Procedures for implementing the steps	Low	60	5.12	1.30	3.27	118	001.>	1.30
	High	60	5.90	1.32			Sig.	High
Result extraction	Low	60	5.22	1.43	1.64	118	0.050	1.57
	High	60	5.68	1.68			Sig.	High

Table 6: T-test for independent samples

Source	Hoteling t.value	F value	DF	EDF	Sig
distributed	57.52	2185.88	3	114	0.000
focused	0.18	6.92	3	114	0.000
MC	0.15	5.76	3	114	0.000
Interaction	0.15	5.85	3	114	0.000

Table 7: T-test for independent samples

Dependent Variable	Practice	MC	Mean
Extracting tools and equipment	Distributed	low	6.43
		High	6.43
	Focused	low	6.33
		High	7.30
Procedures for implementing the steps	Distributed	low	5.07
		High	5.10
	Focused	low	5.17
		High	6.70
Result extraction	Distributed	low	5.27
		High	6.!0
	focused	low	5.17
		High	155.27

3. There is a statistically significant difference at the level (0.05) between the mean scores of participants who studied using the (distributed) activities and the mean scores of those who studied using the (focused) activities in the CCE on the dimension of extracting results for the observation card related to reproductive health skill in favor of distributed practice.

The study analyzed CCE practice styles for reproductive health skills development, rejecting the null hypothesis and revealing focused practice style preference after extracting tools and devices. Focused practice is ideal for training requiring flexibility and diversity, as it stabilizes responses and diversifies student behavior, particularly in complex tasks like problem-solving, resulting in more effective outcomes. Hovland's research indicates that distributed practice is more effective in serial-type works because of its ability to dissipate interference during breaks, supporting the overlap assumption (Krigolson, *et al.*, 2021).

The previous results agree with the results of[6,24,25], i.e. distributed activities are a cost-effective and efficient method for improving learning effectiveness and efficiency.

The study differs from[21], which found that focused learning is superior to distributed learning. Thus, focused practice is more efficient and time-saving in the short term than distributed practice, which is time-consuming and reduces cognitive flexibility.

To assess whether there was a statistically significant difference at the 0.05 level between the mean scores of participants with high mental capacity (MC) and those with low MC in the CCE, following the application of the observation card on reproductive health skills, an independent samples t-test was conducted. The results, as presented in Table 5, were used to evaluate this hypothesis.

From Table 5, the calculated (F) value for the "Extracting tools and equipment" dimension equals (0.015), which is statistically significant, which indicates the preference for (high) MC over (low) MC, as the mean of high MC (6.87) is greater than the mean of low MC (6.38). Likewise, Table 5 showed that procedures for implementing the steps dimension are statistically significant, which indicates the preference of (high) MC over (low) MC, as the mean of high MC (5.90) is greater than the mean of low MC (5.12).

Finally, Table 5 shows that the result extraction dimension is statistically significant, which indicates the preference of (high) MC over (low) MC, as the mean of high MC (5.68) is greater than the mean of low MC (5.22). Thus, the Second hypothesis was rejected, and the alternative hypothesis was accepted, which states:

There is a statistically significant difference at the level (0.05) between the mean scores of participants with (high) MC and those with (low) MC in the CCE in the post-application of the dimension of extracting tools and devices for the observation card associated with reproductive health skills in favor of those with capacity High mentality.

There is a statistically significant difference at the level (0.05) between the mean scores of participants with (high) MC and the mean scores of individuals with (low) MC in the CCE in the post-application of the dimension of the procedures for implementing the steps of the observation card related to reproductive health skills in favor of those with High mentality capacity.

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There is a statistically significant difference at the level (0.05) between the mean scores of participants with (high) MC and the mean scores of individuals with (low) MC in the CCE in the post-application of the dimension of extracting results for the observation card associated with reproductive health skills in favor of those with MC high.

Mental Capacity (MC) is a learner's ability to store and process information, with high MC individuals excelling in reproductive health skills, while low MC individuals may require additional support.

The research findings are in agreement with the results of [32,45,46] which showed a statistically significant difference in favor of students with high MC. However, these findings differ from the results of [33,48], which showed no difference between students with high and low MC.

To determine whether there were statistically significant differences in the mean scores of the experimental groups after applying the observation card, an analysis was conducted to examine the interaction between the style of practicing activities (distributed/focused) within the CCE and the level of mental capacity (MC)1. (high/low) among participants. Table 6 reveals significant differences in mean scores between four experimental groups after applying an observation card related to reproductive health skills, attributed to the interaction between practicing activities and MC level. Table 7 reveals that the experimental group (2) (focused/high) demonstrated superior reproductive health skills in extracting tools and2. equipment, with a mean score of 7.30, and in implementing steps, with a mean score of 6.70, and a result extraction of 155.27. The study found no significant difference (0.05) between participants using distributed and focused activities in the cognitive absorption scale post-application, and the hypothesis's validity was tested using an independent sampling t-test. 3.

According to Table 8, the value of (F) for the second variable, which represents participant practice in cultivating cognitive absorption in the CCE, in the dimension of focused immersion, is (001), which reveals a preference for the practice of (distributed) activities over (focused) activities. 4.

The mean of practicing focused activities (18.75) is greater than the mean of practicing distributed activities (16.17). As for the “enjoyment and satisfaction” dimension, Table 8 demonstrated that the mean of practicing distributed activities (18.32) is higher than the mean of practicing focused activities (16.65), which indicates a preference for (distributed) activities over (focused) activities. As for the "Curiosity" dimension, it has a value of (0.077), and the mean of practicing distributed activities (16.10) is higher than the mean of practicing focused activities style (14.93), which reveals a preference for the practice of distributed activities over focused activities. As for the "ignoring time" dimension, Table 8 shows that the mean of practicing distributed activities (17.40) is higher than the mean of practicing focused activities (16.20), which reveals a preference for the practice of distributed activities over practicing focused ones.

Based on Table 8, the third hypothesis was rejected, and the alternative hypothesis was accepted, which states that:

There is a statistically significant difference at the level (0.05) between the mean scores of the participants who studied using the (distributed) activities and the mean scores of those who studied using the (focused) activities in the CCE in the post-application on the focused immersion dimension of the cognitive absorption scale in favor of the distributed practice.

There is a statistically significant difference at the level (0.05) between the mean scores of the participants who studied using the (distributed) activities and the mean scores of those who studied using the (focused) activities in the CCE in the post-application on the enjoyment and satisfaction dimension of the cognitive absorption scale in favor of the distributed practice.

There is no statistically significant difference at the level (0.05) between the mean scores of the participants who studied using the (distributed) activities and the mean scores of those who studied using the (focused) activities in the CCE in the post-application on the curiosity dimension of the cognitive absorption scale.

Table 8: T-test for independent samples

The Dimension	Practice type	N	Mean	Std. Deviation	T	Df	F-value	Effect size
focused immersion	Distributed	60	18.75	3.84	3.97	118	001.>	3.56
	Focused	60	16.17	3.26			Sig.	High
Enjoyment and satisfaction	Distributed	60	18.32	3.95	2.53	118	0.006	3.62
	Focused	60	16.65	3.25			Sig.	High
Curiosity	Distributed	60	16.10	4.93	1.44	118	0.077	--
	Focused	60	14.93	3.92			Not Sig.	
Ignoring time	Distributed	60	17.40	3.91	1.97	118	0.026	3.34
	Focused	60	16.20	2.65			Sig	High

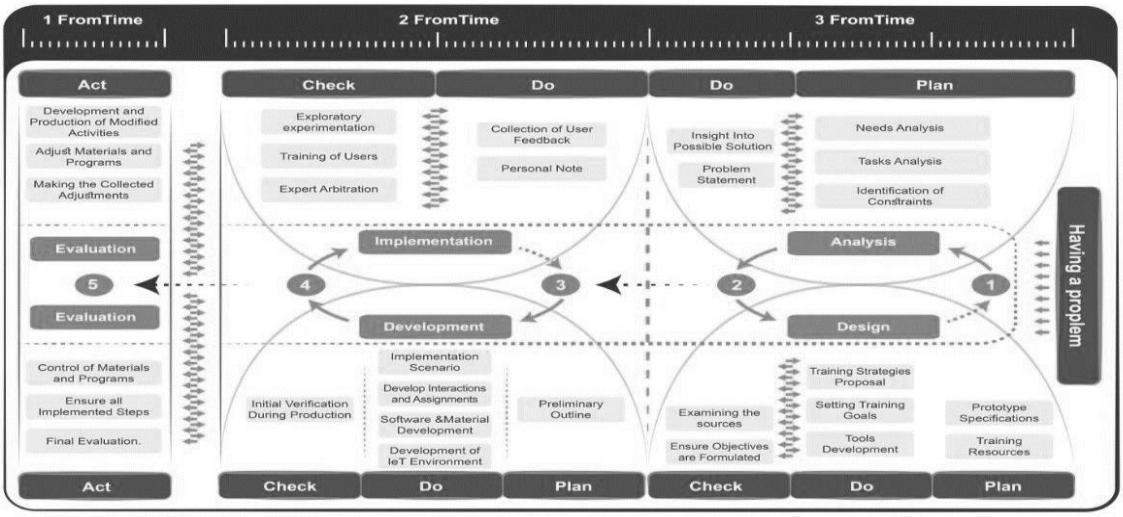

Table 9: T-test for independent samples

The dimension	MC	N	Mean	Std. Deviation	T	df	F-value	Effect size
focused immersion	High	60	18.25	3.84	2.34	118	0.010	3.71
	Low	60	16.67	3.56			Sig.	High
enjoyment and satisfaction	High	60	18.37	3.63	2.69	118	0.004	3.60
	Low	60	16.60	3.58			Sig.	High
Curiosity	High	60	16.70	4.54	2.99	118	0.002	4.33
	Low	60	14.33	4.11			Sig.	High
ignoring time	High	60	18.63	3.12	7.06	118	.001>	2.84
	Low	60	14.97	2.54			Sig	High

Table 10: T-test for independent samples

Source	Hoteling value	F value	DF	ZF	Sig
distributed	58.37	1648.90	4	113	0.000
focused	0.24	6.65	4	113	0.000
MC	1.45	40.82	4	113	0.000
Interaction	1.36	38.47	4	113	0.000

5. There is a statistically significant difference at the level (0.05) between the mean scores of the participants who studied using the (distributed) activities and the mean scores of those who studied using the (focused) activities in the CCE in the post-application on the dimension of ignoring time dimension of the cognitive absorption scale in favor of the distributed practice.

Distributed practice offers students additional practice through implicit rehearsals during rest periods, a form of mental training where they pretend to practice during downtime. Hovland's research reveals that distributed practice is more effective in serial-type work, as it mitigates the impact of interference during training during downtime, particularly in connected sequential actions and skills. To determine whether there was a statistically significant difference at the 0.05 level between the mean scores of participants with high mental capacity (MC) and those with low MC in the CCE on the cognitive absorption scale following the post-application, an independent samples t-test was conducted, as shown in Table 9.

Table 9 illustrates that the "focused immersion" dimension is statistically significant, as the mean of high MC (18.25) is greater than the mean of low MC (16.67), which reveals that (high) MC is preferred to (low) MC. As for the "enjoyment and satisfaction" dimension, the mean of high MC (18.37) is higher than the mean of low MC (16.60), which indicates a preference for (high) MC over (low) MC. As for the “Curiosity” dimension, the mean of high MC (16.70) is higher than the mean of low MC (14.33), which shows the preference for (high) MC over (low) MC. As for the "ignoring time" dimension, the mean of high MC (18.63) is higher than the mean of low MC (14.97), which shows that (high) MC is preferred over (low) MC.

Thus, the fifth hypothesis was rejected, and the alternative hypothesis was accepted, which states:

The results are:

1. There is a statistically significant difference at the level (0.05) between the mean scores of the participants with (high) MC and the mean scores of individuals with (low) MC in the CCE in the post-application on the focused immersion dimension of the cognitive absorption scale in favor of distributed practice.
2. There is a statistically significant difference at the level (0.05) between the mean scores of the participants with (high) MC and the mean scores of individuals with (low) MC in the CCE in the post-application on the enjoyment and satisfaction dimension of the cognitive absorption scale in favor of distributed practice.
3. There is a statistically significant difference at the level (0.05) between the mean scores of the participants with (high) MC and the mean scores of individuals with (low) MC in the CCE in the post-application on the curiosity dimension of the cognitive absorption scale in favor of distributed practice.
4. There is a statistically significant difference at the level (0.05) between the mean scores of the participants with (high) MC and the mean scores of individuals with (low) MC in the CCE in the post-application on the dimension of ignoring time of the cognitive absorption scale in favor of focused practice.

The results of the focused/distributed practice style difference in the CCE in the development of cognitive absorption showed that the alternative hypothesis related to the cognitive absorption scale in the dimensions of focused immersion, enjoyment, satisfaction, curiosity, and ignoring time in favor of the distributed practice was

accepted and the null hypothesis was rejected. The study explores the relationship between practice style and MC in UOH students' cognitive absorption in CCE, emphasizing the significance of effective information organization for increased satisfaction and faster knowledge assimilation. To examine whether there were statistically significant differences between the mean scores of the four experimental groups on the cognitive absorption scale in the post-application, the study analyzed the interaction between the style of practicing activities (distributed versus focused) in the CCE and the level of mental capacity (high versus low).

Table 11: T-test for independent samples

Dependent Variable	Practice	MC	Mean
Centered Immersion	Distributed	low	20.77
		High	16.73
	Focused	low	15.73
		High	16.60
Enjoyment and Satisfaction	Distributed	low	20.47
		High	16.17
	Focused	low	16.27
		High	17.03
Curiosity	Distributed	low	18.53
		High	13.67
	Focused	low	14.87
		High	15
Ignoring Time	Distributed	low	14
		High	20.80
	Focused	low	15.93
		High	16.47

Table 10 reveals significant differences in mean scores among four experimental groups. Table 11 shows that the experimental group (2) (focused/high) outperformed other groups in post-measurement of reproductive health skills in extracting tools and equipment, with a mean score of 7.30, 6.70 procedure dimensions, and 155.27 result extraction.

Discussion

The findings revealed that focused activities are more effective in enhancing reproductive health skills compared to distributed activities. This aligns with theories suggesting that focused practice stabilizes responses and diversifies behavior, particularly in complex tasks like problem-solving. However, it contrasts with other studies supporting the effectiveness of distributed practice in tasks requiring sequential actions.

The significant advantage of high MC participants supports the view that individuals with higher cognitive capacity are better equipped to process and apply complex information. This finding suggests the importance of tailored support for low MC participants to improve their performance. The interaction between activity style and MC level indicates that both factors play a crucial role in learning outcomes. High MC participants benefited more from focused activities, suggesting that cognitive capacity may amplify the effectiveness of targeted practice styles. Distributed activities outperformed focused activities in promoting cognitive absorption, particularly in dimensions like focused immersion and satisfaction. These results highlight the benefits of spaced learning in sustaining attention and enhancing overall engagement.

The results confirm that high MC participants consistently outperform low MC participants across all cognitive absorption dimensions, emphasizing the role of cognitive capacity in optimizing learning experiences. The significant differences across experimental groups demonstrate that the combination of practice style and MC level creates diverse learning outcomes, reinforcing the need for adaptive learning strategies that consider both factors.

Conclusion

The study suggests that distributed activities in CCE can significantly improve students' understanding of reproductive health skills. The research highlights the importance of cloud-based learning environments and educational design standards in CCE to improve performance and cognitive abilities, suggesting focused and distributed practice styles. The study presents a design model for CCEs, emphasizing the importance of adopting them. Future research should explore the relationship

between learner's cognitive styles and practice styles, focusing on superficial/deep cognitive styles, to improve cognitive absorption, thinking skills, and final product quality.

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Ethical approval

All procedures performed in the study followed the ethical standards of the institutional research committee of the Scientific Research Dean of Hail University (IRB Log Number: RG-22007) and with the 1964 Helsinki Declaration and its later amendments.

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Data availability statement

The raw data supporting the conclusion of this article will be available upon request from the corresponding author.

Conflict of interest

the authors declare that they have no conflict of interest.
The research was applied to students (while they were learning) and did not include experimenting with animals.

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