Experiential Design Thinking Learning Model through Virtual Co-Working Spaces

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***Abstract*—This study employed a research and development methodology with the objectives of developing an experiential design thinking learning model through virtual co-working spaces to enhance digital entrepreneurship competencies. The model integrates experiential learning concepts, design thinking processes, virtual co-working environments, and the digital entrepreneurship competency framework. The sample comprised 30 undergraduate students majoring in Business Information Technology. Data were analyzed using descriptive statistics. The findings reveal that the experiential design thinking learning model through virtual co-working spaces comprises two principal components: (1) a six stage experiential design thinking learning process encompassing User Understanding, Experience Creation, Reflection, Prototyping, Experimentation, and Real-World Integration; and (2) virtual co-working spaces incorporating seven dimensions: instructional management, technology infrastructure, collaboration mechanisms, support systems, security protocols, motivational elements, and assessment frameworks. The overall evaluation of the model indicated a high level of appropriateness (*M* = 4.59, SD = 0.50). Among the individual dimensions, data security achieved the highest mean score (*M* = 4.77, SD = 0.43), followed by learning process activities (*M* = 4.67, SD = 0.48). These results demonstrate that the model is highly appropriate and shows strong potential for application in enhancing digital entrepreneurship education within contemporary contexts.**

***Keywords*—experiential learning, design thinking, virtual coworking space, digital entrepreneurship**

I. Introduction

According to the World Economic Forum, the competencies essential for 21st century employment have undergone significant transformation, particularly digital competencies, creativity, problem solving, and collaborative abilities [1]. For digital entrepreneurs, the capacity to integrate these competencies with a profound understanding of technology and consumer behavior within digital contexts has become a determining factor for contemporary business success.

Furthermore, the COVID-19 pandemic has accelerated rapid transformations in work modalities, learning approaches, and business operations, particularly the transition to online systems, consequently establishing virtual co-working spaces as critical mechanisms for driving educational and business activities [2].

A comprehensive literature review reveals that experiential learning constitutes an effective pedagogical approach for enhancing professional skills and competencies, particularly within entrepreneurial development contexts [3] define experiential learning as a learning process that emphasizes learners' knowledge construction through authentic practice within specified contexts, aimed at achieving learning objectives aligned with real world professional situations. Furthermore, collaborative learning principles play a crucial role in fostering competencies in communication, problem solving, and teamwork, which are fundamental competencies essential for digital-age entrepreneurship [4, 5].

However, the application of experiential design thinking integrated with virtual co-working spaces for developing digital entrepreneurship competencies has received limited scholarly attention, particularly within the Thai context, where persistent challenges exist regarding technological infrastructure and educational resources [6]. According to the National Statistical Office, Thailand continues to face constraints in internet accessibility, connection speeds, outdated technological equipment, as well as limitations in educators' competencies for integrating digital technology into instructional practices.

Consequently, this research aims to develop an experiential design thinking learning model through virtual co-working spaces to enhance digital entrepreneurship competencies among higher-education students. The model emphasizes the cultivation of analytical thinking abilities, problem solving skills, collaborative competencies, and the application of skills in business creation that can be developed into future careers. This initiative is anticipated to contribute to human capital enhancement and strengthen the nation's competitive capabilities within the digital economy context.

II. Research Objectives.

1) To develop an experiential design thinking learning model through a virtual co-working space.
2) To evaluate the appropriateness of the design thinking learning model through virtual co-working spaces.

III. Literature Review

A. Experiential Learning

Experiential learning, a concept rooted in the theories of John Dewey, Paulo Freire, and David A. Kolb, emphasizes learning through direct experience and reflection, distinguishing itself from traditional educational methods by fostering active participation and personal engagement in the learning process [7, 8]. Kolb's experiential learning cycle, which includes stages of concrete experience, reflective observation, abstract conceptualization, and active experimentation, serves as a foundational model for this approach, aiming to transform the educational system from a

traditional to a more individualized, student-centered process. This model encourages students to take responsibility for their learning, enhancing their cognitive structures, attitudes, and skills through hands on experiences [9]. In practice, experiential learning can take various forms, such as study abroad programs, internships, service learning, and classroom activities like rearranging seating to promote interaction, all of which aim to deepen understanding and retention of knowledge [10]. The approach is particularly effective in fields like sport and performance psychology, where it shifts the focus from instructors as knowledge dispensers to facilitators of deeper, practical understanding [11]. Moreover, experiential learning is not limited to academic settings; it is also applied in higher education, community programs, and professional training, where it supports the assessment and accreditation of prior learning experiences. This method not only enhances students' academic and practical skills but also instills civic values and self confidence, as learners connect theoretical knowledge with real world applications [12–14]. Overall, experiential learning represents a dynamic and transformative educational approach that aligns with modern pedagogical goals by fostering a more interactive and reflective learning environment [15].

B. Design Thinking

Design thinking represents a user focused, solution oriented approach that has achieved widespread recognition in diverse sectors such as business, education, and engineering, owing to its creative methodology for tackling intricate problems. The framework encompasses a systematic five phase process: empathize, define, ideate, prototype, and test, which collectively emphasize comprehending and fulfilling user requirements [16–18] Emerging from professional design disciplines, this approach has transformed into an interdisciplinary methodology that promotes innovative problem resolution through design oriented methods of understanding, implementing, and reasoning [19]. This framework extends beyond conventional design applications and has been modified to address systemic challenges and complex "wicked" problems, establishing it as an essential innovation instrument across varied environments [20]. The methodology promotes experimentation, feedback collection, and continuous refinement, which are fundamental for creating successful solutions [21]. Within academic environments, design thinking enables educators to develop innovations that improve educational experiences through the integration of contemporary digital technologies and resolution of student centered issues [22]. Additionally, its implementation in 3D manufacturing for educational research illustrates its adaptability in creating concrete educational materials that satisfy particular learning objectives [23]. The extensive integration of design thinking in business and management curricula highlights its importance as a strategic instrument for cultivating creativity and innovation. In summary, design thinking's focus on empathy, collaboration, and cyclical development establishes it as an effective methodology for addressing complex challenges across multiple fields.

C. Virtual Learning Environments (VLEs)

Virtual Learning Environments (VLEs) have established themselves as a central element in modern educational systems, employing information and communication technologies to expand learning opportunities beyond traditional academic settings. VLEs transcend basic website functionality, representing comprehensive platforms that synthesize various educational tools to strengthen learning activities across distance and traditional learning formats [24]. They deliver a complete, web-based framework that supports flexible, schedule independent course participation, incorporating diverse media elements such as audio, video, and written content to create engaging educational experiences [25]. The progression of VLEs has been substantial, advancing from primitive forms like radio and television broadcasting to sophisticated digital systems that feature immersive environments, educational games, and simulation programs [26]. These platforms accommodate numerous educational functions, permitting students to obtain mentorship, examine different cultural contexts, and engage in participatory learning activities. The COVID-19 crisis underscored the vital role of VLEs, enabling educators to preserve communication and interaction with students, encouraging collaborative participation despite geographical constraints [27]. However, difficulties continue to exist, particularly the requirement for VLEs to integrate social networking capabilities to strengthen student participation and engagement. Moreover, the implementation of cloud computing and Virtual reality innovations is being examined to tackle performance limitations and improve educational delivery [28]. Despite these difficulties, VLEs maintain their important position in academic institutions, delivering a versatile, engaging, and customized learning environment that satisfies the needs of modern education.[29]

D. Differences between LMS and Virtual Co-Working Spaces

In contrast to traditional Learning Management Systems (LMS), which primarily serve functions related to course administration, content delivery, assessment, and learning analytics, a virtual co-working spaces. is designed to facilitate real time, collaborative, and co-creative learning processes. LMS platforms, such as Moodle, are optimized for organizing instructional materials, managing student enrollments, and monitoring learner progress, thereby providing a robust infrastructure for instructional planning and delivery. By comparison, VCWs emphasize synchronous interaction, collective ideation, rapid prototyping, peer feedback, and authentic task performance often conducted within shared digital environments such as communication channels, interactive whiteboards, online meetings, and co-editable documents. These affordances allow VCWs to simulate entrepreneurial practices and foster co-creation among learners and instructors. Consequently, while LMS platforms address the question of "How is the course managed and delivered?", VCWs respond to "How do learners co-create, iterate, and obtain immediate feedback on ongoing work?". This distinction highlights the novelty of the proposed model, which positions experiential design thinking activities within a VCW to complement, rather than replace, the LMS infrastructure.

E. Digital Entrepreneurship

Digital entrepreneurship signifies a revolutionary

transformation in the business venture domain, facilitated by the incorporation of digital instruments and technological innovations. It connects conventional business creation with digital advancement, facilitating the establishment and identification of novel commercial opportunities within a more flexible framework [30, 31]. This entrepreneurial approach is distinguished by its responsiveness to the digital marketplace, where business creators utilize digital technologies to produce goods and services, frequently challenging established economic frameworks and encouraging social and economic participation [32, 33]. The digital marketplace supports the creation and exchange of digital products through platforms, which serve as fundamental components of digital entrepreneurship, although they introduce complications including network dynamics and competitive pressures [34]. The development of digital entrepreneurship has been expedited by technological progress, including cloud computing solutions, which minimize technical obstacles and enable adaptable business operations, supporting gender parity and sustainable growth [35]. Essential components of digital entrepreneurship encompass digital technology, entrepreneurial capabilities, prospects, assets, and operational frameworks, which together constitute the foundation of digital business ventures. The digital modernization of enterprises improves market accessibility and expansion possibilities, enabling operations without geographical or time constraints while encouraging creativity and innovation [36]. However, digital entrepreneurship encounters obstacles including competency deficits and infrastructure limitations, requiring supportive business conditions and policy measures [37]. The COVID-19 crisis has additionally emphasized the significance of digital entrepreneurship, demonstrating its contribution to economic stability and innovation [38]. As digital entrepreneurship progresses, it provides extensive research possibilities to investigate innovative business frameworks and success strategies in the digital era [39].

IV. Research Methodology

This study employed a Research and Development (R&D) approach with the aim of designing, developing, and evaluating an the proposed learning model among undergraduate students.

To validate the proposed learning model, expert review was conducted with a panel of seven experts. The panel consisted of three instructional design specialists, two entrepreneurship educators, and two experts in educational technology. All experts held doctoral degrees in their respective fields and had more than five years of professional and academic experience. The experts were university lecturers and industry professionals with expertise in instructional design, educational technology, and entrepreneurship, selected for their knowledge relevant to the model's components.

The detailed procedures of the study and the development process are presented as follows:

A. *Developing an Experiential Design Thinking Learning Model through a Virtual Co-Working Spaces*

This research investigates relevant theoretical foundations from contemporary literature to synthesize components of an experiential design thinking learning model within virtual co-working environments. The study employs two key methodological approaches: first, the development of the proposed learning model; second, an evaluation of the model's appropriateness and effectiveness in developing digital entrepreneurship competencies through Virtual collaborative learning environments.

Methodological Framework for the proposed learning model. The researcher conducted a comprehensive literature review encompassing the systematic examination, analysis, and synthesis of pertinent scholarly sources, including peer reviewed academic journals, authoritative textbooks, and empirical research studies from both domestic and international contexts. The methodological approach was implemented through a sequential process structured as follows:

Contextual Analysis and Documentary Examination. A comprehensive contextual investigation was conducted to examine pedagogical research about instructional design and learning management systems. Through a systematic synthesis of data derived from scholarly literature encompassing authoritative textbooks, peer-reviewed academic journals, and empirical research publications from both national and international sources theoretical frameworks were comprehensively analyzed. The collected data underwent rigorous content analysis to establish a robust conceptual foundation for the experiential design thinking learning model, which is implemented through Virtual collaborative environments to enhance digital entrepreneurship competencies.

The analytical framework encompasses six core theoretical constructs: (1) Experiential Learning Theory, (2) Design Thinking Methodology, (3) Virtual Learning Environment Architecture, (4) Digital Co-Working Spaces Dynamics, (5) Digital Entrepreneurship Paradigms, and (6) Entrepreneurial Competency Development Models.

Based on the synthesis of data obtained from the review of documents, textbooks, academic papers, and research studies—both domestic and international—related to theoretical concepts, the information was analyzed and synthesized using content analysis. The purpose was to develop a conceptual framework and process for learning experiential design thinking through virtual co-working spaces in order to enhance the competencies of digital entrepreneurs. The framework includes the following components:

The experiential learning process is a process in which learners develop knowledge, skills, and values from direct experience. It provides opportunities for learners to participate in experiential education to help learners develop critical thinking, consisting of 6 steps. The following are as follows: 1) Conceptualization and Focusing, 2) Activity / Concrete Experience, 3) Reflective Observation Report, 4) Abstract Conceptualizations, 5) Active Experimentation, and 6) Application of desired learning. The analytical synthesis of the study findings is presented in Table 1.

Design thinking refers to a cognitive process that involves a deep understanding of complex problems and the formulation of solution-oriented strategies. It emphasizes a user centered approach to problem solving, which can lead to

innovation ultimately creating differentiation and competitive advantage. The process is driven by the intention to produce tangible outcomes that effectively address users' needs and specific contextual challenges, resulting in practical and meaningful solutions or innovations.

Table 1. Synthesis of experiential learning processes

EXPERIENTIAL LEARNING PROCESSES	[39]	[40]	[41]	[42]	[43]	[44]	SYNTHESIS
Pre-Encounter Assessment	/						
Orientation / Conceptualization and Focusing of Encounters	/	/	/			/	/
Organizing activities / creating experiences to make them concrete.	/	/	/	/	/	/	/
Sharing and Reporting	/			/		/	
Reflective Observation and Reporting of Encounters / Reflections (reflection)	/	/	/	/	/	/	/
Abstract Conceptualization and Modifying	/		/		/		/
appraisal Testing or proving a hypothesis (Active Experimentation) after encountering the experience	/		/	/	/	/	/
Applying the desired learning outcomes into practice		/	/	/		/	/

Table 2. Synthesis of design thinking processes

DESIGN THINKING PROCESSES	[42]	[43]	[44]	[45]	[46]	SYNTHESIS
Empathize	ü	ü	ü	ü	ü	ü
Observe		ü				
Defend Problem	ü	ü	ü	ü	ü	ü
Ideate	ü	ü	ü	ü	ü	ü
Prototype	ü	ü	ü	ü	ü	ü
Test	ü	ü	ü	ü	ü	ü
implement			ü			

From the study and synthesis of the process in Table 2. Design thinking can be concluded that there are 5 processes of design thinking. as follows

1) Empathies: Create an understanding of the problem that needs to be solved or understand the consumer group. From collecting data from local experts or collecting data. Ask the opinions of most people until they reach the closest conclusion to the truth (Fact).
2) Defining Problem is the process of analyzing and summarizing various data until it comes out with a brief definition or services that we want to create to solve the above problems.
3) Ideation is the brainstorming of creativity, which will use whatever method the team deems most appropriate. Whether it's making a mind map, brainstorming ideas, or using keywords to expand.
4) Prototype is the use of ideas to give shape to concrete shapes. Whether it is a product or a business plan, a plan or model can be created in digital form, or a mock up material can be used to create a model that looks like the real thing first. To create a common understanding for everyone in the team.
5) Test is the use of the model to try it out with the target audience to get feedback and further development in the most appropriate way.

Elements of a Digital Virtual Co-Working Spaces. A digital virtual co-working space is a learning management model through modern technology that allows learners to learn from anywhere, anytime, and can choose to learn what they are interested in through the Internet. Instructors design curriculum management through online tools It allows the transition of the educational process from the classroom to the Internet. Aims to simulate and replace physical classroom environments for remote learners.

Table 3. Synthesis of element of digital co-working spaces

ELEMENT OF DIGITAL CO-WORKING SPACES	[44]	[45]	[46]	[47]	[48]	SYNTHESIS
Strategy and Roadmap	ü		ü		ü	ü
Discussion platforms / Two-Way Communication	ü		ü			
Project Management	ü					
Electronic Accounting Services	ü					
Artificial Intelligence / Smart Search / Embedded Analytics	ü	ü	ü		ü	ü
Chatbots	ü		ü		ü	ü
Collaborative Culture	ü	ü			ü	ü
Security / High Personalization	ü	ü	ü	ü		ü
Cloud Infrastructure / Communication Infrastructure	ü			ü	ü	ü
Video Conferencing	ü					
Flexible Integrations		ü	ü		ü	ü
Device Management		ü		ü	ü	ü
Short Course (Microlearning)					ü	

From the synthesis of elements of the digital Co-Working Spaces in Table 3. It can be summarized as follows:

1) Teaching and learning management strategies include: teaching situations, learning materials, supporting, mentoring at stake. 2) Learning Platforms; LP 3) a technological component include: Chatbots, Artificial Intelligence, Smart Search, Embedded Analytics, Cloud Infrastructure, Communication Infrastructure 4) Learner Engagement and

Management / Collaborative Culture 5) Security and High Personalization 6) Flexible Integrations and 7) Device Management

B. Create a Tool for Evaluation of the Proposed Learning Model

Create a tool for evaluation of the proposed learning model.

1) Assessment creation process

An Assessment of the proposed learning model. The steps to create it are as follows:

1) The researcher studied sample assessments on learning styles from relevant documents and research related to teaching and learning. Information Technology and Educational Technology and Competency Design
2) Determine the topic of the assessment. The researcher identified the points for the evaluation, including 1) the elements of experiential design thinking, 2) the process learning process, and experiential design thinking, 3) the elements of a virtual co-working spaces, and 4) the competency of digital entrepreneurs.
3) Design Assessment Form When the point for the interview was about the Learning model Therefore, the researcher used various issues to design an interview about the learning style using the Rating Scale according to Likert's Scale method, which is a question that expresses an attitude or feeling towards something, divided into 5 levels.
4) Based on the recommendations provided by the advisor, the researcher revised and improved the work accordingly. The suggestions were used to enhance the quality of the assessment instrument, ensuring greater validity and reliability in preparation for subsequent evaluation by subject matter experts

2) Data collection

The researcher engaged a total of seven experts specializing in teaching and learning, business administration, and educational technology to participate in the data collection process.

Relevant literature and research studies were reviewed and synthesized, focusing on experiential design thinking learning models implemented through virtual co-working spaces to enhance digital entrepreneurship competencies.

The researcher provided a detailed explanation of the proposed experiential design thinking learning model, which utilizes virtual co-working spaces to foster the development of digital entrepreneurship competencies.

5) An analysis of the suitability of the experiential design learning model through a virtual co-working spaces to strengthen the competency of digital entrepreneurs by 9 experts was used to determine the mean and standard deviation one by one.
6) The average value obtained is evaluated against the measurement criteria using the section type assessment form. The Rating Scale according to Likert's Scale, which is a question that expresses an attitude or feeling towards something, is divided into 5 levels.
7) The total mean of the mean and standard deviation were used to analyze the quality of the data compared to the established evaluation criteria, the data was presented in a tabular format, and the data was summarized under the table of the data analysis report.

In this developmental study, a group of 30 undergraduate students majoring in Business Information Technology (BIT) participated in a pilot trial of the proposed experiential design thinking learning model. The trial was conducted over a six week period as part of a short course embedded in their program. The purpose was not to measure long term outcomes, but to provide an initial exploration of how students engaged with each stage of the model.

During the implementation, students worked in small teams and engaged in activities aligned with the six stages of the model:

User Understanding—Students conducted needs analysis and interviews with potential users to identify challenges in digital entrepreneurship.

Experience Creation—Teams brainstormed ideas and designed initial concepts for digital business solutions.

Reflective Framing—Each group discussed insights gained, reframed their problem statements, and refined their ideas accordingly.

Prototyping—Students developed low fidelity prototypes (e.g., mock ups, business model canvases) of their proposed solutions.

Experimentation—Prototypes were presented to peers and instructors for feedback, followed by iterative improvements.

Real-World Integration—Students produced a final project output demonstrating how their digital solution could be applied in practice.

Throughout the process, students received guidance from instructors via the virtual co-working spaces, which served as the central platform for collaboration, resource sharing, and feedback. Although formal pre and post-tests of competencies were not conducted, descriptive data were collected from expert evaluations of the learning model, as well as from student reflections and feedback during the trial. These results contributed to validating the model's appropriateness and its potential effectiveness in fostering digital entrepreneurial competencies.

V. Results

A. Results of the Development of Experiential Design Thinking Learning Models through Virtual Co-Working Spaces

Elements of the proposed learning model The elements are as follows:

Part 1 "Inputs" include:

1) Learning Objective: Focus on students to express their opinions and be an important factor in the operation by requiring learners to develop their abilities, create learning, and entrepreneurial skills, and have the ability to become digital entrepreneurs.
2) Teacher Analysis: Teachers must understand the learning activity plan using the experiential design thinking process to be in accordance with the learning activity plan model. Monitor learners and report on learning management results according to the prescribed format.
3) Student Analysis: Undergraduate learners. Internet network usability, Basic business knowledge, and computer literacy.

4) Content analysis: The content is suitable for undergraduate learners by dividing it into steps according to the developed learning style.
5) Learning Activities Plan: Teaching and learning activities that encourage learners should be in line with the content of the lessons and can be applied in practice and actual work. It emphasizes that learners think and take action.

Part 2: Components of the proposed learning model include: 1) Empathic Focusing, 2) Experiential Ideation, 3) Collaboration and Culture, 4) Conceptual Prototyping, 5) Testable Experimentation, 6) Applied Integration.

Part 3: Virtual co-working space as a tool for this research consists of 7 aspects: 1) Pedagogical, 2) Technological, 3) Collaboration and Culture, 4) Supportive Functionalities, 5) Security and Data, 6) Engagement and Motivation. and 7) Assessment and Reflection. The details are as follows:

1) Pedagogical. includes: Learning Activities, Learning Resources, Supervision, Curriculum Linking, User Contextual Analysis (Instructors, Learners, Administrators)
2) Technological. includes: Learning Platform, Video Conference, AI, Chatbot, Cloud, Data Analytics, Online Whiteboard, Avatar, Breakout room, Simulation Tool
3) Collaboration and Culture. includes: Collaborative Culture, Peer Support, Management, Communication Platform, Virtual Workspaces, Online Resources, Virtual Meeting Room.
4) Supportive Functionalities. include: project management system, electronic accounting,
5) Security and Data. includes: Security, Access, Privacy.
6) Engagement and Motivation. includes: gamification, learning goals, medal and reward systems.
7) Assessment and Reflection. consist of Reflection system, Time tracking, Peer feedback.

The Experiential Design Thinking Learning Model implemented within a virtual co-working spaces to enhance digital entrepreneurship competencies comprises the following components:

1) Users are divided into 3 groups:

Learner means all learners who are enrolled in the system.

Instructor means a person who manages competency data, content according to competency, and learner assessment tests.

System Administrator will be the person who manages the system and the server.

The working components in the system include the following systems:

- Content management system for instructors to add, edit, and delete content for each competency.
- Test management system for teachers to add, edit and delete exams used to test learners' knowledge.
- Communication and exchange system to provide a channel for instructors and learners to communicate individually and to be able to follow learners.
- Learner evaluation system so that teachers Evaluate the results of learning activities and inform learners of the results. It is evaluated from the learners' taking the test.
- Learner data management system for adding, deleting and editing learner data and assigning permissions to system users and managing learner segmentation.

2) Evaluation Digital entrepreneurship competencies consist of 3 areas: Knowledge, Skills, and Attitudes.

- Knowledge include: K1: Knowledge of Digital Technology, K2: Knowledge of Data and Analytics., K3: Knowledge of Digital Business Model., K4: Knowledge of Digital Ethics., K5: Knowledge of Entrepreneurship.
- Skills include: S1: Utilization of Digital Tools., S2: Business Data Analysis., S3: Online Communication and Collaboration., S4: Digital Marketing., S5: Online Presentation and Pitching.
- Attitudes include: A1: Creativity and Design Thinking., A2: Adaptability and Lifelong Learning., A3: Responsibility and Digital Ethics., A4: Leadership and Initiative., A5: Perseverance and Resilience.

3) Reverse data Therefore, learners are an important factor in the operation by requiring learners to develop their abilities and contribute to the learning of digital entrepreneurship competencies.

The researcher took the key elements obtained from the synthesis of learning patterns. Experiential design thinking through virtual co-working spaces to enhance digital entrepreneurship competencies to design learning models. Creating a picture to connect the relationship between the learning process and the elements. The details are shown in Fig. 1.

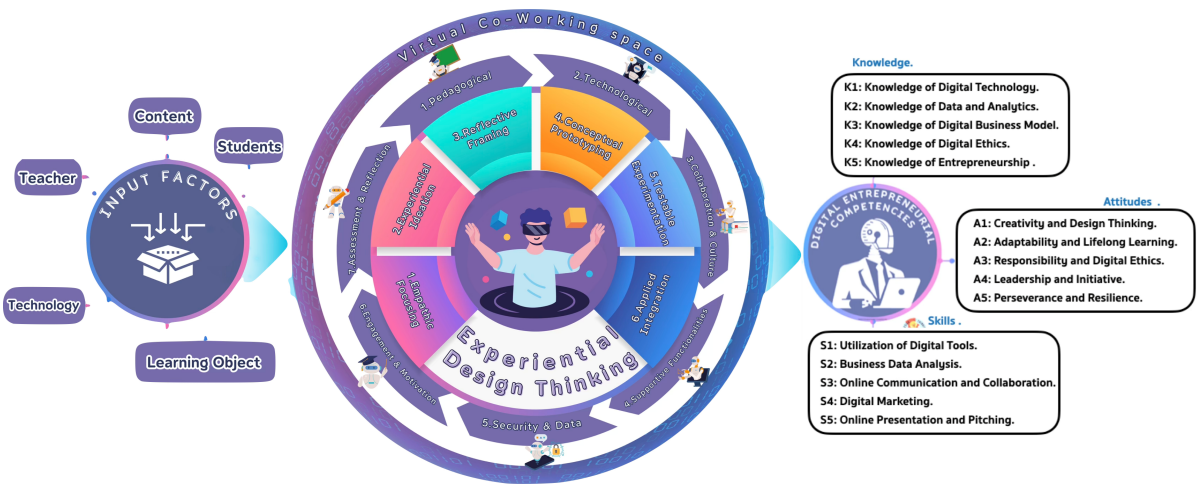

Fig. 1. Diagram of the experiential design thinking learning model implemented through a virtual co-working spaces, showing the six-stage learning process and related components.

B. The Evaluation Results on the Appropriateness of the Experiential Design Thinking Learning Model Implemented through Virtual Co-Working Spaces to Enhance Digital entrepreneurship competencies

Table 4. The appropriateness of experiential design thinking learning models through virtual co-working spaces

Issues of Appropriateness of the Model	Expert opinion		
	Mean	S.D.	level suitability
1) The experiential design thinking learning model through Virtual Co-Working Spaces is in line with the principles and concepts that are fundamental in developing learning styles.	5.00	0.00	highest
2) The objectives of the learning model are suitable for the principles and concepts of the learning model.	4.71	0.50	highest
The Experiential Design Thinking Learning Process			
2.1.1) Developing a User-Centered Conceptual Framework	4.86	0.00	highest
2.1.2) Creating Experiences through Creative Thinking	4.57	0.58	highest
2.1.3) Reflective Thinking and Problem Framing	4.37	0.60	High
2.1.4) Concept Synthesis and Prototyping	4.57	0.53	highest
2.1.5) Systematic Testing and Evaluation	4.54	0.56	highest
2.1.6) Integration and Practical Application	4.43	0.58	High
2.2) Components of a Virtual Co-Working Spaces			
1. Instructional Management	4.71	0.50	highest
2. Technological Infrastructure	4.86	0.00	highest
3. Collaborative Engagement	4.57	0.50	highest
4. Supportive Functions	4.86	0.50	highest
5. Security and Data Protection	4.57	0.50	highest
6. Motivation and Engagement	4.43	0.58	High
7. Assessment and Reflection	4.57	0.58	highest
The Mean Score of the Components of the Virtual Co-Working Spaces	4.65	0.45	highest
3. Clarity and Continuity of the Learning Model Components	4.43	0.50	High
4. Coherence and Consistency among the Learning Model Components	4.71	0.00	highest
5. Appropriateness and Clarity of the Sequence of Components	4.57	0.50	highest
6. Overall Completeness and Relevance of the Learning Model Components	4.43	0.58	High
7. Practical Applicability of the Learning Model Process	4.43	0.58	High
Overall	**4.61**	**0.43**	**highest**

Table 4 summarizes the experts' ratings for each aspect of the model's appropriateness (5-point scale) The results show that The learning model was found to be consistent with fundamental learning theories and principles. Each component of the model was deemed appropriate, clearly defined, and logically sequenced. The components demonstrated coherence and alignment with one another, and the structure of the model was considered easy to understand. Overall, the model was assessed as comprehensive, relevant to the learners' needs, and aligned with the research objectives. Furthermore, the learning process was considered practically applicable. The overall evaluation result indicated a very high level of appropriateness ($\bar{x}$ = 4.61, S.D. = 0.43).

The experiential design thinking learning model implemented through a virtual co-working spaces facilitates communication, interaction, and responsive engagement between learners and instructors. It supports the delivery of learning content through diverse media formats, including text, audio, images, video, and multimedia. The model emphasizes structured learning processes that incorporate both individual and collaborative group activities conducted within the digital environment. The activities incorporated into the designed system are demonstrated in Figs. 2–4.

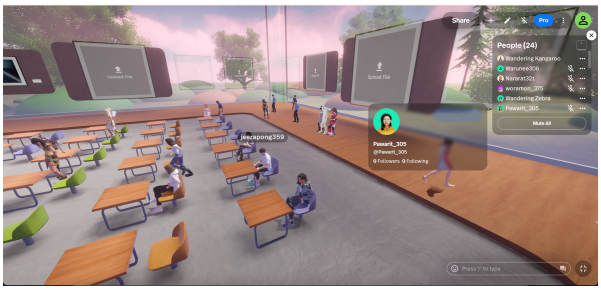

Fig. 2. An example of the virtual co-working spaces from the proposed model.

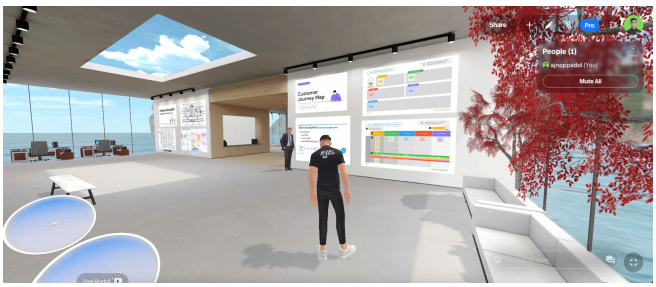

Fig. 3. Contents on virtual co-working spaces.

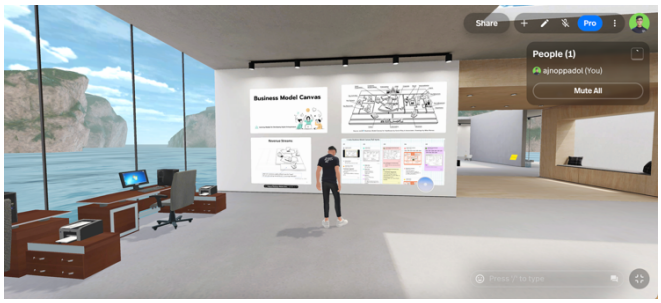

Fig. 4. Activities on virtual co-working spaces.

VI. Discussion

This research revealed that the integration of experiential learning principles, design thinking processes, and virtual co-working spaces yields promising results in the development of digital entrepreneurship competencies. The proposed model comprises two core components: a six-step experiential design thinking learning process and the application of seven key dimensions of virtual co-working spaces. Expert evaluations indicated a very high level of appropriateness, with an average score of $\bar{x}$ = 4.61 and a standard deviation of S.D. = 0.43.

Notably, experts rated the information security dimension

as the most appropriate aspect of the model ($\bar{x}$ = 4.77), followed by the learning process activities ($\bar{x}$ = 4.67). This evaluation aligns with the findings of [42, 43] who emphasized that a secure and interactive Virtual learning environment not only enhances the quality of the learning experience but also fosters greater learner engagement and satisfaction.

Kolb's experiential learning theory was selected as the foundational framework for designing the learning process due to its emphasis on providing learners with authentic experiences, followed by opportunities for reflection and application of acquired knowledge. This approach aligns with the perspectives of Salimon and Evans, who assert that experiential learning empowers learners to construct their own understanding and enhances their sense of ownership over the learning process.

The incorporation of design thinking concepts helps to strengthen creative problem-solving skills and user understanding for learners. This echoes the concept of Buchanan and Liedtka who see design thinking as an effective tool to deal with complex problems (Wicked Problems), especially in the context of education and innovation development

Another issue that I think is important is that we design the model based on the framework of digital entrepreneur competencies. This makes learning clear and measurable, both in terms of knowledge, skills, and attitudes, especially competencies in information technology, online communication, and communication. This is in line with the work of Dudin et al., Bachmann et al. and Zambrano et al. who see digital competency as an important indicator of entrepreneurial intentions in the digital era.

The virtual co-working spaces utilized in this research functions as a simulated laboratory that closely mirrors real world contexts. This approach aligns with the findings of P. Goeser and C. Williams [28], who assert that Virtual learning environments have the capacity to transform learners from passive recipients of information into active knowledge creators.

From a holistic perspective, the proposed learning model implemented through virtual co-working spaces represents a systematic integration of interdisciplinary knowledge. It demonstrates significant potential for practical application in fostering digital entrepreneurship within higher education. Furthermore, it serves as a foundational framework for the broader implementation of competency-based learning approaches aligned with the evolving demands of the digital economy and society at scale.

Future research should therefore adopt more rigorous empirical approaches, including larger and more diverse student samples, pre/post assessments, longitudinal studies, and inferential statistical analyses. Such studies will be critical in determining the actual impact of the model on developing digital entrepreneurship competencies and in strengthening the evidence base for its adoption in diverse educational contexts.

Potential barriers and limitations in adopting the model across different educational contexts"

1) Resource limitations: insufficient ICT infrastructure, unstable internet connectivity, and limited access to digital devices.
2) Human factors: varying levels of digital skills among students and faculty, as well as possible resistance to adopting new pedagogical approaches.
3) Institutional constraints: budget limitations, lack of administrative support, and policy restrictions that may hinder adoption.

VII. Conclusion

The findings of this study offer several significant implications. Theoretically, the research demonstrates that integrating concepts from multiple disciplines can lead to the development of a novel conceptual framework with strong potential to foster digital competencies. However, actual learning outcomes were not directly measured in this initial study; thus, the perceived effectiveness is inferred primarily from expert judgment and participant perceptions. This limitation underscores the need for future research to empirically validate the model's impact on student learning and competency development. Practically, the proposed model can be implemented in teaching and learning management to prepare students better to become competent and innovative digital entrepreneurs.

Educators can adopt this model by utilizing online collaboration tools to create virtual co-working experiences, following the six learning stages to guide students through a project from empathy to execution.

For educational institutions, this model provides a viable approach to reconfiguring instructional strategies in alignment with the demands of the digital economy and society. It promotes a competency-based learning approach that bridges theoretical knowledge with practical application.

For policymakers, the study offers valuable insights that can inform the strategic planning of national digital human resource development initiatives.

However, the study has limitations. Notably, the effectiveness of the model has not been extensively tested in real world educational settings, and longitudinal studies tracking its long term impact on entrepreneurial behavior have yet to be conducted. Future research should aim to implement the model across diverse educational contexts, evaluate its long term outcomes, and enhance its adaptability for broader applications.

In conclusion, the proposed learning model represents an educational innovation with a strong potential to address the evolving needs of a digital society. It serves as a promising framework for advancing 21st century entrepreneurship education.

Conflict of Interest

The authors declare no conflict.

Author Contributions

N.S. contributed to the research design, data collection, and analysis. They played a significant role in the conceptualization and development of the study's framework and were involved in drafting and revising the manuscript. the literature review, developing the research methodology, and coordinating the data collection process. They also contributed to interpreting the results and provided critical revisions to the manuscript. P.W. and P.N. provided expertise

in the Experiential Design Thinking Learning Model, contributing to the theoretical framework and analysis. They also assisted in data interpretation and provided substantial feedback during the manuscript's preparation. contributed to the analysis of the critical communication skills assessment, supported the data interpretation, and was involved in the review and refinement of the manuscript. All authors contributed to completing the paper and had approved its final version.

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