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Research Article

A Proposed Instructional Model Based On Digital Learning Ecosystem To Promote Critical Thinking And Problem-Solving Skills For Nursing Students

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ABSTRACT

This research was aimed to: 1) study the problems and needs of nursing students; and 2) develop a digital learning ecosystem model to enhance the students' critical thinking and problem-solving skills. The sample, selected by simple random sampling, included 265 nursing students and 10 instructors. The research instruments included: 1) a survey of the students' problems and needs, and 2) an interview form on teaching and learning conditions. Data were analyzed using mean, S.D., and Priority Needs Index (PNI) and content analysis. Results revealed that: 1) The highest needs from the students' desired expectations were the environmental component ($\bar{X}$=4.36, SD 0.75, PNI $_{modified}$= 0.16) and the Instructor component ($\bar{X}$=4.46, SD= 0.65, (PNI $_{modified}$= 0.10) 2) The teaching and learning management indicated that the environment and learning atmosphere were conducive to the students' learning. However, there were shortages of modern technology to promote learning and a lack of diverse teaching and learning activities; and 3) The Digital Learning Ecosystem developed using case studies and scaffolding techniques to promote the students' critical thinking and problem-solving consisted of 6 elements: 1) learners, 2) facilitators, 3) scenarios, 4) scaffolding, 5) environment, and 6) evaluation. This Digital Learning Ecosystem may contribute to the development of the nursing students' critical thinking and problem-solving skills.

Index Terms— Digital Learning Ecosystem, scaffolding, critical thinking and problem-solving skills, nursing students' needs.

I. INTRODUCTION

Critical thinking and problem-solving skills are what learners need in order to be able to reason in a variety of inductive or deductive ways in various situations using a systematic thought process to make decisions and solve problems [1].Using advanced thinking processes encompassing causes and effects are an intellectual process which is carefully considered in order to come up with the best and reasonable ideas and answers and which will lead to the planning and problem-solving to suit each situation [2],[3]. Learners with critical thinking skills are individuals who have the ability to solve problems effectively[4]. Nursing education, therefore, requires students to cultivate critical thinking and problem-solving skills which will result in better efficiency in planning nursing care for patients and being able to take care of patients in critical conditions [4],[5]. In addition, teachers must create motivation and encourage students to expect success in their practice [6].

The scaffolding techniques, according to Vygotsky's theory [7] were found to help increase enthusiasm in learning and participation in case discussions which resulted in increased learning outcomes. Scaffolding as a means to helping guide students' work or provide information that is ambiguous to support students' learning in order that they can become independent in thinking out critically [8],[9]. Gradually, they will be able to interact in learning situations and solve problems on their own [10],[11]. Recently, nursing education has

employed the context of real situations in order to develop students' analytical thinking so that they could make decisions to solve various problems reasonably [12]. From a synthesis of research in the past 5 years (2019-2023), it was found that case-based learning (CBL) was frequently implemented in teaching the nursing profession to develop nursing students' critical thinking and problem-solving skills by organizing learning and learning in actual conditions in the clinic. With this method, students work together to analyze case studies in order to plan nursing care [13],[14],[15]. Research on teaching and learning in the classroom by having students work together to analyze case studies in order to plan nursing care[16],[17],[18]and the organization of classroom's teaching and learning together with online lessons by having students jointly analyze case studies to plan nursing care in the classroom and individual self-study through online lessons [19] revealed that the methods could encourage students to think critically and they were able to supply solutions to solve problems. Today, however, modern technology is used in teaching and learning by emphasizing more interactions between students and teachers and supporting students' learning by giving them access to various applications on the Internet or other networks that will help them explain complex problems, analyze possible causes of the problems, and create solutions to solve them, thereby promoting problem-solving skills in learners [20],[21].

Keeping up with the digital learning era makes knowledge accessible quickly anywhere and at any time. Using technology as a transmitter to students results in students learning about innovation and new technology by creating a learning environment that supports the learning process to create self-motivation among learners [22]. A learning environment using technology to organize teaching and learning in a systematic way covers all areas of the learner and facilitates learners to access learning at any place and time. A communication network which is a link between students and teachers, also known as "Digital Learning Ecosystem" [23] is an interactive online learning system that can systematically help determine the level of student understanding by using elements of learning management [24]. In the ecosystem there will be connections to form a learning community which helps promote students' learning according to the potential of each individual [25],[26]. When designing a favorable online learning environment for students so that they are inspired to study and acquire knowledge on their own, the essential elements are to provide them with learning assistance. The scaffolding techniques according to the Vygotskian theory [7] may help solve problems in teaching and learning because they help support student learning by creating a menu of consultations, providing advice, and responding to students' questions and needs [27]. Scaffolding may help students become more enthusiastic in learning and participate in case discussions, resulting in increased learning outcomes [10] and promote critical thinking and problem-solving [28],[29].

This study recognizes the importance of developing critical thinking and problem-solving skills in learners. Its objective was to design a Digital Learning Ecosystem using case studies as a basis along with scaffolding techniques to promote nursing students' critical thinking and problem-solving skills in order to plan quality nursing practices for patients.

Research Objectives

1. To study the problems and needs of nursing students in developing critical thinking and problem-solving skills.
2. To study and design a Digital Learning Ecosystem using case based learning as a basis to promote nursing students' critical thinking and problem-solving skills.

Research Methodology

This study employed a research and development process. The population consisted of 472 students and 38 nursing instructors from a nursing college in Central Thailand. The sample, calculated by using the Krejcie & Morgan formula and selected by simple random sampling, included 265 students and 10 nursing instructors.

Research Instrument

Two sets of research instrument were employed:

1. A survey of problems and needs in the development of critical thinking and problem-solving skills of nursing students consisted of 50 questions with the index of item- objective congruence (IOC) of 0.90 and Cronbach's Alpha of 0.87.
2. An interview form on current conditions and needs for developing critical thinking and problem-solving skills of nursing students for teachers included 9 questions with the IOC of 0.95.

Protection of Research Participants

The research protocol has been approved by the Ethics Committee for Consideration of Human Research Projects of Srinakharinwirot University (Certification document number SWUEC-662108, dated October 19, 2023). The researcher explained the research objectives, expected benefits, data collection process, and the rights of participants to withdraw from the research as well as giving information that research data would be kept confidential, used in this research only and presented in an overall manner.

Data collection

The researcher collected data by visiting the sample group and taking action to protect the rights of the sample group, then had the sample group (students) answer the questionnaires within 50 minutes and conducted interviews with the sample group (teachers) taking 30 minutes each.

Data Analysis

1. Quantitative data analysis was performed using mean, standard deviation and finding the Priority Needs Index (PNI).
2. Qualitative analysis was carried out using content analysis.

Results

1. There were 5 components in the problems and needs of nursing students in developing critical thinking and problem-solving skills including the teaching and learning management component, the learner component, the teacher component, the environment component, and the learning evaluation component as follows:
1.1. The problems of learning management to
develop critical thinking and problem-solving skills of nursing students were as follows:

1) In terms of teaching and learning management, it was found that the teaching and learning organization for large groups of students was not able to stimulate individual learning and evaluate students thoroughly. Even though the focus was on student-centered learning, the theory section contained a lot of content, so instructors were concerned about content coverage. As a result, the promotion of students' thinking and problem-solving could not to be carried out as planned. For the practical section, there were too many case studies, resulting in little preparation on the part of students. Consequently, the students had to spend a lot of time trying to review and understand the content. This made it less possible to promote students' thinking and problem-solving skills.

2) In terms of the teaching component, it was found that teachers and students had a poor relationship, causing students to stay silent and not answering teachers' questions, thus creating an unfavorable learning environment. Though teachers used a variety of teaching methods, their teaching methods were not interesting, making it difficult to stimulate student learning.

3) As for the student component, it was found that learners had different basic learning foundations. There were those who liked to search to learn things, and those who did not like searching but preferred to be spoon fed. The latter lacked readiness to learn; they read few books and did little research for new knowledge. As a result, they lacked self- confidence and were afraid of making decisions for fear that they would make mistakes. They lacked data analysis skills and presented unreliable information and were unable to give reasons to solve problems. They chose to solve problems accidentally because they were not well planned or their solutions to problems did not go through a good thought process. They chose traditional ways of problem-solving.

4) In terms of the environment, it was found that the classroom lacked a favorable learning atmosphere, and was with little modern technology to promote learning. For example, there were no online programs that could simulate patient care situations for students to care for patients step by step until the patient's condition improves. They needed programs that allow learners to access and share opinions which can be shared online simultaneously. Most of the case studies used were uninteresting paper documents which did not seem to stimulate thinking and problem- solving and the students were not very interested.

5) Regarding the evaluation of learning outcomes, it was found that the methods for evaluating learning outcomes were incomplete. Most of the assessments used were subjective and objective tests. The tests used did not yet stimulate thinking and decision-making skills. For subjective tests, the marking schemes were being developed. There was no follow-up assessment of individual thinking and problem-solving skills of the students.
1.2 Nursing students' needs in learning managements to develop critical thinking and problem-solving skills were as follows:

Table 1 Nursing Students' Needs in Learning Management to Develop Critical Thinking and Problem - Solving Skills

The students' needs in learning management were found to be at a high level ($\bar{X}$=4.01, SD=0.78). Desired expectations were at a high level ($\bar{X}$=4.39, SD=0.70). The rankings of the needs from the highest to lowest desirable expectations were as follows: the environment component ($PNI_{modified}$= 0.16), the teacher component (PNImodified= 0.10), the learner component, the learning evaluation component $(PNI)_{modified}$= 0.08), and teaching and learning management component (PNImodified= 0.06), respectively.

Component	Current Condition			Desired Expectation			PNI	Level of Needs
	$\bar{X}$	SD	Level	$\bar{X}$	SD	Level		
1. Teaching and learning management	4.05	0.74	high	4.31	0.72	high	0.06	5
2. Learner	4.04	0.77	high	4.37	0.69	high	0.08	3
3. Instructor	4.05	0.79	high	4.46	0.65	high	0.10	2
4. Environment	3.77	0.84	high	4.36	0.75	high	0.16	1
5. Learning evaluation	4.12	0.74	high	4.46	0.65	high	0.08	3
Total	**4.01**	**0.78**	**high**	**4.39**	**0.70**	high	**0.09**	

Results revealed that there were needs, ranked from the highest to lowest desired expectations, namely: encouraging learners to evaluate situations and finding new solutions if the previous problem – solving method is not achieved, encouraging learners to identify the best solution to the problem, and encouraging learners to solve problems that correspond to the cause of the problem, respectively.

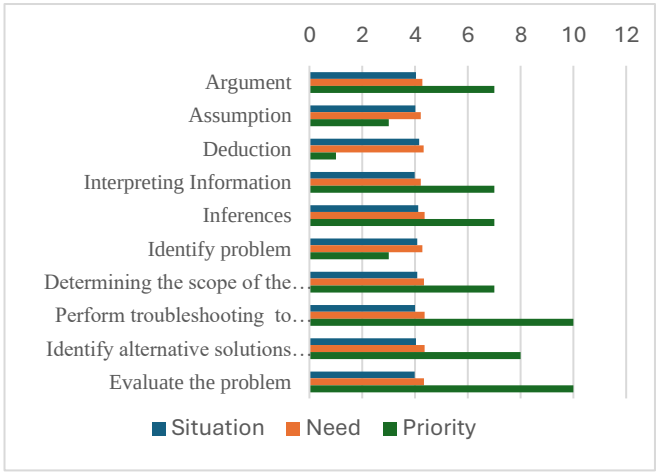

Fig. 1 Needs in Teaching and Learning Management

It was found that there were needs from desired expectations, ranked from highest to lowest, including: students wanting an online teaching management system, students having a learning plan for each subject, and students regularly searching for knowledge by themselves, respectively.

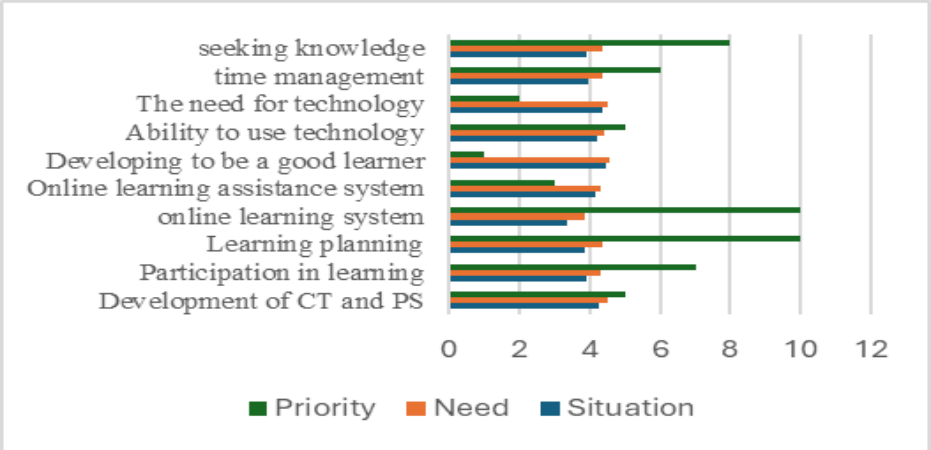

Fig. 2 Needs in Learning Management in the Student Component

Results revealed that the needs, ranked from the highest to lowest desired expectations, included: teachers realizing differences in students' learning, teachers developing the use of new technology to improve the teaching and learning, and teachers' ability to organize their teaching in many different styles, respectively.

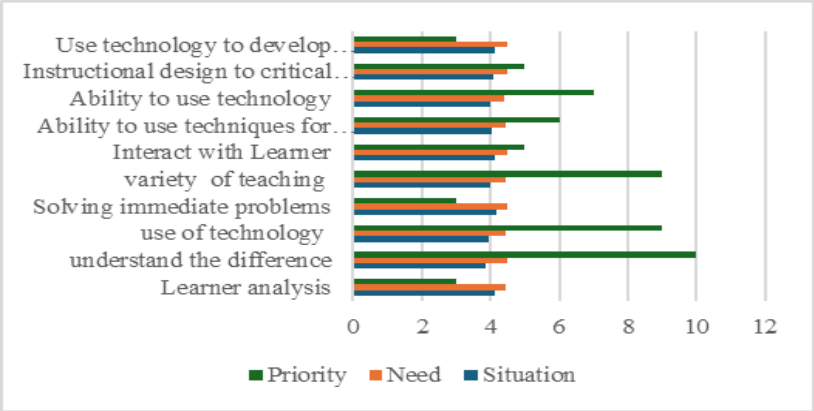

Fig. 3 Needs in Teaching and Learning Management in the Teacher Component

It was found that the needs from the desired expectations, ranked from highest to lowest, included: having created an online classroom environment that promotes learning, having managed the classroom environment to promote learning appropriately and having created an atmosphere for organizing classroom activities to promote student learning, respectively.

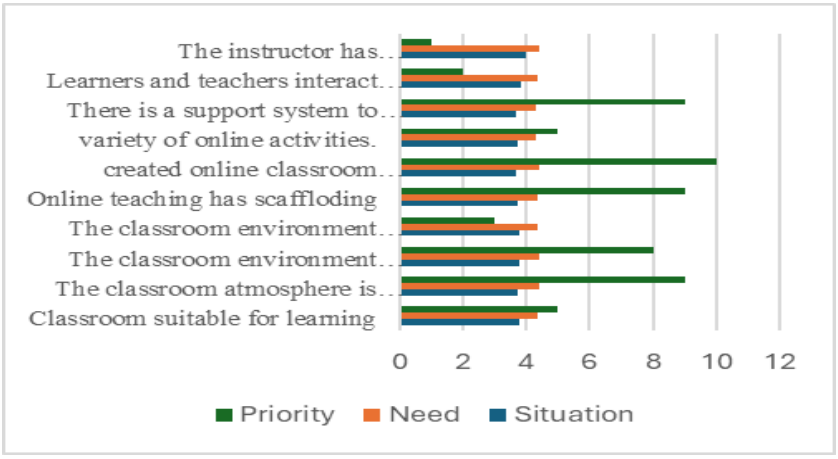

Fig. 4 Needs in Environmental Learning Management

It was found that the needs from desired expectations, ranked from highest to lowest, included: methods for evaluating learning outcomes were found to be consistent and appropriate to the learning content, having a learning evaluation format which could notify the results to students immediately so that they could improve their learning, and having an evaluation that reflected the learners' self-improvement in critical thinking and problem-solving skills, respectively.

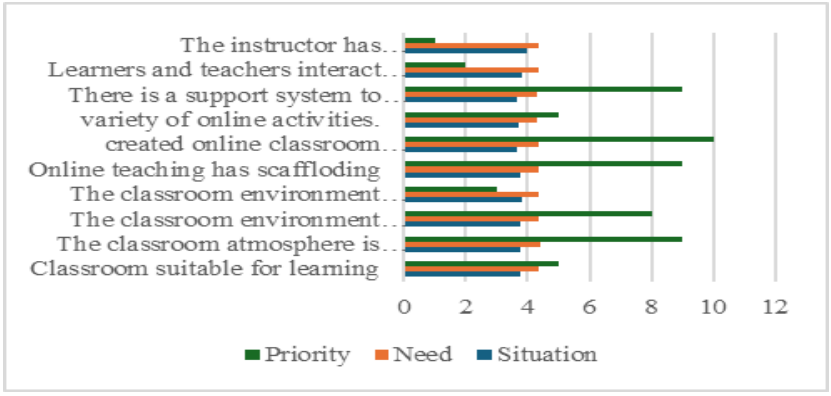

Fig. 5 Needs in Learning Management in Terms of Learning Evaluation

2. Designing a Digital Learning Ecosystem Using Case Studies to Promote Critical Thinking and Problem-Solving Skills of Nursing Students.

2.1 The Digital Learning Ecosystem using Case based learning in combination with scaffolding techniques to promote critical thinking and problem-solving skills of nursing students consisted of 6 elements:
1) learners

2) facilitators
3) scenarios
4) scaffolding
5) environment
6) evaluation

Fig. 6. A Digital Learning Ecosystem Model to Promote Critical Thinking and Problem - Solving Skills of Nursing Students

2..2 Evaluation of the components of the learning model in the Digital Learning Ecosystem

Table 2 Results of the evaluation of the components of the teaching and learning process in the Digital Learning Ecosystem

The results of the evaluation of the Digital Learning Ecosystem Model from 5 experts revealed that the overall system was the most appropriate. The overview of the Digital Learning Ecosystem Model covers the principles of the teaching model, student components and components of the digital learning environment.

evaluation topic	Mean	S.D.	Level
The components of the model covering the main aspects of the teaching model	4.80	0.45	highest
Using basic principles and concepts to develop the teaching and learning model in the digital learning ecosystem.	4.80	0.45	highest
The digital learning ecosystem consisting of 6 elements: learners, facilitators, scenarios, scaffolding, environment, and evaluation.	4.80	0.45	highest
Component 1: Learners	4.80	0.45	highest
Component 2: Facilitators	4.60	0.55	highest
Component 3: Scenarios	4.92	0.11	highest
Component 4: Scaffolding	4.92	0.18	highest
Component 5: Digital learning Environment	4.92	0.18	highest
Component 6: Evaluation	4.80	0.45	highest
Total	4.87	0.24	highest

Discussion

1. The study results on current conditions and needs for developing critical thinking and problem-solving skills of nursing students revealed that the current conditions and desired expectations were at a high level. When considered each aspect individually, it was found that the environment aspect was at a lower current level than other aspects and had the highest PNI value, indicating the need for development. The aspects with the greatest need included: creating an online classroom environment that promotes learning, managing the classroom environment to promote learning, and managing the atmosphere of classroom activities to promote student learning. The analysis of students' feedback indicated that that online classroom learning was is not interesting as it did not have proper media to promote learning. Teaching and learning in the 21st century places importance on technology as it facilitates effective interactions between students and teachers and promotes learning in an interesting atmosphere. This is consistent with the studies by Sathida

Sakulrattanakulchai and Krittaporn Haocharoen [30] who found that students had the need for suitable physical environment because it positively affected students' self-learning and provided an environment conducive to the development of problem-solving skills. Previous research revealed that two-way communication and "real time" [30] reinforced interactions between students and teachers and could be linked together within the online learning system [31]. The learning environment is classified as a support system for teachers to create motivation for students [32].

2. The design of a Digital Learning Ecosystem from the students' needs and desired expectations consisted of 6 elements:1) learners, 2) facilitators, 3) scenarios, 4) scaffolding, 5) environment, and 6) evaluation. Overall, the evaluation results from experts were at the highest level.

The Digital Learning Ecosystem is the organization of learning environment in the digital system by selecting main tools and equipment that contribute to mutual interactions between teachers and learners [25]. The design of the Digital Learning Ecosystem in this study was taken from the suggestions of the needs of nursing students and nursing instructors as follows:

2.1 The learner component consisted of learners and their peers. The students needed a learning plan for each subject to organize online learning. The system will place students in a learning community that consists of their peers and various knowledge sources to choose from, as well as from the teacher and their self-directed learning in the system. Learners and their peers can communicate with each other in the system. Learning will be mediated by interactions with their peers within the learning community [33].

2.2 The facilitator component consisted of nursing instructors and technologists. There were needs for instructors to have understanding of students who had different learning styles. The Digital Learning Ecosystem is therefore designed to incorporate a 2-way communication channel for learners to participate in learning and ask challenging questions that stimulate thinking, to participate in the discussion of case studies and summarize key points. These will lead students towards reasonable problem-solving and learning at a deeper level [13].

2.3. Regarding the scenario component, nursing education required realistic situations, for example, videos, still pictures, animations, and simulations to help learners gain understanding of and link to actual patient care. These will also attract students' attention and stimulate learning [34]. Therefore, the design of the Digital Learning Ecosystem requires a system that can present patient information, such as displaying a critical point in the changing condition of the case study and the results of patient care. This will encourage learners to identify the best solution for each problem and use existing knowledge and previous experiences to make decisions [35].

2.4 Regarding the scaffolding component, students expected to have assistance in the management of teaching and learning in the online system so that they could develop themselves. Teachers were also expected to interact with students regularly during teaching and learning. As a result, the Digital Learning Ecosystem incorporates a menu to provide learners with assistance which includes intricate information, guidance, and discussions over the internet. Providing learners with expert advice and learning resources using scaffolding techniques can help develop students' critical thinking and problem-solving abilities [10],[28]. This is consistent with Vygotsky's theory (1978) which maintains that scaffolding consists of 4 important concepts: creating mutual understanding between students and teachers, continuous diagnosis to adjust the level of assistance, collaborative interactions, and the reduction of assistance and transfer of responsibility [7]. Such scaffolding activities support intellectual skills that help develop higher-order thinking and promote problem-solving strategies [11].

2.5 As regards the environment component, the students expected and needed more efficient and interesting online teaching. They needed quick Internet connections with easily accessible platforms to promote quality learning. Therefore, the teaching and learning ecosystem was designed to incorporate interacting environments such as devices, tools, software, and operating systems. It also includes students, teachers, and content designers who design contents using various media within the Digital Learning Ecosystem. All the components will be connected as a learning community in the ecosystem and help promote students' learning according to their individual potential [25],[26].

2.6 Regarding the learning evaluation component, the students expected and needed to have evaluation results notified to them immediately so that they could use them to improve their learning. They needed evaluation methods that are consistent with and appropriate to the learning content. Therefore, the Digital Learning Ecosystem was designed to be evaluated as a situational examination. This allows learners to see their own assessments every time, resulting in self-planning for self-development [36].

Conclusion

The study on the promotion of critical thinking and problem-solving skills of nursing students focuses on using learning arrangement on the Digital Learning Ecosystem together with case studies and scaffolding techniques. The Digital Learning Ecosystem consists of 6 components: 1) learners, 2) facilitators, 3) scenarios, 4) scaffolding, 5) environment, and 6) evaluation. All the components are conducive to learners' learning. The teaching and learning activities can be arranged synchronously or asynchronously between students and

teachers. The teaching and learning success emphasize the development of nursing students' critical thinking and problem - solving skills so that they will be able to plan appropriate and effective nursing care.

REFERENCES

1. S. Sakunya and W. Supap, "The development of creative problem-solving competency on the application of linear equation for one variable topic on mathematizing process of 7 th grade students," *Journal of Education Naresuan University*. Vol. 22, No. 4, pp. 88-100, 2020.
2. P. A. Facione. *Critical thinking: What it is and why it counts*. http://www.insightassessment.com/CT-Resources/Teaching-For-and-About-Critical-Thinking. 2020.
3. R.H.Ennis and H. Robert, "A logical basic for measuring critical thinking skill," *Journal of Education Leadership*. Vol. 43, pp. 44-48, 1985.
4. T.S. Midilli& G. Altas, "The Relationship between Critical Thinking Disposition and Problem-Solving Skills in Nurses," *International Journal of Caring Sciences*. Vol. 13, No. 3, pp.1890-1897, 2020.
5. J. Kaewsakulthong, M. Leeyuthanont and P. Uraiwan, "The Effect of Using a problem-solving Ability Program to Improve Problem Soling Skill in Nursing Student, Borommarajonani College of Nursing Suratthani," *Journal of Health and Nursing Education*. Vol. 26, No.1, pp. 7-27, 2019.
6. S.Sinthuchai, V. Rachawat and P. Yod-A-Sa, "Scaffolding: Appling for Learning and Teaching in Clinical Setting," *Journal of Boromarajonani college of nursing, Surin*. Vol. 8, No. 2, pp. 68-79, 2019.
7. L. S. Vygotsky. *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press. 1978.
8. S.V. Kampen, "Scaffolding Experiential Learning in the Undergraduate Graphic Design Studio," *International Journal of Design Education,* Vol. 15, No.1, pp. 221–229, 2021.
9. S. Coffman, M. Iommi &, K. Morrow, "Scaffolding as active learning in nursing education," *Teaching & Learning in Nursing*, Vol. 18, No.1, pp. 232–237, 2023.
10. J.G. Gómez, H.H. Riaño, & V.H. Riaño, "Scaffolding System for Solving Problems in Engineering Education,", *Revista Ingenierías Universidad de Medellin*. Vol. 20, No.39, pp. 35–53, 2021.
11. J.Rokhmat, Marzuki, Wahyudi, & S. D. Putrie, "A strategy of scaffolding development to increase students' problem-solving abilities: The case of physics learning with causalitic-thinking approach," *Journal of Turkish Science Education*. Vol. 16, No.4, pp. 569-579, 2019.
12. K. Jolumluk and A. Satiman, "Effects Of E-Learning by Using Problem-Based Learning for Critical Thinking, The Problem-Solving Ability and Cooperative of Undergraduate Students Faculty of Education," *Veridian E-Journal*. Vol.11, No.2, pp.1422-1439, 2018.
13. S. Raksatham and S. Wannasuntad, "Effect of Applying Case- Based Learning through Professional Learning Community on Problem Solving Skill of Nursing Students,"*Journal of Health and Nursing Research*. Vol. 36, No. 3, pp. 220-232, 2020.
14. T.Punsomreung,S. Kanhadilok,R. Prasertsri and S.Inchaithe, "Effects of Case Based Learning and Simulation Based Learning on Students' Perceptions of Clinical Judgment and Students'Clinical Judgment," *Journal of Nursing and Education*. Vol. 14, No.1. pp. 14-32, 2021.
15. S. Ornlaor,S.Wattana, K.Apinyalungkon and Y. jaradrattanapaiboon, "Effects of a Case-Based Learning on Clinical Decision Making among Nursing Students," *The Southern College Network Journal of Nursing and Public Health*. Vol. 9, No.1, pp.69-80, 2021.
16. T. Rakpanusit1and R. Ruangrit , "The Effects of a Case-Based Learning Method Combined with Concept Mapping and Reflective Thinking on the Level of Critical Thinking among Nursing Students in Pattani," *The Southern College Network Journal of Nursing and Public Health*. Vol. 8, No. 3, pp.18-31, 2021.
17. F.Roshangar, E.F.Azar, P.Sarbakhsh, & R.Azarmi, "The Effect of Case-Based Learning with or without Conceptual Mapping Method on Critical Thinking and Academic Self-Efficacy of Nursing Students," *Journal of Biochemical Technology*. Vol. 11, No.1, pp. 37–44, 2020.
18. M.Gholami, F. Changaee,K.Karami, Z.Shahsavaripour, A.Veiskaramian, & M.Birjandi, "Effects of multiepisode case-based learning (CBL) on problem-solving ability and learning motivation of nursing students in an emergency care course," *Journal of Professional Nursing*. Vol. 37, No. 3, pp. 612–619, 2021.
19. P. Ratchapakdee, P. Chamnankit and V. Vonganusith, "Development of a Blended Learning Instructional Model Based on Collaborative and Case-Based Learning to Enhance Learning Achievement, Problem Solving Thinking, Teamwork Skills, and Attitudes toward Nursing Profession of Nursing Students,"*Journal of Social Science and Cultural*. Vol. 7, No..2, pp. 460-488, 2023.
20. A.A.Koehler, H.Fiock, S.Janakiraman, Z.Cheng & H.Wang, "Asynchronous Online Discussions during Case-Based Learning: A Problem-Solving Process," *Online Learning*, Vol. 24, No. 4, pp. 64–92, 2020.
21. S.Dhawan, "Online learning: a panacea in the time of COVID-19 crisis," *Journal Education Technology System*. Vol. 49, No. 1, pp. 5–22, 2022.

22. C.Tørris, M.E.Meyer, I.H.Sandbekken, H.Halvorsrud &M. Molin, "Nursing Students' Perceived Learning Outcomes, Motivation to Learn and Grade Achieved in a Digital Blended Learning Course: A Norwegian Cross-Sectional Study," *Education Sciences*, Vol. 12 No.7, N.PAG, 2022.
23. S. Maneehaet and P. Wannapiroon, "A digital learning ecosystem with artificial intelligence for smart learning.," *Journal Education Naresuan University,* Vol. 21 No.2, pp.359-373, 2019.
24. T Meepung, S.Pratsri & P. Nilsook, "Interactive tool in digital learning ecosystem for adaptive online learning performance," *Higher Education Studies*, Vol.11 No. 3, pp.70–77, 2021.
25. K.Sarnok,P.Wannapiroon, P.Nilsook and N.Chalermsuk , "System Architecture and Elements of Digital Learning Ecosystem for Teaching and Learning with Digital Storytelling for Teacher Professional Students*," Sikkha Journal of Education*, Vol. 6 No. 2, 2019.
26. I.K.Ficheman and R. D. Lopes, "Digital Learning Ecosystem: Authoring, Collaboration, Immersion and Mobility. *Eighth IEEE International Conference on Advanced Learning Technologies,* 2018.
27. N. Kitjaroonchai & C. Phutikettrkit, "Online Scaffolding Strategies: Case Studies of Asian EFL Learners in an Academic Writing Course," *Theory & Practice in Language Studies,* Vol. 12, No. 10, pp. 2036–2047, 2022.
28. P.C.Lin, H.T.Hou & K.E.Chang, "The development of a collaborative problem solving environment that integrates a scaffolding mind tool and simulation-based learning: an analysis of learners' performance and their cognitive process in discussion," *Interactive Learning Environment*s, Vol. 30, No. 7, pp.1273–1290, 2022.
29. S.M.Ruder, C.Stanford & A.Gandhi, "Scaffolding STEM Classrooms to Integrate Key Workplace Skills: Development of Resources for Active Learning Environments," *Journal of College Science Teaching*, Vol. 47, No. 5, pp. 29–35, 2018
30. S. Sakulrattanakulchai and K. Haocharoen, "Physical Environmental Arrangement to Encourage Students' Self-Directed Learning at Thammasat University, Rangsit Campus," *Arch Journal Issue*, Vol.18, No. 1, pp.122-139, 2014.
31. T.Wannaprapha & A.Todsapim, "Online Learning Environment in 21st Century Education," *e-Journal of Education Studies Burapha University*, Vol.1, No.1, pp.1-10, 2019.
32. C.Kaeomaniand P. Wetwiriyasakun, "The DevelopmentofAnInstructionalModelUsingCaseBasedLearningtoEnhanceStudentsTeacher's CriticalThinking," *Silpakorn Educational Research Journal*. Vol. 12, No. 2, pp. 480-497, 2021
33. A.Ploysopon, "Developing of Lesson Plans in the Course of Psychology for Learner's Developing by Using a Peer Assisted Learning on Social Networks," J*ournal of Rajanagarindra*, Vol. 19, No. 1, pp.1-7, 2022.
34. S. P. Rao, "The Importance of Speaking Skills in English Classrooms. *Alford Council of International English & Literature Journal*," Vol. 2, No. 2, pp. 6-18, 2019.
35. P.Songwatthanayuth and S.Polin, "The Curriculum for Nursing Students in The 21st Century: Case Study and Transformative Learning. *Journal of Royal Thai Army Nurses*," Vol. 20, No. 2, pp.10-16, 2019.
36. V.Villarroel, S.Bloxham, D.Bruna, C.Bruna& C.Herrera-Seda (2018). Authentic assessment: creating a blueprint for course design. *Assessment & Evaluation in Higher Education*, Vol. 43, No. 5, pp. 840–854, 2018.