



Enhancing 21st Century Learning Competencies among Thai Higher Education Students: A Meta-Analytical Approach

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ABSTRACT

This research aimed to investigate the characteristics of studies related to enhance of 21st century learning competencies among Thai higher education students and offer recommendations for enhancing these competencies. A selective analysis of 16 studies conducted from 2018 to 2022 was undertaken, utilizing a questionnaire to document research characteristics. Subsequently, the data underwent analysis through meta-analysis and content analysis methodologies.

The synthesis of research findings highlighted a predominant focus on critical thinking skills in studies on cultivating 21st century learning competencies among Thai higher education students. Additionally, attention was given to communication, creativity, and cooperation skills. Commonly employed research tools included learning styles, learning methods, and digital instructional media.

The research synthesis underscored the significant influence of learning methods tools (score: 4.40, 95% CI: 3.02, 5.79), followed by learning styles tools with a high influence (score: 3.10, 95% CI: 1.80, 4.39). Conversely, digital instructional media tools exhibited the least influence (score: 1.70, 95% CI: 0.94, 2.47). Furthermore, the study proposed a framework for cultivating critical thinking, communication, creativity, and cooperation skills among Thai higher education students within the realm of 21st century learning competencies.

Index Terms— Learning Competencies, Higher Education, Meta-Analytical

I. INTRODUCTION

The onset of the second decade of the 21st century has witnessed rapid transformations in societal, economic, and political domains, alongside significant advancements in technology. These developments have led to a profound alteration in various dimensions of human cultural practices, ushering humanity into the era of Digital Disruption. This epoch signifies a period of disruptive change catalyzed by digital technologies, precipitating swift and pervasive shifts in societal paradigms and modes of existence.

The aforementioned circumstances have prompted governmental agencies in Thailand to heighten their efforts in fostering adaptability among Thai citizens to cope with multidimensional changes. This is evidenced by the National Strategy for the 20-Year Plan (B.E. 2560-2579), which delineates strategies for developing and enhancing human resources to ensure that learners receive quality education encompassing knowledge and ethics universally and equitably. The aim is to empower individuals with skills and capabilities conducive to national development in alignment with the principles of sufficiency economy and the evolving landscape of the 21st century global arena.

Furthermore, the Thai government has announced the 12th National Economic and Social Development Plan (B.E. 2560-2564), which outlines Sustainable Development Goals (SDGs) and endeavors to transition Thailand towards Thailand 4.0 while emphasizing the importance of inclusivity across all sectors, including occupational groups, regional levels, and national levels, towards sustainability, prosperity, and resilience.

Notably, Strategy 8 focuses on advancing science, technology, research, and innovation to enhance the competitiveness of the production and service sectors and improve the quality of life for citizens. [1]

Additionally, a continuous policy framework has been established in the 13th National Economic and Social Development Plan (B.E. 2566-2570) to enable Thailand to overcome various challenges and progress towards becoming a secure, prosperous, and sustainable nation, guided by the principles of sufficiency economy as espoused by the national strategic intent (National Strategy Plan 12-13). [2]

The awakening of the Thai education system is evident through the Ministry of Education, as facilitated by the Office of the Secretary-General of the Education Council, which has formulated the National Education Plan for the years 2560–2579 B.E. This plan establishes objectives and directions for the management of education in the country, aiming to ensure that all Thai people have access to quality education opportunities and equity, to develop an efficient education management system, and to cultivate a workforce with competencies aligned with labor market demands and national development needs. Additionally, the National Education Standards Framework for B.E. 2561 has been developed as a tool for educational institutions nationwide to guide education management in alignment with local contexts and the quality of life of local communities, fostering desirable characteristics among learners both during and after their education, and cultivating a new generation of Thai individuals embodying the attributes of Thai 4.0, who will play a crucial role in fostering the country's sustainable and prosperous development with pride [3]. The characteristics of Thailand 4.0 individuals are outlined as follows: 1) Lifelong Learners: They are committed to continuous learning and possess skills to adapt to the digital age. They value Thai wisdom, possess life skills for sustainable livelihoods, and aim for a high quality of life for themselves and society. 2) Innovative Collaborators: They have intellectual, digital, and creative skills, collaborating to create technological and social innovations that benefit themselves and society. And, 3) Resilient Citizens: They have a strong sense of national and global citizenship, understanding ethical principles and contributing positively to their country and the world. Education focuses on preparing individuals for the challenges of the 21st century global society. [4]

Upon conducting research on the synthesis of studies regarding the promotion of learning competencies in the 21st century for learners, there is a dearth of research that has systematically studied, collected, and synthesized research in this area. However, there is evidence of synthesized research on learning competencies in the 21st century in subtopics such as innovation research to develop analytical thinking skills in the Thai language learning domain of basic education students through discourse analysis, systematic research synthesis of teaching methods to enhance higher-order thinking: critical thinking and creative thinking, and research synthesis of social studies teaching management to develop process thinking skills of basic education students between the years 1999-2010, utilizing discourse analysis and content analysis, among others. [5] [6] [7]

Based on the preceding discourse, scholars acknowledge the importance and imperative nature of consolidating research pertaining to the advancement of learning proficiencies among Thai tertiary-level students in the 21st century. This endeavor will be undertaken through quantitative research synthesis employing meta-analysis techniques to amalgamate research findings and construct a conceptual framework delineating strategies for fostering 21st century learning proficiencies among students. This framework will function as a blueprint for forthcoming research endeavors aimed at augmenting learning proficiencies among students in the 21st century. Addressing Research Question 1: "What are the implications and requirements of synthesizing research to promote 21st century learning competencies among Thai higher education students?" and Research Question 2: "How can this synthesis inform future research efforts aimed at enhancing learning competencies for students in the 21st century?"

II. METHODOLOGY

The objective of this study is to synthesize research on the promotion 21st century learning competencies among Thai higher education students. The researchers have outlined the scope of the study as follows:

A. Definition & Meaning

1) Synthesis of research refers to the systematic gathering of postgraduate-level research articles from education and educational science journals accredited by the Thai-Journal Citation Index Centre (TCI), Group 1, from the year 2018 to 2022. These articles pertain to the promotion of learning competencies in the 21st century. The synthesis process involves both qualitative content analysis of research articles and quantitative research synthesis through meta-analysis. The aim is to summarize the findings of research that contribute to the promotion of learning competencies in the 21st century.

2) A Meta-Analytical Approach refers to the statistical process of synthesizing quantitative research findings from studies addressing the same research problem. It involves analyzing data using standardized statistical indices, typically employing the methodological framework of Glass. The process entails examining the aggregated statistics to compare, summarize findings, and present a framework for future research.

3) 21st Century Learning Competencies refer to the set of skills that are essential for comprehending information, content, lessons, and diverse narratives, as well as for innovating to address the needs of the

digital society. These competencies encompass communication skills, creative thinking skills, teamwork skills, and critical thinking skills.

4) Learners refers to the sample group utilized for gathering and consolidating research data, specifically denoting Thai higher education students.

5) The methods for promoting 21st century learning competencies encompass the tools, steps, and learning management processes aimed at equipping learners with communication skills, creative thinking skills, teamwork skills, and critical thinking skills.

B. Literature Search and Retrieval

This study focuses on researching the promotion of 21st century learning competencies for students, conducted between the years 2018 and 2022. This timeframe coincides with the period of the implementation of the national educational standards in Thailand in the year 2018. Consequently, during this period, all tertiary education institutions underwent curriculum adjustments to align with the national educational standards.

1) The population and sample group.

The population utilized for this study comprises research articles at the graduate level from journals in education and educational sciences that have been peer-reviewed and accredited by the Thai-Journal Citation Index Centre (TCI), Group 1. These journals have been published from the year 2018 to 2022 and consist of 7 journals: (1) Journal of Education, Chulalongkorn University, (2) Journal of Educational Studies, Khon Kaen University, (3) Journal of Educational Studies, Naresuan University, (4) Journal of Educational Studies, Prince of Songkla University, Pattani Campus, (5) Journal of Educational Studies, MSU, (6) Education Journal, Chiang Mai University, and (7) Journal of Educational Research, Faculty of Education, Rajabhat Phibulsongkram University. The total number of research articles is 1,774. The criteria for selecting the sample group are as follows:

a) Research articles with titles in the Thai language that include terms such as "Learning competencies" or "21st century skills" or "Creativity skills" or "Critical Thinking skills" or "Problem Solving skills" or "Communication skills" or "Collaboration skills" or "ICT" should be included. These articles should also contain corresponding terms in English within their titles.

b) The research should include a sample group of Thai higher education students.

2) Variables under study:

a) Independent Variables include:

(1) Types of tools used to promote learning competencies in the 21st century for Thai higher education students.

(2) Tools utilized to enhance learning competencies in the 21st century for Thai higher education students.

(3) Duration of promoting learning competencies in the 21st century for Thai higher education students.

b) Dependent Variables consist of 21st century learning competencies comprising critical thinking skills, communication skills, teamwork skills, and creative thinking skills.

3) Tools

a) Data Recording Form for Promoting Learning competencies in the 21st Century for Thai higher education students.

b) Encoding Guide for the Data Recording Form for Promoting Learning competencies in the 21st Century for Thai higher education students.

c) Content Alignment Assessment Form for the Data Recording Form and Encoding Guide for Promoting Learning competencies in the 21st Century for Thai higher education students.

d) JBI critical appraisal checklist for systematic reviews and research syntheses.

4) Data Analysis

In this study, data analysis was conducted using the STATA software (version 14.2) to determine the effect size factors and to assess heterogeneity differences. PRISMA Flow Chart for Literature Searching and Reviewing

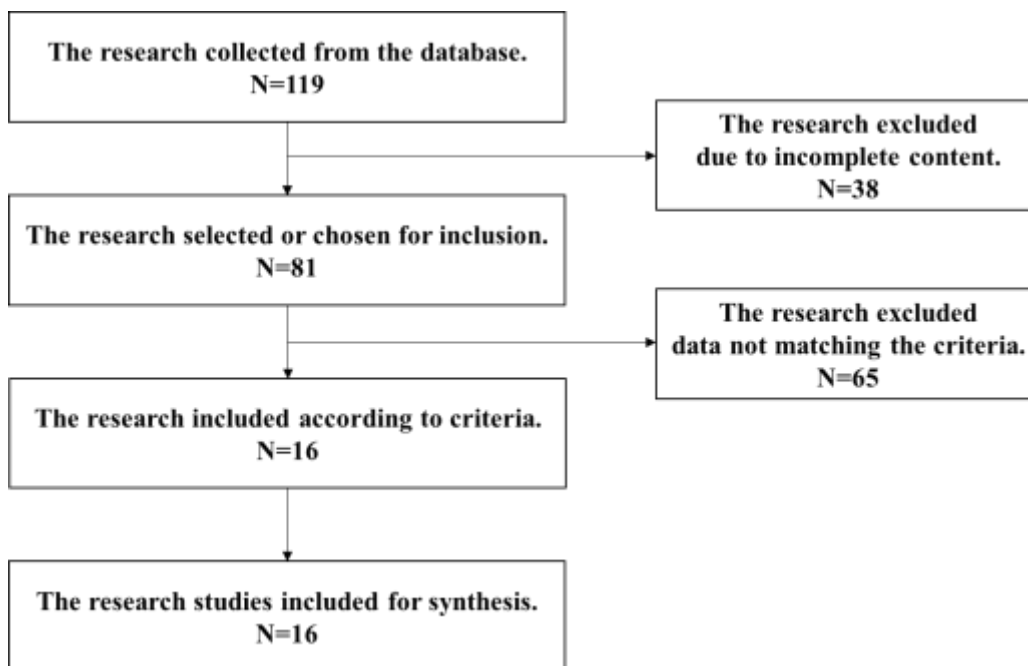
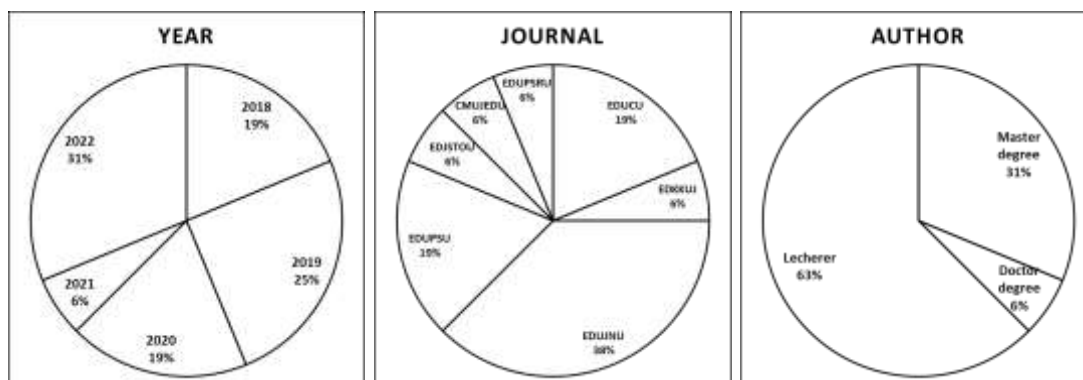


Fig 1 PRISMA Flow Chart for Literature Searching and Reviewing

III. RESULTS

From a research investigation conducted at the graduate level, examining journals in education and pedagogy certified by the Thai-Journal Citation Index Centre (TCI) Group 1, spanning from the year 2018 to 2022, a total of 119 issues were identified. Among these, there were 19 issues from the Chulalongkorn University Journal of Education, 10 from the Khon Kaen University Journal of Education, 44 from the Naresuan University Journal of Education, 18 from the Prince of Songkla University Journal of Education, 9 from the Mahasarakham University Journal of Education, 11 from the Chiang Mai University Journal of Educational Studies, and 8 from the Rajabhat Pibulsongkram University Journal of Education. Following the exclusion of incomplete research content, 38 issues were eliminated, leaving 81 research articles. Subsequently, a study was conducted to select research works meeting the criteria. Upon review, 16 research articles were deemed suitable for systematic literature review and synthesis of research to examine the influence of promoting 21st century learning competencies for Thai higher education students. The presentation of study findings is divided into two sections: Section 1 detailing the characteristics of the research works and Section 2 analyzing the influence of promoting 21st century learning competencies for Thai higher education students. The key findings from each section are as follows:

Characteristics of Research Dissemination



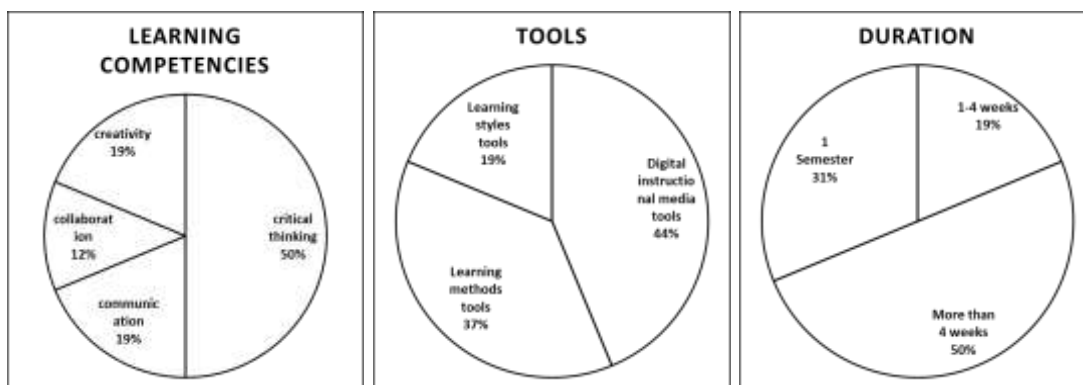


Figure 2 Characteristics of Research Dissemination

Figure 2 showed the characteristics of research publications encompass the year of publication, the journals of dissemination, and the authors. It is found that research concerning the promotion of learning competencies in the 21st century for Thai higher education students is predominantly disseminated in the year 2022 (31.25%). The majority of these publications appear in the Journal of Education and Innovation (37.50%), with over half of the principal authors being professors in tertiary education institutions (62.50%). Regarding research focusing on the enhancement of learning competencies in the 21st century for Thai higher education students, the most prevalent skill is critical thinking (50%), whereas the least prevalent is teamwork (12.50%). The most commonly utilized research tools are techniques/methods (43.75%), followed by instructional formats (37.50%) and digital media (18.75%). The preferred duration for experiments is typically over 4 weeks but less than a semester (50.00%).

A. A Meta-Analytical Approach

The results of the data analysis regarding the promotion of 21st century learning competencies for Thai higher education students, derived from the synthesis of all 16 research articles, were studied using the STATA statistical software. The analysis involved examining frequency, influence values, confidence intervals, standard scores, and assessing heterogeneity using the Heterogeneity test. The data analysis was categorized into four main points, including the promoted 21st century learning competencies, types of tools used to promote 21st century learning competencies, duration of promoting 21st century learning competencies, and detailed information as follows:

- 1) The effect size of promoting 21st century learning competencies for Thai higher education students, categorized by the specific 21st century learning competencies that have been promoted.

Table 1 The effect size of promoting 21st century learning competencies for Thai higher education students, categorized by the specific 21st century learning competencies that have been promoted.

21 st Century Competencies	Learning	f	OR (95% CI)	z	p-value	I ²
1) Critical thinking skills		8	2.83 (19.2, 3.75)	6.07	<.01	91.6%
2) Communication skills		3	2.00 (1.49, 2.52)	7.59	.08	59.7%
3) Collaboration skills		2	3.47 (-1.26, 8.20)	1.44	<.01	98.1%
4) Creativity skills		3	5.95 (4.31, 7.58)	7.12	<.01	86.5%
Total		16	3.30 (2.51, 4.09)	8.22	<.01	94.8%

The table 1 presents the frequency values, influence coefficients, confidence intervals, standard scores, and heterogeneity assessment of the promotion of 21st century learning competencies among Thai tertiary education students, categorized by 21st century learning competencies that have been promoted. From the analysis of data from 16 research studies, it was found that the promotion of 21st century learning competencies had an average influence coefficient of 3.30 (2.51, 4.09). Creativity skills had the highest influence coefficient at 5.95 (4.31, 7.58), followed by collaboration skills at 3.47 (-1.26, 8.20), critical thinking skills at 2.83 (19.2, 3.75), and communication skills at 2.00 (1.49, 2.52) in descending order. Further details are depicted in the accompanying figure 3.

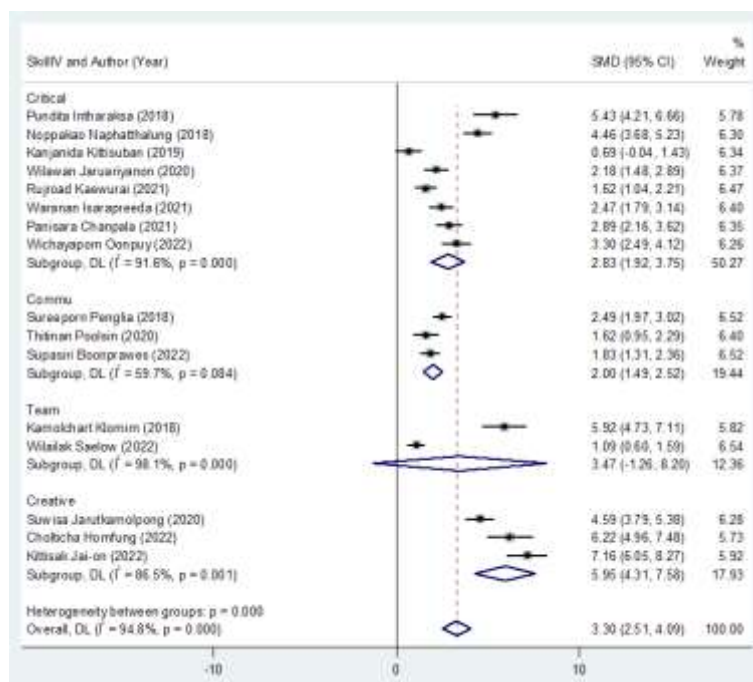


Figure 3 The effect size of promoting 21st century learning competencies for Thai higher education students, categorized by the specific 21st century learning competencies that have been promoted

2) The effect size of promoting 21st century learning competencies for Thai higher education students, categorized by the types of tools used that have been promoted.

Table 2 The effect size of promoting 21st century learning competencies for Thai higher education students, categorized by the types of tools used that have been promoted.

Tools	f	OR (95% CI)	z	p-value	I ²
1) Learning methods tools (In fig 3 label "Model")	3	1.70 (0.94, 2.47)	4.36	<.01	80.6%
2) Learning styles tools (In fig 3 label "Technique")	6	4.40 (3.02, 5.79)	6.24	<.01	93.6%
3) Digital instructional media tools (In fig 3 label "Digital")	7	3.10 (1.80, 4.39)	4.68	<.01	95.5%
Total	16	3.30 (2.51, 4.09)	8.22	<.01	94.8%

The table 2 presents the frequency, influence coefficients, confidence intervals, standard scores, and heterogeneity assessment of promoting 21st century learning competencies among Thai tertiary education students, classified by the type of tools used to promote these skills. From the analysis of data from 16 research studies, it was found that the types of tools used to promote 21st century learning competencies had an average influence coefficient of 3.30 (2.51, 4.09). Instructional format tools had the highest influence coefficient at 4.40 (3.02, 5.79), followed by technical/methodological tools at 3.10 (1.80, 4.39), and digital media tools had the lowest influence coefficient at 1.70 (0.94, 2.47). Further details are depicted in the accompanying figure 4.

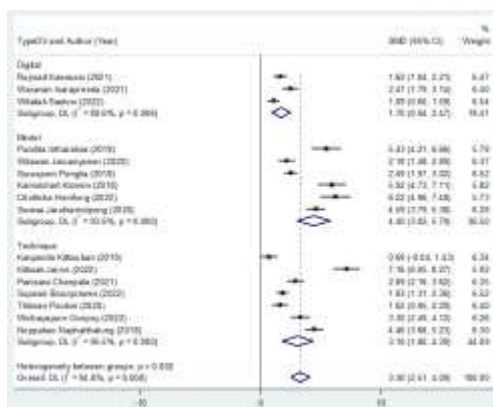


Figure 4 The effect size of promoting 21st century learning competencies for Thai higher education students, categorized by the types of tools used that have been promoted.

Discussion

The synthesis of research on promoting 21st century learning competencies among Thai higher education students yields multiple benefits. For educators, it offers guidance in tailoring learning management processes, including promotion methods, tool selection, and scheduling, to effectively foster these skills among students. For learners, it facilitates the development of 21st century competencies, equipping them with the readiness to adapt to future changes while maintaining a sense of fulfillment. Additionally, for administrators, it provides valuable insights for enhancing personnel training, enabling them to cultivate suitable learning management processes that promote 21st century learning competencies among Thai tertiary education students.

Through the analysis of data utilizing meta-analysis, several critical issues have been identified as follows:

B. Learning methods tools are highly effective in promoting 21st century learner competency due to their ability to engage learners, personalize learning experiences, facilitate collaboration, enhance accessibility, foster critical thinking and problem-solving skills, promote information literacy, and encourage lifelong learning. The research titled "Learning Model to Promote Teacher Students' Creative Thinking for the 21st Century Learning Innovation Design: Faculty of Education, Nakhon Phanom University" sought to develop and assess learning models aimed at enhancing creative thinking among teacher students. The study revealed that the implemented learning models effectively facilitated creative thinking, with a mean rating of 4.68 and a standard deviation of 0.39, indicating the highest level of appropriateness. Furthermore, there was a statistically significant improvement in teacher students' creative thinking post-implementation compared to pre-implementation, with a significance level of 0.05. The learning model comprised components such as situational challenges to stimulate critical thinking, exploratory strategies for innovation, practical engagement in innovative practices, and critical analysis of outcomes with feedback incorporation for improvement. These components were synthesized from relevant research works focused on promoting creative thinking [8]. By leveraging interactive technologies and innovative approaches, educators can create dynamic learning environments that equip learners with the skills, competencies, and mindset necessary to thrive in today's rapidly evolving world, enabling them to adapt to new challenges and opportunities throughout their lives.

C. The learning style promoting 21st century learner competencies is characterized by a student-centered approach, project-based learning, integration of technology, experiential learning, and a focus on global awareness and cultural competency. This approach empowers students to take an active role in their learning process, fostering adaptability and readiness for diverse contexts. In accordance with the educational discourse, the study titled "The Learning Management Using a Model Based on the STEM Education Concept to Promote Problem Solving and Decision-Making Skills of Teacher Students" aims to experiment with the application of a learning management framework aligned with STEM Education principles to review and analyze the process of activities organization through the utilization of the STEM Education model. The study investigates the problem-solving and decision-making skills of teacher students following their engagement in these activities. Upon comparing the scores before and after the activities, it was observed that they improved post-engagement. Furthermore, an analysis of the self-assessment of problem-solving and decision-making skills by the students revealed moderate levels before the activities, which subsequently increased significantly after the activities. It is evident that cognitive behaviors are crucial and should be nurtured from childhood to adulthood, progressing from a basic to a more complex understanding level. This attribute is pivotal for fostering quality classroom management. Therefore, educators should comprehend the significance of processes, problem-solving, and decision-making, and utilize appropriate and effective decision-making principles and tools [9]. By incorporating real-world projects, leveraging technology, and emphasizing cultural understanding, students develop critical thinking, collaboration, and problem-solving skills essential for success in today's fast-paced and interconnected world. It empowers students to actively engage in their learning and adapt to various contexts, preparing them for success in a rapidly changing world.

D. Digital instructional media tools are valuable for promoting 21st century learner competency by enhancing engagement, accessibility, and real-world application of knowledge. The study, "Developing Efficient WebQuest-Based Instruction through Online Social Network for Enhancing Analytical Thinking Skill, Evaluative Thinking, and Self-Directed Learning Behavior of Teacher Education Students," investigates the effectiveness of web-based inquiry learning in teacher education. It compares the outcomes of students engaged in web-based learning via online social networking with those following traditional teaching methods. The results reveal that students in the web-based learning group showed improved self-directed learning behavior compared to their pre-instruction levels and outperformed students in the traditional teaching group in this aspect. This suggests that web-based inquiry learning fosters self-directed learning, allowing students to access diverse resources, interact with peers and instructors online, and manage their study schedules independently [10]. However, their effectiveness is maximized when integrated within a learning methodology that prioritizes effective teaching methods and pedagogical approaches. Ultimately, the synergy between innovative tools and teaching practices are essential for 21st century learning competencies in a modern education. Learning methods provide the foundation for education, encompassing pedagogical approaches and instructional strategies. While digital tools can enhance learning, their importance is

secondary to the methods themselves. Effective implementation, human interaction, adaptability, and fostering critical thinking are key considerations in utilizing both methods and digital tools for optimal learning outcomes.

IV. CONCLUSION

The research synthesis underscored the significant influence of learning methods tools (score: 4.40, 95% CI: 3.02, 5.79), followed by learning styles tools with a high influence (score: 3.10, 95% CI: 1.80, 4.39). Conversely, digital instructional media tools exhibited the least influence (score: 1.70, 95% CI: 0.94, 2.47). Furthermore, the study proposed a framework for cultivating critical thinking, communication, creativity, and cooperation skills among Thai higher education students within the realm of 21st century learning competencies.

V. APPENDIX

Study (s)	Journal (s)	Title (s)	Digital access (s)
Cholticha Homfung (2022)	Journal of Education and Innovation	The results of using the creative learning activities by applying the motif for enhancing the concept on motif in folktale, creative writing ability and develop students' abilities in the 21st century	https://so06.tci-thaijo.org/index.php/edujournal_nu/article/view/241045
Kittisak Jai-on (2022)	Journal of Education and Innovation	Using problem-based learning approach to enhance student teachers' lesson design ability for 21st century	https://so06.tci-thaijo.org/index.php/edujournal_nu/article/view/244927
Supasiri Boonpraws (2022)	Journal of Education	Development of communication skills of undergraduate students by using game-based learning with google classroom application to provide reflection	https://so02.tci-thaijo.org/index.php/edupsu/article/view/243394
Wilailak Saelow (2022)	STOU Education Journal	The development of t-pack model online instruction to promote team work for undergraduate students	https://so05.tci-thaijo.org/index.php/edjour_stou/article/view/255891
Wichayaporn Oonpuy (2022)	CMU Journal of Education	The learning management using a model based on the stem education concept to promote problem solving and decision-making skills of teacher students	https://so01.tci-thaijo.org/index.php/cmujedu/article/view/245309
Rujroad Kaewurai (2021)	Journal of Education and Innovation	A development of learning activity using fishbone diagram via Facebook to enhance project problem analytical ability of students	https://so06.tci-thaijo.org/index.php/edujournal_nu/article/view/201621
Wilawan Jaruariyanon (2020)	Journal of Education Studies	The development of the analytical thinking ability enhancement model to enhance teacher students, faculty of education, rajabhat universities through knowledge management learning	https://so02.tci-thaijo.org/index.php/EDUCU/article/view/240866
Thitinan Poolsin (2020)	Journal of Education	Integrating project-based learning to improve english speaking skills among students in physical education program, institute of physical education, yala campus	https://so02.tci-thaijo.org/index.php/edupsu/article/view/220171
Suwisa Jarutkamolpong (2020)	Journal of Education	Learning model to promote teacher students' creative thinking for the 21st century learning innovation design: faculty of Education Nakhon Phanom University	https://so02.tci-thaijo.org/index.php/edupsu/article/view/244534
Kanjanida Kittisuban (2019)	Journal of Education Studies	A visualization system using positive reinforcement theory to develop problem-solving skills and self-esteem in young college-educated farmers	https://so02.tci-thaijo.org/index.php/EDUCU/article/view/231845
Pundita Intharaksa (2019)	Journal of Education and Innovation	The development of learning management strategy based on the application of problem-based learning and metacognition approaches to enhance ability of problem solving with critical thinking, self-regulating and learning achievement of undergraduate students Kasetsart university	https://so06.tci-thaijo.org/index.php/edujournal_nu/article/view/77885
Waranan Isarapreedaa (2019)	Journal of Education and Innovation	Developing efficient web quest-based instruction through online social network for enhancing analytical thinking skill, evaluative thinking, and self-directed learning behavior of teacher education students	https://so06.tci-thaijo.org/index.php/edujournal_nu/article/view/183529
Panisara Chanpala (2019)	Journal of Education and Innovation	The development of instructional model to enhance creative problem solving for student teachers at Rajabhat University	https://so06.tci-thaijo.org/index.php/edujournal_nu/article/view/190682
Sureeporn Penglia (2018)	Journal of Education Studies	A Study of Problem-Based Learning to Enhance the English Communicative Skills of Learners in the Faculty of Education, Pibulsongkram Rajabhat University	https://so02.tci-thaijo.org/index.php/EDUCU/article/view/148088
Kamolchart Klomim (2018)	Journal of Education Khon Kaen University	Comparing learning achievement between active learning classrooms with king's philosophy integration and general classrooms to enhance problem-solving skills and team learning competencies among teacher students of early childhood education	https://so02.tci-thaijo.org/index.php/EDKKUJ/article/view/161747

Study (s)	Journal (s)	Title (s)	Digital access (s)
Noppakao Naphatthalung (2018)	Journal of Education	Learning Management by Using CIPPA Model with Graphic Organizer Technique on Analytical Thinking Ability and Learning Achievement in Subject of Classroom Research in Early Childhood Education of Student Teachers Majoring in Early Childhood Education	https://so02.tci-thaijo.org/index.php/edupsru/article/view/96837

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