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THEMATIC REVIEW ON TEACHING APPROACH IN FOSTERING THE CT SKILLS IN ARCHITECTURAL EDUCATION

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Abstract
Teaching critical thinking (CT) presents a formidable challenge, yet it holds tremendous significance in our increasingly intricate world. Employing the right teaching methods and strategies is essential to nurture CT skills effectively. This study endeavors to investigate the teaching methods present in recent literature, between 2010 and 2021, that may contribute to fostering CT in architectural education, utilizing Atlas.ti 8. Furthermore, we conducted a comprehensive search for journal articles across electronic databases using identical keywords. Employing a search string from three prominent databases (Scopus, Science Direct, and Mendeley), we identified 22 articles for subsequent analysis. A thematic review of these 22 articles revealed 24 initial codes that succinctly encapsulated the findings within the literature. The discourse surrounding CT in architecture education can be categorized into five primary domains: collaborative approach, constructivist approach, inquiry-based approach, and integrative approach. This discovery holds promise for enhancing pedagogical practices in architectural education to enhance students' CT skills.

Keywords: Pedagogical approach, teaching strategies, architectural education, higher education.

INTRODUCTION

Critical thinking (CT) encompasses the cognitive processes, methodologies, and mental frameworks employed by individuals to resolve problems, make informed decisions, and acquire new knowledge (Sternberg, 1986). Understanding this skill is imperative to prevent hasty conclusions devoid of thoughtful consideration. It demands a set of academic standards including coherence, relevance, consistency, and more (Fisher, 2019). CT is a fundamental competence that should be mastered by both students and graduates of higher education. Achieving this proficiency necessitates a sustained developmental process within students' cognitive abilities. However, to ensure effective learning and impactful CT growth, faculty must carefully consider classroom dynamics and teaching methodologies

(Aladro & Pucheta, 2022). Integrating learning strategies with appropriate instructional techniques can significantly enhance CT skills (Fausan, Susilo, Gofur, & Yusop, 2021).

Demonstrating high levels of knowledge and fostering the right attitudes in students requires instructional approaches that encompass diverse pedagogical methods, questions that vary in cognitive demands, and activities that stimulate critical thinking (Ab Halim, Osman, Aziz, Ibrahim, & Ahmad, 2021). Research by Sèna and Etienne (2022) reveals that while many educators are familiar with the concept of CT, they often fail to impart these cognitive skills to their students due to disillusionment with the declining quality of the educational system's instruction. Numerous studies have shed light on teaching methods employed to cultivate critical thinking (CT) within architectural classrooms. However, there is a noticeable dearth of literature concentrating specifically on teaching approaches that directly contribute to the development of CT skills. Consequently, this paper sets out to conduct a thematic review based on a literature review spanning the years 2010 to 2021, with a focus on the teaching methods in architectural education. This review will address the following question: "What are the prevailing teaching approach practices in architectural education that are discussed in the literature from 2011 to 2021 and support the enhancement of CT skills?"

METHODOLOGY

The study employed the ATLAS.ti tool to conduct a thematic review, as introduced by Zairul in 2020. The primary objective of this paper is to examine the discourse surrounding pedagogical approaches utilised in architectural education to bolster the development of critical thinking (CT) skills. To compile the relevant literature, the researcher gathered data from various countries and diverse academic scholars, spanning the years from 2010 to 2021. In total, the researcher has amassed 98 research papers from the existing body of literature. Subsequently, pertinent information from these papers were extracted, including their titles, journal names, publication years, research objectives, methodologies employed, contextual details, and findings. Following a rigorous filtration process, only 59 papers met the criteria for further analysis. It is important to note that some papers did not align with the specific aims of this study and were consequently excluded from further examination. During the preliminary analysis, 34 papers were excluded from consideration. The papers that passed through the initial screening were categorized based on factors such as their country of origin, publication year, field of education, and the objectives of the respective studies. The research methodology framework that is adhered to is visually represented in Figure 1.

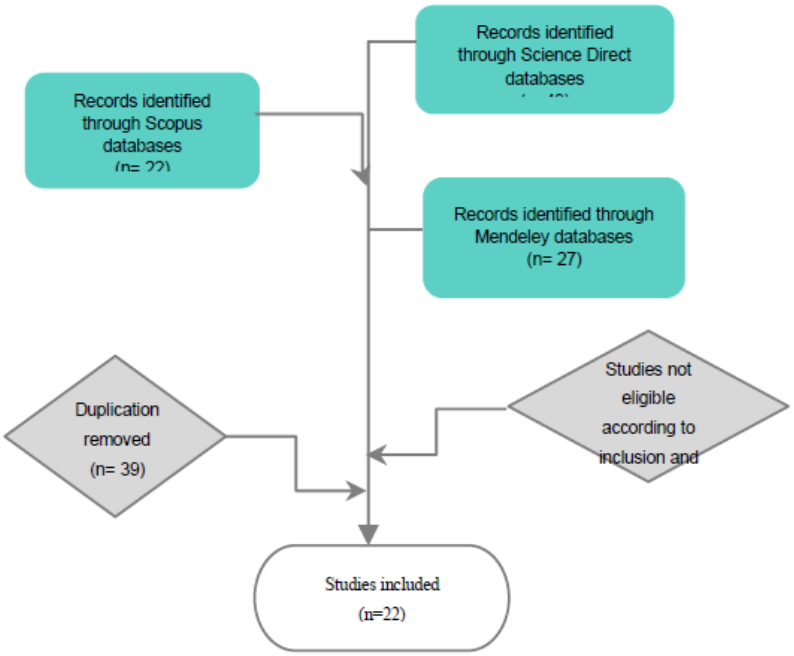

Figure 1. Example of figure for the full paper

In the initial phase, the researcher conducted a systematic examination of research articles to assess the current state of scholarly knowledge regarding the integration of CT (Computational Thinking) in higher education architectural programs. We obtained published articles from three online databases: Science Direct, Scopus, and Mendeley, utilizing a predefined search string detailed in Table 1. This search across the three databases yielded a total of 98 publications. However, after excluding unrelated, incomplete, and duplicate entries, the review narrowed down to 25 relevant papers. We further refined our selection by considering only articles published within the past eleven years (from 2010 to 2021 inclusive). After this step, the researcher meticulously reviewed the abstracts of these papers to eliminate any articles that were deemed irrelevant to the topic. As a result, the researcher has identified 25 papers as the foundational basis for our review. Articles that primarily focused on CT in primary and secondary schools were classified as irrelevant, as depicted in Figure 1.

Table 1. Search string for online databases

Databases	Keywords	Documents
Scopus	TITLE-ABS-KEY (" critical thinking " AND "architectur* education")	17 documents
	TITLE-ABS-KEY (" critical thinking " AND "interior design education")	6 documents
Science Direct	"critical thinking" AND "architectural education" year 2010-2021	48 documents
	"critical thinking " AND "interior design education" year 2011-2021	1 document
Mendeley	"critical thinking" AND "architectural education":[2010 TO 2021]	19 documents
	"critical thinking" AND "interior design education" year 2011-2021	8 documents

Next, all 25 metadata were exported to ATLAS.ti 8 and later were created as primary documents. From the metadata established in Mendeley, some groupings were initiated automatically in the code group as shown in Figure 2. The classifications in ATLAS.ti 8 has made the sorting much easier and systematic. In the first round of coding, 32 initial codes were produced. As the study goes along, the codes were grouped into several themes to answer the research question, "What are the current teaching approach practices in architectural education that supports CT skills?". It resulted to four main categories and 24 sub-categories. The findings of this review will be divided into two parts: Quantitative and Qualitative findings.

RESULTS

Quantitative Findings

The result of this study will be presented in two forms of analysis. First are quantitative findings and next section is followed by qualitative findings. This section focuses on quantitative findings involving the authors of the previous study and the year, theme, or country.

Table 2. Theme according to the year

Topics	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021	Totals
Constructivism Approach	1	2		1	2		1	1	1	1		10
Integrated Approach			3		1	1		2	2		1	10
Inquiry-based Learning Approach	1	1	1						1			4
Collaborative Learning Approach					1					2		3

Journal paper from the database queries of the phrase "CT in interior and architectural Education" were limited. The papers involved were found published in various of journals. The search strings identified 25 articles through several periodicals namely, International Journal of Educations and pedagogy Science, Higher Education studies, Procedia Social & Behavioral Science and much more (Table 2). From the Table 2 below, the trend of publishing is undulated along 11 years period. The highest publication is 5 publications in year 2015 followed by 4 publication in 2012. While the year of 2013, 2016, 2019 and 2021 only 1 publication in each year. Data shown very limited study on the CT in architectural elements as well as interior design education.

Table 3. Article reviewed based on journals

Journal Source	2010	2011	2012	2013	2015	2017	2018	2019	2020	2021	Totals
Advances in Environmental Biology			1								1
Ain Shams Engineering Journal									1		1
International Journal of Architectural Research-IJAR	1						1				2
Computing for a better tomorrow - Proceedings of the 36th eCAADe Conference							1				1
Critical Learning in Digital Networks					1						1
IASS Symposium 2019								1			1
Iberian Conference on Information Systems and Technologies, CISTI 2015					1						1
International Journal of Environmental Science & Sustainable Development									1		1
Life Science Journal		1									1
MEGARON						1					1
Problems of Education in the 21st Century							1				1
Procedia - Social and Behavioral Sciences		1	2	1							4
Proceedings of 5th INTBAU International Annual Event							1				
Proceeding of International Conference on E-Learning , ICEL									1		1
Societies										1	1
Thinking Skills and Creativity						1					1
Turkish Online Journal of Educational Technology					1						1
www.FORMakademisk.org			1								1
Totals		3	4	1	3	2	4	1	3	1	22

The study found that the trends of research discussing about the CT in interior and architectural education are most popular in Turkey and United Kingdom as in Table 4. However, the study in UK found that 3 studies done by same author in different year of publication. Findings also indicated that the study from other country namely Iran, Malaysia, Australia, India, Lebanon, New Zealand, Spain, UAE, Mexico, Russia, Bahrain, Serbia, Belgium, and Czech Republic.

Table 4. Authors according to country

No.	Author, Year	India	Iran	Lebanon	Malaysia	New Zealand	Spain	Turkey	UAE	UK	Mexico	Bahrain	Serbia	Belgium	Czech Republic
1	Afify (2020)								√						
2	Andjomshoaa (2011)		√												
3	Asefi (2018)		√												
4	Cakir (2013)							√							
5	El-Daghar, K. (2020)			√											
6	Garcia-Almirall, P., Redondo, E., Valls, F., & Fonseca, D. (2015)						√								
7	Ibrahim, N. L. N., & Utaberta, N. (2012).				√										
8	Kiliçaslan, H. (2018)							√							
9	Krstikj, A. (2021)										√				
10	Lamela, S. (2020)											√			
11	Milic, R. J., & Nikezic, A. (2017)					√									
12	Milošević, J. (2019)												√		
13	Newton, C., & Pak, B. (2015).													√	
14	Ramaraj, A., & Nagammal, J. (2017)	√													
15	Salama, A. M. (2010)									√					
16	Salama, A. M. (2012a)									√					
17	Salama, A. M. (2012b)									√					
18	Torun, A. Ö., Tekçe, I., & Esin, N. (2011).							√							
19	Utaberta, N. (2012).				√										
20	Varinlioglu, G., & Turhan, G. D. (2018).							√							
21	Vavruskova, M., & Pospısıl, M. (2015)														√
22	Yurtsever, B. (2017)							√							
		1	2	1	2	1	1	6	1	3	1	1	1	1	1

Qualitative Findings

This section describes the qualitative findings of the thematic review. Each article is carefully scrutinised, and the underlying theme is found. By closely examining the supporting and extension work of each study article, the key findings are presented under each theme. Findings asserted the constructivism approach is the most popular teaching approach used in built environment education. Then it followed by a collaborative approach, inquiry-based, reflective, and finally integrative approach.

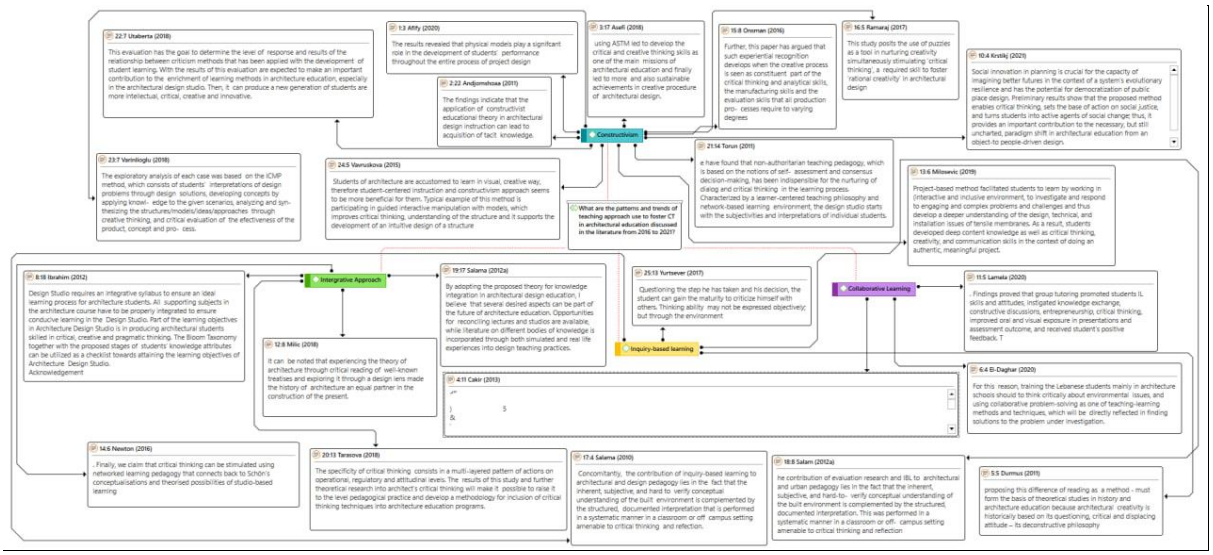

Figure 2. The polyline view of the articles answer the research question using thematic review

Theme 1 : Constructivism Learning Approach

Constructivism places a strong emphasis on the authenticity of knowledge creation and its practical application in the real world, both of which hold significant importance for individuals and society as a whole. Additionally, it underscores the active involvement of learners in the process of constructing knowledge (Singh, Singh, Alam, & Agrawal, 2022). This approach involves the cultivation of active cognitive processes, allowing learners to develop and construct meaning and knowledge (Kim, 2005).

Within this constructivist framework, there are 11 sub-categories where authors discuss various methods and strategies. These include the utilisation of physical models (Afify, 2020; Vavruskova, & Pospısıl, 2015), the implementation of puzzles as a method (Ramaraj, 2017), critical thinking methodologies (Utaberta, 2018), and project-based learning approaches (Milosevic, 2019; Krstikj, 2021). The study posits that employing a constructivist approach in architectural education could serve as a typical method for enhancing the creativity and critical thinking skills of learners.

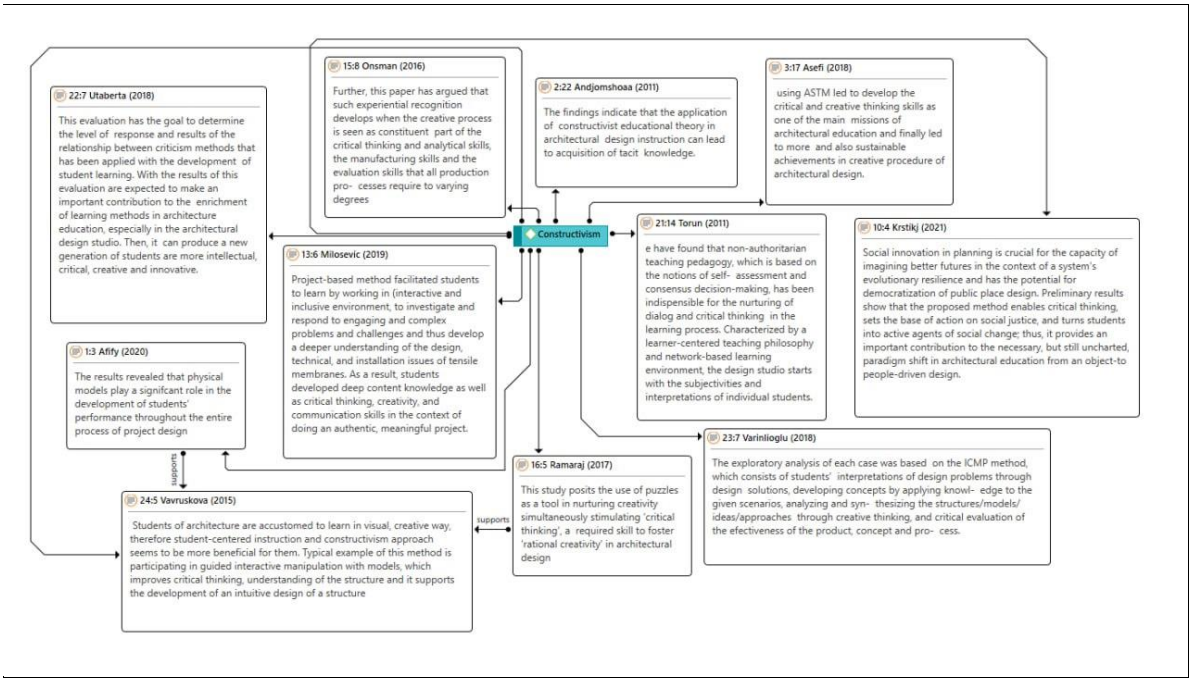

Figure 3. Network review of Constructivism Approach Theme

Theme 2: Integrative Approach

The term "integrative approach" denotes a comprehensive and well-coordinated strategy that blends various elements, perspectives, or methods to address complex issues or achieve desired outcomes. It places significant emphasis on the integration of multiple pieces of knowledge, viewpoints, or methodologies to attain a more comprehensive and intricate understanding or solution (Ruggiero, V. R., & Lizardo, O., 2009). This approach has proven effective in helping students overcome their reservations and actively engage in communication, participation, and interaction with their peers during classroom discussions (Aljumah, 2011).

Research conducted by Sughra and Usmani (2022) indicates that students exposed to an integrated curriculum demonstrated higher levels of critical thinking (CT) when compared to those following a traditional curriculum. This study identifies five sub-categories within this learning approach. Specifically, this approach involves the incorporation of Bloom's taxonomy (as observed in one study), the theory of architecture (as seen in one study), the theory of knowledge (as found in one study), network learning (as demonstrated in one study), and the integration of multi-layered action, regulatory, and attitudinal levels (as identified in one study) in architectural education. This multifaceted approach contributes significantly to the acquisition of CT skills within the classroom setting.

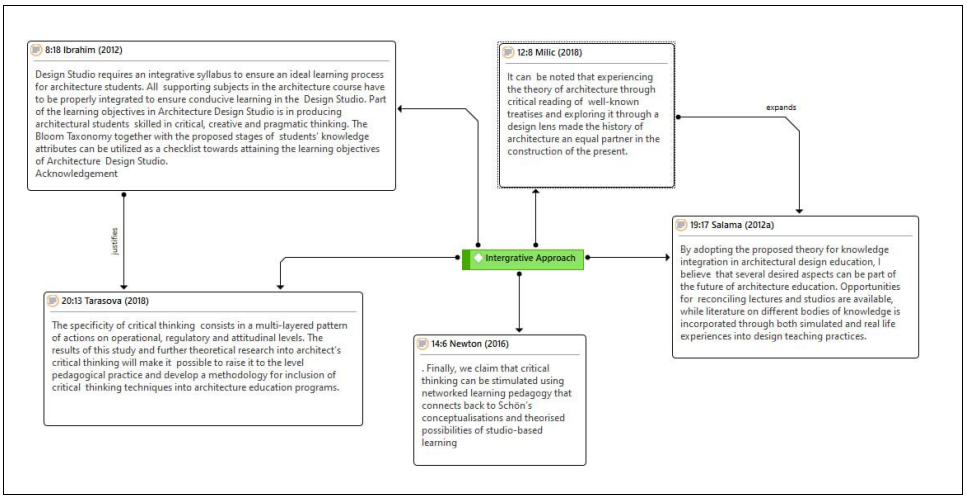

Figure 4. Network review of Integrative Approach Theme

Theme 3: Inquiry-based Learning

The goal of inquiry-based learning is to let students actively explore and investigate questions, issues, or occurrences in order to build knowledge, hone their CT abilities, and cultivate a deeper grasp of the material (National Research Council.,2000). This study posits four sub-coding under this approach. The previous study found that this approach could enable CT skills in architectural education. The questioning method is the most popular method used in supporting the CT skills.

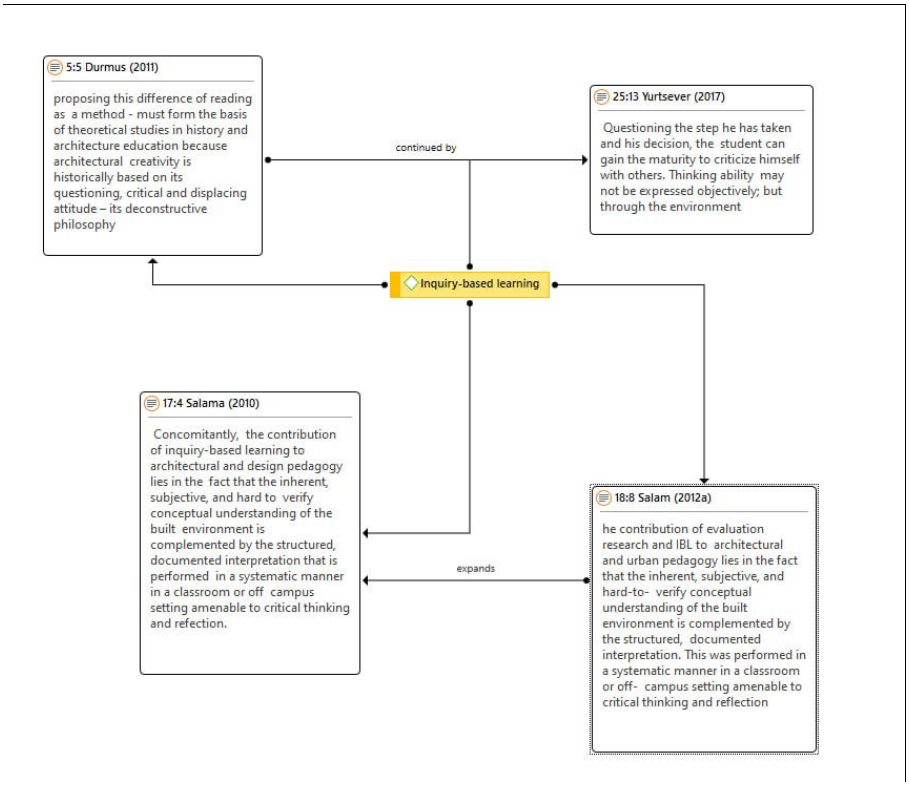

Figure 5. Network review of Inquiry-based Learning Approach Theme

Theme 4: Collaborative Approach

Collaborative learning involves students working together in pairs or groups to accomplish tasks, and it has the potential to enhance critical thinking (CT) skills, thereby improving problem-solving, creative thinking, and decision-making abilities (Doheim & Yusof, 2020). Collaborative learning is also widely embraced in the teaching and learning of architectural education. This popularity may stem from the perceived benefits of group work, which can help alleviate stress, especially when addressing challenging questions (Zabit et al., 2018). Unfortunately, this study reveals that the collaborative approach is not as commonly utilised in architectural education.

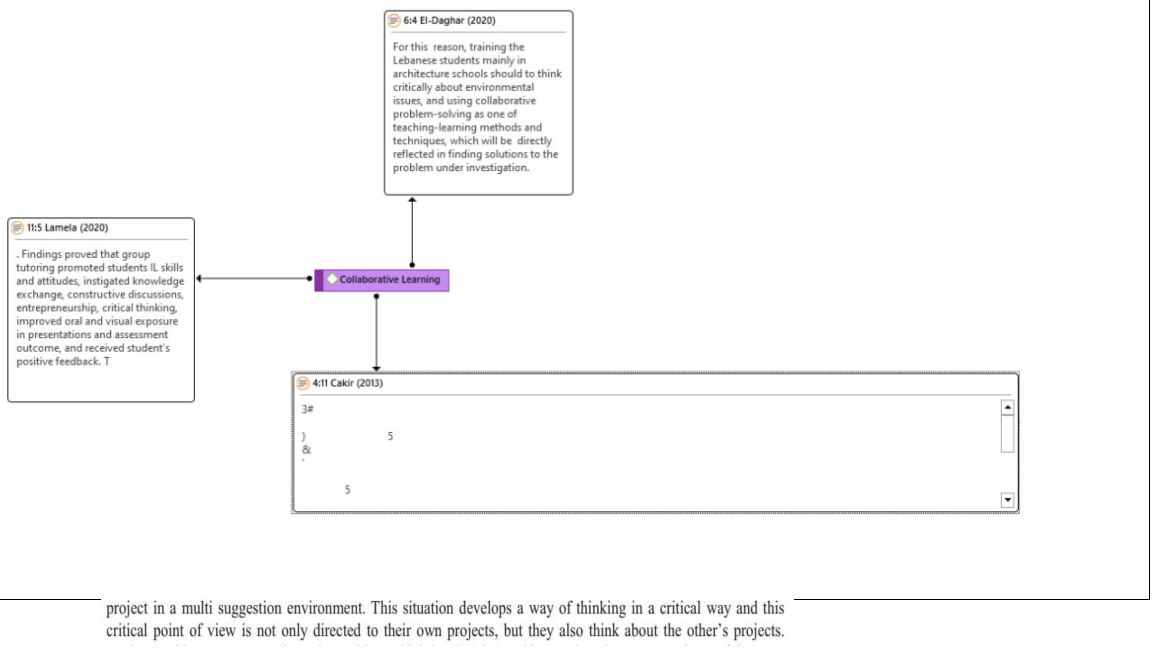

Figure 6. Network review of Collaborative Approach Theme

CONCLUSION

The primary objective of the current research is to examine teaching methods within architectural education that can effectively enhance critical thinking (CT) skills. The study demonstrates that these instructional approaches have a positive impact on nurturing critical and creative thinking skills within the realm of architectural education. Instructors play a pivotal role in selecting appropriate teaching methods that encourage the development of these skills. Moreover, educators are increasingly influenced by their comprehension of CT competence, which affects their teaching strategies and classroom activities. It is imperative for teachers to actively contribute to the establishment of a democratic learning environment, the development of a comprehensive curriculum, and the delivery of relevant content (Kiliçaslan, 2018).

As a result, it is crucial for instructors to familiarise themselves with a variety of teaching approaches, enabling them to accurately align their choices with the specific knowledge required in the course content while concurrently promoting creative and critical thinking skills. The study reveals that the current teaching methods within architectural education are somewhat limited, particularly in their support for students' critical thinking abilities. Consequently, future research could explore teaching methodologies from other disciplines within the built environment domain that could contribute to the enhancement of critical thinking skills.

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