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Original Research Article

Explaining the Concept of Critique Sessions in Architectural Education System*

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Abstract

Problem statement: The process-oriented teaching of architectural design courses, which includes mainly a range of activities and essentially involves themes such as subjectivity and objectivity, problem-finding and inference, and induction and conclusion, is guided using critique. Measuring the level of knowledge, insight, design ability, and perception of architecture students in architectural design courses based on understanding absolute concepts on the one hand and the process of relativizing the concepts, on the other hand, is done considering such criteria as formulating and prioritizing the system of design problems, the explanation of problem-solving approaches, and the quality of processing creative ideas in each of the design subjects. The current procedure used in the education system of architecture in the architectural faculties of Iran has led to a kind of ambiguity in the concept of critique, which necessitates researching and scrutinizing the way of criticism and assessments of critique.

Research objective: The current research aimed to analyze the concepts hidden in critique to formulate the main elements of critique for measuring students' design ability while explaining, examining, and criticizing the views obtained from interviews with experts.

Research method: This research is qualitative employing the grounded theory method and semi-structured interviews. By using the grounded theory, the data obtained from exploratory interviews with 21 experts in the field of teaching architectural design courses in Iranian universities were analyzed in three stages of open (initial) coding and extracting subcategories and categories. The semantic units including 312 headlines and open codes in the form of 42 propositions were conceptualized. Additionally, the subcategories consisted of 12 major propositions, and the categories including 3 cores were extracted in the next step.

Conclusion: The results of the research indicated that critique in the architectural education system is a concept beyond just correcting students' works. It is based on the three levels of "essence", "strategy", and "management methods".

Keywords: *Critique, Architectural Design Studio, Design Process, Grounded Theory, Architectural Education.*

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Introduction

In a design studio, both inductive and deductive approaches are used in the teaching-learning process of architectural design courses according to the system of design problems. The inductive approach is based on experimental philosophy, progress from the parts to the whole, and the design problem and is implemented by observing the progress of the project stages (Hettithanthri & Hansen, 2022). One of the goals of the inductive approach to architectural design is to identify patterns and provide solutions to design problems (Shaqour, 2021), which is achieved by emphasizing the analysis of samples and students' visual design thinking employed in physical modeling and manual design techniques (Abdelhameed, 2011). On the other hand, the design process is carried out with a deductive approach based on rationalist philosophy through general information and progress from the whole to the parts. The purpose of using this approach in architectural design is to teach the principles, theories, and basic concepts of design to students. In general, both inductive and deductive approaches to the design process are used in the design studios in sessions called critique sessions. Critique sessions are the main aspect of architectural education (Dannels, 2005; Webster, 2005) and form the most important element of the standard design studio pedagogy (Murphy et al., 2012). Therefore, critique sessions are the backbone of the design education assessment (Uluoğlu, 2000; Utaberta et al., 2013). Critique as a set of dialogic processes and activities develops the ability to self-regulate performance on future design tasks while informing the students on current design tasks (Carless et al., 2011). Critique not only allows instructors to determine the level of students' learning but also provides the grounds for making educational decisions to inform learners of their progress in the design process so that through the critique, they can review their design process based on the commentary of discussions on the design subject in the design studio (El-Latif et al., 2020).

Critique has a history as old as academic architectural education in Iran and has been derived from a French word that was entered into the literature of architecture education at the University of Tehran, Faculty of Fine

Arts, by the graduates of the National High School of Fine Arts (École Nationale Supérieure des Beaux-Arts), known as Beaux-Arts de Paris, and gradually spread to other faculties in Iran. In the first decades of academic architectural education in Iran, the assessment of the instructors' critique sessions on the architectural designs presented by the student was aimed at realizing the highest level of qualities in relation to the accepted principles and patterns of architectural design (Ansari, 2007), which was transferred in a hierarchical system from the instructors to seniors and from the seniors to juniors (Hojat, 2022). Considering that the field of design requires creative thinking more than other skills and abilities, the criteria used in the assessment of the produced works face ambiguities (Utaberta et al., 2010). Additionally, due to the relative comprehensiveness of design knowledge, it is also difficult to identify, understand, classify, and shape the process of using it (Ayiran, 2015).

Therefore, although a correct assessment of critique can explain the level of expectations and provide opportunities for students to receive appropriate feedback while observing, monitoring, and performing practices related to the subject of design (Anthony, 1991), many architectural schools in Iran have not established clear goals for the critique of architectural designs. Field evidence also indicated the plurality and relative dispersion of the opinions of instructors in the architecture and urban planning faculties and experts of the architectural design and education process on the concept of critique. In addition to such ambiguity, critiques may be based on instructors' personal preferences in some cases, causing the broader goals of the educational program to be neglected (McDonald & Michela, 2019). Change in the system and content of academic education (Hojat & Ansari, 2010), the lack of goals specified for critique, the complexity and multidimensional nature of teaching architecture courses, especially the course of architectural design (Megahed, 2018), open-ended discussions on the design subject in the design process with no attention to epistemological areas (Hojat, 2004), and ambiguity in the concept of critique-correction session not only can mislead students about the nature of design skills (Mewburn, 2012) but also may hinder

their professional development (Webster, 2005). The study by Feizi and Dezhpasand (2022) categorized the shortcomings of current architecture education from the points of view of learning-based factors into 7 levels, including the relationship between the theory and practice, the relationship with the educational sciences, attention to the learning process, the lack of motivation of architecture students, teacher-centered and student-centered teaching, attention to individual differences in learning, and experience-based teaching.

John Lang (1987) also studied the importance of methodology in the process of design education hoping the results would lead to the understanding of the overt and hidden processes in the design on the one hand and would present the overall structure of the design process and its subsets on the other hand. Therefore, the current research aims to analyze what happens in the critique sessions of design courses in Iranian architecture faculties using a qualitative approach based on the grounded theory method and exploratory interviews. In doing so, the study attempts to explain the hidden factors of critique as a frequent and influential event in architectural design education.

Review of Literature

As design is one of the most complex types of problem-solving, design education should be accompanied by different learning methods to provide students with needed knowledge, abilities, and skills (Megahed, 2018). In other words, the common characteristic of all design projects is that students must apply their previous knowledge and skills by imitating “true” professional practice in future design challenges (Habibullah et al., 2022). Students are taught in design studios through a series of presentations and discussions, and then they are evaluated by the instructor. Kvan and Jia (2005) argue that if the design program starts with open-ended problems, a wide range of learning methods can be used in design studios.

In contrast to the lecture method, students learn by working on projects in a design studio where they are asked to present graphically an effective solution to a hypothetical problem defined by the instructor

(Oh et al., 2013). This requires the ability to solve problems using knowledge in various fields such as science, art, mathematics, technology, philosophy, theory, and history (Acici, 2015). Learning by doing is a process in which the design problem is preferred over the lecture and becomes the tool by which architecture is taught. This teaching method was used in the 1890s at the Ecole des Beaux-Arts in Paris for art and architecture education (Utaberta et al., 2010).

The process of architectural design education in studios is organized so that strengthens students’ creativity and experiential learning (Yurtkuran et al., 2013). In design studios, students use various tools such as graphical simulation systems through which design goals are displayed for learning purposes (Lebahar, 1983). Visual documents such as sketches, conceptual diagrams, plans, sections, elevations, and perspectives are associated with physical mockups and models that are presented simultaneously or progressively during the design process and explain possible solutions for the design problem by the transition from conceptual (subjective) processing to the production of (objective) drawings.

In the assessment of architecture education, the most important issues are when the critique should be added to the design processes and which type of critique can be suitable for each session to have the best mechanisms for controlling the design process (Utaberta et al., 2013; Utaberta et al., 2010). Due to the importance of these issues, it is necessary to study and analyze the design in studio-based learning to determine the critique methodology that is particularly effective for a specific stage of design (Megahed, 2018).

Design studios have been at the center of the design education system and the design instructors in the studios play an effective role in the development of students’ design projects using a kind of educational method known as studio critique by transferring their design thinking knowledge on the one hand and their expertise and professional experience on the other hand (Dorta et al., 2016). In the studio critique process, the design ideas inspired by aesthetic choices are considered to animate the features of the students’ designs and to work in a different context from what the students have

presented by redefining the details in new historical or conceptual terms (Murphy et al., 2012).

In the study by McDonald and Michela (2019), critique has been defined as “the examination of an idea, phenomenon, or artifact”. In the field of design, using the term “critique” involves the evaluation of an idea as well as the design itself (Hokanson, 2012). In design, the term “critique” is often shortened to “crit”. Other terms with similar meanings are review and jury and generally include activity in studio pedagogy (Schön, 1985). The term critique is generally used here to refer to a wide range of activities, including systematic and objective examination of students’ design projects (Hokanson, 2012), which provide opportunities for students to present their design solutions, explain their reasoning, and receive feedback from their instructors and peers (Cennamo et al., 2011; Dannels et al., 2008). Therefore, critique is an initial method by which instructors evaluate students’ ability to work and design both formatively and summatively (Cennamo et al., 2011). Using critique, instructors transfer design knowledge to students (Adams et al., 2016), model how experienced designers think and act (Budge, 2016), and provide a framework around which novice designers can develop their professional identity (Percy, 2004). According to what was explained in this research, the term “critique” is considered equivalent to “Correction”.

Although critique is an assessment process that includes knowledge transfer (Uluoğlu, 2000), communication, (Wong, 2011) and presentation in a public setting (Dannels et al., 2008), the role of critique in design education is more extensive than the assessment function. Critique sessions are a place for socializing students into the world of architecture as a professional practice (Murphy et al., 2012). Critique not only plays a significant role in education but also teaches directly the practice of making.

Studio critiques are a moment in which students learn to become members of a practice community, where relationships between different members of the community are discussed, the ethos of an individual as a designer is explained, independent thinking is promoted, an egalitarian work culture can appear,

social relationships and professional identities can be developed, and self-analysis and the ability to reflect on the design process are mastered (Scagnetti, 2017).

In the design process, the term critique often refers to a type of verbal interaction (Oh et al., 2013), which can include informal peer conversations (Gray, 2013), formal and informal desk critiques between instructors and students (Goldschmidt et al., 2010; Hokanson, 2012), or the review of student work milestones by juries (Anthony, 1991). The study by Utaberta et al. (2010) also indicates that the assessment tool in architectural design includes nine levels: individual critique, peer critique, group critique, interim critique, final critique, critique in the form of discussion panel, public critique, desk critique, and pin-up critique.

Purposes, processes, norms, and expectations differ between disciplines or even between instructors in the same discipline (Brandt et al., 2013). However, in all contexts, the form of conversational critiques is usually “unstructured” and somewhat “unpredictable” (Huet et al., 2007). Therefore, instructors must make judgments, sometimes make comments quickly, and in some cases, provide small and partial guidance on the subject of the design (Christensen & Ball, 2016; Goldschmidt et al., 2010), and teach the possibility of exploring design problems. According to what was extracted from the literature review, 21 indices that specify critique features were recognized as listed in Table 1.

Research Methods

The present research was conducted using the interpretive paradigm of epistemology with a qualitative approach and the grounded theory method. In grounded theory, the systematic development of theoretical understandings is done using the collection and detailed analysis of qualitative data (Parker, 2018). The process of grounded theory is different from Hypothetico-deductive logic which is usually used in research where meaning and knowledge have already been established (Roman et al., 2017).

In grounded theory, a set of procedures is adopted based on theoretical coding and sampling processes

Table 1. Critique indices extracted from the literature review. Source: Authors.

Findings	Method	References
Backbone of assessment	-	(Uluoğlu, 2000; Utaberta et al., 2013)
The central role in architectural education Process	Qualitative	(Dannels, 2005; Webster, 2005)
The most important element of standard design studio pedagogy	Qualitative	(Murphy, et al., 2012)
Dialogic processes that support students' practical activities	Qualitative	(Carless et al., 2011)
Enhancing students' ability to self-regulate performance on a future task	Qualitative	(Carless et al., 2011)
Determining the level of learning of students	Qualitative	(El-Latif et al., 2020)
Skill training in the design process based on commentary	Qualitative	(El-Latif et al., 2020)
Clear expectations, self-monitor, and receiving feedback	-	(Anthony, 1991)
Adopting the best mechanisms to manage the design process in each session	Qualitative	(Utaberta, et al., 2010)
Reviewing and critiquing by the jury	-	(Schön, 1985)
Providing systematic and objective examination of a student's design work	-	(Hokanson, 2012)
Providing opportunities for students to present their design solutions		
Developing skills in articulating reasoning	Qualitative	Cennamo, et al., 2011; Dannels et al., 2008)
Receiving feedback from instructors, peers, and occasionally guests		
Evaluating students' work and design ability in a formative and summative way		
Communicating with design instructors	Qualitative	(Adams et al., 2016)
Knowing the thinking process and actions of experienced designers	Qualitative	(Budge, 2016, Percy, 2004)
Helping to develop the professional identity of novice designers		
Forming a series of interlocking reasoning processes	Qualitative	(Murphy, el al., 2012)
Assessment process including knowledge transfer, communication, and presentation in a public setting	Qualitative	(Dannels et al., 2008, Uluoğlu, 2000, Wong, 2011)
Developing social relationships, professional identities, and self-analysis	Qualitative	(Scagnetti, 2017)

to construct a model or theory using inductive logic (Roman et al., 2017). In the grounded theory method, the researcher continuously pays attention to the semantic gaps and conceptual blanks to consider the accuracy, consistency, stability, meaningfulness, generality, and verifiability of the theory. Frequent returns to more data and previous data emphasize the necessity of editing the theory draft by the researcher so that with the required corrections, the studied theory enjoys conceptual density and conceptual specificity while having the necessary explanatory power (Farasatkah, 2009).

The data of the current research was collected using semi-structured in-depth exploratory interviews, which included mainly the guide questions and revolved around the purpose of the research to fully understand the perceptions of the respondents. When conducting the interviews, in addition to posing questions about what, why, and how to implement critique in architectural design courses, the technique of follow-up questions was used to extract important sentences with the concept of critique.

The criterion for selecting the interviewees was informed

and knowledgeable people in the field of design research, which was based on purposive non-random and snowball sampling while considering the diversity of the groups. Therefore, the participants were 21 instructors working in universities and research centers in Iran, including Cultural Heritage Research Institute, Bu-Ali Sina University, Payam Noor University, Shahid Rajaei Teacher Training University, University of Tehran, Hakim Sabzevari University, Soore University, Shahid Beheshti University, Iran University of Science and Technology, and Iran University of Art. The interviews were conducted over a period of 3 years from August 2019 to August 2022.

According to the time and place conditions and the request of the participants, the research data was collected using face-to-face or virtual interviews (via Skype). The duration of each interview was 60 minutes on average, containing 135,000 words, and continued until reaching data saturation. To assess the saturation, two approaches of code saturation with a focus on referring to a range of thematic issues and meaning saturation with a focus on the enriched perception of the issues were considered (Hennink et al., 2017).

Data analysis was done by using open coding, and to meet the research objective, i.e. identifying the themes hidden in the concept of critique of architectural design courses, the following key activities were done (Table 2).

Results

The systematic search conducted in the present research aimed to identify themes hidden in the concept of critique at the level of conceptual ordering so that by analyzing and classifying 312 semantic units, 42 propositions were conceptualized in the form of open codes, and subcategories consisting of 12 major propositions were obtained, which include the framing the design problem, integration and coherence in design education, personalization of design education process, ideation, targeted guidance, learner-centered facilitation, strengthening and consolidating design teachings, cognition orientation, dialogue orientation, search orientation, skill orientation, and process orientation. Additionally, the categories were formulated with 3 cores including critique nature, critique strategy, and critique management methods, resulting from the qualitative data of the research that have been presented in Table 3.

Discussion and Analysis of Results

The analysis of the coded data indicated that the critique nature, critique strategy, and critique management

methods were the main axes according to the opinions of the instructors and researchers in the field of architectural education in Iran.

Nature represents the essence of an object, and the nature of critique also represents its truth and is raised in response to the question of what critique is. It is expected that if artificial intelligence takes over and succeeds in the architectural design process, the critique nature in the architectural design studio will also change and transform, which necessitates rethinking and redefining the meaning and function of critique.

Strategy means setting goals and providing a plan to achieve them. In other words, strategy is a general and long-term plan that determines the way of acting in a particular situation. It consists of a set of processes and activities that are designed and explained to achieve a specific long-term goal. The critique strategy is also one of the important factors in the design process, which explains the type of duties of the instructor in front of the activities of the architecture students on the design problem. Choosing or designing a suitable educational strategy is the responsibility of experts in the field of educational technology and educational design.

The method is also a unique way by which individuals or groups form language, art, architecture, and other cultural artifacts to match their goals and reflect their identity. While manifesting the thoughts and

Table 2. Key activities in data analysis. Source: Authors.

Stage	Activity										
1	Sorting audio data and text records										
2	Listing the data based on rereading and analyzing line by line and word by word in the form of precise and clear propositions while observing the principle of the brevity of the proposition and meaningfulness as much as possible.										
3	Assigning a conceptual label to each semantic unit, forming step-by-step small concepts and conceptual frameworks (subcategories), achieving a category from conceptual frameworks, and continuing this cycle until the classification of the entire data										
Checking the reliability and validity of the research and the validity of the categories through member checking and audit checking.											
	<table border="1"> <thead> <tr> <th>Criterion</th> <th>Activities conducted in the research</th> </tr> </thead> <tbody> <tr> <td>Credibility</td> <td>The degree of credibility of the interpretations of each of the categories and subcategories through the confirmation of the data and the research process by 5 instructors of the fields of educational research and architecture with expertise in design research.</td> </tr> <tr> <td>Transferability</td> <td>Triangulation of data using previous documents and research, as well as triangulation researcher/investigator using a research assistant</td> </tr> <tr> <td>Dependability</td> <td>Preparing sufficient documentation related to the concept of critique and design research and a detailed description of the studied procedures and the context and conditions of the research</td> </tr> <tr> <td>Confirmability</td> <td>Explaining sufficient details of the process of data collection and analysis</td> </tr> </tbody> </table>	Criterion	Activities conducted in the research	Credibility	The degree of credibility of the interpretations of each of the categories and subcategories through the confirmation of the data and the research process by 5 instructors of the fields of educational research and architecture with expertise in design research.	Transferability	Triangulation of data using previous documents and research, as well as triangulation researcher/investigator using a research assistant	Dependability	Preparing sufficient documentation related to the concept of critique and design research and a detailed description of the studied procedures and the context and conditions of the research	Confirmability	Explaining sufficient details of the process of data collection and analysis
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Confirmability	Explaining sufficient details of the process of data collection and analysis										
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Table 3. Classification of the codes resulting from the interviews. Source: Authors.

Categories	Subcategories	Initial codes
Critique nature	Framing the design problem	Developing problem-solving thinking skills in theoretical and practical fields Analysis of the design problem background Strengthening lateral thinking and SCAMPER technique
	Integration and coherence in design education	Establishing effective interaction between theoretical and practical courses Transferring design knowledge and experience Reflection-decision in design practice
	Personalization of design education process	Considering individual differences A feeling of sufficiency and worth Considering emotional characteristics Considering cognitive characteristics Development of psycho-motor skills
Critique strategy	Ideation	Synectics and strengthening reproductive thinking Providing the grounds for the discovery of design ideas Determining the scope of design concepts
	Targeted guidance	Engaging the mind with the design problem Exploring the architectural design problem Valuing process-oriented products Disambiguation of the design process
	Learner-centered facilitation	Adaptation and organization of the ideation process of the design problem Making architectural design studio programs purposeful
	Strengthening and consolidating design teachings	Doing various design practices ranging from simple to complex Thinking and reasoning in the design process Adding value to learning design based on metacognition
Critique management methods	Cognition orientation	Analysis and understanding of the environmental components of the design subject Cognition construction Meaningful learning experience Developing the ability to process complex design problems
	Dialogue orientation	Dynamic dialogues Communication between instructor and student about the design problem Guiding criticism Self-analysis and self-correction
	Search orientation	Questioning based on design requirements Collaborative ideation Directing the mind to search purposefully Brainstorming based on visualization
	Skill orientation	Sketches and graphic drawings Application of digital tools in architectural design Articulating and describing the design characteristics Making models
	Process orientation	Provoking thought for ideation at the beginning of the design problem Consolidating design ideas Organizing the final presentation of the design

feelings of people and groups, methods realize the possibility of representing meaning in the real world. Thus, according to each of the selected codes, the general strategies in each section can be explained as follows.

• **Critique nature**

Critique, as a type of formative assessment, is a continuous effort in which the student’s mind is guided toward the design problem using three dimensions of knowledge, insight, and ability with the guidance of the

instructor (Hojat, 2003). It is essentially based on the three factors of framing the design problem, integration and coherence in design education, and personalization of the design education process. Critique, as a frequent and influential event in the architectural education system, takes place during weekly sessions and in the setting of architectural design studios (Sadram & Nadimi, 2015), and in this process, an enthusiastic and interested student of architecture achieves a relatively clear understanding of the propositions related to the problem(s) of the design subject by studying and analyzing the design subject with a spirit of curiosity and questioning.

- Framing the design problem

Criticism and formative assessment of architectural works of students in sessions including instructors and students, known as critique sessions, under the title of framing the design problem include a range of propositions such as developing problem-solving thinking skills in theoretical and practical fields, analysis of the design problem background, and strengthening lateral thinking and SCAMPER technique. The correct framing of the system of design problems is a defined, limited, refined, deepened, and organized intellectual platform that provides the possibility of questioning or problematization. In fact, framing the design problem is the designer's first mental representation of the problem and helps to recognize the aspects of the problem in the designer's first encounter with the problem (Shariatrad & Nadimi, 2016), and as a mental action, requires a large amount of cognitive activity (Cross, 2004).

Framing includes a selective look at the design situation in a specific way for a period or stage of work. This selective focus allows the designer to manage the enormous complexity and inevitable conflicts of design by structuring and directing thought while temporarily suspending some issues at the same time. According to Lawson (2006), the skill of creating and manipulating frames is a key skill in determining how the design process continues. Thus, if the framing of the system of design problems is not done correctly, the relationship between the difficulty and the problem becomes discrete or loose. In the process of turning a difficulty into an Problem, the use of conceptual and analytical tools and

the application of specialized language and expression should be in favor of deep understanding and critical knowledge of design issues. If this is not the case, verbosity, clichés, disagreeability, and dispersion prevent the realization of new ideas and concepts in the design process.

Developing problem-solving thinking skills in theoretical and practical fields: Design problems are complex, nested, and intertwined in nature (Megahed, 2018) and involve such aspects as design goals and approaches, the demands and needs of the space users, climatic, geographical, social, cultural, and economic potentials hidden in the plan location, general processes and evaluation criteria, and other technical aspects and regulations related to the design subject. Identification, analysis, and explanation of challenges make it possible to develop problem-solving thinking skills in theoretical and practical fields in a continuum of diagnosis, conceptualization, rules, and regulations on the one hand (Akbari Sheldarei et al., 2009) and provide the grounds for the formation and guidance of lateral thinking skill and SCAMPER technique, on the other hand. Therefore, the process of criticism and formative assessments in architectural design studios by the instructors and students is often generative and productive so that the critique is promoted from a static, passive, interrupted, one-sided, and simple fault-finding state to a dynamic, continuous, melodic, periodic, process-oriented, active, creative, interactive, directive, flexible, and changeable state based on deep thinking and logical arguments. At higher levels of education, according to the talent and mental capabilities of the students and in proportion to the design subject, the advanced stage of problem-making in architecture can also be included. Thus, beyond solving the design problem, a student interested in architecture can problematize architectural knowledge with desire and passion, curiosity and questioning, agency and activism, and creativity and spontaneity.

Analysis of the design problem background: Examining the design problem background and findings related to the problem prevents the repetition of previous ideas and provides the grounds for innovation. The analysis of the design problem background, which is

called the study phase in the critique sessions, includes such goals as a better and more accurate understanding of the design problem, definition, limitation, refinement, and deepening of the system of design problems, and the selection of more precise methods and strategies. Comprehensive, deep, coherent, accurate, and strong analysis provides the possibility of better ideation and the development of creative design ideas based on the analysis of the background of the system of design problems. In the light of the analysis of the design problem background, the designer's perception can frame the totality of the problem, the relationships between the problem components, their priority and importance, and the threats and opportunities resulting from the response to the problem, which may lead to the representation of unexpected ideas of solutions (Shariatrad & Nadimi, 2016).

Strengthening lateral thinking and SCAMPER technique: Lateral thinking in architectural design is a creative approach that requires breaking away from traditional methods and conventional thinking patterns to create innovative solutions. Processes and techniques such as challenging previous habits and assumptions, expressing random metaphors about designs and techniques to stimulate new ideas, detaching from previous and conventional patterns, abstract representation of problems before reinterpreting them in the final design, accepting the possible complexities in the design problem, and interdisciplinary collaborations can help designers to break out of closed mental frameworks and discover new ideas and perspectives. The study carried out by Crolla et al. (2019) considered one of the goals of critique sessions to develop students' lateral thinking skills and spontaneity, which made it possible for them to pay attention to design problems from unconventional points of view (Utaberta et al., 2011). Another effective technique for developing lateral thinking is SCAMPER, which is used systematically to develop creative problem solutions. SCAMPER is an acronym formed from the abbreviation of substitute, combine, adapt, modify/magnify, purpose, eliminate/minimize, and rearrange/reverse, which provides a structured strategy for architects by adopting a non-linear approach and exploring different

perspectives (Eissa, 2019) to think outside the box and paves the way for the ideation of architects and designers by providing a set of intellectual stimuli (Hamza & Hassan, 2016; Lawrence & Xavier, 2013).

• **Integration and coherence in design education**

Aiming to create values such as realizing innovative thinking in architectural design, distinguishing and classifying architectural information, recognizing relationships and meaningful systems of architectural knowledge (Zeinali Nasrabadi & Farahza, 2022), increasing the transfer of teachings and the availability of knowledge acquired in the design situation (Anderson & Krathwohl, 2001), deep learning experience, adopting a holistic approach, and organizing the constituent components into a single system (Brophy & Lewis, 2012), and the ability to implement theoretical knowledge and teachings in the design process, architectural design education in critique sessions requires the principle of integration and coherence. Achieving this goal depends on such actions as establishing effective interaction between theoretical and practical courses, transferring design knowledge and experience, and reflection-decision in design practice.

Establishing effective interaction between theoretical and practical courses:

In line with the development of the design subject, the practices of the architecture students in the design studio require attention to the connection with the teachings of the theoretical courses, and in the critique sessions, establishing effective interaction between both theoretical and practical courses provides the grounds for the formation of meaningful connections between the knowledge and skills of architecture students. While coherent curricula provide clear learning paths, fragmented curricula often lead to superficial knowledge. Therefore, when the topics included in the theoretical courses of architecture are appropriate and related to practices logically and purposefully while interacting with them synergistically and progressively, they provide more comprehensive, deeper, and more effective learning for students. For example, historical and theoretical courses including history, art, aesthetics, psychology, sociology, wisdom and philosophy, economics, and management, or construction technology courses including statics,

construction material technology, climatology and climate studies, and many other sciences along with the skills of observation, drawing, and construction are involved in the design courses and the architectural design studio, which can imply the concept of coherence, while each of the knowledge alone does not have much connection with each other and sometimes they belong to different fields of knowledge (Mondegari et al., 2022). Therefore, the coordination of theoretical educational content and practical skills based on the design problem prepares the architecture student to face the complexities of the design process. Achieving this target requires the purposeful design, combination, and balancing of learning packages and their presentation by the instructor in the critique sessions. Therefore, the coordination and connection between the general body of theoretical courses and the components of practices provide the grounds for integrated and holistic perception aiming to increase insight in the context of critique.

Transferring design knowledge and experience: In the process of architectural design critique, the instructor of architecture transfers his/her design knowledge and experience when facing the quality of ideation, variety of concepts, and sketches presented by the student through writing or verbal expression. The research by Cunningham (1980) considered the constant problem in education to be the connection between transferred knowledge and design practice. It emphasized the consolidation of a situation that has been divided due to the convenience of the education process.

In the light of weekly critiques, students' ambiguous and vague ideas in response to the design problem are upgraded to clear visions. In other words, the expression of hidden concepts in the field of design knowledge and experience by the instructor using the critique provides the possibility of systemic thinking and the ability to analyze and process the idea-concept for the architecture student. The findings of the research carried out by Adams et al. (2016) and Uluoğlu (2000) emphasized the effective role of critique in transferring the design knowledge and experience of instructors to students, and the study done by Budge (2016) also confirmed the possibility of modeling the way of thinking and action of experienced designers in the light of critique.

Additionally, while indicating the important role of critique in architectural design studios, Erçevik Sönmez (2020) and Priya et al. (2020) pointed to such advantages as facilitating the transfer of instructors' knowledge to students, strengthening learning, and improving the design education process. Hojat (2022) also formulated architectural education at the intersection of the three levels of art, industry, and judgment, and considered the acquisition of design knowledge and skills as the cornerstone of the architectural industry as a part of the architectural education system.

Reflection-decision in design practice: Thinking and decision-making are important parts of the design process, and the architecture student must make several decisions during the course of a project while reflecting. The hierarchy of these decisions includes a range from planning (general) to design (specific). In the continuum of planning, preparing a mission statement, determining project goals, determining measurable performance requirements, and creating conceptual relationships are included, and in the continuum of design, there are design concepts, technical specifications of elements and materials, and finally the built form (Duerk, 1993).

The complexity of the decisions is important in the sense that prioritizing and balancing the components included in the triad of analysis, synthesis, and evaluation in the design process has significant effects on the presentation of the final design solution and its product. Thus, the design methodology literature presents decision-making based on a normative approach with methods and rules for structuring the decision-making process and selecting alternatives based on criteria (Hansen & Andreasen, 2004). While rethinking the issue of coherence in architecture education, the study by Mondegari et al., (2022) pointed to the concept of rhetoric as a position of decision and action.

- Personalization of design education process

Although the instructor's conversations with the students during the critiques in the architectural design studios are relatively general and comprehensive regarding the design problem, the individual differences of students, the level of their learning, and the way they face the design problem, as well as the importance of attention to the soft (non-technical) skills, including considering

individual differences, the feeling of sufficiency and worth, considering emotional-cognitive characteristics, and the development of psycho-motor skills are emphasized to personalize the process of teaching design skills.

Considering individual differences: Basically, teaching in design studios is different from working as a consulting engineer who deals with design professionally, in the sense that according to some experts, the design process is more important than the product in architectural design education. Evidently, all students in a studio take a common set of necessary courses. However, each student brings his/her unique characteristics, such as the ability to perceive space, gender, and cultural background to the learning experience (Alizadeh Miandouab et al., 2022). This importance point should be considered in the way the teacher interacts with the student to personalize the process of teaching design skills. While acknowledging the plurality of students' ideas in response to the problems raised in architecture studios, Hojat (2004) also emphasized the guidance of the project considering each of the students. In other words, emphasizing the individual differences and acquired technical and non-technical skills, face-to-face training of each of the students present in the design studios plays an efficient and effective role in using specific and unique methods by the instructors to guide and flourish ideas.

Feeling of sufficiency and worth: Paying attention to the cultural and social contexts of the students can affect their attitude towards architecture, and if these differences are noticed and recognized by the instructor in the critique sessions, first of all, the student gains a sense of sufficiency and worth. He/she then achieves success in his/her design process. For example, an average student, according to the teacher's diagnosis, may need encouragement and persuasion, while a student with low self-confidence should be treated differently. In this way, the student can discover his/her unique self and also understand the unique self of his/her peers. Therefore, honoring the student, motivation, and excitement for learning, and paying attention to the flourishing of the student's talents and outstanding behavioral and scientific traits are among the factors that

lead to the feeling of sufficiency and worth in critique sessions.

Considering emotional and cognitive characteristics:

Learning materials related to architectural design and acquiring knowledge about architecture in accordance with the design problem are concerned with the cognitive field. In the critique sessions, the attention to the cognitive field to develop the mental skills of each student, including recognition, recall, understanding, the ability to apply what has been learned, analysis, synthesis, and evaluation, is one of the strategies of personalizing the architectural design education process that ranges from superficial learning to very deep understanding of the material. For example, the 6 levels of learning architectural design courses in critique sessions can be organized in a continuum from recalling the components of architectural knowledge, understanding theories and explaining architectural ideas, and using a methodical process in solving design problems to the realization of the architectural product based on the process, the integration of the architectural information related to the design problem, the criticism and evaluation of the quality of the architectural design, and the creation of the architectural work.

Propositions such as the level of interests and tastes, preferences and attentions, emotions and feelings, and the values and attitudes of the student towards the subject of architectural design and solving the design problem form the main core and the consistent element of the emotional field. The critiques in architectural design courses are also made by the instructor based on the emotional levels of each student. These levels include mental attention and acceptance by the student, awareness of the dimensions of the design problem, desire to receive, selective attention, desire to react and satisfaction in reaction, valuing, accepting and prioritizing value, commitment, organization, conceptualization of value, internalization of value, generalized attitude, and personality creation (Safavi, 2005).

In the practical education of architecture and during critiques in design studios, the emergence of emotional relationships or positive and negative biases between instructors and students is inevitable, and it seems that instructors can manage appropriately the emotions

between the parties based on their experience in teaching. The emotional bonds formed based on the instructor's affection and the student's devotion (Haskell, 2001) include the attitudes and values that ensure the student in the critique process that the conversations will lead the subject of his/her project to a clear result. Sadram (2017) argued that the correct imitation of the instructor by the student was not only a prerequisite for creativity but also caused the formation of the "emotion of education" based on friendship and intimacy between the imitator and the imitated and expanded the creative interaction between them. While defining the two-way interaction in the system of novice student and expert instructor, the study by Nadimi (2010) introduced and analyzed six cognitive aspects in the process of teaching professional skills and two ternary series on the part of instructor (including support, guidance, and being a role model) and the part of the student (including self-discovery, reflection, and expression) under the title "cognitive master-apprentice". This two-way emotional interaction is based on feelings, attitudes, values, beliefs, and personality traits. It provides the grounds for the student's transcendental movement towards creating an architectural work.

Development of psycho-motor skills: Realizing the development of psycho-motor skills in architectural design education requires the readiness of each student in three cognitive, emotional, and physical aspects according to his/her talents and capabilities. In architectural design education, the critique sessions start with the observation and imitation of the instructor by the student. Then, the architecture student achieves the level of easy and automatic execution by doing the practices without help from others while observing the accuracy and elegance in the practices and sometimes by mixing more than one skill and performing the movements coordinately without any doubts.

• Critique strategy

Critique cannot be considered an activity isolated from the whole education and learning process. Rather, other elements of the education system, including theoretical and practical courses, course syllabus, educational system, the quality of the educational settings, and the mastery of the instructor on teaching methods in design

studios, lay the foundation for a better understanding of the multiple and diverse dimensions of design problem-solving skills. The strategy of critique does not have a fixed and identical nature in each session of the semester. This means that with the progress of the design and according to its subject as well as the formative assessments during the semester, the contents of each of the critique sessions are expressed to improve the quality of the architectural design. The critique strategy not only provides the grounds for ideation and directs the design studio program but also facilitates a holistic approach to guiding the process of learning design skills on the one hand and strengthens and consolidates design teachings on the other hand.

- Ideation

Ideation is a vital stage in the architectural design process, which includes the production, development, and communication of ideas and concepts that are obtained based on creativity and systematic exploration. In the critique sessions of architectural design courses, the ideation process can be realized through systematic analysis of design problem. Of course, it should be noted that ideation is not limited to the initial stages of the design process, but can take place cyclically in the design process. Ideation is the inner whisper of the architect with the architectural work, which is expressed visually through various media. Therefore, synectics and strengthening reproductive thinking, discovery of design ideas, and determining the scope of design concepts can be considered under ideation in the critique strategy.

Synectics and strengthening reproductive thinking: The excellence and skill advantages of each student in the critique sessions depend on his/her ability in visual, graphical, and conceptual representation of upgraded ideas of the design problem, which strongly requires the reproduction of design alternatives. Of course, achieving such a goal needs the concept of synectics and reproductive thinking in critique sessions. The proposition of brainstorming, which is related to the word sketch, is always expressed by the instructor in the design critique sessions and refers to the synectics and reproduction of multiple and diverse ideas of the design problems. The classification of produced ideas and their correction and adjustment, which are done by the

instructor with the cooperation and participation of other students in the design studio, is validated by reasoned discussions and critical analyses and evaluations. The findings of the research by Shoop (2014) emphasized the increase in the involvement of the students' minds, immersion in the design problem, and the use of gamification theory in improving the effectiveness of critique sessions, followed by the formation of reproductive thinking. The study done by Knight et al. (2019) also pointed to the interrelation of innovation and evaluation as one of the approaches to synectics, which requires discipline in synectics and flexibility in the design process. Therefore, evaluative thinking contributes to new learning by providing evidence to chronicle and monitor the progress, successes, failures, and roadblocks in the innovation process (Earl & Timperley, 2015).

Discovery of design ideas and determining the scope of design concepts: Systematic analysis of the design problem is the starting point of architectural innovation and ideation so that the formulation and development of mental schemas related to the design problem can lead to the excitement of the student's mind to express ideas and reproduce innovative concepts. Therefore, in critique sessions, the architecture student is asked to prioritize explicit and implicit design problems and to represent their physical equivalent in drawing and visual language and sometimes in writing. Sharif and Nadimi (2013) classified idea generation into 5 levels, including understanding and interpreting the problem, expanding the problem, analyzing and organizing the aspects of the problem, discovering and creating solutions, and finally combining and consolidating the solutions in the form of a general design influenced by the designer's creativity or innovative thinking. They also argued that idea processing required evaluation and selection of the most favorable solution for the problem, aiming to complete the idea as an acceptable design influenced by the critic's thinking. Therefore, idea generation is based on creative thinking and uses analysis skills to evaluate, select, and formulate the system of design problems to find innovative solutions in the design process, while idea processing is based on analysis to evaluate, make decisions, and choose the most satisfactory idea.

The importance of dealing with ideation for the design problem in an interactive relationship between instructor and student originates from the fact that the initial design idea is a reflection of the design problem in the designer's mind and separates such terms as idea, sketch, and concept from each other (Lawson, 2006). In addition to explaining the idea as the source of thought, the study by Panahi et al. (2014) introduced the concept as the branches of thought and the starting point of realization, meaningfulness, and implementation of the idea. Darke (1979) considered setting a goal or a small set of goals before the analysis of the problem by designers, which caused the reproduction of possible solutions to be limited to some mentally manageable solutions.

Explaining how to transform thought and imagination into architectural space and to associate and convey concepts to the audience, the study by Noori Mokram et al. (2023) considered the design idea as the primary thinking, the project frame, and the strategy for dealing with the project while the design concepts make the students' revealed idea(s) meaningful by a series of critiques including design education, sketching, teaching appropriate geometry, and examining previous successful samples. Clearly, due to the multiplicity and complexity of the components affecting the design process, it seems unlikely that all the dimensions of the design problem are organized at once in the mind of the novice architecture student so that it is possible to reproduce ideas corresponding to each problem. Therefore, the priority of identifying the design problem and formulating a theoretical framework is the precursor to entering the design issue (Lang, 1987). It is the critique process in the design studios that develops the possibilities within the scope of the architecture student's authority and guides him/her in the transition from the idea to the seen and from the seen to the phenomenon he/she is thinking about. In this way, discovering design ideas and developing concepts corresponding to the ideas in the architecture student's mind can be a purposeful system.

• Targeted guidance

The guiding aspect of the critique has a progressive and context-oriented approach, and engaging the mind when facing the design problem and using knowledge, ability,

and insight make it possible to experience new horizons of problem-solving in the light of exploration. Therefore, critique which is usually purposeful, methodical, measurable, process-oriented, product-oriented, and can be assessed and evaluated makes the mind fertile in reproducing ideas related to the design problem. The study by Pourshanzari et al. (2013) showed that learners who participated in the problem-based learning method experienced a better quality of learning while developing critical and collaborative skills among their peers.

Engaging the mind with the design problem: Design requires the complex mental process of obtaining various types of information, combining them into a coherent set of ideas, and finally realizing the ideas (Lawson, 2006). Therefore, thinking and experiencing new horizons of the design process engages the mind of the architecture student with the design problem. The realization of this goal requires a wide range of new strategies used in the methods of teaching design courses. Presenting a clear and precise definition of the design problem, explaining the scope of design goals and assumptions, and emphasizing the importance of studying the practical, case, and similar samples to analyze the existing solutions and adapt them to the unique requirements of the design problem, emphasizing the graphic representations, and providing textual reports of possible solutions for the design problem are examples of strategies to engage the mind with the design problem.

Problem-oriented learning makes it possible for the architecture student to achieve a new configuration of understanding the different dimensions of the problem and providing innovative solutions with an accurate and responsible attitude to the components of the design problem (Jakaitis, 2015). In this method, the student's mind engages with propositions such as what, why, and how to face the design problem, searching for suitable solutions, the skill of communicating critically with other students, group discussions about the development of the design concept (Asojo & Vo, 2021; Khalil, 2020), and the skill of developing design literacy (Yorgancıoğlu & Tunali, 2020). Immersion of students in real design settings and interaction with stakeholders and experts bring them new horizons of design challenges in the problem-

oriented learning approach. Cooperation, compromise, and communication with students in the design studio settings when deciding how to solve the design problem and expressing the solutions are the intellectual achievements of the students as a result of the proficiency of their minds in the face of the design problem (Sahin, 2019).

However, it should be noted that the relative complexities in problem-oriented learning caused by how to configure the components of the design problem require the simplification of tasks and modeling of the design thinking process, both of which are not separate and complement each other in a way. The strategy corresponding to this requirement is the use of scaffolding in education, which is the process of guiding the learner to transition from the current knowledge and achieving the teachings he/she is supposed to learn (Arefe et al., 2020). The main potential of this method is to reduce the complexity of the learning task by clarifying the structure of the tasks, dividing the task into smaller parts, highlighting the important parts of the tasks, and informing the learner to recognize and perform the different steps of certain simpler activities in the design process (Eslinger et al., 2008). In general, scaffoldings can be placed in four types of educational goals: a) learning the knowledge (expressive); b) learning how to learn (metacognitive), c) learning the use of educational tools and settings (procedural); and d) learning how to adapt and modify educational characteristics and contexts (transfer of learning) (Azevedo et al., 2008).

Exploring the architectural design problem: During critique, design problems require providing simple and organized interpretations of the design subject, and the guiding approach of critique transfers the instructor's professional and academic experience to the student while improving the student's ability to analyze and understand the architectural knowledge of the environment in the light of questioning and exploring the design subject. Sakman (1962), quoted in Akbari Sheldarai et al. (2009) explained the benefits of exploration such as increasing the ability to understand science, creative productivity, and developing the skills of receiving and analyzing information and argued that the purpose of exploration was to create rational

order and develop necessary skills for posing questions and doing research. Additionally, such propositions as brainstorming in focus groups, concept mapping, and reasoning with a group of peers based on thinking to deal with various aspects of the design subject form the basis of critique which is generally accompanied by suggestions from the instructor and other students. Therefore, to implement the exploratory model in the critique sessions, it is suggested that the instructor of the architectural design course should consider such things as disturbing the mental habit of the student, questioning, hypothesizing, experimenting, analyzing, and drawing conclusions.

Valuing process-oriented products: The answers presented in the form of approved documents in design courses, such as drawings, conceptual-physical mockups, and sketches are the products of design course students during the semester. Therefore, the quantity and quality of the critique products is a function of the level of the design problem, the level of the student's perception of the problem, the variety of ideas, and possible challenges in the context of the design problem, which are achieved with a process-oriented approach during the semester. The instructor's guiding role in organizing the products produced during the semester makes it possible to relate the skill of solving problems to creative approaches in the design process. Although the critiques in the architectural design courses have a process-oriented approach during the semester, the final product of architectural design at the end of the semester is a methodical, precise, targeted, responsive, and innovative result of formative assessments in the critique sessions. Thus, the final result or product of architectural design confirms the connection between the process and the product of each of the works when it is assessed by the instructors and experts in the judgment sessions.

- Learner-centered facilitation

In the process of cognitive construction from solving the design problem, the most responsibility for learning is directed to the student and the instructor has the role of facilitation and guidance (Memarian, 2019). Therefore, playing the role of facilitator in design education is one of the main topics of critique, helping to achieve such goals as the disambiguation of the design process,

adaptation and organization of the ideation process of the design problem, and making architectural design studio programs purposeful.

Disambiguation of the design process: The diversity of parameters related to the design subject, such as climatic, structural, and construction technology issues, solving spatial relationships to respond to performance, the effective potential of the site in organizing the architectural form and space, symbolism, conceptualization, formulation, etc. may lead to a kind of ambiguity and confusion in the mind of architecture student. Therefore, the instructor's critiques on the student's design during the semester remove the ambiguity of the design process while teaching how to face the system of design problems. Various strategies can be suggested to get out of the ambiguity and confusion in the system of design problems. For example, during the critique sessions in the design studios, the architecture student should present new formulations of the system of design problems while rereading the design problem according to the feedback provided by the instructor. Additionally, with the development of knowledge and information, the use of parallel thinking and the reproduction of numerous alternatives can go beyond the removal of ambiguity and confusion and create value in solving the design problem so that several ideas are pursued in parallel and in a period of time to select the best answer at the right moment and sometimes they are combined.

Adaptation and organization of the ideation process of the design problem: The correct design of the learning path and adapting the content of the critiques based on the progress of the design and according to the level of knowledge, insight, and ability of each learner realizes the principle of learner-centered facilitation of design education. Ordering and organizing the mechanism of the student's imagination and thinking in the ideation process of the design problem, which is dynamic and changing in nature, are based on the adoption of strategies that are effective in guiding the design studio. These strategies range from developing a systematic framework for structured criticism (El-Latif et al., 2020), learning self-regulation, and paying attention to time management (Ateş Akdeniz, 2023) to forming a follow-

up circle and providing feedback from the design process (Utaberta et al., 2011).

Making architectural design studio programs purposeful: The architectural design curriculum is explained in the first design studio sessions based on the educational goals, and the realization of the details of the program implementation requires making the design studio programs purposeful to better observe and monitor the critique sessions. Determining the schedule of each session, explaining how to study and use the content of the theoretical courses taught in accordance with the design subject, possible visits to valuable architectural works or any other educational event that improves the quality of learning design courses can be considered among the goals of the architectural design studio program.

• **Strengthening and consolidating design teachings**

What is transferred from the design teachings in the critique sessions by the instructor to the student requires strengthening, stabilization, and consolidation, which can be done using a dynamic and continuous process by creating an active learning setting in architectural design studios. The stabilization of design teachings in the process of weekly critiques in architectural design courses is realized by doing various design practices ranging from simple to complex. Additionally, thinking and reasoning in the design process and adding value to learning design based on metacognition are other effective components of strengthening and consolidating design teachings.

Doing various design practices ranging from simple to complex: Consolidation of architectural design teachings is based on repetition and intelligent practice. One of the strategies to consolidate what the student has learned about how to solve the design problem is the presentation of practices by the instructor, which pose targeted challenges in the system of design problems and provide the architecture students with the ability to architectural analysis and thinking about the design problem based on their past experiences. It should be noted that the diversity and multiplicity of purposeful design practices bring more durability and quality of learning to architecture students.

Thinking and reasoning in the design process: In the critique sessions, the presentation of relatively complex questions and challenges by the instructor of the design course requires high-level skills of the student, such as reflection and thinking, effective discussion, and reasoning. In the process of solving the design problem, the effective thinking and reasoning of the architecture student promotes his/her analytical power and architectural reasoning power, decision-making skills, and the quality of his/her ideas when expressing possible solutions for the design problem. Timely feedback given to the student by both the instructor and the peers has an important effect on the way of thinking and architectural reasoning because it provides the grounds for conscious compliance with rational rules.

The path of discovering and expressing possible solutions to the design problem requires mastery and expertise in questioning. Questioning, which is a companion to thinking and a level of mental effort, requires compliance with principles and rules that provide the grounds for a deeper understanding of the design process while clarifying the issues and creating effective communication with the instructor and peers. Knowing the types of questions related to the design problem, distinguishing and separating questions, classification, effective application, and application of questions are among the strategies for getting familiar with the principles and rules governing critique sessions, which strengthen and consolidate the design teachings. Findings of research conducted by Livingston (2006) also indicated that reasoning about ideation for the design problem is not just a mental operation in its limited cognitive sense. Rather, it is a purposeful, responsive, evaluative, and researchable embodied action with an interactive approach.

Adding value to learning design based on metacognition: In the critique sessions, when the architecture student consciously analyzes the cognitive processes, control, regulation, and active revision of his/her thinking of the design problem based on the three fields of knowledge, insight, and ability, he/she achieves the transcendent field of metacognition. For example, the student asks him/herself questions about the system of design problems, including the amount of

his/her knowledge and insight of the design subject, the time required to discover and present possible solutions, how to plan and estimate the design product, and the assessment of the level of receiving and understanding the content related to the design problem is generally an indicator of his/her entry into the level of metacognition. Therefore, learning the architectural design process, which is a heavy and difficult activity, not only is simplified and facilitated in the light of metacognitive skills but also adds value to the learning process. Therefore, the realization of metacognitive processes in critique sessions, while facilitating and improving information processing and its efficiency, brings reinforcement and consolidation of design teachings in the light of self-efficacy, true self-concept, and self-regulation. In other words, metacognitive experiences in the critique sessions of design courses help the architecture student to find out his/her position in a cognitive operation on the content related to architectural knowledge, to realize the progress of his/her practical skills and mental processing, and to identify and evaluate hidden and obvious obstacles and challenges to provide solutions to the design problem.

• Critique management methods

Design is one of the most complex types of problem-solving (Megahed, 2018), and design education should be realized with different learning methods to develop and deepen the knowledge, insight, and ability needed by each student. The multiplicity and diversity of architectural design critique management methods according to the level of relative knowledge and experience of the instructor regarding the design problem may be based on cognition orientation, dialogue orientation, search orientation, skill orientation, and process orientation.

- Cognition orientation

The process of absorbing, expanding, and processing all mental activities related to acquiring knowledge, including perception, attention, memory, intellectual horizon, and problem-solving, depends on cognitive development so that the physiological structure of the human brain provides the grounds for the production of knowledge and skills by absorbing environmental stimuli and the interactions between them. Cognition-

based critique management which is rooted in cognitive learning theory emphasizes the internal mental processes involved in acquiring knowledge, investigates how people perceive, process and store information, and highlights the importance of understanding thought processes. In the cognition-oriented management of critique sessions, analysis and perception of the environmental components of the design subject, cognition construction, meaningful learning experience, and empowering the student in processing the complex problems of the design subject provide effective grounds for learning so that the students can try to maintain and understand it in the light of linking and networking the new information provided about the design problem and the existing knowledge.

Analysis and understanding of the environmental components of the design subject:

Recognizing and examining the variables affecting how to express the solution for the design problem involves the analysis and perception of the environmental components of the architectural design problem in critique sessions by the student, which generally take place through argumentative discussion and its outcome is the formation of critical thinking and the process of construction of cognition and mental skills to solve the design problem. By learning the skill of data analysis in critique sessions, the architecture student processes the data more deeply and achieves a wider and more refined understanding of the issues related to the design problem while understanding the spiral process of description, comparison, categorization, and conceptualization. This understanding is similar to the spiral process between details and description of the hermeneutic circle (Alonso Schökel & Maria Bravo, 1998). These skills include independent thinking, organization, inference, prediction of results, problem-solving techniques, and insight. Since this strategy is based on the fallibility principle of epistemology, the process of perception is realized based on the subjects' personal experiences. Therefore, the architecture student enters the active learning stage in the critique sessions of the design course after directly engaging with his/her experiences in the design studio learning settings. Activities such as intelligent data collection and processing, free thinking,

group discussions in the design studio, forecasting and presenting possible solutions and answers to the design problem, making mental models and personal exploration of the design process form the foundations of the formation of students' ability to analyze and understand the components of the design problem, which is realized in the semester-long critique sessions.

Cognition construction: The cognition construction process is based on the idea that knowledge is not passively absorbed, but is actively constructed by learners based on their existing cognitive structures and experiences, which provide grounds for a deeper understanding of the educational subject. The study by Feizbakhsh et al. (2023) also indicated that the cognitive capabilities of students provided an opportunity for flourishing thought, strengthening decision-making power, and improving the effectiveness of the educational practice of graduates.

Active learning strategies of architectural design courses, including problem-solving, joint discussion and group work, brainstorming, and coordination of theoretical courses and practices, are achieved in critique sessions under the supervision of the instructor of the architectural design studio. Knowledge and meaning are actively constructed through the interaction of existing knowledge with new information. When exchanging opinions and expressing problem-solving solutions in the critique sessions, the organization of knowledge is the responsibility of the student and he/she should take responsibility for his/her learning. Thus, the student independently implements theoretical teachings in accordance with the way of doing the practices and participates actively in learning with peers. Basically, this process helps the active development of knowledge (Fleischmann, 2021). By engaging learners in this dynamic process, they can deepen their understanding of the educational topic and actively use their cognitive structures and experiences to construct meaning.

Meaningful learning experience: To manage architectural design education, the goals, values, and concepts related to the design problem as pre-organizers are introduced by the instructor in a general, comprehensive, abstract, and brief way and more detailed and subsidiary content is gradually presented

according to the rate of progress to form a better understanding of the design problem in the student's mind. Then, during the next critique sessions, new knowledge and detailed information and content about the design problem, if taught correctly, make the design process easier and more meaningful for the architecture student. The condition for the realization of meaningful architectural design learning based on critique is to arouse internal motives compared to external motives. Cognitive attraction and desire as internal motivation originate from the learner's curiosity and interests in discovery, deep perception, and dealing with the settings (Seif, 2007). Paying attention, focusing, supplying, and satisfying internal motives cause such satisfaction that stimulates the motivation of the architecture student for further learning.

Developing the ability to process complex design problems: One of the requirements for the empowerment of architecture students' thinking to process complex design problems is to hold efficient and effective critique sessions. The study conducted by Dempsey and Brennan (2018) indicated that rethinking curriculum design and placing the student at the center of the design process can be one of the approaches to strengthen the high-level thinking in the students, providing them with the grounds for processing complex design problems. Various practices such as physical criticism and analysis of valuable architectural works can be considered for introductory students to teach the basic concepts while familiarizing them with the way of thinking of designers and explaining the ways of architectural thinking (Yorgancıoğlu & Tunalı, 2020).

Achieving this goal includes such practices as modeling by making a mockup, sketching, and writing an essay on the design subject. Of course, in the higher years, the use of computational thinking and computer software for the development of thinking skills based on the level of complexity of the problem has a significant effect on empowering the mental processing of students, and it seems to open new horizons at the intersection of architecture with other fields such as basic sciences, humanities, additional technologies, etc. The findings of the four-year longitudinal research by Senske (2017) also pointed to the better educational performance of students

in computational courses due to their growing interest and passion for topics related to computer architecture and the use of computer science education research in the planning of architectural design courses.

- Dialogue orientation

The strategy of dialogue is one of the common methods for the management of the critique sessions of architectural design studios, which creates an environment of trust, mutual respect, and mental growth in the light of constructive views and feedback for architecture students. The dialogue orientation in the critique sessions requires dynamism, guidance, communication between instructor and student, self-analysis, and self-correction of the student.

Dynamic dialogues: Studio-based dialogues in critique sessions have a dynamic feature so that they include description, narration, imagination, verbal illustration, comparison, use of terms related to the design process, drawing and sketches, and even in some cases, making mockups and models. Therefore, they lead to the formation of a kind of constructive and effective interaction between instructor and student. The dynamism governing the dialogues between the instructor and the student in design studios makes it possible for the mental world of the architecture student to imagine, and if it is accompanied by inputs such as strong will, abundant enthusiasm, perseverance, and persistence in doing architectural practices (sketching), it brings such values as prosperity, development, and progress of design skills (Antoniades, 1990). The results of the research by Nadimi (2010) also emphasized that the increase in the students' determination, will, and intention to learn causes them to be firmer in their personality traits and decode and perceive what they learn in a more integrated way in terms of emotional and emotional arousal. It seems that such an assumption leads to the realization of the exalted thinking of self-regulation.

Communication between instructor and student about the design problem: The dynamic and effective studio-based dialogues in critique sessions make it possible for the instructor and the student to be present in each other's qualitative world (Glasser, 1990) so that while establishing a mental connection and mutual

understanding between the instructor and the student, communication between them about the design problem is formed based on a deep and interactive relationship to criticize and guide the design subject. The communication between the instructor and the student not only causes the supportive approach to replace aggressive-confrontational approaches but also helps to consider the preferences and attentions, interests and tastes, skills and capabilities, and implicit knowledge and skills of the student by the instructor. Therefore, the critique is an interface between the instructor and the student. It is based on love from the instructor and devotion from the student (Nadimi, 2010), causing a kind of mutual acceptance and forming behavioral relations between the instructor and the student. The study conducted by McClean and Hourigan (2013) pointed to a deep interactive relationship between instructors and students as well as formal or informal discussions on the design problems among peers, aiming to improve the quality of learning in architectural design courses. The effective role of such a method is to strengthen feedback methods and improve students' perceptions. It should be noted that the meaning of the communication between the instructor and the student is not necessarily to use vocabulary and establish verbal communication. In some cases, even the silence of the instructor during the critique of the design problem is evidence of this kind of communication.

Guiding criticism: Guiding criticism based on dynamic dialogues causes the abstract concepts of design knowledge to find real, objective, concrete, and physical manifestations in the student's mind. The realization of guiding criticism presented by the instructor in architectural design courses plays an effective role in forming a constructive and supportive setting, far from destroying and weakening students' morale. Additionally, creating relative balance through the combination of expressing formal and structured criticism and providing informal and conversational feedback facilitates the possibility of modeling critical thinking and encouraging the expression of feedback by peers (peer-to-peer).

Self-analysis and self-correction: Studio-based dialogues in critique sessions are related to the design

subject beyond mere error detection and correction, and it is in the light of these dialogues that the logical reasoning power of the architecture student improves in the process from question to answer. The findings of the research presented by Carless et al. (2011) also emphasized that the dialogue orientation in critique improved students' skills in consciously performing design practices and developed their ability to self-regulate in future design projects, and it was realized by empowering them to acquire competencies such as self-correction, life-long learning, and the skills in analyzing the hidden complexities of the design process evolutionarily. Additionally, Scagnetti (2017) argued that studio-based critiques provided opportunities for the students to learn the egalitarian work culture, develop social relationships and professional identities, and master the design process with the help of self-analysis skills and the ability to reflect.

- Search orientation

In the process of problem-oriented critique, the student's mind learns the skill of reproducing and expressing architectural ideas in the critique process while engaging with the questions- posed by the instructor- and searching for the right answer. The study conducted by Yew and Goh (2016) also referred to the significant impact of the problem-based learning method and emphasized the preservation of knowledge and long-term applications of this method. While directing the student's mind towards more questions, expressing the challenges related to the design problem provides the grounds for reproducing more diverse answers based on visual expression. The manner and diversity of the answers to these questions often arise from the richness of the student's perception of the design problem, which depends on such factors as the scope of the instructor's knowledge-attitude and experience, the design approach, and the explicit and implicit knowledge and skills of the student. Such a process leads to the creation of new elements in the architectural work, implying active learning.

Questioning based on design requirements: The opportunity to ask questions in critique sessions, which is one of the oldest teaching skills, clears up the student's possible ambiguities when facing the design problem. Using the 8 basic techniques of questioning,

including clarifying and continuing, stopping and matching, directing and dispersing, guiding and probing (Raouf, 2006), students' answers are expected to enjoy considerable diversity, innovation, and creativity. Additionally, follow-up questions and the instructor's help to the students in finding answers are another strategy used in the field of questioning that stimulates the student's creativity during the critique sessions (Hojat, 2010). Since the student must provide the answers correctly, it is tried to think more deeply and accurately at the highest level of attention to the design problem. Therefore, the method of asking follow-up questions not only makes possible higher levels of learning for the students but also causes the student to learn the skill of posing clearer, more precise, and deeper questions in a constructive interaction (Safavi, 2005).

Collaborative ideation: In one of the traditional methods of critique in architectural design studios, the works of each student are placed on the table and the instructor invites the rest of the students to talk about it and express their opinions (Gunday Gul & Afacan, 2018). In this technique, design courses are taught using a collaborative approach through criticizing the students' works by peers under the guidance of the instructor. Propositions such as the degree of students' interest in participating in group discussions and expressing their opinions, the depth of students' understanding of the obvious and hidden requirements and challenges of the problem, implicit knowledge and the expression of creative and different ideas, the ability to analyze, combine, and evaluate the design subject by each of the students can determine the level of the quality of this method of critique while emphasizing the principle of preference of the group work.

Directing the mind to search purposefully: In critique sessions, spatial geometric ideas are usually refined in parallel with other ideas. In this method, one of the spatial geometric ideas is changed by considering such issues as the selection of materials, architectural details, and the type of use of building systems in an interactive and two-way relationship with each other until a relatively appropriate and favorable result is achieved. In other words, it is not possible to advance the design process with a linear

approach from details to the spatial idea or vice versa (Lawson, 2006).

Brainstorming based on visualization: Brainstorming based on visualization in the process of architectural design courses has advantages such as understanding the designer's cognition process (Maciel et al., 2021), increasing the use of a collaborative approach in architectural design studios, strengthening lateral thinking, framing new elements in the design process, and improving problem-solving skills (Priya et al., 2020). In each of the critique sessions, students brainstorm and explain the process of developing the concept of their design in a systematic, clear, and efficient way using drawing-visual, writing, and oral skills. In this process, design outputs are realized with better quality in a shorter time (Abdelhamid, 2020).

The mental surveys by students based on the graphic representation of the development process of the concepts of the design subject enrich the content of architectural critique sessions in the light of strengthening creative thinking and criticizing and analyzing architectural works (Brown, 2001). It should be noted that the degree of involvement, the range of perceptions, the level of remembering concepts, and the visual-spatial actions of each student are different in the critique sessions according to their knowledge, insight, and ability. Therefore, in the management of critique sessions, the effective role of mental surveys based on images can lead to enriched insights and new approaches to idea-finding-ideation as well as concept development in the process of architectural design.

• Skill orientation

Dynamic thinking with the aim of creativity and the expression of new elements when providing solutions for design problems based on knowledge and insight is one of the goals of skill orientation. In the critique sessions of the design studio, providing objective studio-based learning (SBL) contexts (Roberts, 2006) is one of the goals of skill-oriented management as one of the methods of critique. In skill-oriented management, outputs such as the ability of the architecture student to use the received information in practice, the student's agency and activism during learning, increasing intellectual creativity and mental ability, increasing

interest in learning theoretical issues, increasing the ability and discovering the student's talents in various fields related to architectural design, the absolute independence of the architecture student to learn from the instructor can be considered among the values of studio-based learning. For example, although the skill of visualization is a relatively complex task due to the nature of the design problem, the dimensions of which have not yet been ascertained for an architecture student, critique sessions gradually provide the basics for processing and objectifying the ideas using such methods as sketches and graphic drawings, application of digital tools in architecture, articulating and describing the characteristics of the design, and building the model.

Sketches and graphic drawings: Sketches, visual notes, and graphic drawings presented explicitly and directly by the instructor on the architectural documents provided by the student, including plan, site plan, elevation, section, perspective, and details, in each session of the semester-long critiques are one of the common methods of critique by instructors in architecture design studios. Instructor's sketches as a design teaching tool and one of the critique methods for students who experience the first years of architecture education are more general and make the multiple dimensions of the design problem more concrete, objective, and accessible for architecture students (El-Latif et al., 2020). While facilitating effective communication between mind and hand, sketches are a manifestation of the instructor's thoughts and feelings at the moment of interaction with the student (Sung et al., 2019). Sketches presented in critique sessions provide quick and clear feedback to students (Budiman et al., 2021). Visualizing abstract concepts related to the design problem (Crolla et al., 2019) and providing a graphic frame of architectural ideas, crystallization of ideas and expression of new relationships and features in the early stages of design (Helmi & Khaidzir, 2016), encouraging students to analyze their creative thoughts (Suwa & Tversky, 1996), the formation of a better mental connection between the instructor and the student on the design problem (Utaberta et al., 2013), cognitive development, deep concentration and comprehensive understanding of the student of the design problem (Chrzanowska, 2019), explanation of design ideas, and development of initial

concepts (Santos et al., 2022) are some of the benefits of the instructor's sketches and visual notes on the works of novice students in architectural design critique sessions. The study by Majidi et al., (2023) also indicated that the human mind prefers processing visual and tangible information to verbal, numerical, and abstract information. Therefore, visual note-taking acts as a bridge between the confused and chaotic world of scattered information outside the mind and the multi-sensory and meaningful world inside the mind. Such ability facilitates the processing and storage of information in long-term memory.

The visual expression by the instructor in an implicit way, not explicit, on the design problem is another method of critique to promote metacognition and form the student's critical thinking (Thurlow et al., 2019). The conceptual sketches and the implicit expression presented by the instructor during critiques indicate drawing diagrams, ideograms, schemas, conceptual models, and general combinations of shapes and forms, and the purpose of this method is to stimulate students' design thinking.

Application of digital tools in architectural design:

It should be noted that in the critique process related to the designs for the end of the bachelor's and master's degree programs, the digital design process and graphic simulation can be used effectively in form finding, form processing, and creative innovation in idea processing based on the design problem. According to the study by Gheorghe (2019), the application of digital tools leads to more constructive and creative capabilities than the design process using paper and pencil. The application of digital tools in architecture promotes active participation, collective knowledge, and students' creativity and motivation (Abdalla et al., 2021 & Hassanpour & Şahin, 2021). In recent years, the development of digital graphic presentations such as augmented reality and virtual reality has made it possible for students and instructors to experience the full-scale representation (1:1 scale) of virtual models and better understand the sense of depth and spatial volume (Liu et al., 2020).

Articulating and describing the design characteristics:

Although architectural thinking is often represented by sketches (Lawson, 2006), according to (Schön, 1985),

the design instructor uses oral expression, written expression, or even hand or pen movements in critique sessions to convey design concepts. Therefore, sketching and talking about the design subject is one of the effective methods for guiding the design subject (Cross, 1982). The study by Sadram (2022) also indicated that in the process of critique, the instructor's verbal visualization causes the storage of verbal information, and sketching with a pen leads to the storage of visual information in the long-term memory of the student. Articulation, explicit or implicit oral expression, and the instructor's descriptions of the quality of the architectural space in critique sessions of design courses not only lead to the formation of innovative, meaningful, and creative solutions (Heylighen et al., 2007) but also translate the invisible layer of meaning and deep structure of metaphorical themes and concepts into the comprehensible layer and the surface structure of visual propositions (Chomsky, 1968) so that the abstract concepts and the dimensions of the design problem become more tangible, and finally, the student's ability to solve problems is developed (Cilella et al., 2010). Therefore, verbal visualization and imagination (a mental form of the design's features) in critique sessions facilitate the process of forming the ideas of students who mostly have higher intuitive powers and better ideation capabilities.

Making models: The technique of making models facilitates the discovery of design ideas in the process of studio-based critiques, which can be presented in the form of formal mockups, sketch mockups, conceptual mockups, diagram mockups, detail mockups, or collages. Mockups provide the opportunity to explore and interpret geometric-spatial qualities and make it possible to test and experience comprehensively and tangibly ideas related to the design problem for better visualization and understanding. The collage also represents multi-layered atmosphere and spatial concepts through visual elements such as texture, color, and pattern.

In critique sessions, making mockups and 3D models (Úbeda Blanco et al., 2019), as an intermediary tool, facilitates the implementation of new technologies, the transfer of abstract concepts to reality, and the development

of design concepts (Sachanowicz, 2019). By making a model (mockup or collage), design concepts become tangible and understandable (Sholanke et al., 2018), the principles of organization and geometric-spatial relations (Cabas, 2017) are explained, and an opportunity is provided to discover conceptual ideas and a better perception of space.

• Process orientation

Process orientation in a specific time interval can be considered as another component affecting critique methods. In other words, how the methods of critique are appropriate to the design subject and the progress of each student, considering the principle of time management during one academic semester, is determined based on such propositions as provoking thought for ideation at the beginning of the design problem, consolidating the design ideas, and organizing the final presentation of the design.

Provoking thought for ideation at the beginning of the design problem: The process from stimulation to consolidation of the student's mind in accordance with the progress of his/her design is one of the common processes used in critique sessions of design courses, aiming to enrich the quality of teaching architectural design courses. Generally, in the first weeks of the semester, to deeply understand the dimensions of the design problem, theoretical studies are conducted in response to questions such as what, why, how, where, when, and for whom. The tools of this knowledge can be the study of sources, interviews with experts and users, and observation of phenomena related to the design problem to discover the level of wants and needs, preferences and attentions, interests and tastes of users, as well as the requirements and considerations of the design problem (first divergence of the mind).

Consolidating the design ideas: In the second stage, students refine, limit, and define the problem to frame the system of design problems. For this purpose, a logical combination of propositions derived from the data of the first stage is subjected to data mining and organization to achieve values and attitudes, themes and meanings, opportunities and challenges, principles and methods, and finally, the potential contexts extracted

from the design problem (the first convergence of the mind). The end of this stage is asking the question "How can...?" It is the transition point to the third stage.

Organizing the final presentation of the design:

In the third stage, the students are asked to develop ideas based on the defined problem so that they can be reviewed by the instructor in the critique sessions. Encouraging and persuading students to develop multiple and diverse ideas is one of the common strategies used at this stage, which is achieved by brainstorming and representing ideas in the form of writing a scenario or presenting a sketch. To objectify the selected idea, concepts that are appropriate and correspond to the dimensions of the design problem and the centrality of the selected idea are developed according to architectural considerations (functionality and spatial relations, detailing, and aesthetic concepts), technical considerations (climate, building systems, facilities), and landscape considerations (management of views, perspective, and landscape) (the second divergence of mind).

In the fourth stage, which corresponds to the final weeks of the semester, the skill of summarizing and presenting architectural documentation is considered (the second convergence of the mind). According to the double diamond model (Fig. 1) which includes discovery, definition, development, and delivery, adopting such a method in critique sessions in the architectural design studios causes the allocation of time to the management of the design process to be optimized and it is ensured that the design will have a user-oriented and efficient approach (Seo, 2022).

Additionally, the panel of discussion and criticism of students' works in courses that are presented in parallel with other instructors makes it possible to share ideas and opinions of instructors. The final criticism that often takes place in the judgment session is considered the last critique session of students' works, and it is of great importance that almost a significant range of knowledge and skills related to the design subject, obtained by an architecture student, is exposed to the criticism and evaluation of the instructor and the peers. Therefore, it is suggested that the instructors of the

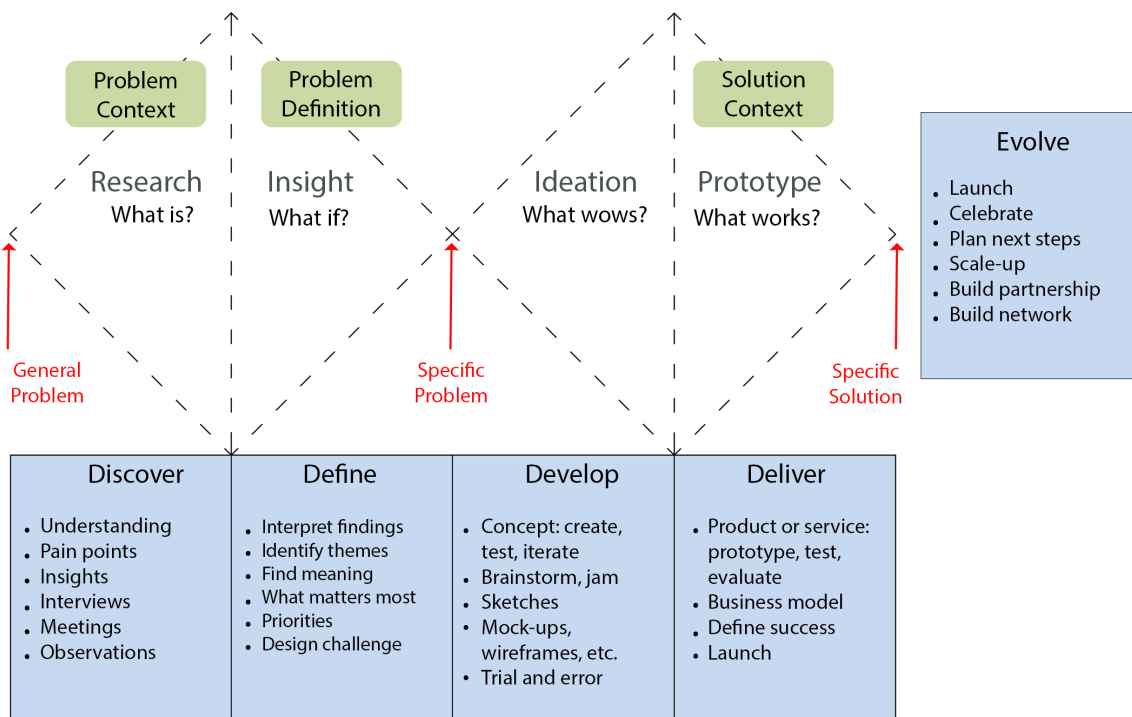


Fig. 1. Double diamond model. Source: British Design Council (2019), Available in <https://www.designcouncil.org.uk/sites/default/files/asset/document/Double%20Diamond%20Model%202019.pdf>.

architectural design course use this opportunity to make additional recommendations regarding the presentation of the students while respecting the emotions of the students.

Conclusion

Analyzing, understanding, and presenting appropriate solutions by the student when facing a system of design problems requires the provision of correct and constructive feedback from the knowledgeable and experienced instructor in the critique sessions. The problems demand a processual, complex, nested, and multidimensional approach, Critique has been the legacy of Beaux-Arts teachings in Iran’s architectural education system, and in the critique process, the architecture instructor corrected the students’ designs considering functional, technical, and aesthetic aspects and graphic expression. The output of the critiques was often in line with the intellectual path of the instructor of the design studio, and it was possible to shape and align students’ thoughts with the attitudinal horizons of the design studio instructor. However, with the gradual changes in the architectural education system and the emergence of the postmodern movement, equivalents such as

criticism and evaluation caused a kind of change and transformation in the concept of critique.

The studies of the present research confirm that the nature of critique, which is based on the formative assessments during the semester, helps to achieve the following three objectives. The first one is the development of knowledge, which institutionalizes the fundamental knowledge related to architecture education by teaching theoretical principles to empower students in analyzing design problems. Additionally, applied knowledge is achieved by teaching implementation methods to increase the student’s skills in the practical application of knowledge. The second goal is to expand the insight of students when facing design problems. Achieving this goal includes such actions as introducing the student to the nature of the field of architecture and its scope, exciting, motivating, and stimulating the student’s thinking to reveal and observe the hidden layers of the meanings and concepts of architecture (beauty, proportion, balance, stability, and efficiency), understanding the opinions and thoughts hidden in valuable architectural works, scrutinizing and analyzing how they have been formed considering the time and place, providing the student with the implicit knowledge

related to architecture courses, and explaining how to use it in the process of analyzing the design problem. Finally, the third goal is to improve the student's creative skills in expressing how to solve design problems.

The triple goals of knowledge, insight, and ability in the design process are realized through a frequent and influential event in architectural design studios known as critique. The findings of this research indicated the nature, strategy, and management methods are the selected codes. The critique nature which represents its truth is based on the three factors of framing design problems, integration and coherence in design education, and personalization of the design education process. Critique strategy means setting goals and planning to achieve them, including a set of processes and activities that are considered to achieve this purpose. The critique strategy is also one of the important factors in the design process, which explains the type of duties of the instructor in front of the activities of the architecture students on the design problem. Choosing or designing a suitable educational strategy is the responsibility of experts in the field of educational planning. Propositions such as ideation, targeted guidance, learner-centered facilitation, and strengthening and consolidating design teachings are classified under the critique strategy. Finally, critique management methods, as a system of diverse methods, are classified as cognition orientation, conversation orientation, search orientation, skill orientation, and process orientation according to the time and place considerations by the instructors (Fig. 2).

Analyzing the concept of critique and recognizing its dimensions, which is one of the most efficient and effective activities in the architectural education system, can provide the grounds for the creativity of instructors in inventing new ways of teaching design courses while providing new educational horizons and increase the quality of the implementation of critique sessions of design courses. For example, the emergence and widespread dominance of artificial intelligence will sooner or later affect architectural education, leading probably to a transformation in the nature of design courses. It is suggested that future research should investigate the application of artificial intelligence in

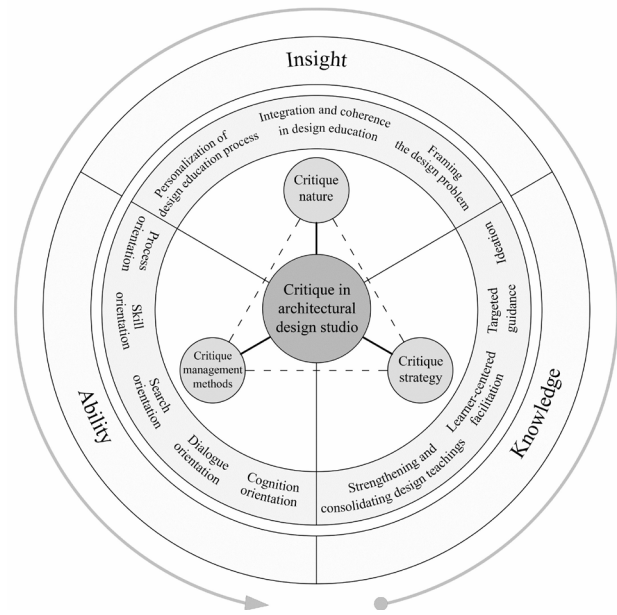


Fig. 2. Theoretical model of the concept of critique. Source: Authors

the critique nature, strategy, and management methods by posing some questions. Additionally, research can analyze and compare the intersection of teaching-learning theories in the field of educational sciences with the findings of the present research to institutionalize the concept of critique in the context of research on education while investigating how to quantify the qualitative concept of critique when teaching architectural courses in design studios based on (analytic and holistic) rubrics to provide clear and specific feedback of instructors on the student's learning process. In addition, the effect of the quality of the environmental features of the design studios, including the component of location, can also be studied in another research.

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