



# Reflective thinking and self-assessment: A model for the architectural design studio

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## Abstract

Developing, experimenting, and sharing critical pedagogical approaches is becoming increasingly important in architectural education, which supposedly superposes theory and practice. In this article, the authors reveal and reflect on an enriching pedagogical approach to the traditional architectural design studio. It is acknowledged that students develop comprehensive examination and internalization abilities by developing reflective thinking and self-evaluation abilities that complement each other. Based on the pioneer educational theory of John Dewey, the researchers' selected instructional interventions. Using the action research method, four additional modes conceptualized towards disciplinary literacy -reading, mapping, discussion, and peer assessment- were injected into the traditional studio process during a semester of architectural design course. The pedagogical approach is built on questioning the two basic creativity-based abilities of learners: reflective thinking and self-assessment. The fundamental questions are: How can a reading-discussion setup designed to nurture disciplinary literacy in the design studio be a factor in developing reflective thinking ability? How can the systematic peer assessment exercise be a factor in the students' self-assessment and reflective thinking skills as a learning outcome? The results argue for the effects on students' intangible skills. The model studio setup exhibited two remarkable findings, showing that (i) the reading-discussion mode is more effective in generating reflective thinking and (ii) the systematic peer review exercise is more effective in gaining self-assessment ability. The aim is to contribute to the theory of education by making the model application in the field of architectural design studio accessible and reflective for other educators.

**Keywords:** architectural education, disciplinary literacy, peer assessment, reflective thinking, self-assessment, studio-based pedagogy

## 1. Introduction

Developing, experimenting, and sharing critical pedagogical approaches is becoming increasingly important in architectural education, which supposedly superposes theory and practice. Architectural theorist Vidler (2000) states that the programs that diversify and enrich this tendency in architectural education guide raising curious and productive individuals. In this context, the literature (Dutton, 1991; Nicol & Pilling, 2000; Findeli, 2001) underlines the importance of applying research, development, and expertise, as well as technical skills in design studio pedagogy. The recent report on Turkish Architectural Education Policy published by the Union of Chambers of Turkish Engineers and Architects (TMMOB) in 2020 underlined the importance of developing critical thinking and regular monitoring, discussing, and evaluating the relationships of becoming a multi-wayed thinker in relevant vocational education. Comprehensive handling of projects to foster design thinking and their internalization by the student was identified as problems in the design studio environment. In this context, this work suggests some strategies for the development of critical thinking in line with constructive education approach, due to the aforementioned pivotal

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issue of regular monitoring, discussing, and evaluating in design studio pedagogy. This work investigates these wide issues partially; in a search for stimulating complementing reflective thinking and self-assessment abilities in architecture students. The strategies were tracked during the active research and their effectiveness is evaluated at the end.

Based on the pioneer educational theory of John Dewey, the researchers' selected instructional interventions, entitled as "additional modes" -reading, mapping, discussion, and peer assessment-exercises are planned and inserted in the traditional design studio setup. This case is addressed here as the "model studio" that allowed tools for disciplinary literacy and reflective thinking. The term disciplinary literacy describes "the use of reading, reasoning, investigating, speaking, and writing required to learn and form complex content knowledge appropriate to a particular discipline" (McConachie & Petrosky, 2009, p. 16). Thus, the model studio specifies disciplinary literacy as the medium for judgment to transition into purpose. In other words, it is constructing knowledge for design thinking, informing the design process. This work aims to evaluate the effects of the additional modes on students' reflective thinking and self-assessment abilities. The research questions are as follows:

How can a reading-discussion setup designed to nurture disciplinary literacy in the design studio be a factor in developing reflective thinking ability?

How can the systematic peer assessment exercise be a factor in the students' self-assessment and reflective thinking skills as a learning outcome?

## **2. The Traditional Architectural Design Studio and the Context for Developing the Model Studio**

From the 17<sup>th</sup> century to the present day, the definition of the architect has been as an actor combining four specializations – academician, craftsman, engineer, and social scientist. The first formal school of architecture, the French School of Fine Arts (l'Ecole des Beaux-Arts) handled architecture as a fine art and the teachers were well-educated academicians. There wasn't much designing involved because mastering the desirable formal composition and beauty have been the most important outcomes. The next two specializations place less emphasis on form; craftsmanship comes from craft and folklore traditions, while engineers come from technology and applied mathematics backgrounds. The Polytechnic School (l'Ecole Polytechnique) founded in 1794 to train builders and engineers for the construction of military structures, ships, and industrial structures, formed the characteristics of the German Bauhaus and the Russian Vkhutemas in the early 20<sup>th</sup> century, and the technical school movements that spread rapidly in Europe and many developing countries throughout the middle of the century. The master teachers in these models are seen as professors who have the best design principles and styles. The difference compared to the first model solely being academics is that these studio masters were also practitioners. Professional competence is a skill that can only be achieved by working under these professors (Salama, 2015). Although the first three models appear different, they share a feature in meeting society's needs. All focused on the formal or technological aspects of architecture and created with little or no concern for social and cultural issues (Salama, 2007).

The general profile of the 20<sup>th</sup> century architect was as one who designs everything about a project and has the power to make all decisions. The architect of the 21<sup>st</sup> century is in the discovery of any need, she/he tends to bring together the components made possible by nature, sector, technology, and economy in the most appropriate way to overcome that situation. In this regard, instead of asking 'what does an architect do?' issues such as 'what should an architect think?', 'how does an architect do?', or 'How does an architectural design emerge?' gain importance. Accordingly, in a contemporary and future design studio, learning should occur through a process of understanding that involves doing by investigating, criticizing, applying, analyzing, synthesizing, developing, evaluating, etc. in an intercrossed order. Lifelong learning calls for a meticulous communication-based pedagogy devoted to the individual learner and also to a critical learning community. Towards the end of the 20<sup>th</sup> century, the architectural design studio environment is described as a "forum" (Dutton, 1991), "the primary tool towards the development of professional

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skills, culture, and ethics" (Ledewitz, 1985), "a field of reflective professional practice in the design process" (Schön, 1988), "system of values" (Salama, 1995). These definitions of architect-educator-theorists lead efforts for understanding design, and not mastering but educating -terms such as coaching and guiding also appear- literate, curious and productive individuals.

The work of Dewey, a pioneer theorist who revealed the need for innovation, freedom, and pragmatism in education, has guided a wide range of learning sciences and related disciplines. From Piaget (1970) to Kolb (1984), the broad literature of 20<sup>th</sup> century teaching and learning sciences utilizes Dewey's constructivist theories, which he described fundamentally with the concepts of 'impulse-observation-knowledge-judgment'. Dewey's works influenced the design-based education realm, beginning with Donald Schön's (1983) idea on reflection, still drawing out similar issues to the 21st century. Also, recent literature (Scheer, Noweski & Meinel, 2012; Quay & Seaman, 2013; Tarrant & Thiele, 2016; Dixon, 2020) shows the continual actuality of Dewey's approaches in design education and innovation.

Reflective thinking, aimed by the researchers for students to acquire in the model studio, is considered a good way to think about a subject seriously and uninterruptedly and to think about turning it over in mind (Dewey, 2022). In this pedagogical approach, reflection may also be an active and deliberative cognitive process involving a set of intertwined ideas that take into account underlying beliefs and knowledge when addressing practical problems (Hatton & Smith, 1995). Dewey (2022) defines learning in education as the area in which the student should realize and take the initiative, and the teacher is a guide and administrator. Education is; developing habits of curiosity, suggestion, discovery, and testing. In other words, it is the support of one's assets that form the substance for the habit of thinking (Dewey, 2022). Testing habits results in self-assessment in the process. Self-assessment refers to the participation of students in making judgments about their learning, particularly about their achievements and outcomes (Boud & Falchikov, 1989), and to students as active participants. It is a way of increasing their role in the reflection and evaluation of learning processes and outcomes (Boud, 1995).

Kolb (1984) shows Dewey's self-assessment and self-structuring learning process as a circular model (Figure 1). Although the process is depicted as a linear loop, the method treats the cycle's four stages as intertwined fluid phenomena. In his seminal book "Experience and Education", Dewey claims that any beginning point is determined by one's inherent urges and aspirations, but there is no intellectual growth without the reconfiguration and restructuring of impulses and desires. With the psychology of 'stop and think', an individual must suspend the imposed external first impulse and develop an alternative to this impulse through his own reflection and judgment. Intellectuality, or internal drive control through the integration of observation and memory, is formed as a result (Dewey, 1938). Observation is a process of discovery. It is an investigation to discover something unknown that is needed to achieve a practical or theoretical goal. The corresponding data to the observed phenomena constitute the material that needs to be interpreted, explained, and illuminated (Dewey, 2022). The processed material is transformed into knowledge, which is an understanding of what has occurred in similar circumstances in the past, partly from memory and partly from the knowledge, guidance, and cautions of others with more experience. Dewey further asserts that judgment is a factor of the intellectual process and defines judgment as putting what has been observed and recalled together to determine its meaning (Dewey, 1938). Reflexive thinking is how Dewey conceptualizes the intellectual process. The educator's responsibility is to create strategies that prevent students from acting on their first impulse. Taking this into account, making recommendations, and building contexts where knowledge construction will occur.

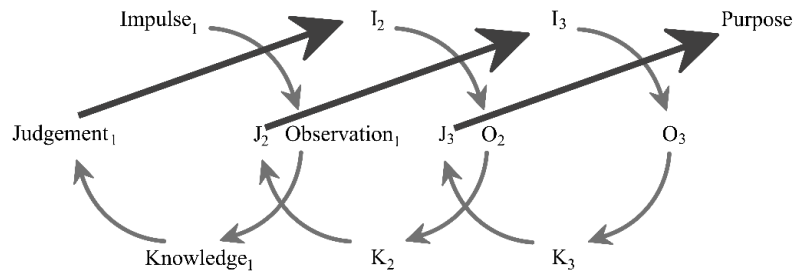


Figure 1 Dewey's experiential learning model illustrated by Kolb

### 3. A Methodology for Disciplinary Literacy in Design-Based Education

The learning strategy that dominates almost all architecture schools in the design studio learning environment is the production of an architectural project operating in the form of semi-structured experiential learning, and learning is tried to be enriched with various forms of representation such as visual, verbal, tactile, and written (Nicol & Pilling, 2000). The main components of this traditional educational process are: identifying the design problem, action-based activities that run as periodic lectures, student work of four different types -desk-based, poster presentation, re-examination via semester/midterm exam-, and final jury evaluation (Kvan, 2001) (Figure 2).

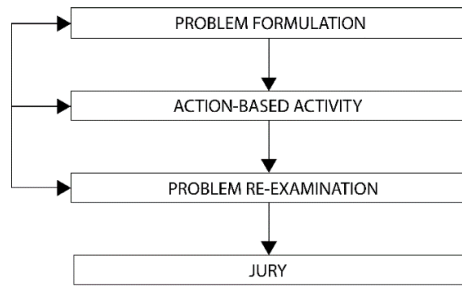


Figure 2 Traditional studio teaching cycle by Kvan

The disciplinary literacy phenomenon embedded as additional modes into the traditional studio setup is described in detail in Figure 3, with reference to Dewey's Model. In this context, the first part of this chapter presents the concepts for the setup and their context for the research methodology.

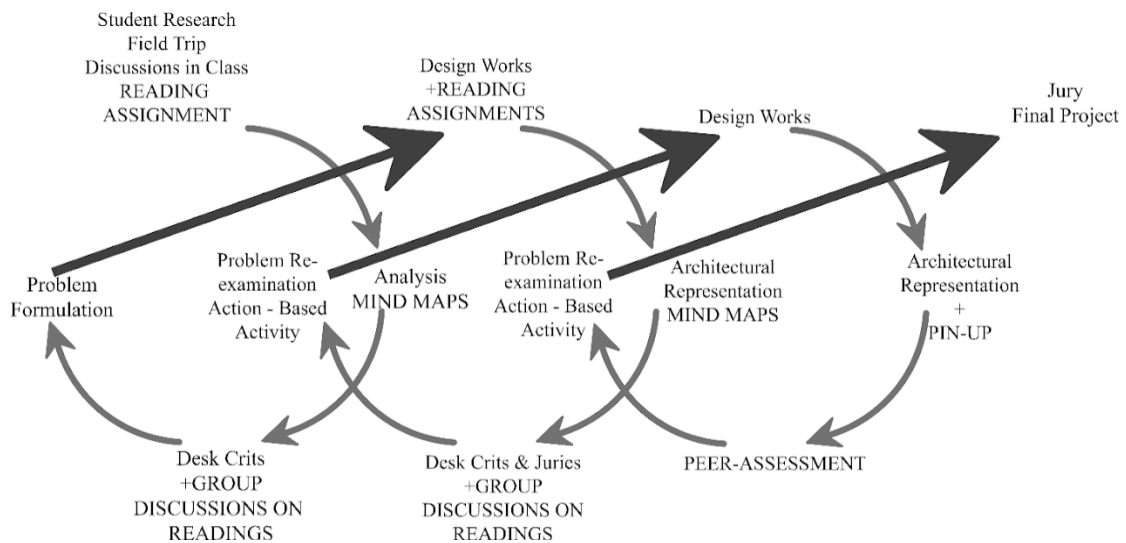


Figure 3 Additional modes in the model studio based on Kolb's diagram of Dewey's model

### 3.1. The Additional Modes of the Model Studio

#### 3.1.1. 'Reading', 'Mapping' and 'Discussion'

In architectural education, students are expected to be active learning environment actors equipped with reflective thinking and self-assessment abilities. Supporting literacy acquisition, dependent on and/or independent from the field of vocational education, should also be considered a significant problem in the studio. Dewey's warning about impulse is instructive at this point. Although it is accepted that the impulse naturally exists in the individual, this is not always the case. To support the formation of impulse, pointing out the traces of the main problems in the discipline as a guiding theme has been the essential purpose of the disciplinary literacy exercise. Dewey (2022) exemplifies how observations of change have an intellectual order and help form a logical attitude, such as the singular events of a well-constructed story or plot. Similarly, the architectural readings chosen by the educators rooted students' impulses and observations that would contribute to the data production and project process during and outside the studio class hours. Dewey (2022) states that conscious summarization and organization become essential when a subject's knowledge is used to generate data to be transferred and used as an influential resource to address them.

In the model studio, students were asked to create a mind map from each reading exercise to summarize and edit (Figure 4, 5). The mapping technique was free, but at the same time, employing diverse mediums was encouraged. Through mapping, personal thoughts were discussed in large groups during class hours. The aim of this session was to lead the way in reflexive thinking. Such an environment -the sharing of inferences- would create the potential to generate new impulses, both individually and socially, as well as help each other to apprehend gaps in the comprehension process and think multilaterally.

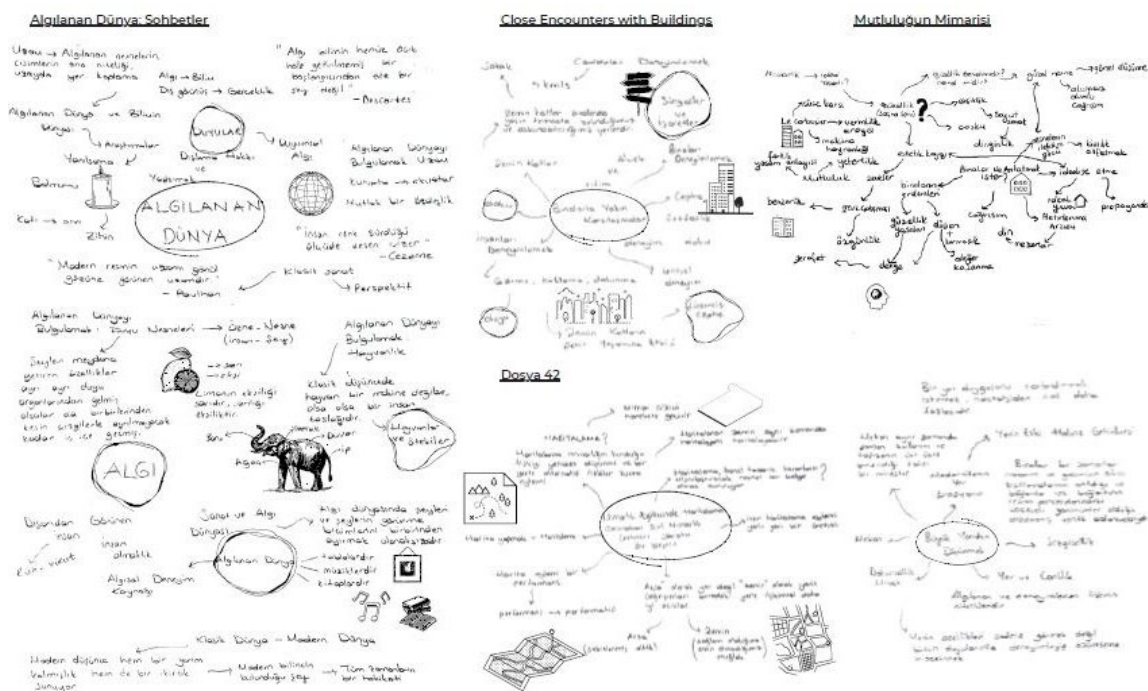


Figure 4 Examples of student reading-mapping collections, presented for in-class discussions



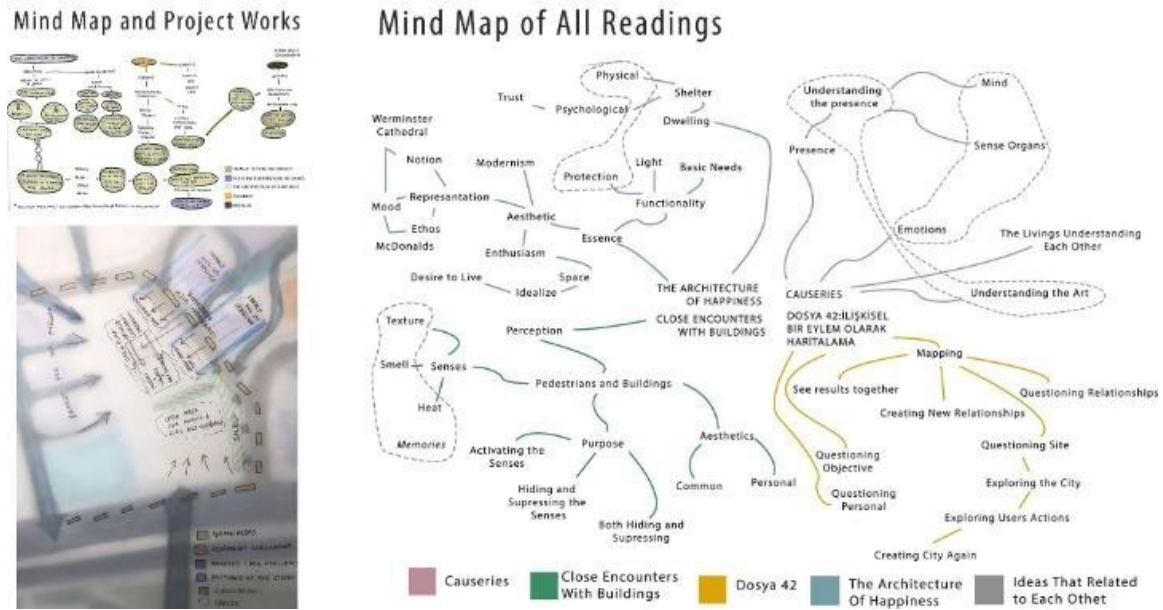


Figure 5 Examples of student reading-mapping collections, presented for in-class discussions

### 3.1.2. 'Peer Assessment'

Nicol (2014), who has extensive research in collaborative learning and assessment-oriented curriculum development, reminds us that commenting on a particular topic will activate highly complex thinking and writing skills. Newly acquired knowledge must be integrated into existing knowledge networks to create individual capital that can be utilized by students to successfully adapt to new learning contexts based on their cognitive processes. Therefore, making evaluative judgments is a process of constructing knowledge. According to Falchikov (2007), the peer assessment method can also be described as students' giving feedback or grades (or both) to their peers based on the superiority criteria determined for a product or performance. In addition, there are several components to the assessment. Boud (1995) clarifies that all evaluations include two steps: making decisions about the criteria of expected performance and making inferences about the related performance's quality. Well-designed assessment systems, as a part of the teaching-learning process but not for comparison of students, set clear expectations, create a reasonable workload, and provide students with opportunities for self-monitoring, repetition, practice, and feedback (James et al., 2002).

Corresponding to Boud's secondary evaluation step, the researchers added peer-assessment exercises in the interest of effective disciplinary reading. Peer assessment requires internalization of the reading material and reflection on peers, which also leads to the achievement of self-assessment skills. According to Knowles (1975), open initiatives that provide the opportunity to develop capacities should be implemented to expand self-assessment skills among all students. Thus, students might criticize their work directly or indirectly while applying the criteria to the work of others in the peer assessment exercise.

### 3.2. The Case Study

The following sub-chapters present the model design studio setup and process as a partial solution to the defined problem. The case study model studio employs the 'action research' methodology. The term, first coined by Kurt Lewin (1944), is "about working toward practical outcomes, and also about creating new forms of understanding, since action without reflection and understanding is blind, just as theory without action is meaningless." (Reason & Bradbury, 2001). Action research has three dimensions. First, it takes place in social practice. Secondly, it is a participatory activity in which researchers work in an equitable collaboration. The third is its method, which consists of 'planning', 'acting', 'observing', and 'reflecting' cycles (Swann, 2002). The first phase includes problem analysis and a strategic plan; acting refers to the implementation of

the strategic plan; observation involves evaluating the action with appropriate methods and techniques; and the last is a reflection on both the evaluation outcome and the whole research process. That can lead to the identification of a new problem, hence a new cycle (Zuber-Skerritt, 1992).

Such a model designed from scratch for experimenting with original content is considered action research in the literature. Reasons for attempting action research are as follows: First, despite the acknowledgment in mainstream architectural education that reflective thinking is the base of the design studio courses, a satisfactory reciprocation mostly fails to exist, including at our affiliated university. Secondly, as architect-educators without pedagogical formation, we and all colleagues should improve ourselves to do reflective thinking and self-assessment. It should be noted that this study does not propose or discuss an educational theory or its relationship to any design product.

The researchers decided to give ample place to the verbal quotes from student interviews in the acting and observing chapter, after reviewing the relationship between the evaluation of peer assessments and rich oral feedback addressing self-assessment. To summarize the interview transcripts effectively and objectively, the coding method is applied to discuss the findings to reflect on the research questions. Thus, the case study analysis employs both qualitative and quantitative methods.

### 3.2.1. 'Planning'

The research was conducted with 27 second-year undergraduate architecture students in Turkey, Gebze Technical University (GTU) Architecture Department in Architectural Design IV studio course. Two coordinator educators were the researchers of this study. The students were divided into two subgroups each led by a coordinator and an assistant teacher. The groups were balanced, including students having the highest to the lowest final letter grade they received in the previous semester's studio. The model studio setup was created by adding disciplinary literacy and peer assessment exercises to the traditional studio curriculum. As in the other studio groups of the same period, group analysis and juries were carried out by the two groups together formed as core jury partners. Furthermore, the additional modes in the model studio were also carried out in pairs. The model studio and the others were carried out simultaneously in the same 14-week period at GTU, but with different structures (Figure 6).

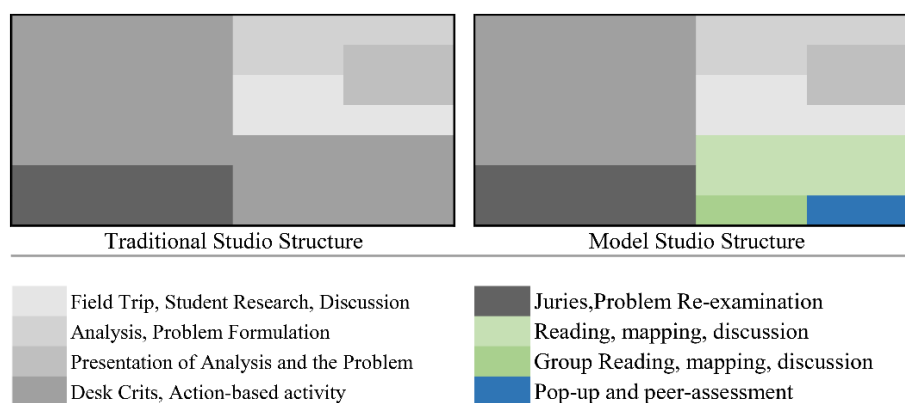


Figure 6 Traditional parallel studio and model studio structures compared

The studio process was initiated by giving the students a location in Tuzla, Istanbul. The first two weeks, the students should determine an architectural problem and propose a program within this framework. The analysis studies proceeded in groups. At the end of the second week, two invited academics in urban space held seminars. The first one on wayfinding, visibility analyses and basic syntactic approaches to understand and analyze the urban realm. The other one covered the cognitive mapping theory briefly, leaning on Kevin Lynch's applications. First jury assigned to group presentations spanned to the third week. The disciplinary literacy exercise was added to the studio process in the fourth week to last until the tenth. The traditional studio setup consisted of two four-

hour classes a week, where students usually illustrate an architectural design by synthesizing their analyses into potentials and situations related to the study area and subject. The model studio deployed the second class of the week to share and discuss the mind-map assignments covering the written and visual materials given in advance in the syllabus. These reading and visual materials under four main themes were uploaded at the beginning of the semester by the educators on the MS-Teams virtual studio channel, which also served as the discussion and collection platform for all the individual and group assignments. The themes are chosen for nurturing the architectural project brief to design “an elementary school building serving the community after school hours” in a vivid urbanized area neighboring a communal shore on one side. The selection of texts was based on their reading difficulty level, content being suitable for second-year architecture students, and meeting the learning outcomes criteria expected by the university department at this project level. The themes and relevant disciplinary reading material are briefly explained below.

**Perception** - Merleau-Ponty was one of the key figures in the development of phenomenology, a philosophical approach that emphasizes the first-person perspective, experience of consciousness. In this context, his seminal work *The World of Perception* provides architecture students with a broad philosophical foundation for understanding perception, embodiment, and spatial experience, which can help them gain an understanding of the difficulties related to designing spaces for children. Also, Merleau-Ponty's ideas have had a significant impact beyond philosophy, influencing fields such as psychology, sociology, anthropology, literary theory, art criticism, and architecture. In the model studio, teaching and learning how interdisciplinarity works was one of the aims. Thus this book was chosen as the initial reading to establish a phenomenological discussion ground at the beginning of the design process.

The short film “Steven Holl Architects: Ex of In House” was the visual reading-discussion material parallel to *The World of Perception*. This experimental residence by Steven Holl Architects explores the use of light, space, and geometry within architectural design. Steven Holl introduced 'seven point manifesto for explorations of "in"', one of which is "the architecture of "in" dominates space via spaces" ([Steven Holl Architects – Ex of in House, Hudson Valley](#)). The video tells how the boundaries between interior and exterior spaces of the house are connected, incorporating intersecting geometric forms and employing inventive construction methods.

**Context** - The scientific paper presenting the theories of the writer-architect's many case studies in several urbanized areas, “Close Encounters with Buildings” by Jan Gehl, published in 2006, presented several insights about living between buildings, one of which was that façade design should be pedestrian-friendly. Briefly, the article focuses on the context of ground-floor architecture and its key function for a livable city and healthy community.

**Tectonics** - The material presented in “Practical Poetics in Architecture” by Leon van Schaik is practical, with an emphasis on analyzing and explaining the sense of poetics at work in designing and creating architecture, yet they remain richly related to writings of Gaston Bachelard and Steen Eiler Rasmussen. The book, published in 2015 contains numerous analytical diagrams and analyzes featured contemporary projects using plans, sections, and pictures. Students were tasked with reviewing and representing the projects chosen from the book as a group project, using van Schaik's sketches and interpretations.

**Visualization & mapping** – The journal “Dosya 42: ilişkisel bir eylem olarak haritalama” (Folder 42: Mapping as a relational act) published by Ankara Chamber of Architects in 2019 included five short articles. As in the editor's introduction ([Alanyalı Aral, 2019](#)), mapping makes variation and deepening possible through coexistences not possible on conventional maps. Aiming to reveal the unprecedented diversity of data and their connections with the 'place' and each other through the search for new and original languages and methods is an action that can be defined as fundamentally relational. These texts are provided to help students comprehend mapping theoretically and visually, as well as to develop their mental maps for reading discussions and cross-context debates in seminars and studio critiques. However, in this conceptualization and

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representation method, which most of the students explored for the first time, these readings were postponed until later weeks because the researchers wanted to see the students' impulsive works first.

In line with these, in the ninth week, to write consistent and valuable criticisms in the assessment tasks, the students were asked to read the comprehensive content and map their comparative analysis within themselves and with each other, and then to represent them together with the project concepts they designed in parallel in the process. The class was devoted to general discussions and criticisms. To foster independence and autonomy and support future learning (Falchikov, 2007), interactivity was encouraged by the educators to take the first steps of critical self-assessment and peer assessment abilities.

One week before the final submission, in the studio class, students were asked to make a preliminary submission with five-minute poster presentations that included the exploration-synthesis-interpretation phases of their projects. During the presentations, the educators did not interrupt or comment. The students were asked to listen to each other carefully and take notes, considering the main topics of the theoretical framework. The goal here was to maximize students' capacity to listen attentively to one another. However, since all students' comments to each other would disrupt time management, the educators formed peer assessment groups of three to four people and announced them at the end of the class. The group members were chosen as a mix of students whose general performances within the scope of the studio course were high-medium-low. The students examined the projects and made detailed remarks to the following questions pre-structured by the educators:

1. Examine the project through its relationship with the place. How do you evaluate the proposal in general, and why? (Consult the book *Practical Poetics in Architecture* and the seminars.)
2. Evaluate the project within urban life, indoor life, and other created values. How did you find their approach, and why? (Consult the books *Practical Poetics in Architecture*, *The World of Perception*, and the film *Steven Holl Architects: Ex of In House*.)
3. Evaluate the project within its close surroundings: encounters with the building from the sidewalks and seashore walking flows. Specify the reasons. (Consult the paper *Close Encounters with Buildings* and the seminars.)
4. Evaluate the project in terms of tectonics. How do you read suggested coatings, materials, configuration, solids and voids, geometry, harmony, etc.? What intangible conditions does the tectonic formation of the structure create, and why? (Consult the book *Practical Poetics in Architecture* and the film *Steven Holl Architects: Ex of In House*.)
5. Evaluate the facades of the project throughout its indoor and outdoor lives. How would you interpret the approach, and why? (Consult the paper *Close Encounters with Buildings*.)
6. Evaluate the diagrammatic explanations describing the project. Explain what kind of information it reveals and its qualifications. (Consult *Dosya 42* journal and seminars.)

Students sent the assignment back to the educators in a limited time after the class, and the educators included the peer reviews in the next open crit.

### *3.2.2. 'Acting and Observing'*

Four mind mapping assignments acknowledged as a reflection of data production from the information were examined. Given tasks were evaluated with poor-moderate-good qualitatively and expressed quantitatively with 1-3-5 scoring. Since the students made the mapping of the tectonic-themed reading requested as group work in the form of a project presentation, they were not found suitable for the given scope and were excluded from the evaluation chart. Considering the general failure seen within the groups in mapping the tectonic-themed reading requested as group work, a comprehensive reading was given on the mapping-themed as a reading assignment

for the eighth week. In the eighth week of reading, only four of the twenty-seven students submitted a mind map and participated in the discussion. While the maximum score in this evaluation for four-week of work was determined as 20, S1 (Student 1), S2, S4, and S5 each got 15 points, and S3 got 18 points.

The peer assessment exercises of those five students, who were successful in reflecting on disciplinary reading, were examined as shown in Table 1. Table 2 includes a description of the coding content and some explanatory excerpts from the students' answers. S1 and S5 gave qualified answers that were highly related to the readings in the peer assessment. S2 and S3 also formed a connection with the readings and had sufficient answers. S4 made fewer references to the readings in her answers compared to others and answered the questions with shorter expressions.

**Table 1** Evaluation of Student Expressions with Codes

	Que01	Que02	Que03	Que04	Que05	Que06
S1	R1Q1	R1Q1	R1Q1	R2Q1	R1Q1	Q1
S2	R1Q1	R2Q1	R2Q2	R2Q1	R2Q1	QX
S3	R2Q1	R2Q2	R1Q2	R1Q1	R2Q2	Q2
S4	R3Q2	R2Q2	R2Q2	R3Q2	R3Q2	Q2
S5	R1Q1	R1Q1	R1Q1	R1Q1	R1Q1	Q1

**Table 2** The Coding System and Sample Excerpts from Student Interviews

<b>CODING</b>	
<b>The relation to readings</b>	<b>The quality of expression</b>
R1: one-to-one related	Q1: in the framework of the question; comprehensive; descriptive
R2: tacit related	Q2: in the framework of the question; superficial
R3: unrelated	QX: outside the framework of the question; unrelated
<b>EXCERPTS</b>	
R1Q1 _ S5 to Que3: "Facades create a hybrid space among themselves. These spaces constitute an alternative for the transition to the courtyard. (...) The users outside the building are drawn into the circulation of the building thanks to these voids."	
R2Q1 _ S3 to Que1: "The structure seems to emphasize functionality instead of relating to the place. (...) missing its relationality in terms of poetics, appealing to emotions."	
R2Q2 _ S4 to Que2: "Although the spaces and their flow were considered, their reflection on the facades that relate to the environment could have been better."	
R3Q2 _ S4 to Que5: "Could the geometry make more sense and relate better to the scenario? Could the voids be more meaningful?"	
Q1 _ S5 to Que6: "The concept in the diagrammatic explanations and the spatial relationships in the bubble diagram are understandable. (...) The structure doesn't describe its tectonics and function with any diagram."	
Q2 _ S1 to Que6: "Analysis of Tuzla and the users, spatial and temporal diagrams are explanatory. Functions could be a little clearer."	
QX _ S2 to Que6: "When I look at the plans and the diagrams in the project with the render, the plans were readable."	

After the process of evaluation and the selection of successful students, the study was completed with the discovery of the students' views and experiences. The researchers decided to interview students whose quantitative value of mind maps and qualitative value of peer assessment reports are superior, regardless of how the added exercises relate to the students' design practice. After a certain period at the end of the term, one-to-one semi-structured interviews allowed these five students to reflect on their own projects. Also, data for further studies was collected by allowing the students to evaluate and criticize the model studio setup. The content of the interview consists of four essential questions with follow-up questions if needed:

1. Would you evaluate the studio's process?
2. Would you evaluate the reading-discussion exercise and the process of forming mind maps?

Follow ups: The degree of difficulty of the readings? Reflections on the project? Did the exercise affect your view of the discipline of architecture? How would you evaluate the thematic reading collocation?

3. Would you evaluate the process of examining your peers' projects?

Follow ups: Did this exercise make you notice an area in the readings that you didn't spot? Has it changed the way you view your project? How do you critique yourself when you consider the peer assessment questions?

4. How do you evaluate the effects of the readings on the final submission projects?

### 3.2.3. 'Reflecting' – Findings and Discussion

All student interview reports were coded with the MAXQDA-2022 qualitative data analysis tool. Table 3 presents the codes created concerning the research questions.

**Table 3** Coding and Relations of Dependent and Independent Variables in the Model Studio

CODING		dependent variables - cognitive abilities		
		Reflective Thinking	Self-assessment	Impact on Design Thinking
independent variables - additional modes	DISCIPLINARY READING	9	3	12
	MIND MAPPING	7	0	0
	DISCUSSION SESSION	2	3	0
	PEER-REVIEW	2	12	4

Considering the variables, significant factors in the development of reflective thinking were disciplinary reading and mind-mapping exercises. In addition, there was no discourse on the effect of group work. Impulse, observation, knowledge, and judgment phenomena, considered the main components of reflective thinking (Kolb, 1984), were followed in various forms in the students' statements shared below.

Specific to the reading exercises; "(...) learned a lot (...), especially from the readings (...) photographed the facades to see if the complex facades (...) that the book tells me and to see which one attracts my attention more", "(...) there was the eye-related [book], the sense-related (...) created an awareness. (...) the truth is more important than what the eye sees (...)", and "(...) used to see every building as a plan in the first year of architecture. Now I look around the street level to understand what this building offers me (...) they actually (...) changed my point of view" statements of students contained traces of observation and impulse. Regarding knowledge construction; students' descriptions "(...) [the reading material] Close Encounters with Buildings (...) describes the user's relationship with buildings. (...) It opened my eyes to what I do.", and "We experience enlightenment (...) whenever we read" were explanatory. About transforming knowledge into judgment, "I saw that we could have a wider perspective with readings. (...) in [last semester] project, (...) perceptions regarding the environment (...) have remained shallow. This time, (...) the readings helped me to look more broadly (...)" and "We should not evaluate the building alone (...) need to consider its setting, (...) building gains meaning with its surroundings. (...) In fact, it becomes more efficient with the work done during the analysis process." quotes were examples. For judgment formation, "In project A, you told me that there is a sit-in. And you showed me project B without saying anything. There is such an area here. But will I be able to realize it by myself? (...) Frankly, I couldn't have done that without reading the books." "I think we wouldn't understand the [design] parameters." were relational statements.

In terms of the mind map exercises, “I forget very quickly. (...) Now, the contents are still in my mind because I made maps three or four times.” expression referred to the memory-related aspect of knowledge construction. Similarly, “(...) extracting that [mapping] was like a summary. When you glance at it, you remember what you read.” and “I could express myself more easily (...) I remember when I checked on maps (...) I had the opportunity to say something.” were examples of simultaneous observation and knowledge construction. “During the reading (...), I perceived it only as a task (...) Now I make my own maps (...)” and “(...) it was great (...) I need to understand how to create maps (...) need to interpret what I understand.” phrases supported the judgment phenomenon.

Self-assessment ability evaluation showed that the peer assessment exercise played a significant role in developing the capability. As Knowles (1975) notes, autonomy in learning, particularly self-learning, is associated with self-assessment. A student's assertions, “I directly opened his/her assignments and viewed the reading maps. (...) There were some that I can use in my project. Both the reading and the project contributed to my project”, showed a learning approach improved independently. Expressions of three students; “While examining their projects, I noticed my own shortcomings. (...) I tried to make an objective comment on mine as well (...) it made your [the educators'] comments more understandable.” “Before [peer assessment], I couldn't give myself a clear comment. But after commenting on three people (...) I was able to observe myself more objectively.”, and “It seems that there isn't any problem with our own project (...) while giving criticism to others, (...) I also realized that some of the problems were also in my project. (...)” indicated a key finding that extending the capacity to criticize and self-criticize ensures the emergence of reflective thinking.

Studio-based learning, by definition, consists of interlinked stages in the design process. In this respect, the effects of additional modes of design thinking were a natural issue of the research. Thus, the student's answers to the last question demonstrated various levels of reflection. A student stated that *Close Encounters with Buildings* reading was the most beneficial, “(...) caught my attention the most (...) I implemented many ideas (...)” through reference to a spatial setting; “(...) in front of every building, it can be a waiting area (...) a smoking area, a place to sit and talk (...)”. Through discussing all the readings, the expressions, “(...) deduced certain parameters from the readings (...) While designing the project, I went back to parameters to figure out if the project is consistent (...)” also showed the learning related to impulse and observation and pointed out the contribution of these processes to designerly thinking. Besides the two students explaining the effects with explicit examples above, other students made implicit comments. One student evaluated its effect on design as a motivation-enhancing and nurturing activity to analyze processes: “(...) when I could transfer readings to the project, I realized that it is joyful (...) by collecting data from the environment (...) becomes more efficient with the studies during the analysis process (...)”. A student stated that she/he made inferences from the readings, but those did not affect her/his practice because of unsuccessful time planning. The other student evaluated the exercise positively and stated that it contributed to the design process. However, the answers could not have been deepened.

The essential problems of the research are detailed above. Also, further findings were gained during the interviews. The students' positive and negative critiques and suggestions for improvement were considered valuable during the evaluation of the model studio exercises.

To understand the implicit information uncovered from the answers, direct questions linked to the exercises were posed afterward. It was asked if they had any suggestions to benefit from the peer assessment exercise. The general feedback data is on the probability of extending the exercise over 14 weeks. All students stated that they would prefer this possibility: “If we had done [peer assessment] one or two more times in the middle of the semester (...)” or “other critiques [peer assessment] (...) could be done (...) also by the previous juries”. Those predictions indicated that peer assessment exercises would have been more beneficial if they had occurred more than once in the process.

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One student offered some ideas for varying representation and communication techniques in mapping, noting that creating mind maps is a stiff yet beneficial exercise: "(...) sculpture made by hand and the writing on the edge of it and taking a photo of it later (...) I understand mind maps better, especially with the examples you recently showed. (...) I had the most difficulty with creating a mind map"; "(...) [combining the maps] every week would be helpful (...) as a guide (...) last time [designing process], I worked by opening and viewing them all the time". A student criticized the order of readings placed in the syllabus in terms of their effect on design practices: "(...) would prefer to read those related to [urban] landscape beforehand (...) because the last weeks I struggled (...) how I can adapt this to my project now? (...)".

A remarkable analogy by a student to describe the impact of various teaching strategies was as follows: "[Readings] benefit us like enzymes. We don't see them openly (...) but they have an effect. But [peer review] (...) it's like a color. We see it, absorb it, and feel it. (...) When I saw an example or saw other methods, I realized that I needed to change more (...)". The analogy depicted the adversity of evaluating the outcomes of reading-discussion exercises without tangible material.

The weekly reading homework and the class reserved for discussions seemed to cause stress in the students. The causes dwelled on time management, taking the time at home to prepare mapping assignments, and peers in parallel studios receiving criticism on the second class of each week. Interviewed students shared their concerns as follows: "Will my project finish? (...) Getting critiques one day a week instead of two, (...) at first there was a tension, will reading put us back?"; "(...) but we couldn't spend much time on the project, and we didn't get much critique."; "Maybe we just had a harder time. (...) Because I received less critique, I was very worried." There were also suggestions to avoid anxiety. A student shared her/his hesitation and proposed her/his solution simultaneously: "If it didn't cut down on design [studio] day, (...) if some things didn't keep up, we said, I would catch up if there were no readings. Actually, not." Another student suggested that the exercises should still exist as an activity for out-of-studio hours or that it could be a package application at the beginning of the semester. Although they acknowledged extra modes in the interviews, they regarded the exercises as separate tasks rather than elements that would improve the design process. They might consider that additional studies have made a secondary contribution based on this reasoning.

#### 4. Conclusion

This research study aims to contribute to the theory of education in the field of architectural design studios by making the model application accessible and reflective for other educators. The plan was to encourage self-reflection on the learning process, provide opportunities to control and adapt learning and observe their contribution to design thinking. The model studio structure presents a series of tasks that nurture critical thinking and internalization skills through reflective thinking and self-assessment abilities.

In general, students used vivid metaphors to describe their learning, which shows a high degree of reflective ability. The most significant findings emerged from the interviews that the reading-discussion setup has a positive effect on developing students' skill sets, especially reflective thinking, and the systematic peer assessment exercise shows a remarkable contribution to acquiring self-assessment ability. Another interesting fact is that the interviewed students mentioned discussing their work more with one or more peers because of the homework -in their words, the reading and mapping exercises. Our students were unmotivated to talk about their projects during the online studios during the research period. We understood that they communicated outside studio hours about their inferences from the given exercises and ways of design thinking, especially after the peer review exercise.

As seen in Table 2, S4 did not complete his peer assessments with one-to-one references to the readings. However, the interviews revealed that the student was more well-informed about the reading material than her/his peers. This situation indicated the need for multi-dimensional questioning for the reliability of the general research results. Moreover, for students with different



representation skills and characters to be active participants, it is recommended to diversify the exercises during the studio process.

The research should be regarded as a pilot for further studies. The participants for the interviews were selected from those who received the highest qualitative and quantitative evaluation scores in the reading-mapping assignments. Therefore, there was a concern that these students might not represent the general population. However, the findings were promising. Except for one interviewed student, the final grades of the other participants were not among the most successful. It might be due to two accompanying reasons. Since the exercises were not graded, the highly grade-oriented students did not show the required care. The second is; since the overall grading was on the final product, reflective thinking, and self-assessment skills were not part of the final marks.

Concerning these issues, the suggestions for future studies are that each exercise should stand clearly in the syllabus with its corresponding grade, and the evaluation of fulfilling learning outcomes should include individual growth as well as vocational growth. Findeli (2001) underlines that if design problems are not handled in a unidirectional and linear process, the concept of the project gains a stronger theoretical position. In this sense, the only way to transform one situation into another is not to produce an absolute material object. In studies based on Dewey's learning model, experiences are based on the development of students' capacities and readiness. The theorist underlines even at the beginning of the 20th century that in evaluating the quality of experience, it is necessary to look at the effect of the experience on later experiences. In light of these discussions, it would be appropriate to include the students in additional research using a longitudinal research design.

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## Resume

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