ITU A|Z • Vol 23 No 1 • March 2026 • 215-233

A framework for concept formation in architectural and interior design education

Burçak ALTAY[1]*, Gülnur BALLİCE[2], Eda PAYKOÇ ÖZÇELİK[3], Gizem GÜLER NAKIP[4]

[1] burcak@bilkent.edu.tr • Department of Interior Architecture and Environmental Design, Faculty of Art, Design and Architecture, Bilkent University, Ankara, Türkiye
ORCID: 0000-0001-5218-4882

[2] gulnur.ballice@yasar.edu.tr • Department of Interior Architecture and Environmental Design, Faculty of Architecture, Yaşar University, İzmir, Türkiye
ORCID: 0000-0002-8564-1821

[3]eda.paykocozcelik@yasar.edu.tr • Department of Interior Architecture and Environmental Design, Faculty of Architecture, Yaşar University, İzmir, Türkiye
ORCID: 0000-0002-0892-633X

[4] gizem.gulernakip@polsl.pl • Department of Theory, Design and History of Architecture, Faculty of Architecture, Silesian University of Technology, Gliwice, Poland
ORCID: 0000-0002-4508-1823

**Corresponding author*
Received: February 2024 • Final Acceptance: September 2025

Abstract
This paper introduces a framework for student learning during the concept formation and development phases of architecture and interior design. The framework, introducing "guiding domains", attempts to integrate case-based and research-based learning within three education applications with theoretical and practical components: a lecture, a short-term workshop, and an integrated course. An overview of these applications is followed by research findings concerning student perspectives on their learning. Student feedback includes survey results from the first two applications and reflection essays from the third. The findings reveal positive learning outcomes whereby the guiding domains expand student perspectives, clarify their understanding of concept development, and encourage diverse projects. The paper contributes to design education by proposing an integral framework for concept development that can be applied in different educational contexts to enhance the theoretical and practical components of student learning.

Keywords
Case-based learning, Concept formation, Design education, Guiding domains, Research-based learning.

doi: 10.58278/0.2026.122

1. Introduction

Education in architecture and interior design is founded on the design studio. Here, students are expected to engage in the creative design process with the required level of complexity. Design educators believe that the final output is not the only significant component of design pedagogy; the design process is also critical because it fosters critical thinking and creativity. With research-based learning, students can examine the content and create critical questions surrounding the concept formation (Salama, 2008; 2013). Accordingly, as Park et al. (2022) suggest, focusing on the concept exploration and analysis processes is effective for design education.

Through descriptive models of design, researchers have investigated how the design process develops, with a focus on the phases of design given multiple constraints acting on it (Lawson, 1997). Abdelhameed (2017) states that the design is composed of several phases, including problem definition, concept formation, creating new ideas, and forming compositions. Folch et al. (2019) also put forward that the creative process of design is comprised of three stages, including preparation, ideation, and verification/evaluation. Darke's (1979) research of prominent architects and their design process revealed that a primary generator or concept envisioned by designers in the initial phases of design pre-structures how the design will progress in later stages.

As Ghim (2022) suggests, the initial stages of the design process are often without a clear structure, which leads to ambiguity not only for the working designers but also their collaborators in practice. With propositions to enhance concept generation methods in design education that offer students a variety of pathways, Eilouti (2021) highlights the need for methods that are not confusing, applicable in the early stages of design process, and usable for a variety of design problems. In this paper, we address these issues by first presenting framework through which we incorporate the various tools and methods that have been used by designers through case studies, introducing "guiding domains", referred to as the domains of design knowledge that have potentials to give inspiration for concept formation. Afterward, we propose the understanding and use of guiding domains within three educational modules for students of architecture and interior design. The very first module aims to introduce the guiding domain concept to students as well as support case-based learning, which is a "lecture-based module". In the second module which follows the "lecture-based module", "short-term workshop", students can apply the guiding domains to their design studio projects. "Integrated elective courses" is the module in which lectures, workshops, and research-based design are combined for better digestion and understanding of concept development phases by students. Finally, we evaluate the effectiveness of these modules for student learning through students' feedback and learning outcomes.

Through this framework proposal, which actually integrates both case-based and research-based learning methods, we are aiming to add to the current literature that allows the students to have a deeper understanding and comprehension of the design process. At the same time, the guiding domains suggested by the framework aim to cultivate the critical understanding and creativity of students.

Regarding this framework and aims, the research questions of the study are as follows:

- What is the perceived efficiency of these three educational modules of the "guiding domains" by students' feedback?
- Regarding the students' feedback, what are the opportunities and challenges of these three modules of the "guiding domains"?
- How is the navigation of early stages of concept development and formation integrated by "guiding domains"?

With the help of these research questions, we are aiming to ensure a new understanding of concept formation with the help of "guiding domains" within three educational modules, both theoretically and prac-

tically, which can guide students in the concept development process of their design projects.

2. Background

This section discusses various methods for concept creation by referencing concept development approaches, design domains, and case-based studies from the existing literature.

2.1. Concept development methods

Concept generation combines critical or evidence-based processes and produces many options through irrelevant inspirations (Eissa, 2019). The concept can be found or produced from any written or visual sources that describe the project's main features and how it will look, feel, or evoke a feeling of the past. The visual concept can only find its expression in the space during the process (Dodsworth & Anderson, 2015). Choi and Kim (2017) argue that learning design theories should be a prerequisite to the design thinking process, especially during concept development, where the process is not based on finding the correct answers. Design educators have, therefore, explored educational applications across courses whereby theoretical and practical knowledge are interconnected and support each other (AboWardah, 2019; Fernando, 2006; Raein, 2004).

Numerous studies have focused on creativity and concept generation to investigate their sources and how they are approached in different design fields. These can be clustered into three main groups: those related to scientific approaches and aspects (Hickman & Kiss, 2010; Amiri, 2011), those related to creative thinking and creativity (Teal, 2010; Budge et al., 2013; Dineen & Collins, 2005; Laamanen et al., 2023), and those considering approaches in different levels of education (Gürel & Potthoff, 2006; Karppinen, 2008).

2.2. Design domains

According to Schön (1983) and Cross (2001), the initial step in concept formation, problem framing, occurs when designers choose particular aspects of the problem to focus on and explore. The restructuring and reframing of the problem continue during further stages of design (Cross, 2001). As such, "frame creation" is a foundational design activity (Dorst, 2011), where a repertoire of "design domains" is utilized (Schön, 1983). Likewise, Sarkar and Chakrabarti (2017) point out that designers rely both on domain knowledge (the specific knowledge base required for a design discipline) and process knowledge (the ability/act of designing that runs across disciplines) when given a design problem.

Across design disciplines, the aim of bridging the gap between research and design has often led to the development of methods that guide idea generation based on varying design domains. For example, an "experience matrix" is used for product design development that foregrounds the three knowledge domains, namely user activities, product components, and operation environments, which are then fed into a structured design process (Ghim, 2022). Eliouti (2018; 2021) proposes eight possible generators of concepts in architectural design studios, introduced as keywords: theme, analogy, metaphor, experience, symbolism, context, scheme, and scenario. According to Makstutis (2018), architectural concepts can take their reference from locations, drawings of history, physical and/or material features, or the purpose of the proposed building using different approaches. Similarly, Van Dooren et al. (2018) posit that designers operate within and across the five domains—space/form, material/structure/climate, function/route, site, and context—to develop their design principles. Inspirations can also take other forms, such as metaphors or analogies (Choi & Kim, 2017).

Based on their research and designer/student feedback, educators who have proposed conceptual tools (Eliouti, 2021; Ghim, 2022) suggest that educational approaches should be clear with a degree of focus and sensitivity to time constraints. Thus, although there is a consensus on the significance of equipping practitioners with the knowledge and tools to enhance the conceptual formation and development stages, what these tools are, and how they can be introduced

to design education remains underexplored.

In the initial phases of design, designers, both novice and experienced, tend to refer to existing design knowledge at that time, which may be founded upon their personal experience or those of others who have come before. As such, rather than creating a new frame, often, an existing frame is utilized (Sarkar & Chakrabarti, 2017). Therefore, to expand the knowledge base, besides one's own experience, designing precedents or utilizing case-based methods can be a fundamental support.

2.3. Case-based method

Among many other resources, design practitioners rely on precedents throughout different phases of the design process, including initial concept formation (Akin, 2002; Heylighen & Neukermans, 2002; Jagtap, 2018). For example, analyzing the idea-generation phases of fashion designers, textile designers, and interior designers, Laamanen and Seitamaa-Hakkarainen (2014) found that, among other sources, existing and previous designs were often primary generators for new designs. Therefore, they suggest, "Novice designers could be instructed to conduct careful investigations of existing designs and analyze the context, using various multimodal mediums" (p. 212).

Although design practice utilizes case-based methods, they are not adequately and systematically utilized within design education (Breslin & Buchanan, 2008). Design precedents can be rich sources that help the designer share related conceptual knowledge explicitly (Oxman, 2004). Analyzing the design process of architectural students within a studio context, Doğan (2013) found that particularly when students have problems in progressing from initial diagrams to actual spatial schemes, the instructors' leading them to the analysis of precedents was a fruitful method.

The analysis of cases develops both the theoretical and instrumental knowledge of the students. Akin (2002) suggests that, with the guidance of instructors, students derive knowledge from the cases through deep investigation and analysis. Accordingly, cases can support instructors in framing what is being communicated in a successful way, which can then open up venues for students' design applications and reflection (Breslin & Buchanan, 2008). Cases can allow discussions that establish the theory-practice relationship in the first years of design education, as often observed by educators (Doğan, 2013; Mahmoodi & Bastani, 2023), students are often reluctant and struggle to start a project and navigate through the design process. Therefore, a systematic presentation of design domains, as applied in successful case studies, can provide a venue where students can establish a firm understanding of concept formation tools that they utilize in their design processes.

3. Educational and research context

Given this background, we ask in this study how educators can guide novice designers to encourage frame creation so that they creatively engage with the design problem. We, therefore, believe that a framework to guide students in sources of concept generation could be beneficial. Even though frameworks are proposed within design educational contexts, and educators have time and again stressed the importance of case-based learning in design, a teaching module that utilizes case-based learning as a fundamental aspect has not been proposed. Practical educational applications that embody the rich existing resources of the built environment to direct students' idea generation are, therefore, a relevant and significant contribution to design education.

Accordingly, we first discuss three instructional applications of the framework with varying degrees of student involvement. Application 1 comprises a single-phase theoretical module, where a lecture offering "guiding domains" includes accompanied design precedents, encouraging case-based learning. The "guiding domains" refer to the domains of design knowledge that architects/interior designers can turn toward, starting from the concept formation phase of a design problem,

to guide their design process. Application 2 comprises the lecture followed by a workshop, where students apply the guiding domains to their design work, applying the theory to design practice. Application 3 focuses on a semester-long elective course on concept formation and development. In the course, the lecture and supportive tasks are followed by a research-based process where "guiding domain" inquiries structure students' concept generation for a design problem. The students end the course with a reflective essay about their learning experience. We inquire about the effectiveness of each application through our research on students' perspectives. The data is collected through surveys and written essays by students and analyzed through quantitative and qualitative methods.

In the following sections, after a brief description of the educational context of the three applications, we introduce the research methodology and findings from the student feedback regarding their learning experience in each context. Table 1 summarizes the instructional applications and research design.

This table represents the data of three different instructional applications—lecture, workshop, and elective course—applied in different universities. While the first three rows focus on the instructional variations, the last four rows compare the research instruments and participants, as well as data collection and analysis methods suitable for each instructional application. The following figure (Figure 1) shows examples from three different instructional applications' process.

3.1. Instructional application 1: Lecture

The first application was presented to 2nd and 3rd-year students of architecture and interior design across three universities. In the lecture, we introduced five sources of concept formation and development, namely "guiding domains", not only as theoretical frames but also as they are

Table 1. *Instructional applications and research design.*

	Application #1	Application #2	Application #3
Instructional tools	Lecture on Concept Formation and Development (CFD)	Lecture on CFD + workshop	Integrated elective course
Context of delivery	Three universities (Yaşar, Atılım, Başkent)	Yaşar University	Bilkent University
Duration of instruction	Two hours	Two hours + four hours	14-week course, three hours per week
Research on student learning: instruments	One survey following lecture	Two surveys, following lecture and workshop	Student reflection papers
Duration of research	Delivered six times between 2017-2020	Delivered twice: 2019 and 2020	Delivered twice: 2018 and 2019
Participants	217 students	50 students	40 students
Data collection and analysis methods	Likert scale questions-Descriptive statistics of response frequencies Open-ended questions-content analysis	Likert scale questions-Descriptive statistics of response frequencies Open-ended questions-content analysis	Text with student focus on design process reflection - thematic analysis

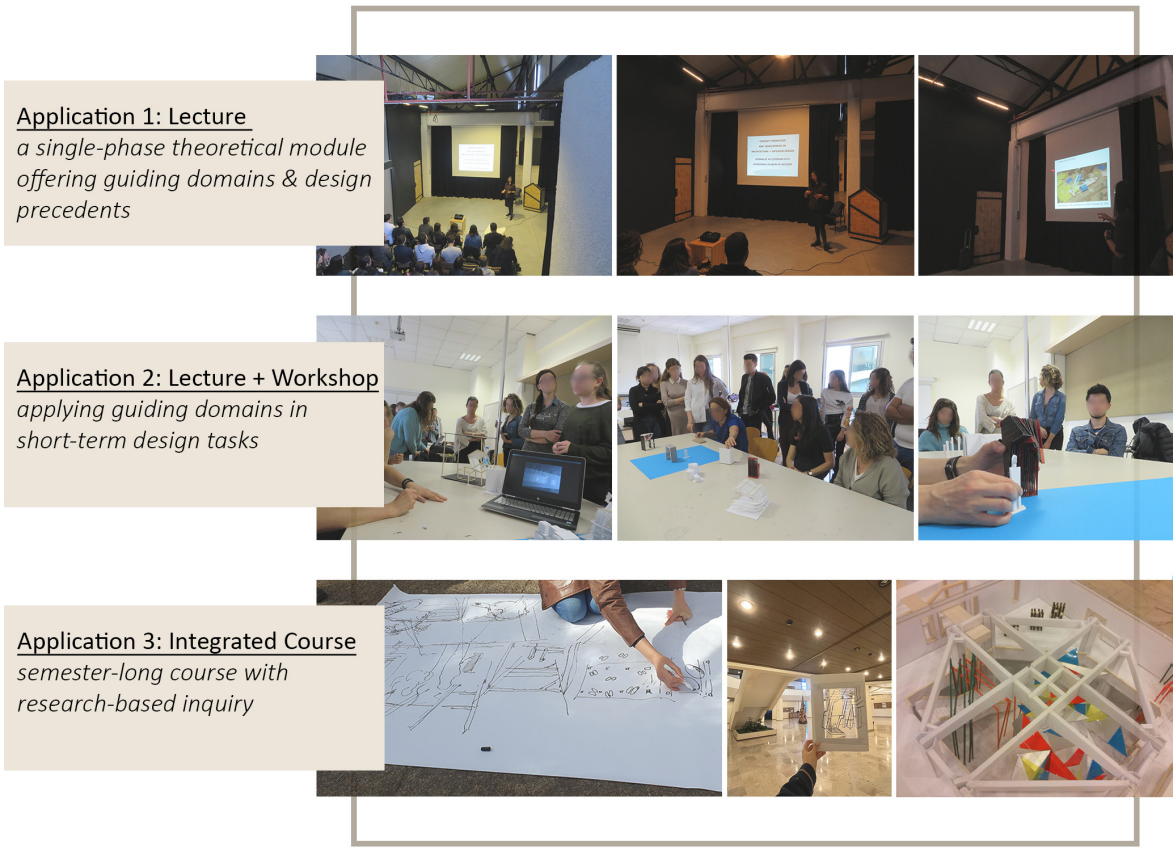

Figure 1. *Instructional applications.*

actively applied in successful design cases within specific contexts. The framework was based on the literature on design methods and thinking (Laseau, 2001; Lawson, 1994; 1997), an analysis of many international and national examples, and twenty years of personal professional experience in architectural/interior design practice (Altay & Porter, 2021).

We introduced the five guiding domains: Symbolism (the representational aspect of a design), site (the cultural, historical, and geographical contexts of the location), program (building type considering the major building function, studying precedents of similar types), geometry (2D/3D geometric relations, proportional systems, typological analysis, etc.), and structure (the system of construction) (Figure 2). These domains are not meant to be limiting or exclusive; rather, they are open to additions and modifications via research and inquiry, particularly during the initial phases of design.

The lecture discussed both architectural and interior design cases for each guiding domain, enriched by designers' written and visual communication during the design phases, such as sketches, models, and progress diagrams. This way, the lecture exposed to the students both the domain knowledge and the process knowledge (Sarkar & Chakrabarti, 2017).

Each guiding domain was presented with 4-7 examples, with a total of around 25 examples. The following cases are some of those discussed: for symbolism, Tadao Ando's Church of Light, Osaka and A. Ragıp Buluç Architects' Expo 98 Turkish Pavilion, Lisbon; for site, Steven Holl's Kiasma Museum of Contemporary Art, Helsinki and SITE's Studio & Offices, Bayard Building, New York; for program, SOM's National Museum of the United States Army, Washington DC, and OMA's Public Library, Seattle, and Prada Store, New York; for geometry, Steven Holl and Vito Attonci's Storefront for Art and Architecture, New York, Frank Gehry's Guggenheim Museum, Bilbao, and Conde Nast Cafeteria, New York; for structure, Álvaro Siza Vieira's Expo 98' Portuguese Pavillion, Toyo Ito and Cecil Balmond's Serpentine Pavilion, London, and Toyo Ito's Pavilion, Bruges.

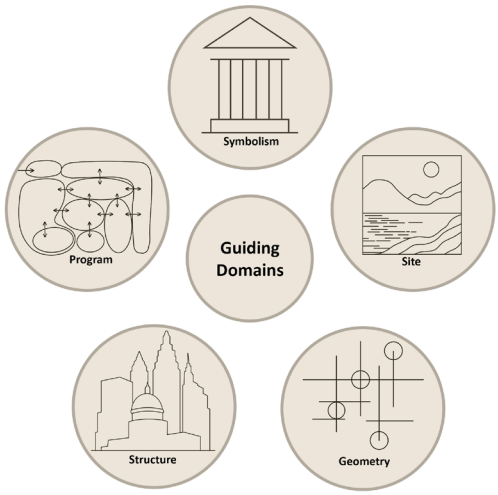

Figure 2. *Guiding domains.*

3.2. Instructional application 2: Lecture and workshop

The second application was applied in the 2015 and 2019 Fall Semesters for second-year interior design students at Yaşar University. In 2015, after the morning lecture, a workshop called "The Wall" was conducted. Students were asked to design a divider panel/unit to be integrated into their café environment as assigned for a group project. While working on their project, they had to focus on at least two guiding domains to formulate their concept: symbolism, site, geometry, program, and structure. In their final design, the students were expected to reflect and give hints about the identity and design concept of the café (Figure 3).

In 2019, after the morning lecture, a workshop related to the students' main project area was conducted called "A Refreshment Stand for İzmir Wildlife Park". Each group of students designed a three-dimensional refreshment stand, which also represented the main café it was part of (Figure 4). As before, students were expected to use at least one of the guiding domains as a source of inspiration while developing their design solutions.

3.3. Instructional application 3: Elective course

The third application was applied as an elective course for third and fourth-year interior architecture students at Bilkent University in the 2017-2018 semesters, named "Concept Formation and Development in Design Process". As before, the guiding domains were initially introduced through the extended lecture. The students also studied and discussed design methods based on key readings from Darke (1979), Forester (1985), Schön (1983), and Zumthor (1998). The course was also enhanced by other student-centered methods (Altay & Porter, 2021), such as exploring the campus and enhancing students' concept formation via sketching skills.

A project was then introduced to students: "You are here: More than Just a Point in the Map". The students were asked to compose a "design in-

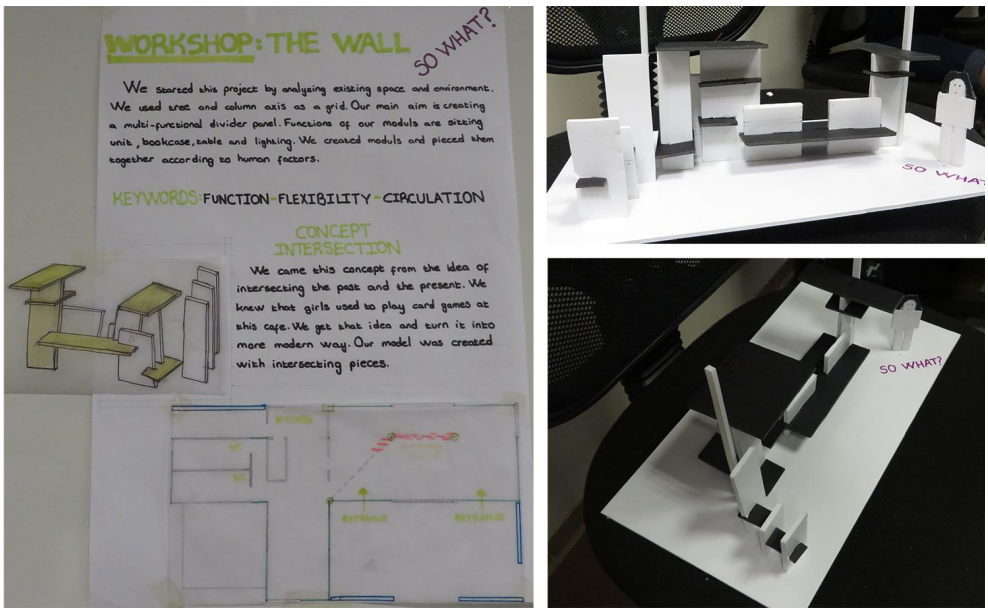

Figure 3. *Student work from the workshop "The Wall".*

tervention" for university building interiors (the Faculty of Engineering conference hall foyer and Faculty of Music and Performing Arts Concert Hall foyer, respectively).

In groups of 3-4, the students first researched (for three weeks) the building, focusing on the chosen guiding domains for their inquiry. Afterward, each group designed an "intervention" in the foyer based on their research. The main requirement was for the concept to be derived from their researched guiding domain. They also incorporated findings from other groups' research and feedback from instructor critics. The students presented their work to a final jury (Figures 5 and 6). A week after the juries, the students wrote reflection essays about their overall learning experience. They explored the impact of research and other factors on their design process, major challenges, and knowledge transfer to the future.

4. Research on student feedback on learning

In this section, following an explanation of the research instruments on student learning, the feedback from students regarding applications 1, 2, and 3 is analyzed.

4.1. Material and methods

4.1.1. Participants and settings

In the research phase, the participants were the students who participated in the lectures, workshops, and the thirteen-week course. Application 1 (Lecture) spanned across three universities, with a total of 217 participants. Of these, 125 students were from Yaşar University, İzmir; 63 students were from Atılım University, Ankara; and 29 students were from Başkent University, Ankara. Yaşar University consisted of second-year interior design students, Atılım University consisted of fourth-year architecture

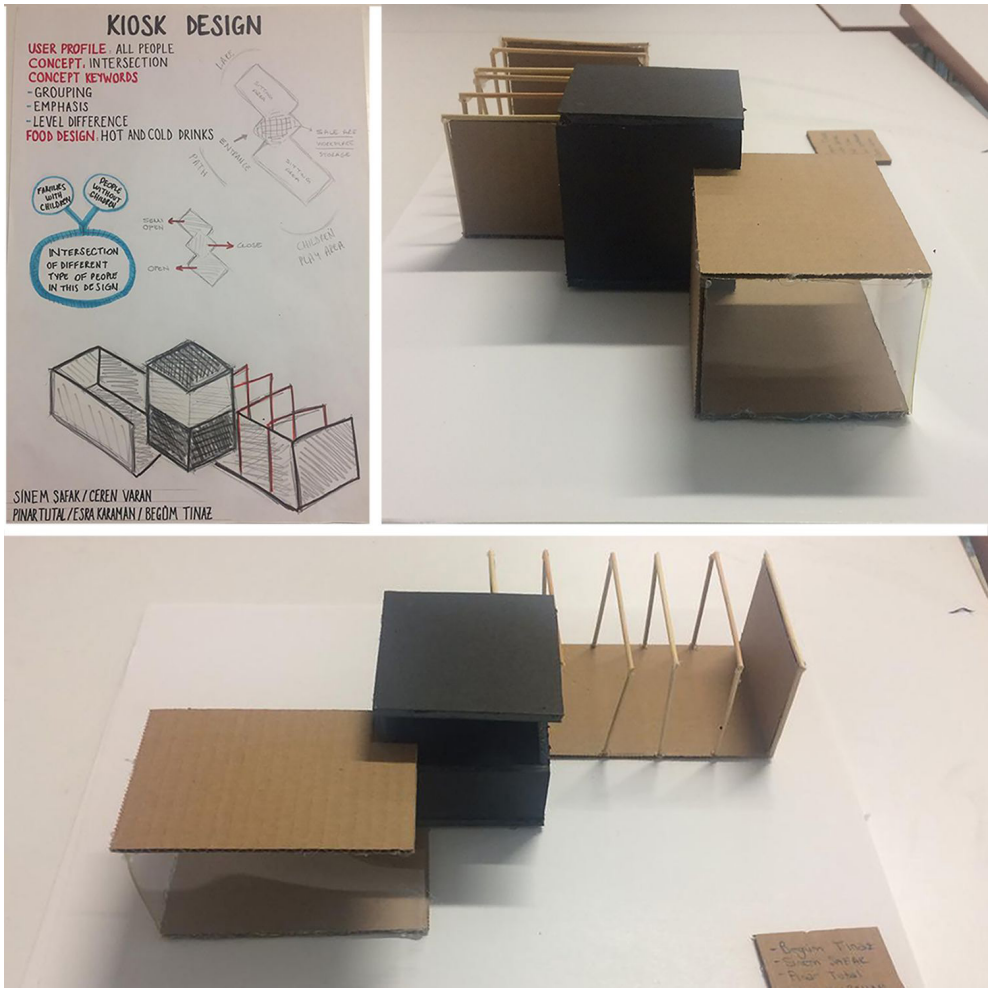

Figure 4. *Student work from the workshop "A Refreshment Stand".*

Figure 5. *Student work in the foyer, "A Different Perspective", based on site.*

Figure 6. *Student work in the foyer, "Structure of Sound: The Harp", based on geometry and symbolism.*

students, and Başkent University consisted of a mixture of third-year architecture and interior design students.

Application 2 took place twice in Yaşar University in İzmir, with a total of 50 participants answering the survey. Of these, 23 attended the workshop in 2019 and 27 in 2020. All were second-year interior design students.

Application 3, on the other hand, was delivered in Bilkent University in Ankara. The elective course was offered primarily to third- and fourth-year interior design students, with a small number (approximately 10%) of second-year students. Over two consecutive terms, 40 students attended the course, submitting reflection papers.

4.1.2. Data collection

As shown in Table 1, the main research instruments for the first two applications were questionnaires that the students completed after the lecture or workshop. In design education, student feedback surveys have been adopted (Altay, 2017; Charlesworth, 2007; Christian, 2018), helping the instructors improve instructional design. The questionnaire was developed based on previous studies on the investigation of student perspectives in higher educational contexts (Altay et al., 2016; Feldman, 2007). The questionnaire primarily explored how the students perceived their learning after each application. The first five structured questions (for Applications 1 and 2) related to the application's effectiveness in various learning domains, followed by two open-ended questions that focused on their learning experience and suggestions for development. It was handed out immediately after the applications.

For Application 3, which spanned a whole semester, the data consisted of reflection papers that the students wrote at the end of the semester, presenting their perspectives on the learning process. The papers varied between 1,300 and 2,500 words. Writing reflection papers was part of the pedagogical program, since reflection is a significant part of learning, enhancing

self-knowledge, and situating one's own experience to guide future action (Ryan, 2013).

4.1.3. Data analysis

For Applications 1 and 2, the closed-ended answers were analyzed through descriptive statistics. For this, student answers were interpreted where each answer sequentially corresponds with an increase of numerical value: "1=Completely disagree, 2=Disagree, 3=Neutral, 4=Agree, 5= Completely Agree". The findings were represented as mean values of each response.

All students answered the open-ended questions with one- to five-sentence responses. These short responses were analyzed through content analysis based on thematic coding (Krippendorf, 2013). As Krippendorf suggests, content analysis is a widely used method to analyze open-ended interviews and focus groups, whereby the researchers derive mainly qualitative inferences from the pre-composed and directed questions (2013). Thus, each text is always contextual and qualitative. The frequency counts of each theme are a supportive and convenient method for summarizing these inferences, rather than the defining aspect of content analysis (Maxwell, 2010). When deciding on sharing the frequencies/percentages of each person commenting, we referred to the following suggestion by Maxwell (2010, p. 178): "Counting the number of instances of things in different categories can be interpreted in variance terms, as creating a nominal scale variable and measuring the frequency in each category. However, it can also be interpreted in process terms. If participants in a study repeatedly make a particular claim or perform a particular action, presenting this fact in numbers isn't necessarily conceptualizing it in terms of variables but can be seen as simply describing the occurrence and distribution of the claim or action in that setting or set of individuals."

For Application 3 student reflection papers, a qualitative thematic analysis was carried out to analyze the content (Boyatzis, 1998; Braun & Clarke, 2006). For this stage of research, we do not provide the counts per theme since the themes were revealed through a reading of the rich text that the students provided regarding their learning experience. Thus, rich thematic descriptions, as voiced by the students themselves, gained significance, and we explicated the themes with quotes that best presented the students' perspectives. The analysis was primarily conducted by the first author. The preliminary coding session took place over two months, during which the identification of the main themes took place. Afterward, from the papers, a subset of data (15%, as suggested by O'Connor & Joffe, 2020) was randomly chosen and coded by the second author. There was consistency with the coding, with one deviation of additional code, which was discussed together to reach a consensus regarding integration and rewording. With a further revision of the literature and theoretical constructs, the authors revisited the data to finalize the four emergent themes. Finally, the thematic content analysis of Applications 1 and 2 was revisited to ensure clarity and consistency in wording.

We see the utilization of the above research methods and analytical procedures throughout architectural and educational literature that analyzes participant views and/or student works. These include a descriptive analysis of closed-ended Likert scale questions (Qureshi, 2019), thematic content analysis of open-ended questions (Kepez & Ust, 2020), and mixed-method approaches (McGee et al., 2022; Ceylan & Soygeniş, 2019; Çalıkuşu et al., 2023).

4.2. Application 1 (lecture) findings

This section covers feedback surveys of sessions from three universities, covering 217 students. Table 2 presents the responses to the closed questions.

According to the survey results, students found the lecture very effective in terms of developing their understanding and relevant to their academic and practical uses. The majority of students said the lecture was clear and easy to comprehend, and they thought the information would be useful not only for their other classes but also for the formulation and development of their design projects. The lecture af-

fected students positively in terms of overall effectiveness.

To better understand the effects of the presentations, open-ended questions were used. These questioned what, if any, were the most positive/effective learning aspects of the lecture, as well as suggestions for the future. Overall, 128 of 217 (59%) participants made additional comments to the open-ended questions. The emergent themes are shown in Table 3.

Regarding the first theme, students mostly commented on their increased understanding and awareness of concepts in architecture and interior design (81%). Students appreciated how the concept "reflects space" or "helps solve design problems". For some students, previous knowledge became more settled and clarified in their minds. Moreover, many students noted that they gained a variety of perspectives and new ideas through the lecture, which enhanced their creativity.

Regarding the second theme, students gained an insight into the design process through the lecture (54%). They improved their awareness of the steps and phases of conceptual design development. Some students also realized how specific tools could be used successfully and were essential parts of the process, such as investigation and research, use of bubble diagrams, drawing and sketching, and making models.

The third theme revolved around interest and focused on one specific guiding domain (32%). The focus varied from one student to another but included all the introduced domains: geometry and structure, contextual factors like topography and site, symbolic aspects, and function. One additional and architecturally significant feature for which students reported increased awareness was "light". Many of them had taken less interest in this feature before the lecture.

Table 2. *Student learning from the lecture: Structured survey results.*

	Questions:	Mean out of 5 (N = 217)
1	Attending the lecture increased my understanding and awareness about the subject.	4.47
2	The lecture was clear and understandable.	**4.52**
3	The lecture subjects can support other courses.	4.35
4	I intend to use what I have learned to form and develop my own design projects.	4.46
5	Overall, the lecture was positive and effective.	**4.59**
	1=Completely disagree, 2=Disagree, 3=Neutral, 4=Agree, 5= Completely Agree	

Table 3. *Student learning from the lecture: Emergent themes (N=128).*

	Main theme (learning)	N	%
1	Enhancing concept/idea formation and development **knowledge**	104	81
2	Insight into the design **process** and impact on concept	69	54
3	Understanding of a **specific guiding domain**	41	32
4	Case-based learning through design **precedents**	38	30
	Main theme (suggestions)		
5	Effective enough; no improvement needed	75	59
6	Format of slide presentation / verbal presentation	38	30
7	Increasing number/type of cases	25	20

Some students also noted specifically that looking at design precedents and cases through the lens of conceptual analysis was particularly helpful (30%). They commented that "seeing worldwide examples opened their minds" and "helped see the environment with new perspectives".

Regarding suggestions, many students (59%) commented that no improvements were needed and stated their appreciation for the lecture. The majority of suggestions (30%) related to the format of the slide presentation, as well as the speech pace and quality of verbal presentation. Suggestions included adding videos and background sound to slides, more breaks, and increasing interactivity between students and instructors. These were incorporated into the lecture in the following years. Another main theme pertained to the type and quality of the example cases (20%). Many of the students wished to have more cases, whether architectural or interior examples. One student also suggested including student work for discussion and analysis.

In total, the greatest percentage of the students found the lecture supportive in terms of enriching their knowledge of concept formation and the design process. According to the students' feedback, the lecture was effective enough to provide insight into the design process and impact on the concept idea.

4.3. Application 2 (workshop) findings

This section presents the findings on student learning after the workshops that followed the lecture at Yaşar University, covering 50 students. The students were asked to complete two separate learning feedback surveys after the whole learning module, the first survey on the lecture (the results of the first have been presented above), and the second on the workshop. The survey questions regarding the workshop were in a similar format to those of the lecture. Table 4 presents responses to the closed questions.

As Table 4 shows, the students mostly agreed with the workshop's learning outcomes, particularly their intention to apply what they have learned in future design projects. However, they reported slightly lower confidence in their ability to transfer concepts learned in the lecture to the workshop context. The educational value and long-term relevance of the workshop in the students' learning process are also reflected in the strong consensus that it enhanced creativity, supported other courses, and helped them develop distinctive projects.

The survey also included open-ended questions. These questioned what, if any, were the most positive/effective learning aspects of the workshop, as well as suggestions for the future. Almost all students (47 out of 50, 94%) commented briefly on what they learned the most and provided suggestions to improve the workshop experience. Table 5 summarizes the themes that emerged from the open-ended questions, with the number of students making each comment.

Table 5 shows that attending the workshop increased many students' concept formation and development skills (45%). It also helped them to reflect on or transform an idea or concept into a design. They were able to refer to knowledge obtained from the lecture (Application 1) during the design process. While some thought that their analytical skills had developed, others felt that they had cultivated creativity, particularly through the emergence of new ideas.

Following their specific focus of inquiry, some students (26%) also commented on one specific guiding domain that they had learned more about and incorporated into their design. Moreover, some students stated that the workshop helped them to look into the details of the project.

In terms of developing conceptual skills and having a structured learning approach, the workshop was found successful. Time management, visual thinking and presentation skills, and teamwork were listed as the other notable skills learned. Students indicated that the workshop contributed to their essential professional and collaborative competencies. Meanwhile, the students suggested increasing of the duration -due to wanting more time

Table 4. *Student learning from the workshop: Structured survey results.*

	Questions:	Mean out of 5 (N=50)
1	Attending the workshop increased my understanding and awareness about the subject.	4.34
2	I was able to transfer concepts from the morning lecture to my own work.	4.14
3	This workshop can support other courses.	4.34
4	I intend to use what I have learned to form and develop my own design projects.	**4.42**
5	This workshop has been effective for my creativity.	4.31
	1=Completely disagree, 2=Disagree, 3=Neutral, 4= Agree, 5=Completely Agree	

Table 5. *Student learning from the workshop: Emergent themes (n=47).*

	Main theme (learning)	N	%
1	Enhancing concept/idea formation and development **skills**	21	45
2	Development of a **specific guiding domain**	12	26
3	Time management	9	19
4	Visual thinking and presentation **skills**	9	19
5	Teamwork	5	11
	Main theme (suggestions)		
6	Effective enough; no improvement needed	12	26
7	Expansion of allocated **time**	13	28
8	Suggestions for project delivery methods	10	21

for presenting their ideas, and for feeling less pressure. Accordingly, further iterations can include longer duration in workshops, and structured support for effectively communicating their final products. Through these revisions, the impact of the workshop on the skills and professional development of the participant can be maximized.

4.4. Application 3 (elective course) findings

This section covers findings on themes derived from individually submitted reflection essays a week after project presentations (in groups). The essays were assessed via formative assessment, where students would earn 5% of the overall course grade upon submission alone. Since the students evaluated the impact of all stages of the course, the major topics were formed around four key themes that were repeated across the students' perspectives, with a focus on design process supports and challenges (Table 6).

The first theme, "uncertainty", was a challenge encountered particularly in the initial phases of the design. The lack of a functional requirement or brief, as well as the expectation to generate a concept based only on a specific guiding domain, created a sense of unease. In short, "freedom" became a "constraint":

The major challenge was also the conflict: an undefined design problem whose answer was hidden in it… It was like treasure hunting (R2).

The only information given was the location of the project, and what was asked of us was to come up with a design idea. To give an example of how I felt: it was like someone asked me to swim when I didn't even know how to swim (R10).

Table 6. *Student learning from the course: Emergent themes (N=40).*

	Main theme (Challenges and supports)
1	Dealing with uncertainty
2	Research into guiding domains
3	Sketching and writing
4	Teamwork and instructor feedback

As the process progressed, students navigated through the uncertainty, relying on certain support. The primary support was, as the second theme suggests, their research. The research into one of the guiding domains seemed to be the initiating and guiding aspect of the concept generation:

While the concept is a guide for the design, research is a guide for the concept (R2).

The more deeply we did research, the more guidance we found. Afterward, everything emerged automatically because we had a good substructure (R30).

Some students specifically explained in detail how the research led them to the guiding design idea:

Analyzing user behavior in detail to understand programming gave me an analytical perspective with the look of a designer (R2) (guiding domain: program and use).

The research outcomes reminded us that buildings are witnesses like the people living in them. We felt this deeply when we had an interview with the architect while listening to his memories (R22) (guiding domain: context- history).

Students mentioned that conducting research on-site, with the attentive experience of the building grounds, was an essential element of concept development:

We went to the building several times to analyze different users. However, we could not get a clear concept idea for weeks. Then one day, we heard music coming softly from the room through us. At that moment, I already knew that we would design something related to sound (R25).

Another significant support during the design process, comprising the third theme, was their increasingly free and confident use of sketching and writing:

We kept a personal journal to write our keywords while trying to generate our forms, and it helped us a lot (R18).

One of the lectures that influenced me a lot was about freehand sketching. Your mind works in collaboration with your hand. Thus, despite working on the computer, it is important to develop concepts with your hand drawings (R25).

As a fourth theme, teamwork and instructor feedback emerged as effective supports. While teamwork enabled shared responsibilities, the conversations helped them gain new perspectives and open up their habitual thought patterns:

As all our group members are different individuals with different backgrounds, knowledge, tastes, memories, etc., many ideas were improved through brainstorming (R37).

Teamwork could also be a challenge, however, and a basis for further reflection:

I had too many group projects, and coordination was a huge problem for too many groups and courses… I might have worked more with the group members and should try to communicate more (R39).

The following comment summarizes the overall impact of the different modules throughout the design process:

The readings, in-class discussions, and cases (in the lecture) that we investigated were very valuable in creating the thinking map for the first stages of the design process. Then, the research and critique parts guided the design. Besides these, the most important part was coordination between group members (R1).

Dealing with uncertainty was one of the most important supports/challenges faced by the students during the design process, at the same time giving them a chance to resolve uncertainties

and overcome them with learned tools. Having a more structured approach for exploring relevant frameworks as well as supporting in expressing and documenting ideas both visually and textually can be considered upon the students' feedback. Teamwork and instructor feedback was also stated as another challenge, which can also be defined as sources of support, showing the crucial role of collaboration in facilitating the learning process.

5. Discussion

The various effects of different instructional approaches—short-term lectures, workshops, and semester-long courses—are highlighted in this study through the student learning outcomes. According to the findings, combining applications provides a more comprehensive learning experience, whereas each method offers different aspects. Application 1 (short-term lectures) was found to be greatly effective by the students in improving their understanding of concept formation. While the importance of well-structured content delivery was highlighted, clarity and understandability received the highest ratings. Although the relevance of the lecture was rated lower than other courses, it was suggested that better interdisciplinary connections and more real-case examples can enhance the integration of their knowledge.

In terms of developing concept formation and design thinking, Application 2 was evaluated as successful with improvements in their skills for developing and refining ideas. Due to the interactive nature of the workshop, students could find a chance to apply their theoretical knowledge, improve their problem-solving skills, and engage in creative exploration. Plenty of students noted some difficulties in converting lecture concepts to workshop tasks, whereas the majority of the students evaluated the workshop as beneficial. According to these findings, more invisible integration between instructional components can be suggested to strengthen knowledge application. According to the students' feedback, they improved their time management, visual thinking and presentation skills, and teamwork. Extending workshop duration, structuring the exercises more in detail, and offering alternative project delivery formats, including interactive sessions and/or collaborative exercises, were some of the suggestions for improvement.

In Application 3 (elective course), managing design uncertainty, articulating ideas, and structuring their research were some of the challenges that students faced, whereas the course successfully supported independent learning and knowledge transfer. Students were able to navigate the difficulties throughout the concept design process with the help of utilizing tools such as in-depth research on the guiding domain, reflecting on their site experience, team and instructor communications and relying on brainstorming via sketching/writing. They were thus able to arrive at successful, creative outcomes with strong conceptual foundations. In their suggestions, students highlighted the additional need for instructor feedback as well as clear project expectations.

The results of student surveys show that the framework proposal in this paper successfully boosts the student's understanding of concept generation, including its process, enlarges their point of view, and fosters their creativity. A structured approach is provided through guiding domains, which also help students navigate the design process and express their ideas more effectively (Application 1). Analysis of design precedents through an analytical framework is achieved by theoretical instruction while their insights are converted into conceptual design outcomes in practical application (Application 2 and Application 3). With this approach, which defined a common language between instructors and students, clearer communication and more in-depth engagement to design concepts were facilitated.

When all three instructional methods were compared, the findings suggest that Application 1 (short-term lecture) provides a theoretical foundation, Application 2 (workshop) assures exploration by hand and fosters creativity, and Application 3 (semester-long course) enables more in-depth learn-

ing and reflection. This data highlights the significance of keeping a balance between these approaches for achieving an optimal learning process. While structuring future courses, more cohesive integration between these elements can be considered so that students can efficiently convert their knowledge between different instructional formats.

6. Conclusion

Cultivating students' ability to efficiently and effectively solve and handle design problems is one of the main targets of design education, which is mainly allied with their capacity for creating ideas in the early design phases. In this study, a framework of "guiding domains" for encouraging students in their design projects of various scales is proposed, guiding them to generate and improve their concepts. Students were engaged in both case-based and research-based learning, supplying valuable feedback on the efficiency of the framework that can be conducted by incorporating all three educational applications with their theoretical and practical components. Our educational applications support Teal's (2010) understanding that concepts articulate complex problems, inviting designers to dwell on them by taking action. In that respect, while the lecture enhanced students' understanding of the built environment via case-based learning, which is a powerful learning tool (Doğan, 2013; Oxman, 2004), the applications via the workshop and course led them to cultivate skills to turn theoretical concepts into design outcomes through reflection-in-action (Schön, 1983) and constructive exploration (Teal, 2010).

In addition to the efficiency of the "guiding domains", this research also defined some additional learning outcomes. Through the collaborative nature of the practical applications, the significance of peer learning is reinforced, in which students can experience teamwork, critique, and knowledge exchange (Budge et al., 2013). Another important finding of this research is related to time management, where some students found the short duration of the workshop as a constraint, while others interpreted it as a catalyst for having idea generation faster and problem-solving more creatively. In the meantime, research-driven elective courses with a longer duration enable students to search guiding domains in detail, supporting more flawless conceptual development. All these findings underline the importance of keeping time constraints and collaboration levels in a balance for better alignment with specific learning objectives.

This research contributes to the literature on design education by proposing a structured method that connects theory and practice in the early stages of the design process, which are addressed across different years and courses in the curriculum (Saghafi, 2021). It introduces strategies that focus on the initial phases of design and supports their implementation through case-based and research-based tools within the framework of "guiding domains." In line with the recommendations of Eliouti (2021) and Ghim (2022), this approach helps address a gap in design pedagogy and offers a framework that can be adapted to different disciplines. The study offers a new model that can be applied to different courses, project types, and various educational settings with the help of case-based and research-based approach integration within a flexible framework. To reinforce its adaptability and relevance, this method was applied across multiple universities. For achieving a deeper conceptual understanding in students, this study highlights the importance of occupying students in reflective and hands-on approaches, which is similar to the emphasis of Salama (2013) on experiential learning.

Although this study has valuable insights, it also has certain limitations to be noted. Cultural and institutional differences as contextual factors, which may have a direct impact on students' learning outcomes, need further research to examine the applicability of the framework in diverse educational settings. In addition to this, the engagement of the students with the framework can be affected by various student levels, as well as different academic backgrounds, and need more controlled studies to evaluate its ef-

fectiveness under different conditions. Further research can also be reserved for framework adaptation in other design-related disciplines to decide its broader applicability.

In general, this research emphasizes the importance of structured guidance in the early phases of design education, specifically concept generation, to show that a well-defined framework can improve the ability of students in terms of generating and developing design concepts effectively. Also, educators and instructors can better support their students while navigating the design process complexities by the refinement of balance between theoretical learning and hands-on application.

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