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Exploring the architectural design process assisted in conventional design studio: a systematic literature review

Upeksha Hettithanthri[1,2] · **Preben Hansen**[1] · **Harsha Munasinghe**[3]

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Abstract
The architectural design process is a unique process that has its inherent phases with specific activities within. Exploring and identifying the real design process which occurs within the conventional design studio is the key focus of this study. This study was carried out by adopting systematic literature review methodology. The most relevant articles for the review were identified by applying an inclusion and exclusion criteria based on a rubric developed to find answers to the research questions developed. For the literature review, 50 articles were selected by eliminating the non-related and non-suitable articles based on the rubric developed. The data was analysed by the content analysis based on the Grounded Theory. Grounded Theory was applied to generate a theory based on the data or findings. The results have given data to draw a Design Process model which is specific for architectural design studio practice. It is evident that the lack of integrating the intended user in the design process has impacted the solutions. Furthermore, many scholars have discussed the architectural design process, but there is a significant gap in discussing the involvement of users and context during the design process.

Keywords Architectural design process (ADP) · User participation · Context · Design thinking · Empathising

✉ Upeksha Hettithanthri
dilini@dsv.su.se

Preben Hansen
preben@dsv.su.se

Harsha Munasinghe
hmunasinghe@georgebrown.ca

[1] Department of Computer and Systems Sciences/DSV, Stockholm University, Postbox 7003, 164 07 Kista, Sweden

[2] Department of Design Studies, NSBM, Green University Town, Pitipana, Homagama, Sri Lanka

[3] School of Architectural Studies, George Brown College, Toronto, Canada

Introduction

Exploring the architectural design studio process and its practice was the key focus of this article. An architectural design studio is a learning process that consists of unique and specific processes adopted on designing (Schön, 2016). Architects create human-friendly living spaces for various functions (Abdullah et al., 2011). The question is if those design solutions address the needs of the users. Since the solutions are generated through a specific process, we have identified a problem that generates problematic results. The voids in the design process led students to generate less realistic solutions. In order to understand the architectural design process, a proper in-depth exploration is needed. This literature review focuses on exploring the process followed in architectural practice which could be helpful in giving potential suggestions to fine-tune the design process to fill the existing voids in the current design process.

Since the actual user of a building is important, our focus is on integrating their involvement into the design process. The research questions were aligned to find answers on how the architectural design process assisted in the conventional design studio has been addressing the actual user of the final product, a space. Investigating how the intended user has been integrated during the design process is the key objective of this study. The voice and insights of the real user could significantly impact the final design, and this will be varied according to the level of their involvement. Especially when, where, and how they get involved in the design process are essential facts that need to be explored.

The ADP should be involved with the mix of functional, structural, environmental and socio-cultural values (Abdelhameed, 2017). In order to do this, a clear picture of the current process needs to be drawn. The product-oriented process does not give the designer sufficient room to empathise (Hargrove & Nietfeld, 2015; Taneri & Dogan, 2021). We believe empathising in an architectural context needs to cover a broader spectrum than being familiar with the site and the users. The support and space created in the ADP to empathise is the problem we see and intend to explore. Moreover, in order to provide remedial solutions, a clear understanding of the problem is needed to be aware. Many design teachers are experiencing less practical, less human-friendly, less focused design solutions while tutoring (Webster, 2004; Yorgancıoğlu & Tunalı, 2020).

Architectural design process

In the architectural design process, the designer (architect) has the sole authority and freedom on developing design ideas and concepts (Lawson, 2006). Those ideas and concepts are refined through several intermediate tutoring sessions where architectural students get the exposure of expert designers within the studio setup (Cennamo et al., 2011). Reflection on action is a prevalent methodology followed in architectural design studio, where students get direct reflections from their design tutors (Schön, 2016). Sometimes, this made them follow their design tutors as role models rather than understanding real meanings or values demanded by the problem at hand.

Architectural design ideas are not generated as a complete formation (Demirkan & Hasirci, 2009; Sinnamon & Miller, 2021; van Dooren, 2020). It is usually a raw, formless, diffuse feeling which needs to be refined through a specific process (Sinnamon & Miller, 2021). This refinement process plays a significant role in generating a design solution. The

initial ideas could be displayed through multiple mechanisms, such as sketches, rough prototypes etc. (Demirkan & Hasirci, 2009). This design process is moulding the inadequately dignified feelings, and finally, the design idea will be materialised on real grounds. Furthermore, by utilising a methodological framework, the design process goes across iterative refinements, creating final design outcomes. The architectural design studio process is a structure that is not focused on a single-dimensional and uniform teaching system (Önal & Turgut, 2017). However, the design student's role should cover from a researcher, ethnographer to designer inculcating many job roles in-between to cater to complex human needs which could be solved through spatial solutions. Design students generate concepts and provide philosophical grounding to their approach, but the problem is how much those concepts could be sustained in real-world scenarios. In order to create novel design concepts, the designer should have a sound understanding and empathetic point of view towards the problem at hand and its associated context (Pallasmaa, 2014).

Soliman (2017) proposed an architectural practice model (Fig. 1) involving four major phases: (a) Programming Phases; (b) Schematic Design Phase; (c) Design development phase; and (d) Construction Documents Phase. According to his model, the design process begins with the Programming phase. Design students are supposed to explore the context and user in detail during the programming phase. In order to explore the context and the user, they are using several tools and techniques. Usually, several field visits, interviews with users, observations are the most common ways followed at the initial programming phase to collect information. The programming phase is followed by the schematic design phase, where students get the opportunity to develop ideas. For that, they use techniques such as brainstorming and analysing. The schematic design phase allows students to ideate their designs. This is the phase where many design generators are coming into play. As

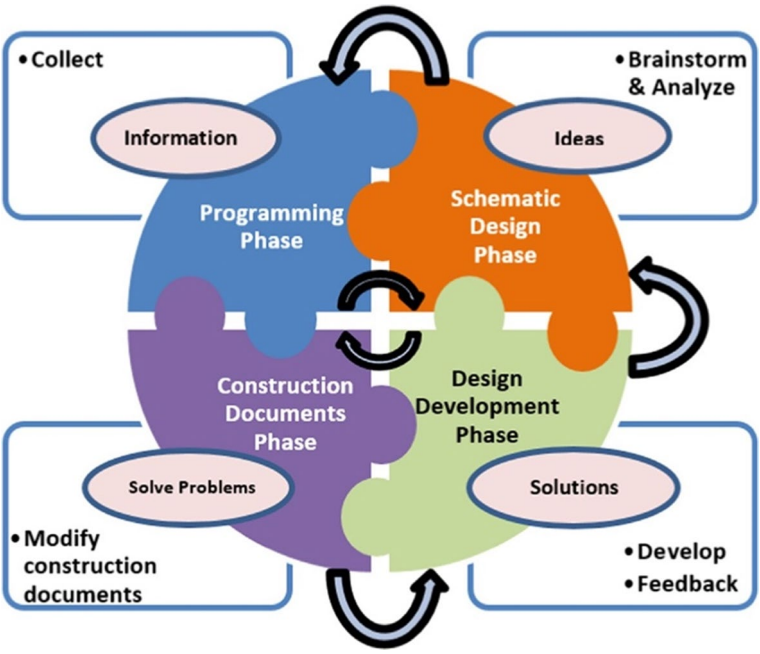

Fig. 1 Design process of architectural practice—Model 1 (Soliman, 2017)

suggested by Soliman, there is a possibility to walk back and forth to do necessary refinements. They move forward to the detail design stage to select the most suitable design idea to do further refinements. At this stage, multiple solutions will be discussed in tutoring sessions between the student and the design lecturer. The design will be further modified with the multiple feedback of the peer lectures. The fourth phase is not practised in the pedagogic design studio, because students mainly deal with pseudo projects that will not be constructed in a real-world context. However, the critical fact is that they learn to do an actual project in a real context while working in an imaginative framework.

Testing the design ideas and solutions is predominantly done within the design studio and testing against the physical and social cultural context is rarely identified in the design process. The critiques in the design studio are open only for the students and design jurors, and it limits the countability of the voice of the real user and the demands of the context.

Rahbarianyazd and Nia (2019a) explained that a design process has more liner characteristics (Fig. 2). It is again starting with identifying the problem. Identification of the problem leads the designer to the analysis phase. They conduct formulations, articulations, transformations, redefining the problem in hand and research. All those activities support understanding the scope of the project and its periphery. According to this model, the Analysis phase leads to the Synthesis phase, which comes with elaboration, ideation, alternative generation, working with variety, proposing divergence, and picturing the status. The outcome of the Synthesis phase leads to the Evolution phase, where the students have a choice upon the design solutions they created; they work with convergence thinking at this stage. The Evolution stage is followed by the Solution phase, marked as the final phase of the design. It is associated with prototyping, composition, modelling, planning, and creating detailed designs. This process has linear development, where all the phases have the possibility to revert to the previous phase. The back-and-forth movement only accommodated within phases which are neighbouring in-between. It acknowledges reverting to the problem from synthesis, evaluation and solution phases.

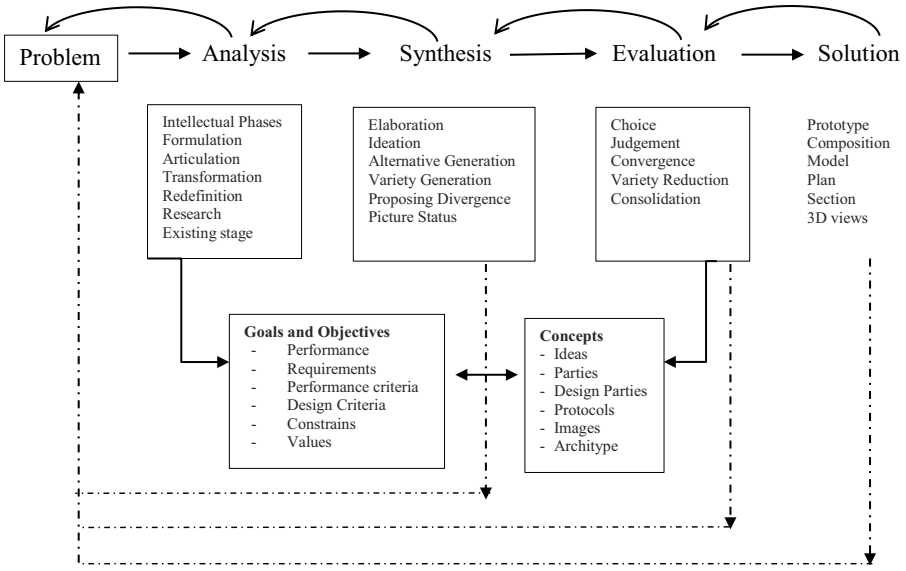

Fig. 2 Design process of architectural practice—Model 2 (Rahbarianyazd & Nia, 2019a)

The below model explains the design thinking process that architectural students are undergoing. The model creates further questions on the analysis phase, there the activities listed have given no sights on exploring the user and the context in depth. The user and context analysis might be hidden within those phases. However, we believe the prominence given to user and context is really lacking in both models we found in the literature.

Even though the architectural design process has several iterations in between, it has shown a linear approach in accommodating the point of view of the stakeholders (Stevens et al., 2019). The design process technically consists of context and user analysis at its inception; however, once the design ideations and solutions were generated, those were never tested with multiple stakeholders to get their reflective feedback, and the designs were only tested with design studio tutors who have no relationship to the socio-economic, cultural context of the user. The architectural design process is based on an objective evaluation of data and the designer's perception (Önal & Turgut, 2017). This quantitative approach lacks empathetic understanding towards multiple stakeholders. Unlike the other form of design, the involvement of real users or stakeholders in the design process is a requirement in the architectural design process (Crowther, 2013). Moreover, this made the designer/architect away from real human needs. However, the initial idea and the process it is taking through will create a scaffolding to place the general solution into a more specific human-friendly solution with embedded empathy (Pallasmaa, 2013).

The mental process the architects are going through with the blend of emotions, notions, and objectives is hard to materialise, and it needs a more unique process than a process-driven technical line-up (Nazidizaji et al., 2015). The involvement of other stakeholders such as users and clients are unlikely in the architectural design process. According to Pallasmaa (2014), *"a sensitive designer imagine the acts, experiences and feelings of the user of the space, but human empathic capacity does not work in that way"* During the design process, the designer switch his role from the designer to the user and imagine the situation and usability of the anonymous user and test his design ideas through imaginative visualisation. This cannot be validated in a real living context and understanding the actual usability and user expectations through the imaginative process is not a successful mechanism because many buildings have been failed during real-life operations (Shin & Thomas, 2015). So, the imaginative approach is not working anymore in real-life usage. The other major problem is how this imaginative process works in group activities. When many designers imagine one usage, they could visualise it in multiple ways, leading the team to wrong dictated design solutions. The expectations, beliefs, values, and socio-cultural context of the designer affects the architect's design space (Önal & Turgut, 2017). This fact needs to be taken into consideration because what we heavily neglect is the social norms, values and socio-cultural context of the designer and the different stakeholders while being in the design studio context (Biskjaer et al., 2021; Ismail et al., 2012).

The interest in the aesthetic appearance of a building or a space is placed at a higher level in architectural practice. Architects and architectural students mainly learn from precedents and provide insightful inspirations to novel designs. However, these precedents and inspirations that they are following might not be feasible in specific contexts. The contextual factors play a vital role in functioning and surviving the building in various socio-cultural contexts.

Is something missing in architectural design process?

The ADP has many conversational moves embedded into its process (Biskjaer et al., 2021). Most of those conversations contain introverted nature because it usually happens with the

involvement of a design student and tutor. In the real ground, the design solutions which architects generate will be utilised by a wide range of stakeholders who do not have any voice during the design process. The voice of the ultimate end users was heavily neglected in the architectural design process. Those stakeholders represent heterogenous contextual conditions and span over a broader spectrum of actual requirements that need to be considered while designing (Patria et al., 2018). Collaborative negotiations and information sharing with heterogeneous stakeholders are lacking in ADP. The assumptions and decisions made in the design studio context will not be valid in the real-world context regarding the actual functionality. Even though the ADP happening in a conventional design studio motivates assumption-based solutions, it could generate many socio and psychological issues while operating (Dizdar, 2015; Pallasmaa, 2014).

Human values, their contextual considerations, the socio-cultural context of various stakeholders plus the cultural schema of the designers, which includes lifestyle, beliefs, perception, living environment, are not counted much during the design process (Önal & Turgut, 2017). The user's context and the designer's context are two significant factors influencing the ultimate design solution. The ADP is creating severe blind spots which were not addressed and will lead to less empathetic and less functional design solutions (Biskjaer et al., 2021).

The voices of the different stakeholders are not counted for ADP. According to the literature reviewed and analysed below, the prominence given on getting the users' point of view and prominence given on experiencing real contextual values are limited. The ADP is more focused on refining and fine-tuning the design ideations through a rigorous supervision process, and in architectural practice, this is called design tutoring (Webster, 2004). The attention to refining the design ideation is visible, but getting reflections from real users who intended to use the building to refine the design was missing. This lap limits the opportunity to make changes as per the reflections of the users during the design process (Hong & Choi, 2011). This has been resulted in generating less functional, less human-friendly design solutions even after going through a very systematic process. The inherent phases of ADP are more steady and show less flexibility in getting the real users into the design process.

Problem formulation

Identifying the missing phases in the architectural design process to develop more human-centric design solutions is the key focus of this study. Analysing the current design process in the design studios supports identifying potential gaps in the practice. The most common and popular design thinking model: Double Diamond Design Thinking process starts from empathising, wrapped with divergent and convergent thinking from either side. This has given room to look and feel the problem at hand from a broader perspective. Investigating why ADP lacks human-centric approaches is a demanding need.

The missing phase/phases could be the most critical phases that could make the design more practical and grounded. Nowadays, the design solutions provided by the students are stereotypical and do not address the different layers of contextual needs (Cennamo et al., 2011). To make this rectified, a proper diagnosis is needed. This literature review aims to identify existing models of the design process practised across the globe. Later, this identification will prepare a solid foundation for suggestions to amend the design process to make it more empathetic.

Research questions

1. What is the design process followed in a conventional design studio?
2. How has the real user and context addressed during the architectural design process?
3. What are the gaps identified in ADP to address the needs of the user?

The goal of constructing the RQ 1 is to investigate the literature on what components are usually involved in the design process in Conventional Design Studio. RQ2 will explore to which extent the actual user and the context have been catered to throughout the ADP. Finally, through this literature review, RQ3 focuses on identifying the gaps of ADP to make possible suggestions/interventions to amend the ADP.

Methodology

For this literature review, articles were browsed and selected systematically. A systematic literature review is a comprehensive analysis conducted to identify, evaluate and synthesise the existing body of complete recorded work. Systematic literature review is a mechanism to synthesise the evidence under a selected subject area which has been presented by using critical and scientific methodologies in identifying the articles, defining the knowledge, presenting them and assessing (Denscombe, 2014). Systematic Literature reviews aims to find most relevant publications presented that could be supportive in answering the research questions generated by adopting explicit methodologies to identify potential articles (Okoli & Schabram, 2010). As depicted by Marvasti (2020) A stand-alone literature review should be systematic, explicit, comprehensive and reproducible (Corbin & Strauss, 2020). Being systematic means those researches need to have been conducted methodically, following a systematic and methodical approach and having rigorous explanations on procedures used. Furthermore, they need to have a comprehensive scope with relevant materials. This systematic review was conducted in 5 key stages: (1) Scoping, (2) Planning, (3) Searching, (4) Screening and (5) Eligibility (Siddaway, n.d.).

Search strategy

As the initial step we browsed articles from well-recognised databases such as SCOPUS, Web of Science, Research Gate, and ScienceDirect. The rationale for selecting those databases is the availability of rich peer-reviewed articles under the subject stream of architectural studies. Peer-reviewed empirical studies written in English were selected at the initial browsing to apply inclusion and exclusion criteria. Peer-reviewed empirical studies written in the English language within the last ten years (2011–2021) were the central focus whilst searching relevant literature for the review (Fig. 3). The reason to select the most recent ten years is to gather the most updated knowledge about architectural design processes currently practised. We established a rubric to filter articles which could explain the architectural design process. Being peer reviewed and published in English, discussions and empirical studies on design process, critical reviews on architectural design phases and studies on design process models were the main rubric in selecting the suitable articles for the review. Rubrics were established in order to find answers to the research questions generated.

Articles were browsed through the advanced search option by using the following keywords. "Architectural Design Process" OR "Design Process of Architects" OR "Designing Process" OR "Design Thinking Process of Architects" OR "Architectural Design Phases and user involvement " OR "Design Phases and user integration" OR "User integration in architectural design phases" were the keywords used in searching. The key words were established to find the most relevant articles which could answer the research questions 1–3 in page no 5. The main aim of this study is to understand the current design process which is practised in the architectural study domain. Therefore, we established the above key words emphasising and giving more focus to the design process or design phases as it will help to answer the research questions constructed. Peer-reviewed empirical studies, literature reviews, peer-reviewed concept papers based on empirical observations and studies were included for initial browsing. Results generated from the initial search were rigorously filtered by reading the Abstract and Introduction. The articles containing empirical studies, observations, studio testing, and quantitative and qualitative approaches to exploring the architectural design process were selected for the second filtration. Duplicates were removed during the second filtration. Most importantly, the articles which contain the studies conducted on exploring the architectural design process, its phases and line up were selected during the first filtration.

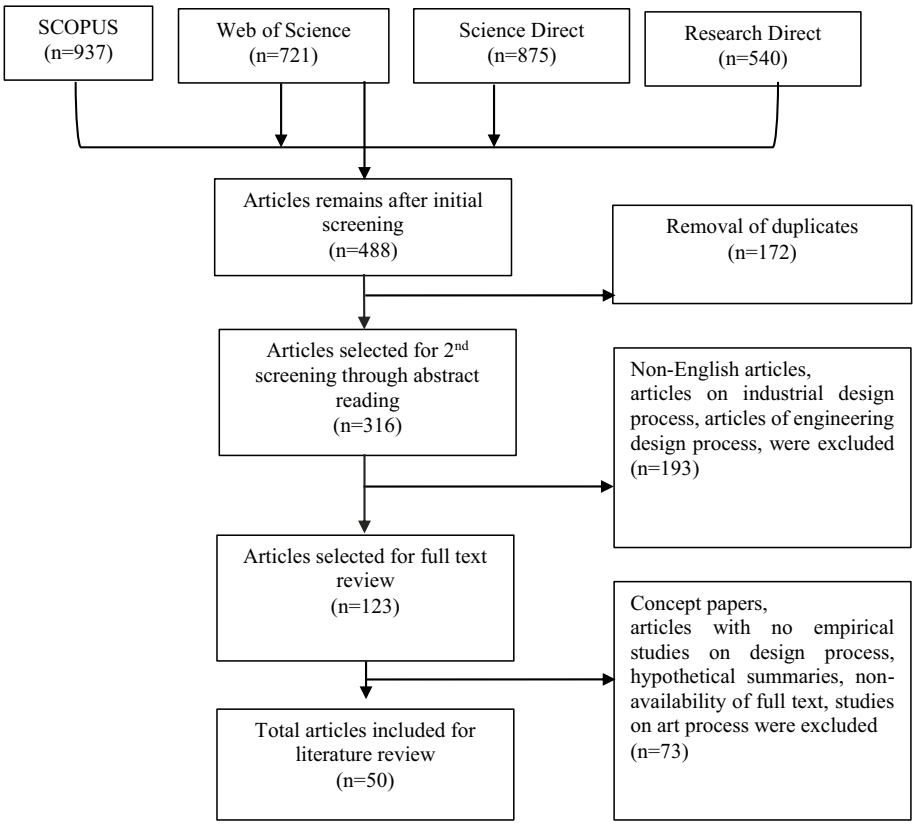

Fig. 3 Flow chart of inclusion and exclusion

Using the above keywords, 3073 articles were found at the initial article browsing. After initial screening, 488 articles were identified and selected for further readings. The duplicates were removed, and 316 remained for abstract reading. After reading the Abstract and Keywords, 123 articles were identified for further readings. Articles containing non-imperial studies, discussion on architectural products but not the process, articles on computer architecture and design learning methods were excluded during the second filtration. After reading the full paper, 73 articles were removed due to no empirical studies on the design process. Furthermore, articles with hypothetical summaries, studies on the artistic process of art studios, and unavailability of full text were removed. Finally, 50 relevant articles were selected for the literature review and analysis.

Inclusion and exclusion criteria

Further, we developed an inclusion and exclusion criteria to filter the articles which could explain the architectural design process. The articles which are having scientific explorations, explanations under below listed 6 criteria were eligible for the final review. The criteria were generated to answer the research questions created. RQ 1 focuses on identifying the design studio's existing process practised. In order to do that, relevant articles were browsed by using a rigorous filtration process. The criteria were generated through the literature content that is relevant to answer the research questions created. The first question identifies the design process followed in the design studio and criteria 1–5 catering to that aspect. These criteria give a clear view of the activities, features, tools, and mechanisms applied and followed in each phase of the design. The literature, which contains discussions on each phase, have been categorised according to the below criteria.

Criteria one focuses on discussions made in the pre-design stage. According to the literature, the pre-design stage consists of site analysis, user analysis, zoning and concept development. Criteria 2 facilitates the schematic design stage, which consists of several brainstorming activities, feedback, and again advanced concept developments addressing the problems they identified during the pre-design stage. The articles, consisting of discussions on those areas, were categorised under criteria 2. Criteria 3 focuses on discussions made in the design development phase, and it consists of creative activities, drawings, model making and presentations. Criteria 4 has listed the activities and features of the fourth phase of the design process, which consists of detailed drawings, 2D, 3D model making, peer feedback, and Interim critiques. The criteria 5 is listing down the studies conducted on presentations and critics happening in the design studio. Criteria 6 addresses the contents that explain the existence of empathising in ADP. The articles containing the above information necessary to answer RQs have been listed in Table 1.

Criteria 1—discussions on Pre Design stage

- Site analysis (SA)
- Interaction/socialisation (IS)
- Context (C)
- User analysis (UA)
- Zoning (Z)
- Problem Framing (PF)

Table 1 Overview of the reviewed papers

	Reference	C1 SA, IS, C, UA, Z, CD, PF, P, SCVS	C 2 BS, I, GI, Ab, GS, FB, CD, CS	C 3 CA, VC, DR, MM, P, PR	C4 DD, 2D/3D MM, PFB, IC	C5 PR/CR	C6 SH, Re
1	Kurak Acici (2015)	x	x	x	x		
2	Dizdar (2015)	x	x				
3	Sagdic and Degirmenci (2015)	x	x	x	x		
4	Stevens et al. (2019)	x					x
5	Durmus Ozturk (2020)		x				
6	Karslı (2015)	x	x				
7	Nazidizaji et al. (2015)	x	x				
8	Önal and Turgut (2017)	x	x				
9	Biskjaer et al. (2021)	x	x				
10	Abdelhameed (2017)	x	x	x			
11	Soliman (2017)	x	x	x	x		
12	Shin and Thomas (2015)	x					x
13	Raonic (2015)	x	x	x	x		
14	Amos Bar-Eli (2020)	x	x				
15	Harputlugil (2018)					x	
16	Rahbarianyazd and Nia (2019b)	x	x	x	x	x	
17	Cikis and Ek (2010)		x	x	x		
18	Saris (2020)	x	x				
19	van Dooren et al. (2018)	x	x	x	x		
20	Bickert and Johansson (2012)	x	x				
21	Hisarligil (2012)		x				
22	Haupt (2015)		x		x		
23	Xu and Izadpanahi (2016)		x	x			
24	KhakZand and Babaei (2018)		x	x			

Table 1 (continued)

	Reference	C1 SA, IS, C, UA, Z, CD, PF, P, SCVS	C 2 BS, I, GI, Ab, GS, FB, CD, CS	C 3 CA, VC, DR, MM, P, PR	C4 DD, 2D/3D MM, PFB, IC	C5 PR/CR	C6 SH, Re
25	Ham (2016)		x				
26	Taneri and Dogan (2021)		x				
27	Yuksel and Uyaroglu (2021)		x	x	x		
28	Kavousi et al. (2019)		x	x	x		
29	Lizondo-Sevilla et al. (2019)		x	x	x		
30	Orbey and Erdogdu (2021)		x	x	x	x	
31	Sinnamon and Miller (2021)	x	x	x	x		
32	Kim (2019)				x	x	
33	Safin et al. (2019)	x	x				
34	Uysal et al. (2012)	x	x				
35	Dorta et al. (2016)		x				
36	van Amstel et al. (2016)	x	x				
37	Halawa et al. (2020)	x	x	x			
38	Jabeen et al. (2021)	x	x	x	x	x	x
39	Casakin and Wodehouse (2021)	x	x				
40	Yurtkuran et al. (2013)		x	x			
41	Grover et al. (2018)	x					
42	Eissa (2019)		x	x			
43	Ismail et al. (2012)				x		
44	Belmonte et al. (2014)				x		
45	Mahdavinejad and Pourbaqer (2014)		x	x			
46	Mahdavinejad et al. (2012)	x	x				
47	Ustaomeroglu (2015)	x	x	x	x		
48	van Dooren et al. (2019)		x	x	x	x	

Table 1 (continued)

	Reference	C1 SA, IS, C, UA, Z, CD, PF, P, SCVS	C 2 BS, I, GI, Ab, GS, FB, CD, CS	C 3 CA, VC, DR, MM, P, PR	C4 DD, 2D/3D MM, PFB, IC	C5 PR/CR	C6 SH, Re
49	Yurtsever (2012)		x				
50	Turgay (2017)		x	x	x		

- Precedents (P)
- Concept development (CD)

Criteria 2—Discussions on Schematic Design Stage

- Brainstorming (BS)
- Imagination (I)
- Getting Inspired (GI)
- Abstractions (Ab)
- Graphical Simulations (GS)
- Instructor/Tutor Feedback (FB)
- Concept Development (CD)
- Creative Stimulants (CS)

Criteria 3—Discussions on Design Development Stage

- Creative activities (CA)
- Visual communication (VC)
- Drawings (DR)
- Model making (MM)
- Prototyping (P)
- Presentations (PR)

Criteria 4—Detail Design Stage

- Detail Drawings (DD)
- 2D/3D model making (2D/3D MM)
- Peer feedback (PFB)
- Interim critics (IC)

Criteria 5—Presentations/Critics (PR/CR)
Criteria 6—Empathising in Architectural design Process

- Bringing stakeholders in to ADP (SH)
- Getting reflections (Re)

Data analysis

To analyse the data collected through the rigorous reviewing process, we applied the grounded theory followed by the content analysis method under the umbrella of qualitative data analysis methods. Grounded theory is a specific mechanism that could be applied to build a theory based on the data collected and analysed (Corbin & Strauss, 2020). Grounded Theory will construct a theoretical explanation for the data analysed. Content analysis was adopted to analyse the data generated through the review. The main reason to apply Content analysis (CA) is because it is very supportive in identifying and analysing any mode of data provided in the literature. Content analysis is a flexible methodology for analysing research text data that could be applied in qualitative data analysis (Neuendorf, 2022). Content analysis allows the researchers to reach the broader spectrum of data,

including text, figures and graphical interpretations, in an impressionistic, intuitive and interpretative way (Franzosi, 2022).

Content analysis allows the researcher to code the text's data into explicit categories (Weber, 2022). "*The goal of the content analysis is to provide knowledge and understanding of the phenomenon under study"* (Hsieh & Shannon, 2005). The content analysis starts from familiarising data, generating initial codes, examining initial codes and generating subcategories, Reviewing the subcategories, developing main categories, defining those categories and reporting them. Those meaningful clusters will show the data's links patterns, formation, and sequences.

The row data identified in the review were fed into an excel sheet and started coding focusing on finding answers to the research questions generated. Inductive coding methodology was adopted for this study. Furthermore, the design process models developed by the research were counted under the content analysis.

Results

Design process followed in conventional design studio

In order to answer the research question 1;" what the design process is followed in a conventional design studio, we found 42 primary codes, 10 secondary codes, 4 categories and 4 major themes.

The primary codes 1–18 in Table 2 are describing the design activities which are done by students at the inception. Stevens et al. (2019) described the scope identification, site analysis and the initial contextual observations are placed at the very beginning at the design process.

The secondary code we identified as Problem seeking consists of 9 major design activities listed as understanding the scope, site analysis, photographic studies, user analysis, user interviews, user observations, brief preparation, observing client requirements and precedents (refer Table 2). Exploring the site, capturing the context through photographs, site analysis are conducted by design students at the very beginning of the design process (Dizdar, 2015). As explained by Önal and Turgut (2017), these initial activities provide a primary understanding about the design scope, context and the user, but it does not give an in-depth understanding about the socio-cultural representation of a particular location. The user interviews, user analysis are conducted by students during initial site visits to understand the user point of views on the given scope (van Dooren et al., 2018). Bickert and Johansson (2012) have explained, the time spent on these initial design activities which are placed at the inception phase of the design process could generate impacts on the design process.

The four major secondary codes listed down under the design objectives are falling under the programming phase. The results depict the programming phase which consists of problem seeking which was placed at the very beginning as the first phase of the design process and we labelled it as the empathising phase, because it consisted of all the activities which are related to empathising in the design process.

Problem seeking is leading to problem identification which consists of SWOT analysis, mapping the information, inspirations and brainstorming (Rahbarianyazd & Nia, 2019a; Raonic, 2015). Building cognitive abilities, logical thinking and rationalising are key objectives which lead the design students to put an initial foundation on the design process

Table 2 Themes, categories and codes of the design process

Key Theme	Categories	Secondary codes	Primary codes
Design Phase	Design Focus	Design Objective	Design activities
Programming Phase/Empathising phase	1. Inception	1. Problem seeking	1. Understanding the scope
			2. Site analysis
			3. Photographic studies
			4. User analysis
			5. User interviews
			6. User observations
			7. Brief preparation
			8. Observing Client requirements
			9. Precedents
		2. Problem Identification	10. SWOT analysis
			11. Defining the problem
			12. Mapping
			13. Collecting Information
			14. Inspirations
	2. Define	3. Logical Thinking and rationalisation	15. Brainstorming
		4. Building Cognitive abilities	16. Make meanings out of confusion
			17. Intuitivism
			18. Discussions
Schematic Design Phase	3. Ideation	5. Exploring	19. Developing potential solutions
			20. Idea sketches
		6. Creative Thinking	21. Abstractions
			22. Idea Generation
			23. Idea Sketches
			24. Mind mapping

Table 2 (continued)

Key Theme	Categories	Secondary codes	Primary codes
			25. Mood boards
			26. Developing Concepts
			27. Sharing ideas
		7. Developing and Testing ideas	28. Testing Concepts
			29. Peer reflections
Design Development	4. Evolution	8. Integration of Advance design skills	30. Detail drawings
			31. 2D visualisations
			32. 3D visualisations, Physical models, 3D models
			33. Detail explanations on design
			34. Overall space visualisations
		9. Moderating	35. Tutoring
			36. Interim critics
			37. Peer reflections
Testing Solutions	5. Studio testing and refinements	10. Testing Design Solutions	38. Peer reviews
			39. Interim critiques
			40. Discussions
			41. Modifications and amendments
			42. Presenting amendments

(refer secondary codes 1–4 in Table 2). logical thinking and rationalising support on defining the scope and we identified it as the second phase of the design process which has been placed in the middle of the empathising phase and ideation phase.

Primary codes no. 19–29 (refer Table 2) have listed ten design activities which support exploring ideas, creative thinking, developing and testing ideas. As explained by Cikis and Ek (2010), students are starting their visual communication through idea sketches, abstractions, mind mapping, mood boards, developing concepts and conceptual diagrams. During this stage creative thinking supports on bringing novel design ideations to solve the problem at hand (Casakin & Wodehouse, 2021). These ideas get expanded with collaborative brainstorming and peer reflections (Uysal et al., 2012). The results depicted the schematic design stage which consists of Ideation coming after the defining phase.

To describe the fourth phase of the design process which is labelled as design development, we identified 7 primary codes from code no 30 -37 which have been listed in Table 2. The fourth phase consists of developing detailed drawings, 2D and 3D visualisations, physical models along with detailed explanations through detailed drawings developed. As explained by Jabeen et al. (2021) the students are integrating advanced design skills along with their creative thinking to express their design solution. This stage is more focused on expressing the design solution through architectural drawings, models and 3D visualisations to design tutors they met at the design studio (Lizondo-Sevilla et al., 2019). The secondary code labelled as "Moderating" has listed down the activities that students are undergoing to get their design proposal moderated. As reported by Kim (2019) the 3D visualisation and 3D modelling have expanded the visualisation ability of students at the design development stage. At the same time 3D visualisations and 3D models have made design tutors easy to understand the student's design approach. To prototype the design solution, students have used 3D visualisations and physical models. The results depict the design development phase is more focused on prototyping the design solutions they generated through several modelling mechanisms. We identified this as the fourth phase of the architectural design process which students are undergoing in conventional design studios.

The codes listed from 38 to 42 (refer Table 2) are showing the testing activities which are undergoing by students during the testing phase. Students are getting tutoring from design tutors, interim critics to assess their design solution and peer reflections from fellow novice designers. The testing design solutions come after the fourth stage of the design process which is taking place in the design studio context. Since students are not going to construct their design solution on ground, they will not get a chance to go ahead with the contract documentation stage and final construction stage (Pallasmaa, 2019). And the literature has not brought any evidence to identify another stage which is followed by testing.

As a consequence of the finding of RQ 1, we have developed the design process model which is shown in Fig. 4. The architectural design process which is done by design students have shown a line-up of sequential activities clustered with in 5 phases starting from empathising which takes place at Inception, defining, Ideation occurs in schematic design stage, Prototyping in design Development phase and Testing happening in solutions stage (refer Fig. 4).

Grounded Theory can be identified as a systematic way of constructing a theory based on the data presented and analysed (Clarke & Charmaz, 2022). Further GT helps the researcher to develop his own theoretical underpinning based on the patterns, connections and information presented in the data which he analysed (Charmaz & Henwood, 2019). After analysing the data presented in literature, we got a clear picture of the current design process which is practised in Conventional design studios. The literature we reviewed has generated empirical data to demonstrate the current design process. The data has been

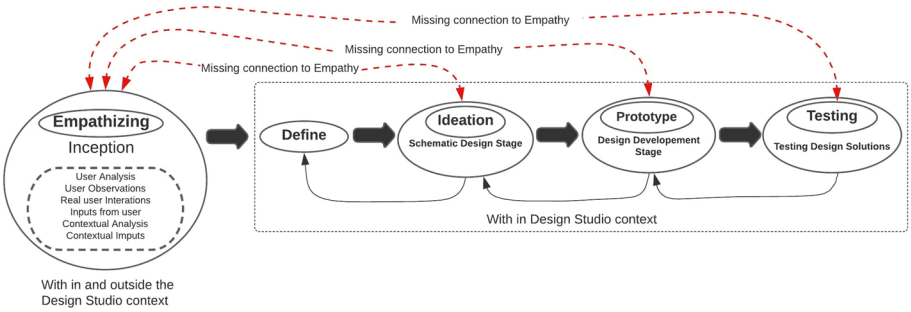

Fig. 4 Design process model followed in conventional design studio (developed by authors)

summarised in the Table 2. The Table 2 describes the design activities, design objectives, design focus and design phases very clearly with each and every activity they are engaging in. The Design process model we developed is specifically relevant to the architectural study domain. In literature we found many process models of architectural practice which are relevant to real life design projects. But the design process which is undergoing by architectural students was not identified or developed by any of those researchers. The design process model we developed, is clearly showing all the phases and interconnections and missing connections between some phases. This is a new finding and a novel theoretical explanation on the architectural design process. This model we developed is a new finding which is developed through the data presented and analysed empirically. Developing the design process model which is practised in conventional design studio context is the outcome of the application of Grounded Theory in this research. This is a new finding which came out as a result of this literature review.

Existence of real user and context in architectural design process

In order to answer the RQ2; "How has the real user and context addressed during the architectural design process?'' We observed the primary codes, secondary codes and themes mapped in Table 2. We observed the user, and the context have been explored by students during the very first phase of the architectural design process which has been labelled as empathising in our design process model (Fig. 4). The primary codes have listed the design activities which are undertaken by students. We identified 42 primary codes explaining the design activities which have been presented in the articles (refer Table 2). Among those, 8 codes are showing up with user analysis, understanding the scope, user interviews, user observations, brief preparation which addresses the user and contextual demands. We observed that the user and context have been addressed during the very first phase of the design process which is labelled as empathising in our design process model (Fig. 4). The codes listed under the other four phases of the design process do not show any evidence on user related activities. Further, the codes listed from 19 to 42 in Table 2 is sequencing down the design activities which come under the rest of the four phases. None of those phases consist of user integration or user related activities. The codes and categories provide the prominence given to the user and context which have been placed at the very beginning of the design process under the empathising phase.

The results depict, the empathising process is only happening at the very first phase and students carry the information they gathered from the first phase to the other four

phases. As explained by Ustaomeroglu (2015) the information related to user and context are reflected in the schematic design stage which is titled as Ideation and design development phase under prototyping. As explained by Jabeen et al. (2021), our results concur with non-existence of users in prototyping and testing phases. Further the codes numbered from 30 to 42 show the methods undertaken by students for prototyping and testing. Design tutors provide their reflections to refine design ideations developed and testing which happens only between design students and design tutors (Shin & Thomas, 2015). We observed the design process has no mechanism to revert back to the user nor context during ideation, prototyping and testing phases. We further, identified this as a missing connection to the empathising phase. We observed the non-existence of user and contextual matters during the other four phases of the design process have created the missing connections to empathy.

The gaps identified architectural design process (ADP)

In order to answer the RQ 3; "What are the gaps identified in ADP to address the needs of the user?", we have analysed the design process model we developed (refer Fig. 4). The design process has given lack of space for the students to empathise with the real requirements. It is evident that user and context exist only during the first phase of the ADP (refer Fig. 4). The data which is summarised in Table 2 has coded the design activities which are undergoing in each phase. It is evident that the existence of the user and the contextual factors are not visible after the initial inception phase of the design process. Students have moved ahead with other activities such as idea sketching, modelling, drawing and tutoring (codes listed from 19 to 42 in Table 2), but none of these activities have reflected the integration of the real user or contextual factors. The limited existence of user and context in the design process is the major problem we identified through this study. This creates a vacuum in the design process. The design ideations, detail designs, and final solutions and testing have become isolated phases without any connections made with user and real contextual factors. We identified this as a missing connection to the empathising phase in our design process model (refer Fig. 4).

We observed that the students are moving from the empathising phase to define phase carrying the data gathered during the empathising phase. They, then move ahead to the Ideation phase. From Ideation phase to Prototype phase and then testing phase. The Ideation phase has no codes generated related to empathising and prototyping phase, it has only activities related to modelling, visualising and 3D presentation with no involvement of user nor context. The testing phase consists of design tutoring, critics, and interim assessments, but again no connection made with users to test design solutions or no contextual testing done. But walking back and forth to the empathising phase, testing design ideas generated, testing design solutions generated with the real user and context is not visible in the data we gathered through this literature review. This is the gap we identified in the architectural design process. The possibilities to walk back and forth to the empathising phase and limited empathising activities are found as problematic gaps in the architectural design process. In answering the RQ 3, we observed the missing connections to the empathising phase have created a vacuum in the architectural design process. Due to those missing connections, ADP has become more lintier with no rational iterations made in-between phases. Less addressed empathy is the gap we observed during ADP.

Discussion

The purpose of this literature review is to get an overview of the design process practised in Architectural Design Studio. Further, it discusses the level of existence of the real user and the context during the design process. For this purpose, 50 papers were identified for review through a systematic filtration process. This study adopted a systematic literature review methodology and data analysed through content analysis based on the Grounded Theory. The RQ1 focuses on identifying the ADP which is followed in conventional design studios. To answer that question, we have developed a design process model based on the findings which are summarised in Table 2. The design process model demonstrates the current practice with certain missing connections we identified. In literature we found many process models of architectural practices which are relevant to real life design projects. However, the design process which is undergoing by architectural students was not identified or developed by any of those researchers. The Design process model we developed (refer Fig. 4) is specifically relevant to the architectural study domain and it is clearly showing all the phases and interconnections and missing connections between some phases. This is a new and novel theoretical finding, describing the architectural design process.

Answering RQ2 has contributed to identifying the placement of the user and context in the design process. It is evident that the user and the context is only visible during the first phase of the design process. Students are empathising only during the initial phase and when they are going forward the empathising activities will get reduced. The missing connections to the empathising phase have created less addressed user requirements. The DP models we identified through the literature survey (refer Figs. 1 and 2) contain similar phases and activities with no significant differences. All the phases were accommodated with a back-and-forth movement with an adjoining phase to refine.

Furthermore, we observed that the active existence of the real user is only visible during the very first phase of those design process models (Figs. 1, 2 and 4). The user has been placed as a source of information, and then their involvement was not taken into the process. After the first phase, the real user and their requirements were represented by design students, and it increases the chances to misinterpret or manipulate the real user requirements. In addition, we observed the non-existence of the user and context in other phases of the design process (Ideation, prototype, testing) has made students less empathetic.

In answering RQ 3, we observed the ability to walk back and forth during the design process. The ability to go through a cyclic process has got limited, because of the missing connections made with the empathising phase. This made the design process linier without cyclic iterations to the empathising phase from ideation, prototyping and testing phases. We identified this as a gap in the architectural design process which needed more interventions. The findings of RQ 3, have contributed to identifying the existing loopholes of the conventional design studio practice.

It is evident that among the selected 50 articles, only three articles have shown interest in bringing the users into the design process. Again, among those three articles, one article discusses urban design practice with the involvement of citizens, which is typically expected in urban design practice. We also observed a gap in the literature on experimenting the user involvement in ADP (refer Table 1) Current ADP lacks revising, observing, and testing design solutions against real contextual demands.

Conclusion

Based on the results and the discussions, we conclude that the architectural design process contains very linier characteristics without the ability to walk back and forth to the empathising phase from ideation, prototyping and testing phases. This linearity has limited the empathising ability of the design students, because there is no room provided in the design process to revert back to the user or the context while designing. Furthermore, we conclude that the real user and the contextual demands have been addressed only during the very first phase (empathising phase) of the ADP and students are carrying information they found at the initial phase to the other phases. This study has brought us the facts to identify the missing connections from ideation, prototyping and testing phases to empathising phase. We conclude by identifying missing connections to the empathising phase which are essential and crucial for the design process.

These three missing connections between the empathising phase are at the ideation phase and occur during the schematic design stage, at the prototyping phase and occur during the design development stage and finally, at the testing phase and occur during the solutions stage of the architectural design process (ADP). Even though the design process has many iterations in between each phase, it fails to modify the design based on feedback from the user point of view. We argue that the involvement of real users has a role to play in the design process, and it needs to be addressed. Finally, in order to visualise the shortcomings based on the literature study, we developed a model depicting the relationships and connections between the different stages and phases in a design process, highlighting the discussed missing connections that need to be considered for improvements.

Future research

This study will contribute to identifying the current design process model and potential gaps to suggest possible amendments in future research. There is a need to investigate potential mechanisms to interconnect the missing connections we identified in ADP in future. The design process of students needs to be refined with research interventions which could integrate the user and contextual scenarios into all the phases of the design process. This intervention will help to increase the empathy of the students and will strengthen the act of empathising. There is a need for more empirical investigations on methods which could bring the real user and real context into the design process. We believe those interventions could create a positive impact on the architectural design process of students which is not much investigated yet.

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