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The Design Process Framework in Interior Design Education: An ACT-R Approach

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Abstract

Many studies have explored interior design pedagogy and developed teaching methods in interior design and interior design pedagogy. However, this study describes the appropriate way to use the conceptual framework of the design process by Yanksari (2020) in teaching interior design. The main research question is**:** how the design process's conceptual framework affects interior design's educational process in the adaptive control of thought-rational theory. This study aimed to explore the impact of the Yanksari 2020 conceptual framework on the educational process of interior design, utilizing Anderson's Adaptive Control of Thought-Rational (ACT-R) theory. A quantitative, one-shot case study approach was used. The author explained the conceptual framework to the 60 senior interior design students. After the final presentation, a survey was conducted to answer the research question. The results showed that the conceptual framework of the design process significantly enhances procedural knowledge. This positive influence is notably strong during the autonomous stage, followed by the associative and cognitive stages, with students expressing strong agreement on its benefits in the interior design educational process. A conceptual framework has been developed for further investigation and educational purposes.

Keywords

Conceptual framework of design process, procedural knowledge, ACT-R theory, student cognition, interior design education.

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1. Introduction:

“The conceptual framework plays a crucial role in achieving an optimal theoretical basis for explaining the project through its philosophies, comprehensive vision, and proposed solutions. It forms the project's foundation, influencing approximately 75% of its implementation due to its strength and significance." (ID student)

To advance higher education in interior design and introduce innovative teaching methods and strategies, the author extends Yanksari’s (2020) work to explore the impact of a new conceptual framework of the design process on student learning. Yanksari (2020) highlighted the importance of investigating how the conceptual framework impacts design outcomes, design thinking, and student learning. This framework offers a systematic approach to design exploration across multiple stages, specifically within the schematic design (SD) and design development (DD) phases, and supports studio prompts. Yanksari's research recommends that future studies assess the effectiveness of this framework within educational contexts. Accordingly, the purpose of this study is to explore the impact of the Yanksari 2020 conceptual framework on the educational process of interior design utilizing Anderson's Adaptive Control of Thought-Rational (ACT-R) theory. This investigation provides insights for educators on effective methods of employing a conceptual framework to enhance interior design teaching methodologies.

The objectives of this study are threefold: to identify the conceptual framework of the design process and relate it to learning theories; to describe appropriate methods for integrating the framework into interior design education; and to develop curricula that incorporate innovative teaching methods. This research provides detailed guidance on structuring an interior design course to achieve deep understanding through studio-based learning. It contributes valuable definitions and new teaching methodologies to address gaps in the existing knowledge within this domain. As the field of interior design education has evolved, the development of innovative teaching strategies and methodologies has become increasingly essential.

In the broader design literature, scholars such as Pakravan et al. (2022), Patel and Alfaro (2022), Sosa et al. (2022), and others have explored various aspects of interior design pedagogy and the development of teaching methods. Pakravan et al. (2022) proposed a framework for integrating urban agriculture into interior design education to promote social sustainability. Patel and Alfaro (2022) employed theoretical frameworks to foster empathetic design responses. Sosa et al. (2022) collaborate with industry partners to incorporate

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upcycling in design education. Additionally, Kaup et al. (2013) examined the integration of real-world projects into design studios to enhance learning experiences, while Asojo (2012) applied ACT-R theory to teaching lighting design.

Despite these advancements, there remains a need for further exploration to align educational practices with rapidly changing industries. This study contributes to ongoing research by investigating new educational approaches in design studios and utilizing a developed framework to enhance cognitive learning in interior design education.

1.1 Research Questions.

Primary Research Question:

1- How does the design process's conceptual framework affect the interior design educational process in ACT-R theory?

Sub-Questions:

- How does the conceptual framework of the design process affect the cognitive stage?
- How does the conceptual framework of the design process affect the associative stage?
- How does the conceptual framework of the design process affect the autonomous stage?

LITERATURE REVIEW:

2.1 The Adaptive Control of Thought-Rational (ACT-R) Theory.

ACT-R theory, developed at Carnegie Mellon University, underscores the importance of procedural knowledge in executing cognitive tasks. It outlines a three-stage skill-development process: cognitive (memorizing facts), associative (practicing skills), and autonomous (achieving automatic performance through repetition). Effective teaching of these procedures requires detailed declarative knowledge, feedback, and ongoing practices for automatization. This study emphasizes procedural knowledge's role in task execution and explores how conceptual frameworks influence students' cognitive development in acquiring procedural knowledge (Anderson 1995, cited by Asojo, 2012).

2.1.1 Procedural Knowledge.

Anderson (1982) identified two critical stages in cognitive skill development: the declarative stage, in which facts are encoded in a propositional network, and the procedural stage, in which procedures are encoded as productions (Taie, 2014). The application of ACT-R in problem-solving has been extensively studied, positing that declarative knowledge encodes environmental information, whereas procedural knowledge encodes transformations of that environment (Yengin & Ince, 2014). From a cognitive psychology viewpoint, expertise in instructional design involves converting declarative knowledge into procedural knowledge through proceduralization. This process requires beginners to understand the components and steps of instructional design to create learning events, with practice leading to routine execution (Norbert et al., 2017).

In this study, declarative knowledge was represented within the conceptual framework of the design process. According to Yengin and Ince (2014), using declarative knowledge to create production rules allows learners to acquire procedural knowledge that can be applied independently through extensive practice. Asojo (2012) notes that Anderson's ACT-R cognitive model outlines procedural knowledge acquisition in three stages: cognitive, associative, and autonomous. Effective procedural teaching requires students to build a detailed declarative understanding, receive feedback, and engage in continuous practice for automatization.

2.2 Teaching Methods in Interior Design Pedagogy.

Design education employs constructivist learning, encouraging exploration, critiques, collaboration, and problem-solving. Interior design courses, categorized as professional education by CIDA. According to CIDA (2018), specific skills are developed through studio-based problem projects, where students gain knowledge through evaluation and feedback. According to several design organizations, the interior design process consists of six phases: “programming, schematic design (SD), design development (DD), contract documents, contract administration, and post-occupancy evaluation”. During SD, students create design concepts such as sketches, bubble diagrams, and preliminary layouts. In DD, they refine designs, add details, and finalize approvals. Design exploration involves evaluating multiple solutions to improve design outcomes (Yanksari, 2020).

Yengin and Ince (2014) developed a teaching method that utilizes work examples to simplify learning by providing step-by-step problem-solving guidance. Worked examples teach students systematic problem-solving approaches, which can vary in applications, such as sequential steps for demonstrating solutions with diagrams or visual aids. Through repeated practice, students form general rules from specific examples and analogies, eventually transitioning their knowledge from declarative to procedural by encoding these examples (Yengin & Ince, 2014).

METHODOLOGY:

To explore how the conceptual framework of the design process affects students' cognitive processes, a quantitative, one-shot case study approach was

employed, as Nachmias et al. (2015) suggested. The author explained the conceptual framework to the 60 senior interior design students. After the final presentation, a survey was distributed to answer research questions. The study design is outlined in Figure 1, which illustrates the research methodology beginning with a one-shot case study approach within the context of Interior Design Studio 6, Capstone Project. This outline visually represents the data-collection process.

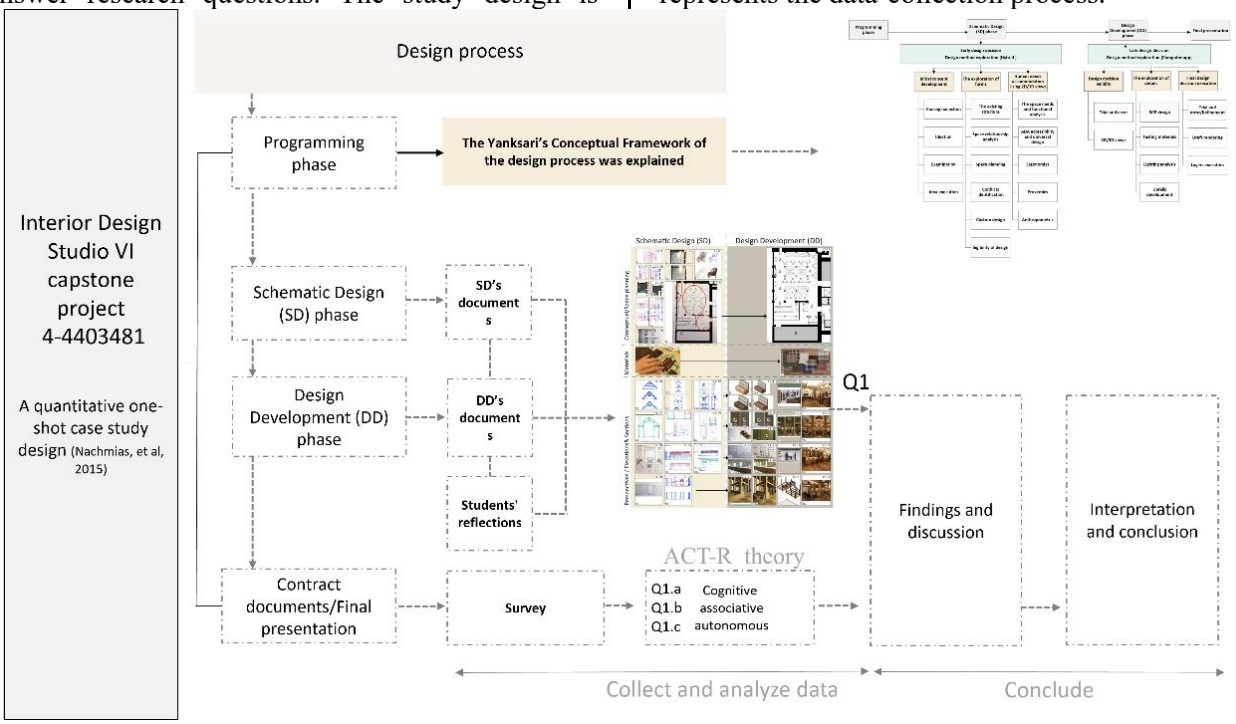


Figure 1. Outline of the Study Design.

Throughout the semester, students engaged in designing a capstone project, progressing through various phases: the programming phase, schematic design (SD) phase, design development (DD) phase, and culminating in the construction document and final presentation stages. The author introduced the conceptual framework of the design process, highlighting its application in the SD and DD phases. The students documented their experiences in these phases to assess the extent of idea development.

Following the final presentation, a survey comprising both closed- and open-ended questions was distributed to address the research questions. The data were analyzed based on three stages of procedural knowledge: cognitive, associative, and autonomous.

Documents from the SD and DD phases and students' reflections provided insights into the main research question (Q1): How does the design process's conceptual framework affect the interior design educational process? The survey specifically addressed the sub-questions: Q1.a, How does the conceptual framework of the design process affect the cognitive stage? Q1.b, How does the conceptual framework of the design process affect the associative stage? Q1.c, How does the conceptual framework of the design process affect the autonomous stage? The findings are discussed, followed by an interpretation and conclusion.

In the first and second weeks, the author introduced Yanksari's (2020) conceptual framework of the design process to 60 senior interior design students and explained the initial assignment, which involved programming. Students began developing a floor plan for their capstone project from the third to the fifth week, integrating juror reviews during the schematic design phase.

During weeks six to 11, students followed to particular design steps to tackle the assigned project, with the goal of achieving the intended outcomes, as Asojo and Vo (2021) outlined. This involved designing several selected areas within their projects during the design development phase, critically investigating the problem, recognizing and obtaining pertinent knowledge, then utilizing this new understanding to develop the initial solutions. The author employed various pedagogical tools, including research binders, mentoring, group discussions, pin-up critiques, prompts, desk critiques, and juror reviews (Asojo & Vo, 2021). This teaching approach aligns with Norbert et al. (2017) in their book "Instructional Design for Learning: Theoretical Foundations,"

which discusses educational planning.

Anderson (1995) suggested teaching strategies that encompass a comprehensive understanding of procedures, utilizing expository and discovery methods, incorporating feedback, and emphasizing regular practice to achieve automatization. These concepts are fundamental to formulating effective teaching methodologies. Teaching strategies based on Anderson's theory were employed in the capstone project course, using the expository method by explaining the conceptual framework within the interior design process as per Yanksari (2020) and the discovery method through assignments and practical tasks interspersed with constructive feedback. Consistent design practice throughout the semester aimed to help students reach an autonomous stage of procedural knowledge.

3.1 Course Description.

The course involves completing graduation project research, emphasizing applying acquired knowledge, skills, and techniques to create an interior design that satisfies functional, aesthetic, and environmental criteria. Students are responsible for preparing the architectural program, planning, analyzing, and developing space, selecting and distributing furniture and materials, and studying the impact of location, lighting, and acoustics. The course requires practical design skills for a project area of at least 2500 m² in an interior design field approved by the supervising teacher. It includes theoretical research comprising pre-design studies, analytical evaluations of existing structures for reuse or rehabilitation, and the proposed function. This involves examining project elements, design standards, spatial relationships, user demographics, and specific project requirements that inform the interior design program. The course also covers the application of design principles and interior design standards (e.g., accessibility and safety) and the development of strategies to solve design problems creatively. Students are expected to present projects and executive drawings using computer-aided design tools. Additionally, the course instills values such as self-assessment of tasks and project completion (Capstone Project Description, 2024).

The course structure is based on Anderson's ACT-R learning theory, which outlines the development of procedural knowledge in three stages: cognitive, associative, and autonomous. In the cognitive stage, students acquire fundamental knowledge of the conceptual framework of the design process. During the associative stage, the students practiced their skills through assignments. In the autonomous stage, continued practice leads to skill automation (Anderson, 1995; Asojo, 2012). The course includes nine assignments reflecting on readings and five practical assignments to fulfill design project requirements, thereby achieving procedural knowledge.

3.1.1 Cognitive Stage of Procedural Knowledge.

During the cognitive stage, the students comprehensively understood the design process as outlined in the conceptual framework. They understood the sequential order and patterns inherent in the design process, gaining insight into the activities involved in both the Schematic Design (SD) and Design Development (DD) phases. The SD phase comprises three stages, and the DD phase comprises three.

In the SD phase, students engaged in early design decision-making through a hybrid exploration of design methods. According to Yanksari (2020), this process comprises several steps:

1- Initial Concept Development: This step involves selecting and generating concepts, examining them, and executing ideas.
2- Exploration of Forms: This phase clarifies the design concept by analyzing existing structures, spatial relationships, space planning, identifying conflicts, and creating custom designs.
3- Accommodation of Human Needs: Students employed 2D/3D views to assess space requirements and functionality, taking into account accessibility, universal design principles, ergonomics, proxemics, and anthropometrics.

In the DD phase, students made late design decisions using computer applications. According to Yanksari (2020), this phase is as follows.

1- Validation of Design Decisions: This was achieved through trial and error using 2D/3D views.
2- Exploration of Details: This includes the Reflected Ceiling Plan (RCP) design, material testing, lighting analysis, and detailed development.
3- Final Decision Execution: This involves trial and error, refinement, draft rendering, and layer execution.

Through these stages, the students developed a foundational understanding of the procedural knowledge necessary for effective design (Figure 3).

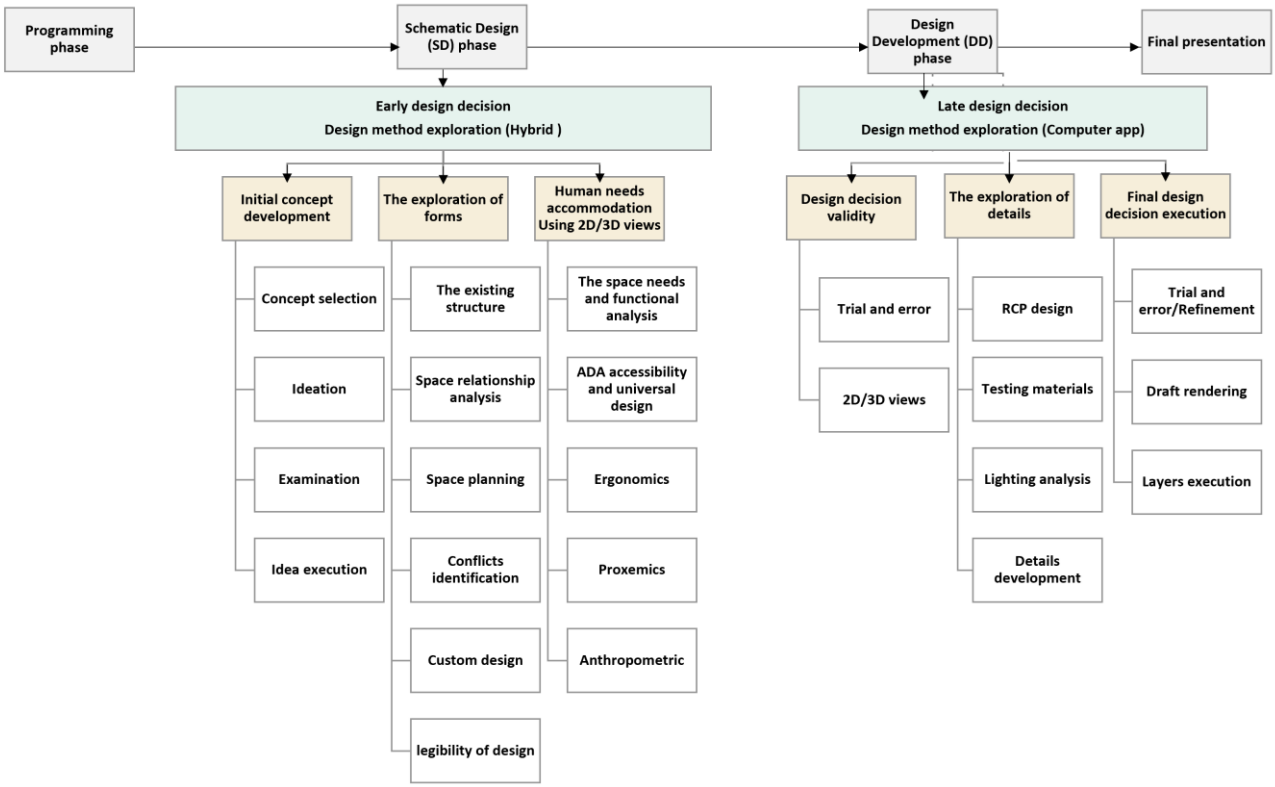


Figure 3. The conceptual framework of the design process by Yanksari,2020

3.1.2 Associative Stage of Procedural Knowledge.

Figure 4 illustrates the differences between the documented processes in the Schematic Design (SD) and Design Development (DD) phases. In this project, students engaged in the associative stage of Anderson's ACT-R learning theory by implementing the framework and documenting both the SD and DD phases. This documentation was organized into a table to serve as a comparative method, allowing for an analysis of the development applied to the design from inception to completion. Desk critiques and juror reviews have provided essential assessments of student learning. Throughout the project, students adhered to the design process outlined in the conceptual framework (Figure 4).

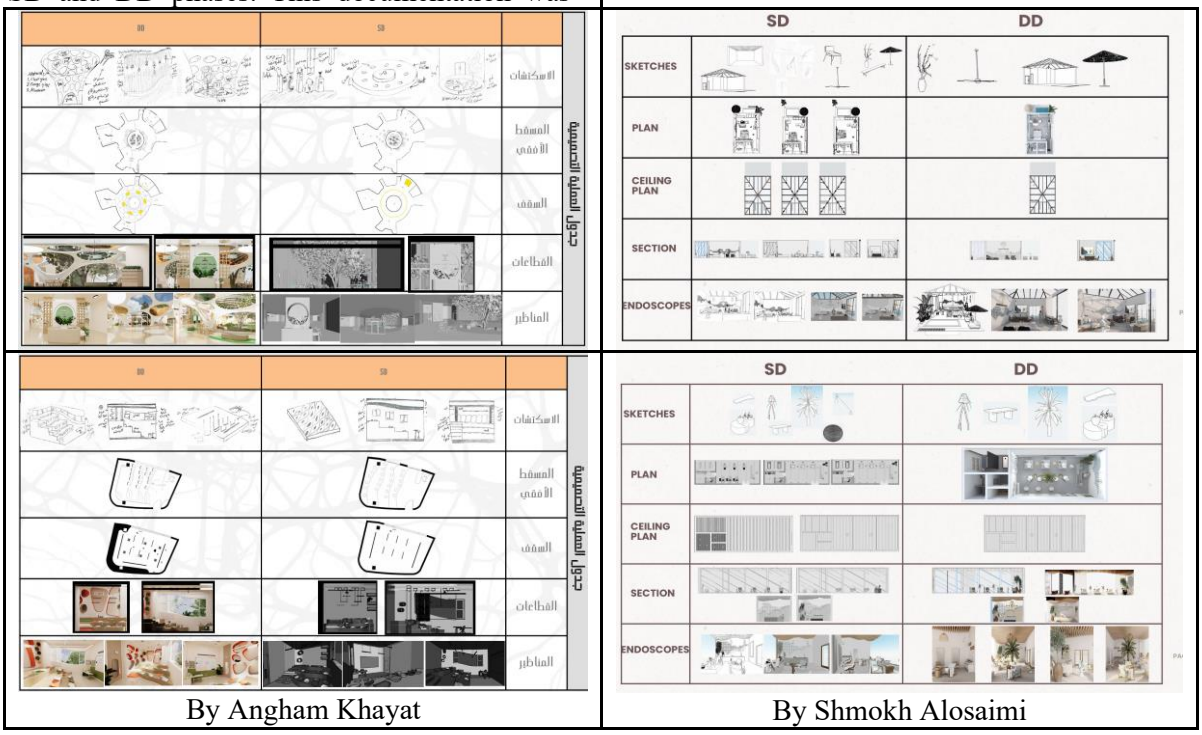
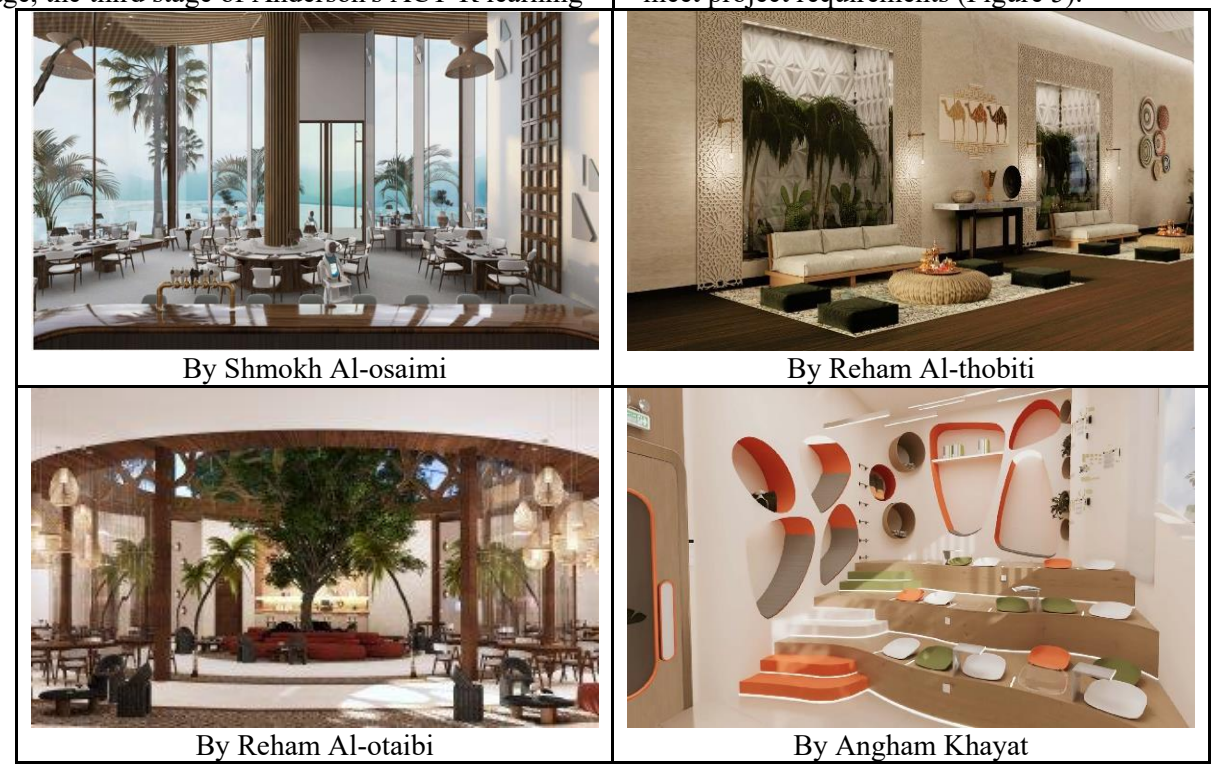


Figure 4. Some document samples that the students performed during the second stage implemented the conceptual framework of the design process.

3.1.3 Autonomous Stage of Procedural Knowledge

Through continued practice of the design process and applying knowledge gained from prior assignments, students advanced to the autonomous stage, the third stage of Anderson's ACT-R learning theory, in the context of this project. In the final assignment, the students achieved an autonomous stage, as evidenced by the outcomes depicted in Figure 5. These final deliverables demonstrate the student's ability to provide insightful solutions that meet project requirements (Figure 5).



By Shmokh Al-osaimi | By Reham Al-thobiti

By Reham Al-otaibi | By Angham Khayat

Figure5. Some students' outcomes after implementing the conceptual framework of the design process.

3.2 Class Activities.

The students acquired substantial knowledge of the design process and various design theories through demonstration lectures and assigned readings. Additionally, they develop advanced skills, including comprehension, application, analysis, synthesis, and evaluation. The instructional methods employed included a flipped classroom approach, discussions, presentations, demonstrations, critiques, and feedback sessions.

Results:

4.1 Content and Internal Consistency Validity and Reliability of the Measuring Instrument.

The questionnaire was initially presented to a panel of ten specialized and experienced arbitrators from the Faculty of Taif University. Internal consistency was assessed by calculating the Pearson correlation coefficient, which revealed strong direct correlations between the axes and the total score, all significant at the 0.01 level. This indicates a high degree of internal consistency in the questionnaire. The reliability of the questionnaire was further confirmed through the calculation of Cronbach's alpha coefficients, which yielded values of 0.92 for the associative stage, 0.89 for the autonomous stage, and 0.88 for the cognitive stage. These results indicated a high overall reliability coefficient of 0.95.

4.2 Statistical Data Processing:

The data were coded and input into a computer, where they were processed and analyzed. Statistical results were then obtained using the Statistical Package for the Social Sciences (SPSS). The data analysis involved the use of the following statistical tests and procedures**:**

- Pearson's correlation coefficient.
- Alpha Cronbach.
- Frequency and Percentage Distributions: These were used to assess the response patterns for each of the independent and dependent variables being studied.

4- Mean and Standard Deviation:

To address the research questions, the mean and standard deviation of the dimensions of the measurement instrument were calculated. These dimensions were then organized in descending order based on the mean for each dimension.

4.2.1 How does the conceptual framework of the design process affect the cognitive stage?

Table 1. The measuring instrument dimensions of the cognitive stage, arranged in descending order

Dimension	Mean	Std. deviation	coefficient of variation (CV)	Rate of CV	Response rate
It is helpful to understand the design process theoretically before practicing it.	4.85	0.577	97	1	Strongly agree
During the design development phase, the conceptual framework informed you to explore and develop design details, including ceiling designs, material selection, and lighting.	4.83	0.376	96.67	2	Strongly agree
The conceptual framework informed you to explore alternative design solutions in the design planning process.	4.72	0.666	94.33	3	Strongly agree
The assignment prompt sheet served as a tool for raising students' awareness of the design process and guiding them throughout the design process.	4.7	0.619	94	4	Strongly agree
The conceptual framework informed you of the development of the design idea in the schematic design process.	4.65	0.799	93	5	Strongly agree
The conceptual framework helps you understand how the design idea develops through 3D graphics and virtual reality simulation in the design development process.	4.6	0.764	92	6	Strongly agree
I am aware of the design process before taking the graduation project course.	4.43	0.909	88.67	7	Strongly agree
I am aware of the full details of the design process before taking the graduation project course.	4	1.164	80	8	Strongly agree
The effect of the conceptual framework in the cognitive stage	4.60	0.73	91.96		Strongly agree

The effect of the conceptual framework in the cognitive stage was at a response level of (strongly agree), where the general mean was 4.60 and a standard deviation of 0.73 with a CV of 91.96%. The author credits the results to the beneficial impact of the conceptual framework during the cognitive stage. It was noted that the students strongly agreed that it is helpful to understand the design process theoretically before practicing it, with a CV of 97%. In examining the conceptual framework's impact on the design process's cognitive stage, notable differences in the means and coefficients of variation were observed. Students strongly agreed with the significant influence of the conceptual framework during the design development (DD) phase, particularly in exploring and refining design details such as ceiling designs, material selection, and lighting, which yielded a CV of 96.6%. This impact was more pronounced than its influence during the schematic design (SD) phase, where students explored alternative design solutions, resulting in a CV of 94.3%. The conceptual framework's impact on the initial stage of the design process, specifically the development of design ideas in the SD phase, was associated with a CV of 93%. Additionally, the framework's role in aiding students' understanding of design idea development through three-dimensional graphics and virtual reality simulation during the DD phase was reflected in a CV of 92%. These findings indicate distinct variations in the conceptual framework's impact on specific stages of the design process. The DD phase, characterized by detailed exploration, exhibited the highest CV, followed by the SD phase's exploration of forms, the initial concept development in the SD phase, and the DD phase's focus on validating design decisions. Furthermore, the assignment prompt sheet effectively heightened students' awareness and guidance throughout the design process, with a CV of 94%. Conversely, the student's pre-existing knowledge of the design process details before the capstone project course registered the lowest CV at 80%, suggesting that the study sample had limited awareness of the intricate details and stages of the design process before introducing the conceptual framework.

4.2.2 How does the conceptual framework of the design process affect the associative stage?

Table 2. The measuring instrument dimensions of the associative stage, arranged in descending order.

Dimension	Mean	Std. deviation	coefficient of variation (CV)	Rate of CV	Response rate
The conceptual framework makes you understand the human needs accommodation in the schematic design phase.	4.82	0.57	96.33	1	Strongly agree
The conceptual framework makes the design process more explicit and more specific.	4.73	0.61	94.67	2	Strongly agree
Applying the design process's conceptual framework in the SD and DD schedule deepened my understanding.	4.72	0.67	94.33	3	Strongly agree
The conceptual framework made me realize that the final design comes after a series of renderings to reach the final decision execution in the DD phase.	4.70	0.77	94.00	4	Strongly agree
The conceptual framework makes the detailed operations more evident in the SD and the DD phases.	4.68	0.77	93.67	5	Strongly agree
The conceptual framework deepens the analysis of the design concept and its use in the forms within the space in the SD phase.	4.62	0.72	92.33	6	Strongly agree
The conceptual framework is a guideline students can use to identify weaknesses in their design process.	4.55	0.81	91.00	7	Strongly agree
The conceptual framework makes me understand conflict identification within space planning in the SD phase.	4.55	0.77	91.00	٧	Strongly agree
The effect of the conceptual framework in the associative stage	4.67	0.71	93.42		Strongly agree

It is clear from the previous table that the effect of the conceptual framework of the design process in the associative stage was at a response level of (strongly agree), where the general mean was 4.67 and a standard deviation of 0.71 with a CV of 93.42%. The author credits the results to the beneficial impact of the conceptual framework during the associative stage. The analysis revealed that students strongly agreed with the significant impact of the conceptual framework on clarifying and specifying the stages of the design process, as evidenced by a high CV of 94.6%. Distinctions in means and coefficients of variation warrant mention. The students acknowledged the framework's substantial influence in understanding human needs accommodation during the schematic design (SD) phase, reflected in a CV of 96.3%. Also, it influenced the students' recognition of the iterative process of renderings leading to the final design decision execution in the design development (DD) phase, which registered a CV of 94%. Furthermore, the conceptual framework enhanced the analysis of design concepts and their application within the spatial forms in the SD phase, resulting in a CV of 92.3%. Similarly, the framework served as a guideline for identifying weaknesses in the design process and improved students' understanding of conflict identification within space planning in the SD phase, with a CV of 91%.

Consequently, the conceptual framework's impact on the design process's micro-stages varies. The human needs accommodation stage in the SD phase exhibited the highest CV, followed by the final design decision execution stage in the DD phase and, subsequently, the exploration of forms stage in the SD phase. Additionally, the results indicate that applying the conceptual framework in both the SD and DD phases expanded and deepened students' comprehension of the design process, as demonstrated by a CV of 94.3%. This application further clarified the micro-stages in both the SD and DD phases, with a CV of 93.6%.

4.2.3 How does the conceptual framework of the design process affect the autonomous stage?

Table 3. The measuring instrument dimensions of the autonomous stage, arranged in descending order.

Dimension	Mean	Std. deviation	coefficient of variation (CV)	Rate of CV	Response rate
The conceptual framework helps you be more thoughtful about design decisions and encourages you to explore more design solutions.	4.85	0.52	97.00	1	Strongly agree
The conceptual framework of the design process enhances my learning effectiveness.	4.80	0.58	96.00	2	Strongly agree
The conceptual framework of the design process helped me achieve autonomization in interior design.	4.80	0.58	96.00	2	Strongly agree
Applying the conceptual framework in the design studio deepened my understanding of the design process.	4.77	0.43	95.33	3	Strongly agree
The conceptual framework acts as a guide to help students evaluate whether they have reached the final solution.	4.77	0.59	95.33	3	Strongly agree
The conceptual framework allowed me to go through the design process with ease and mastery of the work stages.	4.77	0.50	95.33	3	Strongly agree

Dimension	Mean	Std. deviation	coefficient of variation (CV)	Rate of CV	Response rate
All the steps I learned from the conceptual framework of the design process helped me finish my project.	4.75	0.57	95.00	7	Strongly agree
The conceptual framework made me understand the importance of a trial-and-error approach during the DD phase.	4.68	0.70	93.67	5	Strongly agree
The effect of the conceptual framework of the design process in the stage of autonomous	4.77	0.56	95.46		Strongly agree

It is clear from the previous table that the effect of the design process's conceptual framework in the autonomous stage was at a response level of (strongly agree), where the general mean was 4.77 and a standard deviation of 0.56 with a CV of 95.46%. The author credits the results to the beneficial impact of the conceptual framework during the autonomous stage. The analysis revealed that students strongly agreed that the conceptual framework significantly contributed to their reflective approach in design decision-making and occasionally encouraged the exploration of additional design solutions, as evidenced by a CV of 97%. This framework facilitated the students' autonomization in interior design and enhanced their effectiveness within the educational process, achieving a CV of 96%. Implementing the conceptual framework within the design studio context deepened students' understanding of the design process. It served as a guiding tool, enabling students to self-evaluate their progression towards final solutions. This guidance streamlined the design process and resulted in mastery of the work stages, with a CV of 95.3%. Students also strongly agreed that the comprehensive steps learned from the conceptual framework were instrumental in the completion of their projects, reflected in a CV of 95%. Furthermore, the framework underscored the importance of adopting a trial-and-error approach during the design development (DD) phase, with a CV of 93.6%.

4.2.4 How does the conceptual framework of the design process affect the procedural knowledge in ACT-R theory?

Table 4. The impact of the conceptual framework of the design process on the procedural knowledge of ACT-R theory of interior design, arranged in descending order.

The axis	Mean	Std. deviation	coefficient of variation (CV)	Rate of CV	Response rate
The effect of the conceptual framework of the design process in the stage of autonomous	4.77	0.56	95.46	1	Strongly agree
The effect of the conceptual framework in the associative stage	4.67	0.71	93.42	2	Strongly agree
The effect of the conceptual framework in the cognitive stage	4.60	0.73	91.96	3	Strongly agree
The effect of the conceptual framework of the design process in the procedural knowledge in ACT-R theory	4.68	0.67	93.61		Strongly agree

The data presented in the preceding table indicate that the impact of the conceptual framework of the design process on procedural knowledge, as described by ACT-R theory, was perceived at a response level of "strongly agree." This is evidenced by a general mean of 4.68, a standard deviation of 0.67, and a CV of 93.61%. The author attributes these findings to the positive influence of the conceptual framework on procedural knowledge within the context of the educational process in interior design.

Students strongly agreed on the framework's impact during the autonomous stage, which achieved the highest CV at 95.4%. This was followed by the associative stage, where the framework's influence was also strongly acknowledged, resulting in a CV of 93.4%. Lastly, the cognitive stage was recognized for its impact, with a CV of 91.9%, ranking third in student agreement.

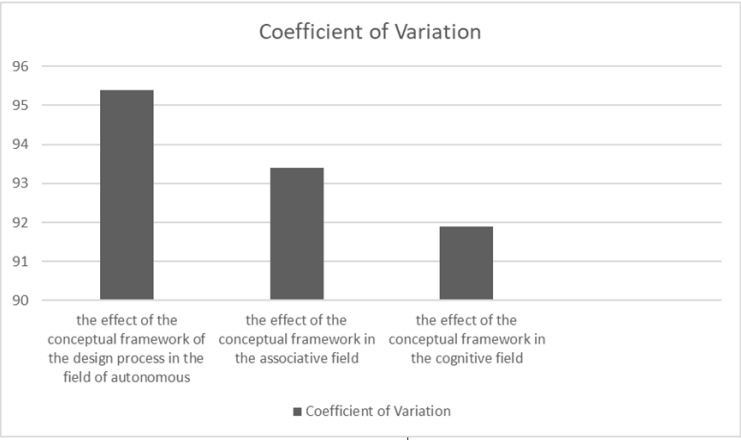


Figure 6. The positive influence of the conceptual framework on procedural knowledge within the context of the educational process in interior design.

DISCUSSION:

The findings reveal that the conceptual framework has varying impacts across different stages of the design process. It clarifies the stages and enhances understanding of human needs in the schematic design (SD) phase and the iterative rendering process in the design development (DD) phase. The framework enriches students' comprehension and clarity of the SD and DD phases of the design process. In Addition, it deepens understanding, aids self-evaluation, and streamlines the design process, leading to mastery of the work stages. It also highlights the importance of a trial-and-error approach during the design development phase. Overall, the framework is instrumental in completing projects and enhancing educational effectiveness.

The conceptual framework significantly facilitated the development of ideas. It provided a clear visual plan for the design process, delineating the sequence from the schematic design (SD) stage to the design development (DD) stage. This framework assisted students by enhancing their scientific understanding and offering a deeper and more comprehensive grasp of the design process. It effectively illustrated the distinctions between the SD and DD stages in a visual format, contributing to smoother initial phases of the design process by clarifying and detailing requirements before practical application. Furthermore, it underscored the importance of generating multiple solutions to design problems.

The steps outlined in the conceptual framework, with their precise detailing of the design process, facilitated the organization of the process, improved planning, optimized time management, and structured the thinking process, all of which aided in project completion. Additionally, the framework promoted creativity and innovation in design, ensuring accuracy, effectiveness, and efficiency in work. It helped understand and address user needs and highlighted the importance of employing a trial-and-error approach during development. Moreover, it established foundational guidelines for the project. The findings suggest that incorporating the conceptual framework as a fundamental component of interior design education in the first year is essential, with a recommendation for further development to maximize its benefits.

CONCLUSION AND RECOMMENDATIONS

The author names and abbreviates the conceptual framework, Yanksari's conceptual framework of the interior design process (YCF-ID). The data suggests that the conceptual framework significantly enhances procedural knowledge. This positive influence is notably strong during the autonomous stage, followed by the associative and cognitive stages, with students expressing strong agreement on its benefits in the educational process of interior design (Figure 7).

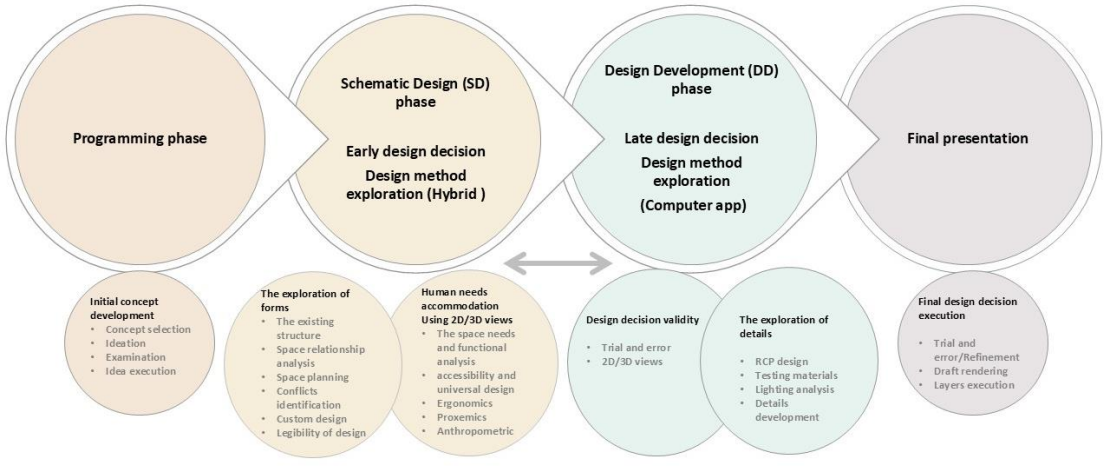


Figure 7. Yanksari's Conceptual Framework of the Interior Design Process.

The diagram illustrates Yanksari's Conceptual Framework of the Interior Design Process (YCF-ID), 2024. It outlines a process flowing through four main phases: Programming, Schematic Design (SD), Design Development (DD), and Final Presentation. 1) Programming Phase: This initial stage focuses on Initial concept development which includes concept selection, ideation, examination, and idea execution. 2) Schematic Design (SD) Phase: Characterized by early design decisions using a hybrid design method exploration. This phase involves the exploration of forms: Examining the existing structure, space relationship analysis, space planning, conflict identification, custom design, and legibility of design. Human needs accommodation: Utilizing 2D/3D views to analyze space needs and functional analysis, incorporating accessibility and universal design, ergonomics, proxemics, and anthropometric considerations. This exploration informs the design decision

validity assessed through trial and error and 2D/3D views. 3) Design Development (DD) Phase: Marked by late design decisions and design method exploration using computer applications. This phase delves into the exploration of details: RCP design, testing materials, lighting analysis, and details development. 4) Final Presentation Phase: This stage culminates in the final design decision execution, involving trial and error/refinement, draft rendering, and layers execution. This presentation incorporates the findings and developments of the previous stages.

Students' responses suggested enhancements to the YCF-ID to make it more comprehensible, particularly in the context of foundational education in interior design studios. Thus, this refined framework is intended for future educational and research endeavors, enabling easier integration and understanding in early interior design studies. As Wiley (2000) explained, the practical application of knowledge transforms explicit knowledge into implicit skill through practice. Anderson's guidelines on implementing ACT-R theory emphasize the necessity for students to receive a clear and explicit presentation of the processes to be enacted, along with strategies for effective execution. This aligns with the pedagogical approach of the YCF-ID, which will be further explored in subsequent research to assess its applicability at introductory levels. These findings corroborate those of (Yanksari, 2020; and Norbert et al. 2017). Yengin and Ince (2014) posit that step-by-step problem-solving methodologies can effectively instruct students in problem-solving techniques.

The author advocates for further investigation to evaluate the conceptual framework's impact on the educational process. This evaluation should employ various research methodologies, such as classic or quasi-experimental designs, to precisely assess the framework's efficacy. Such research would confirm the framework's effectiveness and contribute to its refinement and development of innovative teaching strategies in interior design education.

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