Designing a Design Thinking Model in Interior Design Teaching and Learning

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ABSTRACT

In the last three decades, research on design processes and methods has been the driving force behind the design science development; however, research on design process knowledge has not developed much in Indonesia. This research aims to answer the problems faced by interior design students when they have to complete a design task by applying specific design processes and methods. The choice of technique and method is influenced by the situation & conditions in which the design is carried out. The research was carried out using the "double diamonds" process and method with a problem-solving approach. The research analysis was carried out by examining students' design documents in the interior design course, conducting interviews with students and lecturers, and literature studies. Furthermore, an alternative process model and design method are more prepared to follow the needs and answer the Interior Design Study Program's problems when completing a design task. Research has succeeded in finding process models and design methods called a DT-DI model compatible with interior design students.

Keywords: design process; design thinking; design interior

ABSTRAK

Model Design Thinking untuk Pembelajaran Desain Interior. Dalam tiga dekade terakhir riset tentang proses dan metode desain telah menjadi motor pendorong perkembangan ilmu desain, tetapi di Indonesia riset tentang pengetahuan proses desain ini tidak terlalu berkembang. Riset kali ini mencoba menjawab permasalahan yang dihadapi mahasiswa desain interior ketika harus menyelesaikan rancangan dengan menerapkan proses dan metode perancangan tertentu. Pemilihan proses dan metode dipengaruhi oleh situasi dan kondisi tempat perancangan dilakukan. Pendekatan pemecahan masalah riset dilaksanakan dengan memakai proses dan metode milik "*double diamonds*". Penelitian akan dilakukan dengan memeriksa dokumen perancangan yang telah dibuat dalam mata kuliah perancangan interior, wawancara dengan mahasiswa dan dosen, serta studi pustaka. Selanjutnya disusun alternatif model proses dan metode perancangan yang lebih sesuai dengan kebutuhan serta menjawab permasalahan yang dihadapi mahasiswa Program Studi Desain Interior ketika menyelesaikan tugas perancangan. Penelitian telah berhasil menemukan satu alternatif model proses dan metode perancangan, disebut sebagai model DT-DI, yaitu *design thinking* untuk pembelajaran desain interior.

Kata kunci: proses desain; *design thinking*; desain interior

Introduction

In the last 80 years, the thoughts about design process has developed very dynamically, even in the last 30 years the design method has held a key position in driving the birth of many innovations made by teams of developers and Research & Development (R&D) institutions both commercial and non-commercial (Patter & Pastor, 2016). Design methods are currently used not only by designers and engineers to make product innovations and physical structures, but also by social activists

and business people to create innovations in the forms of social services. Therefore, design methods then appear more solid and become methods, techniques, and ways of thinking and working to solve problems in order to meet the needs of human life.

The study period of undergraduate students in the Department of Design usually lasts between 4 and 5 years. During this period they must complete a number of assignments or design projects. For example, in Interior Design Study Program (hereinafter referred to as PSDI), Faculty of Fine Arts, Indonesian Art Institute of Yogyakarta, there are currently 11 courses related to design. These eleven subjects are comprised of 6 Interior Design courses and 5 furniture and accessory design courses. Each of these courses requires one or more design assignments (*Buku Petunjuk Akademik* (Academic Handbook)*, FSR, ISI Yogyakarta 2019/2020*). In every activity of designing an interior or product, students are asked to apply a certain work process and way of thinking, which is often referred to as a design method. This strongly suggests that the design method is used intensively by PSDI students during their study period. There are many kinds of design methods that students can refer to, such as those offered by D'School Stanford University (2010), Tim Brown (2008), Double Diamonds (2005), DK Ching (1987), or Rosemary Kilmer (2014). Sometimes there are also design methods proposed by the team teaching of every course.

There are two things done in implementing the design method, namely the process and the design work method. The process refers to the steps from receiving a design request to the already-created design. Meanwhile, the work methods are all the activities, both mental and physical, which are carried out to complete the design steps. Nowadays, this design method is more popularly known as design thinking. Design thinking is indeed unique to design and is now widely adopted by other fields of science, of course with some adjustments. The design field that is divided into Visual Communication Design (VCD), Product Design (PD), and Interior Design (ID) also apply the design thinking with adjustments following the focus of the work that is being done.

Furthermore, it can be explained also that most reference design methods published are the series of design methods for professionals; therefore, those series of processes and methods of the work become long and detailed and somewhat difficult for the students to apply it. In addition to this, many lecturers complain that many students face a problem or obstacle when it comes to running the design method. Meanwhile, it is also difficult for these lecturers to provide sufficient time to discuss the process and design techniques in their classes because the design-related courses course already has a lot of material that must be taught to their students.

With this background, it is safe to say that it is important to conduct research on the existing design thinking that is practiced by the current PSDI students. It is also essential to identify the difficulties and also to establish alternative design thinking models that suit better for undergraduate students to complete assignments assigned in the design-related courses. Furthermore, this new design thinking model can be a model that is applied to the entire interior design study in PSDI undergraduate program.

Studies on design methods actually have been conducted by many, and within 80 years the development of the knowledge about design methods and innovation process has been increasingly dynamic and challenging because it has come about simultaneously with the recognition of the complexity of the problems and the rising needs of the people as well as institutions or community organizations to adapt to changes that constantly occur (Patter & Pastor, 2016). Eighty years is a really long journey and the design methods and the innovation process have impacted tremendously on people's lives in the world. In literature studies conducted on the design method issues, it has been identified that there have been no research on design thinking (DT) for interior design study. Apart from this, there are five points that should be highlighted, and these are the findings of these tliterature studies.

Firstly, it is the increasing importance of DT for design discipline and creation. The current design practice, in addition to demanding traditional

cognitive ability, also requires competence for innovation, management, communication, legislation, and the ability to handle pressures, so that the products are able to be marketed quickly. As a field of study the contemporary design, apart from being multidisciplinary, it also demands the designers to collaborate with other stakeholder domains, such as users, retailers, and people from the production department (Garner, 2005). Design thinking can be regarded as a meta-discipline, human-centered framework for generating innovation (Linberg, Noweski, & Meinel, 2010). Within the framework (design) contained the principles and approaches, methodology, methods, skills and capabilities, as well as the way of thinking and practice (Brown, 2008). In addition to being a strategic resource in business development, designers themselves have become increasingly entrepreneurial as many designers are then involved in business development activities (Muratovski & Butler, 2015). In search for strategies to solve problems that arise in the world of work, some organizations have turned to the design profession and strive to adopt the tools and techniques of design thinking (Doorst, 2019; Meyer & Norman, 2020).

Secondly, DT has many benefits not only in creation, but also in other areas, such as education, public health, and other field of studies. (Noweski et al., 2012) argues that design thinking for non-designers provide skills and contemporary competence to conduct research, framing, and creative engagement with complex and ill-defined problems. Studies have proven that with DT educators can compile a design curriculum and develop courses with a wider applicability (Orthel, 2015). Quoting Friedman (2019) that the current challenge is to create a new context for the design process. Some new forms have appeared to respond development, tools, situations, and new technologies. Meyer & Norman (2020) offer a suggestion to expand the taught materials and divide the new challenges in the design into four groups – the performance challenge, systemic challenge, contextual challenge, and global challenge.

Thirdly, DT requires critical and creative thinking ability. Some research suggests that creative

and critical thinking is becoming increasingly important in the arena of global society that talented people and/or designers need to adopt it. Design Thinking (DT) is rich with creative and critical thinking skills (Shively et al., 2018; Triatmodjo, 2014). Likewise, Garner states that when one is teaching design it is necessary for the teacher to develop two forms of intelligence and at the same time build awareness of it. This is in line with Friedman's statement that design study asks a critical balance between inquiry and reflective practice, which combine the process of knowing and doing (Friedman, 2000; Garner, 2005). Research on five majors/departments at five different universities in Canada that provide similar course to design thinking found that the DT delivered involved analytical and creative thinking (Donar, 2011). Other research has confirmed that today's interior designers need two main abilities, namely the ability to think critically to handle increasingly complex design problems and the ability to apply the design process and engage in creative problem solving (Carmel-Gilfilen & Portillo, 2010).

Fourthly, DT can be a cycle of knowledge development and practice of design. An interesting research was conducted by Chon and Sim; they investigated the application of design thinking methodology as an approach in design education. The framework of the preparation of the knowledge can be described illustratively as nonlinear, circular in structure, ranging from the theory (designerly knowing) to practice (design thinking) and research (design knowing). It is also stated that as knowledge, design can be transmitted through practice, process, methodology, and reflection (Cross, 2006). Citing Poggenphol that research and practice can build a theory, then the theory requires confirmation to be proven through research while the practice can foster the need for research, and research is to create the theory; likewise, research can also improve the performance of practice (Poggenpohl in Chon & Sim (2019).

Fifthly, DT may be difficult, but it can be learned and get accustomed to. Chon and Sim also assert that research projects for undergraduate (S-1) students must place the learning as something embedded in social practice in order to encourage

knowledge creation through participation. Initial studies emphasize the importance of learning through team work and social activities to improve the five-steps of design process. DT provides a clear group collaboration process and an interdisciplinary team to build (process) research and analysis, reflection, and ideation (Chon &Sim, 2019). In other research, it is also stated that students need to get used to (learning) working in groups and carry out consensus and consensual action among them (Triatmodjo, 2014).

Some of the theories that become the basis for conducting the research are the theory by Jones (1970) on complexity in design activities, the theory by Cross (1982) on designerly way of knowing design, the theory by Kelley & Littman (2002) on design thinking, and finally Ching (1987) theory on information that must be managed when designing interiors. In his book Design Methods, Jones asserts that in the modern era, new design methods are needed to overcome three problems, namely the complexity of problems in design objects, complexity in design work (involving many parties), and complexity in the mode of feeling and design thinking. (rational, logical, imaginative, expressive). In this book, Jones also states that the the design method is a process of externalizing and visualizing the thoughts of the person or parties involved in the process (Jones, 1970).

The second theory by Cross that is presented in his writing piece on Designerly Way of Knowing explains that there are five aspects in ways through which designers understand design objects, namely (1) the designer handles the ill-defined problems, (2) their mode/way of solving the problems focuses on the solution, (3) their mode/way of thinking is constructive, (4) they use 'codes' to translate the requirements of the abstract objects to become concrete objects, and (5) they use codes to 'read' and 'write' on object languages (Cross, 1982). In this theory, Cross emphasizes the procedures that must be practiced by designers.

Meanwhile, Tom Kelly is the founder and CEO of IDEO, a company engaged in the R&D of world-class products; therefore, there is no doubt that this company has a powerful method for generating many new innovations. Kelly was a pioneer in using the term design thinking (DT) as an enrichment of the design method concept of previous design thinkers. This term was then widely used in the world of design and business. Kelly's main focus is in the area of product design. In their book The Art of Innovation IDEO, Kelley & Littman (2002) mention five basic steps in design thinking (DT), namely: (1) understanding the market, clients, technology, and the constraints that may arise; (2) observing people in real life situations; (3) visualizing new concepts to the team and customers; (4) evaluating and refining prototypes repeatedly and quickly; and (5) applying the new concepts for commercialization.

Furthermore, as a study on interior design objects this research requires the theory by Ching (1987) that is on information for interior design. In his book Interior Design Illustrated, Ching (Ching, 1987) states that, in general, there are seven things that must be checked, namely: (1) user requirements, (2) activity requirements, (3) furnishing requirement, (4) space analysis, (5) dimensional requirements, (6) desired quality, and (7) desired relationship.

Methods

This study takes the object of observation of a design method (design thinking) applied by the interior design students when they learn design through courses they have enrolled in. This is a research-led design (Sanders, 2006), a research-based design, an activity of creating works based on research that is conducted before hand on the design object and its users. The research is conducted in the Interior Design Study Program, Faculty of Fine Arts, Indonesian Art Institute of Yogyakarta. The approach used is a problem-solving approach with the hope that this research can reveal difficulties faced by students when they apply a process model and a design method. Furthermore, the real needs and problems faced by the students in the use of design thinking when completing the design process can also be discovered. The final outcome of this research is the drafting of an alternative model of process design or design

thinking (DT), which can be used in learning by the students of Interior Design Study Program (hereinafter referred to as DT-DI).

The population of this research is the works of interior design accompanied by the experience of the students designing these works and the lecturers of Interior Design Study Program who teach the courses. The sample of this study consists of several courses in the odd semester of 2019/2020 academic year. It is because in the odd semester, there are four interior design courses belonging to different levels; 6 students and their works are taken from each class as samples, and 8-12 lecturers are also taken as samples. The methods of data collection are comprised of literature study, studying design document of student's works, and interview with both the students and lecturers.

With regard to the method of analysis, by referring to the research-led design, this research and the creation are conducted using the Double Diamonds model (Council, 2004) with the order of the research implementation that consists of: (1) discover, to understand the situation existing around the object designed, meeting the users (student and lecturers) to find out their needs; (2) define, by using the findings of the first phase, the researcher formulates the problem to be solved in the new DT design; (3) develop, the researcher begins to develop the idea based on the discovered problems, apply new perspective as much as possible to solve the problem; and 4) deliver, conducting a small test on the offered alternative; the test is conducted by FGDs participated by lecturers of the undergraduate study program.

Results, Discussion, and Design

Results

By using the collected data, the subsequent step is sorting and structuring the data according to the research framework that has been made. Broadly speaking, the results of the research are presented into three sub-sections, namely the pattern of using the process, the pattern of using the method, and the pattern of the needs for the DT model for interior design learning (DT-DI).

1. **Process Usage Pattern**

The results of data reading for the process usage pattern are: (1) the process staging carried out in each interior design course (there are four courses) is not similar and the four courses are not mutually sustainable; likewise, the process staging given to the design methodology course is not yet directly related; (2) the process staging found and always present in the four courses is the collection of field data, both physical and non-physical data, as well as the ideation step; (3) the process staging that is often overlooked in the interior design courses is the design evaluation that is due to limited time of the semester; this evaluation is comprised of two elements: the evaluation phase on the design and the on the teaching-learning process; (4) the students state that congestions can occur when they carry out the process staging, and this is due to the design object, communication with lecturers or clients/users, problems with students; and (5) process congestion is more common in the ideation process; this is especially observed in the Final Project (the final course). The cause of this congestion is still unclear; this is brought forward during the FGDs with the lecturers after the data collection.

2. **Method Usage Pattern**

The next data reading is the method usage pattern; these are: (1) students are well acquainted with some methods, such as field surveys, design schematics, mind mapping, mood board, and brainstorming; (2) they have not been introduced to many methods for the creative process and evaluation; (3) they are frequently biased or overlapping in terms used to denote a process or method; (4) they are not observant and critical in raising problems or perspectives in the process of exploration and ideation/developing ideas; and (5) there is no agreement on the must have method for the students.

3. **Needs Pattern**

During the interviews with either the students or lecturers, the matters related to their needs in relation to the processes and method of thinking and working while working on

their design assignments. The need pattern of the students and lecturers on the process model and interior designing method during the teaching-learning process consists of: (1) a complete and clear information system with regard to things that must be done (process and method) in one interior design series; (2) students need to know their positions and actions that must be taken at each step of the process; (3) the process needs to be clear and consistent in its structure and main steps (during their study period from interior design course 1 to 6), these courses do not have to be similar, but there must be a common theme connecting DT in the six courses; (4) showing the process of change from an abstract idea to a concrete object; and (5) there is a need to include the technique of thinking and work, both rational (analytical) and imaginative (creative), to be able to be applied is each steps.

Discussion of the Results

In the following discussions, the first point that is explained is the basis of thinking in developing the model for the process and as a method of working and thinking, and this should be able to address three issues, namely the complexity of the object, the complexity of the parties involved, and the complexity of thinking and working activity. This activity is the externalization of ideas and thoughts that require various forms of visual communication.

This section is divided into four parts, which are the description of the problems encountered, the design concept used in preparing the alternative model of DT in learning interior design (DT-DI), information managed in the DT-DI, and methods that can be used to work and think in DT-DI.

1. Encountered Design Problems

Furthermore, by paying attention to the dialogue that occurs during the data collection, accompanied by the re-reading of the record data and facts written and illustrated in the design documents belonging to the student, it can be concluded that the main problem encountered by students related to design thinking is how

create a composition of Design Thinking (DT) model, which is concise, comprehensive, easily understood and implemented, and able to show the informations that must be managed, the process being conducted, and the method used in the interior design.

2. Model Design Concept of DT-DI

This design concept applies the four principles of design proposed by the Design Council UK, namely: put people first, collaborate and co-create, communicate visually and inclusively, and iterate 3x to maximize the result/outcome (Council, 2004).

The concept being referred to here is comprised of some basic statements (assumptions) that become the bases for finding alternatives to the DT-DI model, namely: (1) the compiled model is used in the context of teaching and learning process (PBM) interior design, especially for undergraduate or diploma students; (2) the model being developed adopts and combines several existing design thinking models in the community; and (3) the model shows information and methods that are relevant and suitable for working on interior design and are also in accordance with the steps in the design process.

Designing a Design Thinking Model for Interior Design Teaching and Learning (DT-DI)

In taking the first step in design development, it is necessary to refer to the opinion of Lindberg et al. (2011) regarding the functions and objectives of the design process. It is stated that the design process was initially intended to provide clarity on the problem area, solution area, as well as the constant adjustment area. Furthermore, it is said that the design method has more benefit for designers in relation to seven things: (1) paraphrasing of design challenge, (2) restriction of the free thinking, (3) an associative network of knowledge, (4) explorative generatition of ideas, (5) multiple idea re-presentations, (6) conscious selection of solution paths, and (7) complementary team members. Therefore, it is important for the aspiring

designers to properly master the issues of this design method.

In the overall model developed, this explanation is tried to be implemented in it. The development of DT-DI model is divided into three preparation steps, namely the interior design process, information that must be managed in interior design, and interior design methods.

1. Series of Interior Design Process

For the interior design process, there are two models that are referred to, namely double diamonds and design thinking model from D-School Stanford University. The first is the double diamonds model, which was created through in-house development by researchers working with Design Council UK.. It has a distinctive shape and easy to remember; this model forms a simple double-diamond shape [information from students]. The form is to describe the design process that needs to be run. There are four phases, namely Discover, Define, Develop, and Deliver, and each step goes into a half of each of the diamond squares. One diamond represents a cycle, which is exploring the problem broadly and deeply (diverging) and then taking firm action by centering or focusing (converging). With two diamond squares, it means that there are two divergent and convergent cycles; these two cycles indicate that in design there are cycles of researching and concluding and working with non-physical conceptual matters, as well as a cycle of experimentation, trial and error, and working with formal physical matters. The second one is the D. School Design Thinking Process Model that was developed by Hasso Plattner of the Institute of Design, Stanford University. In Plattner's description, it is explained that the elements that underlie this process are empathy, prototypes making, collaboration, iteration, and feedback. The process

is taken from engineering method and design, combined with the ideas of art, techniques of social sciences, and insights from the world of business (Patter & Pastor, 2016).

The suggestion expressed in the FGDs regarding the provisional findings of the research is to make two asymmetrical diamonds. Based on the internet search, it is known that there is already a design consultant who combines D.School's Design Thinking model with the double diamonds from the Design Council UK. Watson & Associates from the Netherlands developed this model as a part of trainings they provide for people who are interested in learning design thinking in an informal manner. The model is intended to be used in the design process in general, such as interior design (ID), communication and visual design (CVD), product design (PD), and even for technique and social engineering (Watson & Associates, 2019).

Meanwhile, in this research the adoption of the two models is based on the idea that the stages in the HP's models, namely emphaty, define, ideation, prototype, and test, are very appropriate and more complete and detailed than those in double diamonds. On the other hand, double diamonds were taken as a part of the proposed merger because visually the image of the two diamonds shows two groups of processes, namely the more analytical conceptual group and the more creative formal group. Both groups contain the steps that widen and constrict the procedures and ways of thinking. By seeing the picture, it is expected to direct the users of the models (students) to think between divergent (widen) and convergent (constrict) viewpoint, which means between analysis and synthesis. Nevertheless, it must be admitted that with this combination the
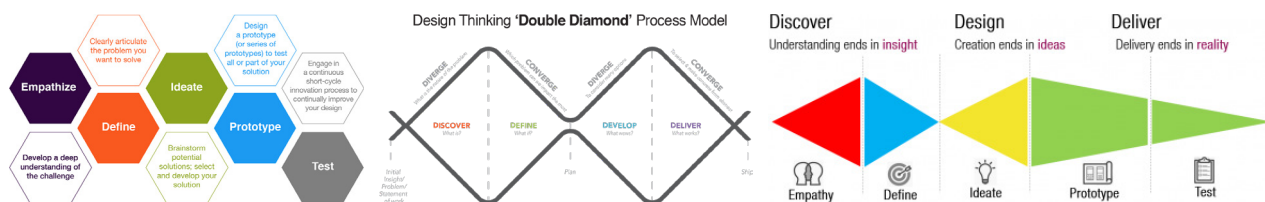

Figure 1. The Design Thinking Model developed by Watson et al. Source: Watson & Associates, NL, 2019.

blend looks asymmetrical because the steps and the images are not aligned. The FGD with PSDI lecturers broadly agreed with the merging of DT and double diamonds, and the lecturers suggested asymmetric shapes of diamonds. This is to accommodate the needs of the details and clarity of the process description.

2. The Information Structure for Interior Design

Referring to the theory of Jones that the design method is a form of externalization of thinking of those involved in the work process of designing that should contain information about the objects designed, enabling communication between the parties involved, and showing the process steps along with the working tool as well as the relationship between one thing and another (input-output, cause-effect, priority scale). This means that in the design thinking model there must be information and communication tools as well as staging and working tools.

It is also important to pay attention to the theory of Cross, numbers 4 and 5 that: "4) They use 'codes' to translate the requirements of the abstract to become concrete object, 5) They use
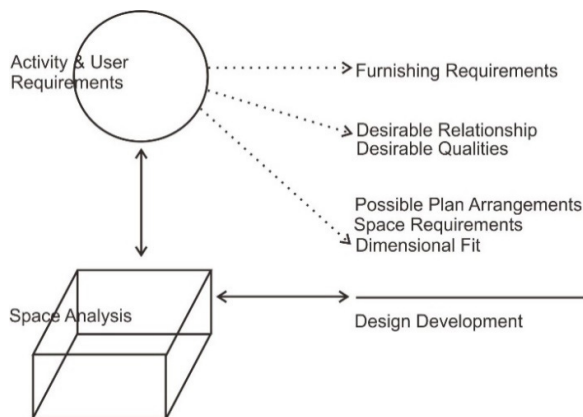
this 'codes' to 'read' and 'write' in the languages of the object" (Cross, 1982). 'Codes' can be defined as practice procedures, namely process and methods/techniques, and inside these also include the things that must be handled to complete the design work. In the context of this research, the codes come from the interior design discipline.

Meanwhile, Ching in his book Interior Design Illustrated mentions that there are seven categories of important information to use for interior designing (1989), and he illustrates these in the following chart.

Furthermore, Triatmodjo (2014) presents an information system arrangement for interior design. The arrangement is the result of the summary of Ching (1987) theory and modifications in teaching practice of interior design in PSDI, FSR, ISI. Based on the system, it can be stated that the first and main functions of the interior space component are the space users, user' activity, and the interior space. The three components are linked with one another and produce the needs of every user activity on the dimensions of space, spatial relations, furniture/ equipment/facility of the space, and the space quality. In the next section the space dimension and spatial relation result in the design of zoning and circulation, while the furniture/equipment/ facility of the space, and the space quality result in a design of the furniture/equipment/facility of the space, and the lighting, sound setting, circulation, and room atmosphere. In the final section is the result of the design in the form of layout of the room, interior elements' configuration, material scheme, and color schemes. See Figure 3 below.

Figure 2. Ching Diagram: Information for Interior Designing. Source: Ching 1989 with adjustments by Triatmodjo, 2020.
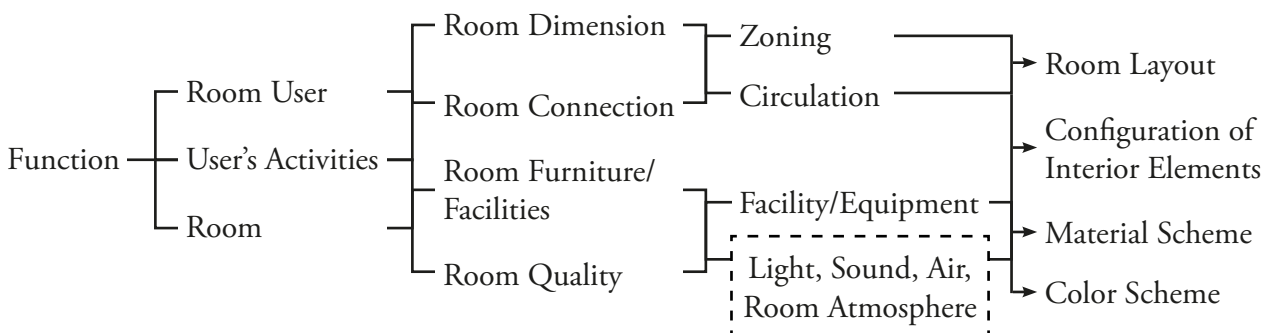

Figure 3. The structure and information flow for Interior Design. Source: Teaching Material of Triatmodjo, 2010.

Additional information contained in the book (Kilmer & Kilmer, 2014) is quite long and detailed in that it describes the journey of professional design process, starting from the emergence of demand up to the realization of a real and 3 dimensional space design that is utilized. Killmers explains that in the diagrams that he has made, the complex problems are divided into simple steps covering the series or stages of design process, purpose, designer terms, project development, and communication between stakeholders. Several technical terms and their explanations contained in Kilmers's book were adopted in the DT-DI model compiled in this creation research.

3. Various methods for Interior Design

Meanwhile, the methods compiled in this section are mostly the methods that have been used by students in doing assignments for Interior Design (a course). The other methods are taken from the methods contained in the book referred to by the researcher, such as Kilmer, 2014; Design Council UK, 2004; and Martin et al., 2016. In the research report there are around 45 methods that have been briefly described as how they work and their uses. In the proposed model, the 45 methods are divided into five design steps. In the journal article, the methods are not explained one by one but only listed; all methods are integrated and described in the proposed DT-DI model.

4. Proposed Design Thinking Model for Interior Design Teaching and Learning (DT-DI)
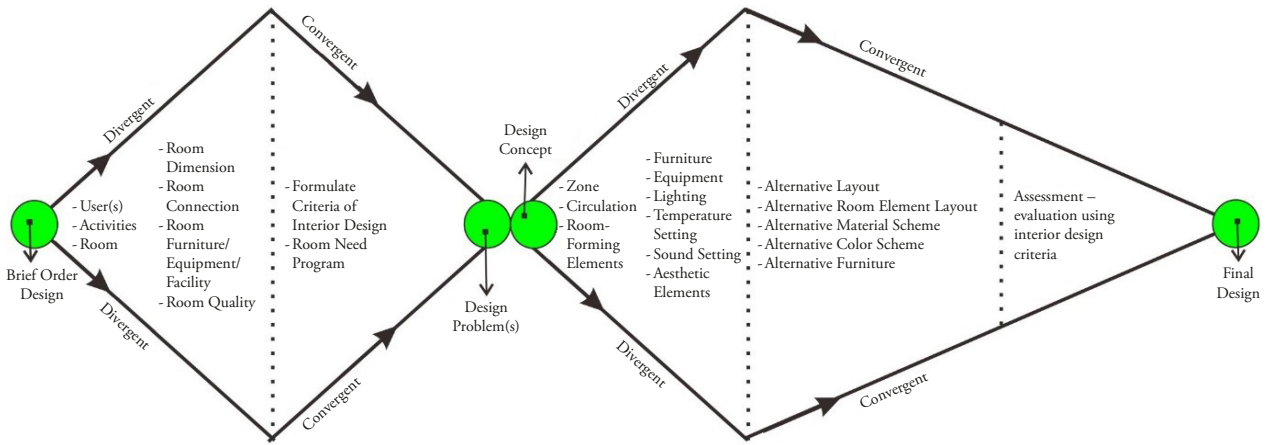
In this last section is presented a picture of the final DT-DI model, which is an arrangement of three main components, namely the process stage, the information managed in the process, and the methods that can be used to complete the work in each stage of the process.

The detailed explanation of the proposed DT-DI model is based on the steps of the process, namely: (1) Empathy, which is the step of exploring the life experience of the design user; the designer is expected to understand their thoughts and feelings to formulate the real needs of the design user. The empathy process can be carried out through observations, involvements in daily activities, in-depth interviews, and literature research; (2) Define, which is a stage to determine three issues – criteria, list of needs, and design problems. There are usually four criteria in interior design, namely function, economy, aesthetics, and symbols. The list of needs is all types of equipment, tools, and room conditions (in terms of quality and quantity) that must be available for the space

Table 1. List of design methods in interior design according to the process stages.

No.	Empathy	Define	Ideation	Prototype	Test
1.	Users Observation	Select and compact	Theme	Prototype	Role Play
2.	Behavioral mapping	Interpret	Style	Bubble diagram	Story board
3.	Client interviews	Find the meaning	Brainstorm	Spatial relation matrix	Make criteria
4	AEIOU	Create program	Design Charette	Mood board	Make criteria
5.	Literature Review	Find insights	Buzz session	Mind mapping	Feedback
6.	Physical & Field Data	Framing the opportunities	Group discussion	Mockup	Test
7	Questionnaire	List of needs	Synectic	-	Choose
8	Survey	Define the Design problems	Scenario	-	Take Lessons
9	Appreciation of the design object	Concept statement	Visual exploration and experimentation	-	-
10	Participant observation	-	Tactile exploration and experimentation	-	-
11.	Field trip	-	Conduct experiments	-	-
12.	-	-	Schematic	-	-
13.	-	-	Sketch	-	-
14.	-	-	Graphic Notes	-	-

Source: Triatmodjo, 2020.

Empathy	Define-Ascertain	Ideation	Prototype	Test-Evaluation
- Observation on user(s) - Interview with client (s) - Surveying user(s) using a questionnaire - Literature study - Field and physical data - Appreciating object's design	- Interpret the finding - Discover its meaning - Identify the theme - Choose and compact - Find an insight - Put opportunities in a framework - Make program	- Brainstorm - Jam/Charette - Exploration, visual and tactile experiment - 3-D shape experiment - 2-D sketch - Graphic notes - Mood board	- Prototype - Mock-up - Role play - Creating a story	- Test, assessment - Weighing - Feedback - Lesson learned

Figure 4. Proposed design thinking model for interior design teaching and learning. Source: Triatmodjo, 2020.

users' activities to be carried out properly; it is also known as programming. Design problems are gaps that occur between existing conditions or situations and conditions or situations that are expected to exist by space users; (3) Ideation, which is the stage of opening the widest possible space for the ideas to be born to answer design problems. At the beginning of the ideation stage, the design concept is usually briefly presented, namely the assumptions or basic thoughts that become the basis for finding solutions. Some of the methods commonly used at this stage are brain storming, visual, tactical, and formal exploration and experimentation, or through 2-D sketches; (4) Prototypes; after many ideas have been generated, the one that appears good and can best answer the design problems is selected, then a more tangible prototype, such as model or form made of clay or other soft materials is made. The prototype is distributed to the team members or to prospective users to get feedback which is then used to revise

the design; and (5) Test-Evaluation, which is the design proposal stage in which the design is nearly complete, and it is assessed using predetermined design criteria. In these test, those who assess are the parties outside of the design team, such as the legal authority, the clients, and the users.

Conclusion

From this study, it is concluded that one model of Design Thinking for interior design teaching and learning (DT-DI) has been created. This is an alternative model that can be applied by undergraduate students of Interior Design Study Program while working on designs in the design-related courses in all semesters.

Thi model consists of five stages in its process, namely Empathy, Define, Ideation, Prototype, and Test. The proposed model includes information and achievements that must be considered and accomplished at each stage of the process. This

model also features a list of 45 different thinking and work methods that can be used to complete the work involved in each stage of the process.

This study also provides recommendations for the application of DT-DI in each design-related course with different different emphases. An emphasis can be placed on each of the steps, on the methods applied, on the information extracted and collected, and on the achievement targets for the any assignment in any design-related course a student is enrolling in.

In addition to the fact that it is taught in Design Methodology (a course), the DT-DI model will be practiced successfully by the students when lecturers of design-related courses are always consistent to explain the design thinking method at the beginning of each semester. In addition, at every turn of the stages the students should be given explanations and understanding of the meaning of the staging, information, and methods to be used

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