

Chapter 2 – Literature Review

Section 1 – Digital Design Process

The architecture digital design process refers to the method and workflow utilized by architects and designers to create, develop, and communicate architectural designs using digital tools and technologies.

2.1.1 Digital Design Process is Totally Different World Compared to Conventional Design Process

Digital design process can't be compared to conventional (paper-based methods). That means, digitalization also changes the traditional processes and sequence of conventional design which also mean changes of relationship between conception and materialization, form and material (Oxman, 2008). Digital design can be defined as a unique set of design logic demands a formulation of the relation between the product of design and the way it is now conceived, generated, and materialized in digital media (Oxman, 2008). [code a]

The causality of the usage of digital media is the architecture students these days tend to be adept at juggling multiple forms of data and images that are represented in digital environments (inside the screen). The way of these days digital design process of “dialogue/feedback” (even though dialogue in this context mean constant feedback and evaluation) between materials and form create a new “design thinking” (Oxman, 2008)(Kuhn, 1998). Digital design environment brings new design tools, new way design thinking, and notion of space (Tepavčević, 2017). [code b]

2.1.2 Computerization vs Computation

Digital design process can also be categorized into two actions, namely computerization and computation. Computerization mimics the design actions of the designer and the way to digitize is preconceived, predetermined, and well defined. However, computation is otherwise. It's an indeterminate, vague, unclear, and ill-defined process (Tedjosaputro, 2020). For example, computation can be found in parametric design process. Most designers can just roughly imagine the final form that he/she wanted. [code c].

2.1.3 BIM Creates Different Perception of Digital Design Process

However, digital design is not only about shape logic and materialization. BIM (Building Information Modelling) creates a very different perception about the digital design process. It makes architect like virtually “construct” a building prior to actual construction (Garber, 2017). Even though it feels like “construct” a building, it's still possible to create commands, actions and customized by variables that defined by the designer in digital media (Luísa Batista de Oliveira Silva & Andréa Quadrado Mussi, 2020). This finite series of steps that follow logical and consistent consequence can help optimize time that consequently increase iteration in design process (Luísa Batista de Oliveira Silva & Andréa Quadrado Mussi, 2020). However, BIM advantages in detail constructions seem useless in competition because almost none of competition need that high-level of information detail. It will be advantageous if the project is won and need a transition from competition into real project (Sørensen et al., 2015). BIM application primary focus is for development final project documentation and all of the commands are optimized to make the final document, not in schematic process (Svetel, 2018). [code d].

2.1.4 Classification of Digital Design Skill and Process

Digital design skills can be categorized based on digital action such or based on digital media format such as computer basics, input and output, raster basics, vector basics, presentation and web basics, 3D basics, drafting basics and GIS production, and portfolio production (Campbell, n.d.). Every digital skill has correlation with each other and every skill gained impacting the other format in different digital media format (figure 4). [code d]

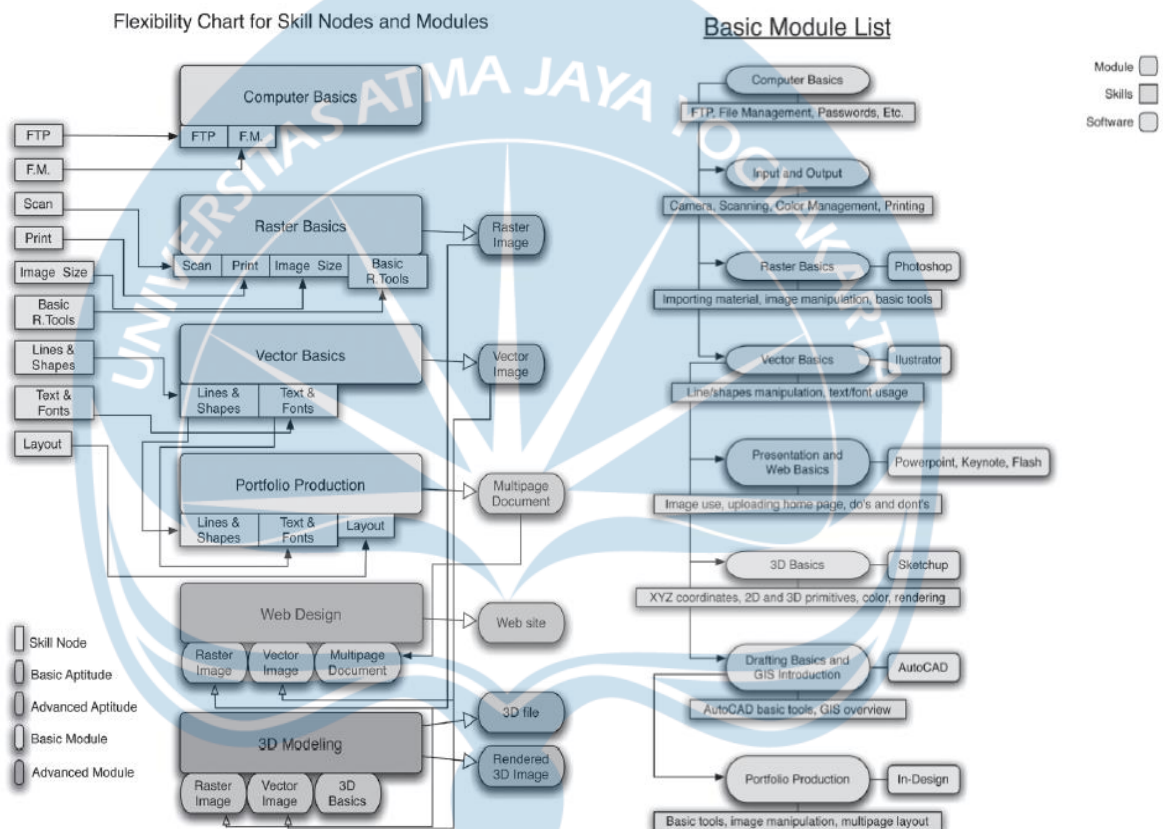


Figure 4 Computer Skill Pedagogy (Campbell, n.d.)

The way to examine digital design process and analog design process (sketching) is different. People tend to comprehend digital design faster than analog when using it as a media to communicate. This means, digital design process can increase the speed of discussion/ feedback iteration faster. However, analog tends to liberate imagination in the design process, making people wandering more, and more engaging as a media for discussion (Brisibe, 2020). It seems analog better for divergent thinking. People tend to verbalize more in analog based design than digital media which means digital design has higher clarity of information. However, the clarity

of the information has also negative consequences for imagination and freedom of alternative design feedback (Brisibe, 2020).

2.1.5 VR & AR Technology in Design Process

In digital design process, a different usage of technology can also create another opportunity of the way architect iterates the design process. VR/AR technology also means a different way of design workflow in evaluation and feedback process. While making the design iteration slower by adding extra steps, it can increase the immersive Ness in design process (Al-Suwaidi et al., 2023).

2.1.6 Consequence of Digital Design Process

The limitation of imagination that is caused by personalized synthetic fantasies in digital design process is absolute. Even though it seems empowered designer, it's not risk-free visualization. It makes designers more detached from all physical and moral constraints. It also makes those who control the digital media, controlled by the digital media (Balfour, 2001). It seems sketches must still in consideration to assemble design thinking. [code e]

2.1.7 Digital Proficiency and Result of Designing

Winners of student architecture competitions often demonstrate a high level of creativity, innovation, and technical proficiency in their final design presentations. They can clearly communicate their design intent, address the requirements of the competition brief, and offer unique solutions to the design problem (Brisibe, 2020).

On the other hand, average (participant) students may struggle with articulating their design ideas effectively, integrating technical details into their presentations, or presenting a cohesive and well-developed design concept. They may also lack the same level of sophistication in their use of digital tools and techniques compared to the upper-level student (Brisibe, 2020). Design

exploration can also be limited to the software's ability rather than the ability of the mind to create mental images (Onosahwo Iyendo & Zafer Alibaba, 2015). However, when understanding or mastering the creative potential inherent in these digital tools, a new architectural language is established and potentially creating new spaces and expressions (Gomes Da Mata et al., 2013). [code f]

Section 2 – Architecture Competition Design Process

2.2.1 Design Phase and Process According to IAI (Ikatan Arsitek Indonesia)

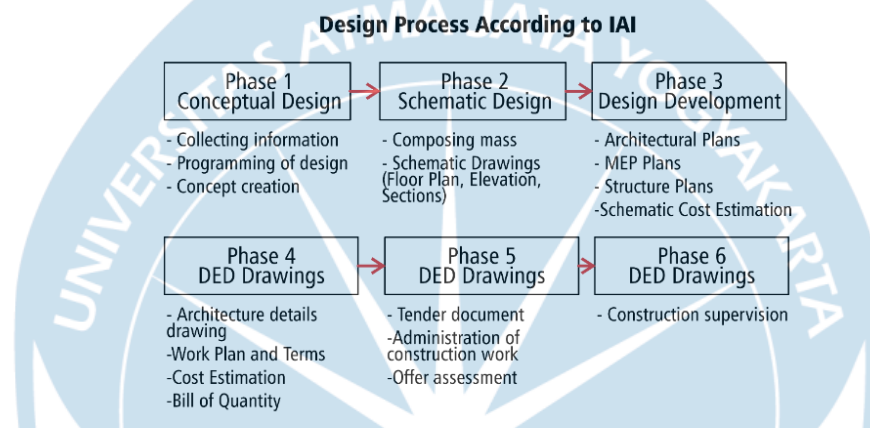


Figure 5 Design Process According to IAI, Source: (Widyaningrum, 2017)

In architecture student competitions, there is a common design phase where participants are required to develop their design concepts based on the competition brief. During this phase, students typically conduct research, analyze site conditions, develop design ideas, create digital models, and iterate on their designs to produce a final proposal. Based on IAI standards about designing process phase, most architecture competition end in second or third phase (if any design development or cost estimation is needed) (figure 5).

2.2.2 Why Examines Architecture Competition is Matter? Impact!

The first & second phase (according to IAI) might also represent more than half of the design impact because abundance of opportunity and critical decision making often occurs in this phase. The more detailed the design, the less impact can be produced (Wang et al., 2002). Examines architecture student competition basically examine the majority impactful part of architecture process and creation (figure 6).

2.2.3 There Are Many External Factor Why A Team Can Win

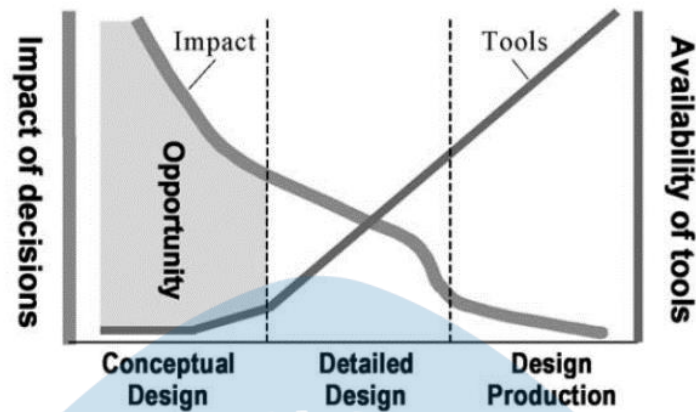


Figure 6 Opportunity Cost, Decision, and Tools Correlation, Source: (Wang et al., 2002)

Architectural competitions are usually seen as a systematic game with only one winner (winner in this term is the architect or team whose proposal is the most convincing). However, architecture competitions are a stage upon which a myriad of actors and elements play out a scenario that involves on several levels (Menon & Vanderburgh, 2014). Student architecture competition can limit the external amount of actor and element, so the winner can be more genuine who is the most convincing. Architectural competition can also act as a social technology for picking winners with 3 benefits, namely: creativity (attractive entries), legitimacy (fair outcomes), and efficiency (time and effort) (Laryea & Watermeyer, 2020). In student competition, most cases it is imaginary. It will be better to select architecture competition that is not based in real cases. So, only creativity and legitimacy become the main concern. It also reduced the bias produced by external factors besides from jury, politics, government, and the number of competitors.

The common final product in architecture student competitions is a set of presentation drawings or boards that communicate the design concept effectively. These presentation materials usually include plans, sections, elevations, perspectives, diagrams, and renderings that highlight the design solution in a visually compelling and informative manner. In architecture competition, visualization is not only consumed by juries, but also other stakeholders. The way of the consumption can be distinguished to traditional anonymous “masquerade”, with interaction

with design visualization without any face-to-face engagement, and face-to-face verbal dialogue with all stakeholders (Jacobsen et al., 2021). By choosing student architecture competitions, researchers can eliminate these factors.

2.2.4 Designing For A Competition and A Real Client is Different

The common design phase in architecture competitions typically refers to the initial stage where participants develop their design concepts based on the competition brief and criteria. During this phase, architect and architecture students brainstorm ideas, conduct research, and create preliminary sketches or digital models to explore different design possibilities. This phase is crucial as it sets the foundation for the entire design process, guiding the development of the project towards a final submission. In architecture competitions, the way to define user and client is different compared to common professional design cases (with client as a partner). It feels like an architect is dancing with an absent partner (in this case user/client). The absent user or client creates a different programming than the actual case. Architect can make its own assumption or consider all potential user simultaneously (Verhulst et al., 2016). It's actually very suitable for architecture students since they have potentially never met an actual client and user.

Section 3 – Architecture Theory In Design Thinking and Design Process

2.3.1 Divergence (Exploratory Thinking) and Convergence (Evaluative Thinking)

The first main theory is in design cognitive style (figure 7). At the basic level, there are two

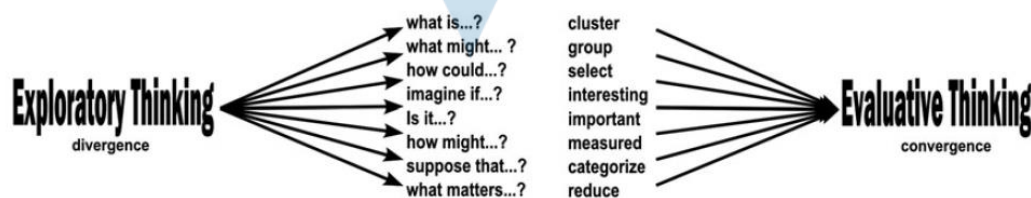


Figure 7 Divergent and Convergent Thinking, Source: (Plowright, 2014)

different types of decision making in design which are divergence (exploratory) thinking and convergence (evaluative) thinking. It's not only in design but in basic human processes level. Designing is possible by combining this thinking style (Plowright, 2014). Divergent thinking

is a type of thinking to investigating exploration as much as possible. While convergent thinking is a type of thinking about how to manage all the of the possibilities into a single idea or one consensus (Livanur Erbil & Fehmi Dogan, 2007). [code 1a]

2.3.2 Logic and Intuition

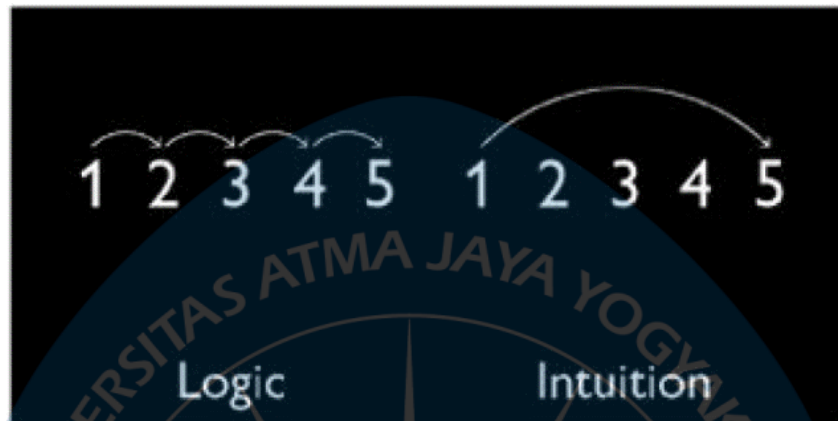


Figure 8 Logic and Intuition Illustration, Source: (Peña & Parshall, 2021)

The second theory is there are two types of people which is logical thinkers and intuitive thinker (Figure 8). Logical thinkers can do very well in programming and used to orderly step by step process. While intuitive thinkers can do well when information is still incomplete. They tend not systematic and poor programmers (Peña & Parshall, 2021). [code 1b]

2.3.3 Algorithmic and Heuristic Thinking

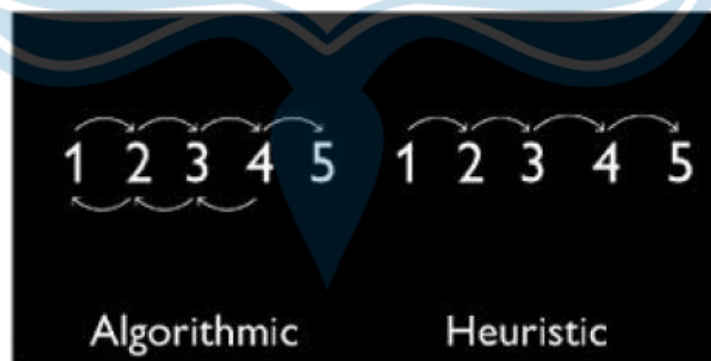


Figure 9 Algorithmic and Heuristic Thinking, Source: (Peña & Parshall, 2021)

While in the middle of the design process, the incomplete information might be found and made the process might be going backward to make the design more perfect which is called algorithmic (figure 9). While heuristics tend to move forward even though the steps are not rigorously sequential and the information is hardly ever complete (Plowright, 2014). [code 1c]

2.3.4 Map of Design Process (Refinement)

When someone makes an analysis and synthesis all the analysis, there is a chance that some analysis is still missing and the evaluation process makes the designers tend to redo everything with better synthesis (Bryan Lawson, 2005). It can be various of things such as data, joint, material, etc. However, due to time, this process of iteration will be limited to a certain number of times depending on time availability (figure 10). [code 1d].

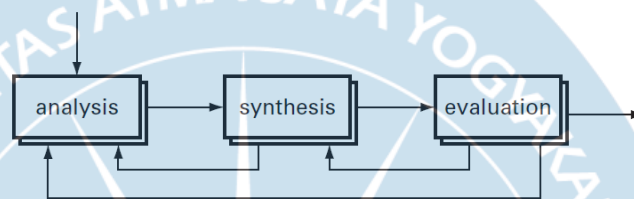


Figure 10 Map of The Design Process, Source: (Bryan Lawson, 2005)

2.3.5 Framework of Thinking Process (Part of Architecture)

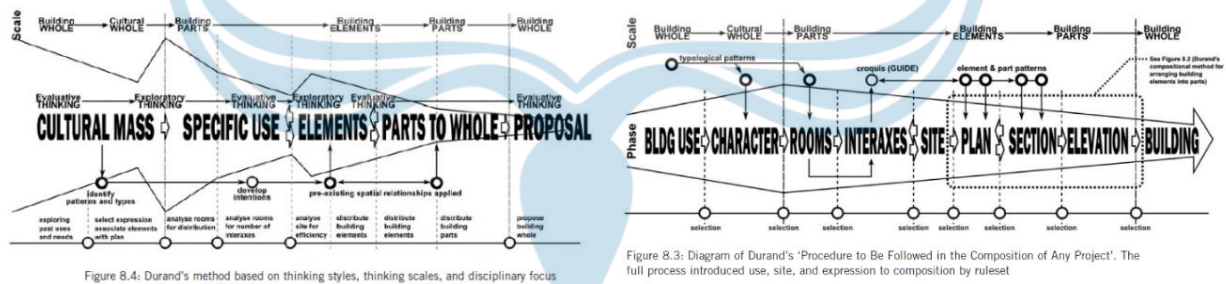


Figure 11 Framework of Thinking Process, Source: (Plowright, 2014)

In the architecture design process, people have various approaches for their own personal design framework. However, the pattern can be examined based on their scale. Some people tend to start small or detail and assembly it to general (big picture), while some tend to start from general (big picture) to the detail (figure 11) (Plowright, 2014). [code 1e].

2.3.6 Group Communication Project

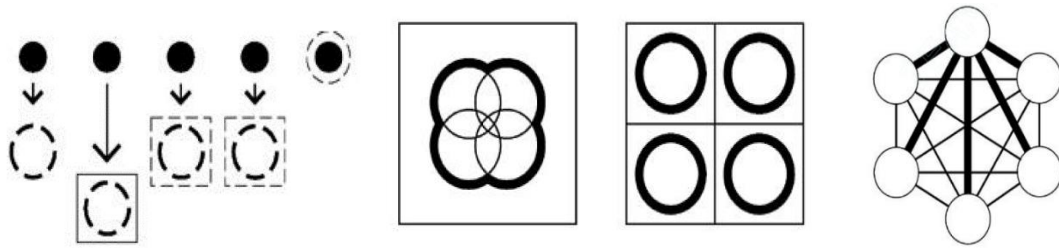


Figure 12 Group Communication Project, Source: (Peña & Parshall, 2021)

Even though the theory is indirectly speaking about group communication projects, it's still applicable how to explain an activity group project work. It can be integrated or compartmentalized, it can be at home, virtual office, or main office, and how the network pattern often occurs in a group (Peña & Parshall, 2021) (figure 12). Compared to work alone, working in a team introduces different problems and possibilities for designers (Livanur Erbil & Fehmi Dogan, 2007). [code 1f]

2.3.7 Information and Data Filtration



Figure 13 Extracting and Prioritizing Data, Source: (Peña & Parshall, 2021)

The architects are often taught to have holistic views. However, there must be a filtering process of information and what should be a priority in a project (figure 13). The ability to handle data clog and maturity about what should be a priority to be solved will also affect on the ability to analyze, synthesis, and divergent and convergent process. [code 1g].

2.3.8 Metacognitive ability

It is said that the architecture competition tends to benefit more for winner than average (participant) (Haupt Patrycja et al., 2019). It seems what makes both parties so different is the metacognitive ability. The iteration and experience of competition in high intensity can increase the self-learning process for the winner while the other (average (participant)) who lack metacognitive ability will be left behind. [code 1h].

Metacognitive skills play a central role in students' learning performance, especially where an amount of procedural knowledge is demanded to solve a task or assignment (Avsec & Jagiełło-Kowalczyk, 2021). Self-directed learning can be measure to five subscale such as awareness, learning strategies, learning activities, evaluation, and interpersonal skill (Avsec & Jagiełło-Kowalczyk, 2021).

2.3.9 Abductive Thinking

Abductive thinking is the ability to think and explore about the future alternative with incomplete piece of information (Dosi et al., 2018). However, it is a double-edged sword. It means the designer has the ability to create many alternatives in high creative confidence but will have fewer difficulties for self-assessment or evaluating their own work because of their confidence (Avsec & Jagiełło-Kowalczyk, 2021). This also means that abductive thinking has correlations with intuitive thinkers. [code 1i] There are also deductive reasoning that proves something must be; and inductive reasoning; shows that something is operative/ operable (Silva, 2019). [code 1i].

2.3.10 Learning Digital Skill for Digital Design Process

Digital design process [can be represent the hard skills {Technology}] has correlation with [knowledge, design thinking, experience, all of the architecture education stuff, etc. (can be

represent as Design {Architecture}}] and metacognitive skill [can be presented as soft skills {learning habits}}]. All of this three these skills will become mutually supportive over time (figure 14). Creativity and autonomy are abilities that can be exercised in design work and considered as higher order thinking skills (HOTS).

HOTS is dependent upon requisite technical skills (hard skills, technology & soft skills, learning habits) and other cognitive resources (design, architecture). It is why it is important to match learning objectives to student level. Novice benefits from direct guidance in basic skills and knowledge, while advanced students should emphasize synthesis and independence. If one of these foundations loses, the learning journey will also loss (Doyle & Senske, 2016). Hypothetically, participant (average (participant)) architecture students have some limitations as a novice and competition is a place for HOTS. [code 1j]

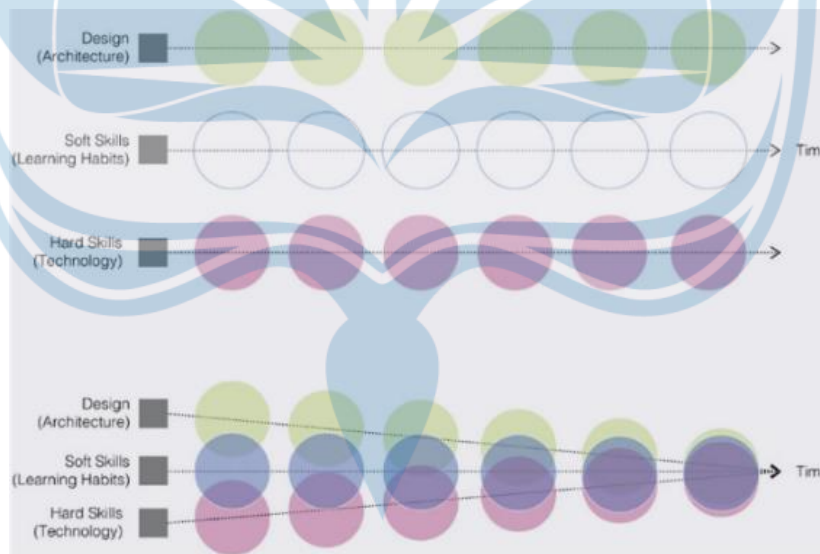


Figure 14 Correlation of architecture student development journey (indirectly explained) even though explained as curriculum in academic context, Source: (Doyle & Senske, 2016)

2.3.11 Design Thinking Traits

There are 5 design thinking traits which are integrative thinking, optimism/ challenge, collaboration, feedback seeking, and experimentalism. Creativity (divergent and convergent thinking) are related to integrative thinking & optimism/ challenge. Critiques are related to optimism/ challenge, collaboration and feedback seeking. Prototyping design iterations are related to feedback seeking and experimentalism (Todoroff et al., 2021). All of the research questions must be able to resolve a competition case in all these traits (figure 15).

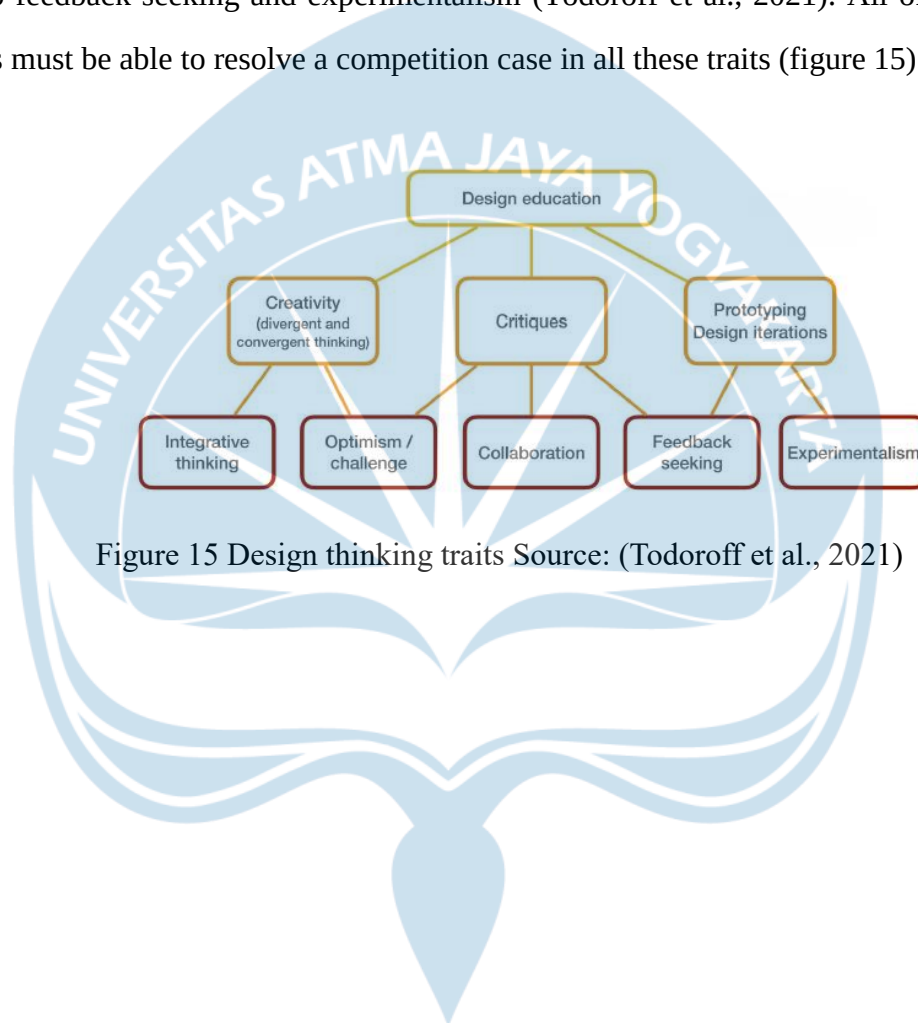


Figure 15 Design thinking traits Source: (Todoroff et al., 2021)