Research Article

Framework Design Thinking as a Teacher Competences

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Abstract.
The ability to produce creative solutions is currently needed due to rapid social, technological, and economic changes. Stakeholders can bring together various points of view to produce comprehensive solutions. Design thinking offers an inventive approach to solving challenging problems. This research offers a comprehensive perspective and understanding of design thinking as a framework for measuring the abilities of prospective teachers. A qualitative approach with documentary content analysis methodologies produces a theoretical competency framework. The findings are then applied to pinpoint design thinking's dimensions and indicators as pertinent competencies, such as empathy, experimentation, optimism, feedback seeking, and collaboration. These results significantly advance our knowledge of how, in the present environment, design thinking may be understood, utilized, and assessed as a critical talent. Considering the increasingly complex and dynamic characteristics of education, this research emphasizes the importance of building design thinking competencies for prospective teachers.

Keywords: assessment, conceptual framework, design thinking, teacher education

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1. INTRODUCTION

The ability to produce creative solutions is currently needed due to rapid social, technological, and economic changes. This involves integrating concepts from various sources, questioning assumptions, and creating innovative and practical solutions. Working together, different stakeholders can combine their viewpoints to develop more diverse and holistic solutions. This circumstance enables scholars, decision-makers, or police-maker to learn from mistakes and continuously refine solutions. Design thinking allows for sustainable solutions to be produced from multiple perspectives. Design thinking is a multi-phase process that involves applying creative and innovative thinking

to solve complex challenges. This skill generates effective and meaningful solutions by leveraging creativity, empathy, and iterative processes [1–3].

The study of design thinking is still relatively new in science education, especially in Indonesia. The implementation of lectures is still quite a lot focused on old trends such as STEM [4] or thinking skills that primarily focus on the cognitive domain [5, 6]. Many studies have explained the importance of design thinking for students during lectures and post-college ability profiles [7]. Krüger (2019) reported that design thinking encourages students' active involvement in the learning process using methods such as experience mapping, interviews, and observations; students can engage in research and exploration, which increases their interest in science. Applying design thinking concepts allows students to apply science concepts in a natural context (Becker & Mentzer, 2015).

Design thinking involves an iterative process of thinking, ideation, prototyping, and testing that helps students develop critical, analytical, and evaluative thinking skills in solving complex science problems. [9–11]. Implementation design thinking in projects-based learning allows students to learn, to work together, to create solutions, to share ideas, and to build mutual understanding. Working in teams encourages collaboration skills between students to solve daily problems [12]. Furthermore, design thinking can increase the effectiveness of science learning and inspire students to become more active in the learning process. This condition is a challenge that must be facilitated immediately for future higher education learning.

The previous facts emphasize design thinking as an ability that must be mastered. The problem arises when the tendency to implement design thinking emphasizes the approach. Research on design thinking, although still limited, is dominated by the placement of design thinking as an approach [13–17]. Therefore, this study comprehensively reviews design thinking as an observable and measurable competency, especially for prospective teachers.

2. METHOD

This study presents various objective perspectives on design thinking, which has gained popularity in recent years. By adopting a qualitative approach, we conducted our research using documentary content analysis to review some documents with a design thinking theme [18]. The sampling technique uses purposive sampling for documen

analysis [19, 20]. Hence, the data sources in this study are the results of recent studies that review the concept of design thinking from books, research paper, training materials, curriculum, and learning guides.

In addition, documents were analyzed to understand the educational approach used to develop design thinking competencies. Data were carefully analyzed to identify patterns, themes, and variables related to design thinking [21–23]. Furthermore, data triangulation is carried out by comparing and examining information from various sources to ensure the validity and reliability of the findings [21, 22]. The analysis results were used to identify dimensions and indicators of design thinking as a relevant competency. Therefore, this research contributes to understanding how design thinking can be interpreted, applied and evaluated as an essential competency in the current context.

3. RESULTS AND DISCUSSIONS

Design thinking was born as a creative problem-solving method in the early 1980s. The term Design Thinking comes from academics such as Bryan Lawson and Nigel Cross who observed how designers such as architects solve problems with a different mindset to scientists or engineers [24]. Design thinking has since developed in various fields like business, engineering, and education. The holistically designed concept of design thinking allows people to work successfully in multidisciplinary teams and make positive changes [25].

As a problem-solving approach that has been proved in socially ambiguous situations, design thinking is the ability to solve problems with scientific steps that suit human needs. (Dosi et al., 2018). Dosi et al. (2018) introduce 17 characteristics as someone who has design thinking mindset. Design thinking also believe to lead the development of creative confidence, which supports students' ability to act and think creatively. In addition, Novak and Mulvey (2021) introduce seven principles of design thinking: human-centred process, empathy, the culture of prototyping, shows, do not tell, bias toward action, and radical collaboration.

Coleman et al. (2020) then suggest design thinking as the ability to work multidisciplinary by collaborating in problem-solving. Five characteristic was declare by Coleman et al. (2020): experimentalism, feedback seeking, empathy, collaboration, and optimism [30]. Some indicators that characterize design thinking from several experts are presented in Table 1.

TABLE 1: Aspects and Indicators of Design Thinking.

Design thinking by [26].	Design thinking by [30].	Design thinking by [29].	Synthesis of Design Thinking
Tolerance- being comfortable with ambiguity	-	-	-
Embracing risk	-	bias toward action	-
Experiental Intelligence	-		-
Human centeredness	-	human centered	-
Emphaty	Emphaty	Emphaty	Emphaty
Critical Questioning			
Holistic view	Integrative learning		-
Problem reframing	-		-
Team working	-	-	-
Multidiciplinary collaboration	Collaboration	radical collaboration	Collaboration
Open to different perspective	Feedback seeking	culture of prototyping	Feedback seeking
Desire to make difference			
Experimentation	Experimentalism	show don't tell (action),	Experimentalism
Learning oriented			
Creative confidence	Optimism	mindfull of process	Optimism
Optimism to have an impact			
Mindfulness			
Abductive Thinking	-	-	-
Envisioning new things	-	-	-

Source: Author(s)

The synthesis produces the characteristics of design thinking i.e. empathy, feed-back seeking, optimism, experimentalism, and collaboration. This research uses five indicators to show the characteristics of someone with design thinking.

Empathy is defined as the ability to adopt another person's psychological point of view. It involves an intellectual identification with another person's experience of feelings, thoughts, or attitudes indirectly. Empathy develops through a needs-finding process where one focuses on discovering the explicit and implicit needs of others. Empathy involves the ability to see things from multiple perspectives, create closeness with students, see and feel experiences through the eyes of others, and recognize the reasons behind student behavior.

Students who have empathetic abilities usually show certain characteristics, including (1) the ability to see from another perspective, (2) the ability to build relationships, and

(3) the ability to communicate effectively. To evaluate students' empathy abilities, it is important to see the extent to which students can feel and understand the feelings, thoughts, and needs of others, as well as how well they can incorporate that understanding into a human-centered design process. Empathy is a complex skill that involves the ability to analyze, predict, and adapt to situations and conditions. This ability is generally assessed through the process of observation. However, you can use open-ended questions or essays to assess students' empathy skills for cognitive contexts. At the end, empathy skills can be enhanced and used effectively in a design thinking context through continuous practice and self-reflection [31].

Feedback seeking is the ability of individuals to actively seek input and suggestions from various parties with different perspectives, aiming to improve the quality or performance of the product or work they produce. Students with feedback-seeking ability will show an apparent willingness to accept input from others without experiencing significant resistance or rejecting the input excessively. They are also likely to engage in discussion activities that facilitate the exchange of ideas and perspectives, either in person or through communication platforms. In addition, students with feedback seeking ability usually have a clear vision of goals and use the feedback to shape or refine strategies and actions to achieve that vision. Feedback seeking ability can be assessed by observing an individual's behavior in situations that allow for the exchange of suggestions, as well as through questionnaires or interviews designed to explore an individual's attitudes and practices related to seeking and receiving feedback from others.

Optimism is a psychological attribute reflected in a student's belief to face challenges confidently. This belief is not only a driving force to solve problems but also arouses intense curiosity, encouraging individuals to overcome obstacles faced with active efforts in finding solutions. Students with high optimism tend to refuse to give up in the face of challenging problems. Instead, they see every obstacle as an opportunity to grow and learn. This ability results in creative and effective solutions and provides a solid psychological drive to keep trying even in difficult situations.

While optimism does not always guarantee success, student who possess it still benefit. Students not only move forward to overcome obstacles but also have a deep awareness of the process they are going through. This leads to solid metacognition, where students can explore and evaluate the strategies and tactics, they use in dealing with problems. Hence, optimism is not just about maintaining beliefs but also about strengthening adaptability and self-reflection. This enables individuals to face challenges with an open and flexible attitude, ready to learn from experience

and develop personally and professionally. In research, optimism can be explored with questionnaires, projection tasks, interviews, and observation sheets related to the context of design thinking [32].

Experimentalism is the ability of individuals to adopt new approaches to dealing with problems and have no fear of failure because failure is considered a step towards discovering new opportunities and learning. Individuals with this ability tend to stick to something other than existing methods or solutions but are open to testing new ideas and alternative strategies. The main ways experimentalism is assessed include observing a student activity in dealing with problems, rapid prototyping to test new ideas, and formulating and testing hypotheses in an experimental environment. In addition, the quality of visualization in planning or sketching products is also an important indicator of this ability, as the visualization process is often the first step in developing new ideas.

The experimentalism assessment process involves observing how individuals explore and deal with problems in real situations, including the extent to which they are willing to take risks and experiment with new ideas. Rapid prototyping and product iteration are also important ways of assessing experimentalism, as these processes demonstrate student ability to test and refine the ideas time. Furthermore, hypothesis formulation and experimental testing are practical assessment tools, allowing students to test assumptions about potential solutions in a controlled environment. Thus, assessing experimentalism involves a combination of behavioral observation, prototyping, and hypothesis testing, which provide a comprehensive understanding of student ability to adopt an experimental approach to problems and create innovative solutions [33].

Finally, collaboration is a critical element of design thinking, where every design thinker is expected to participate in multidisciplinary teams consisting of individuals with different backgrounds, perceptions, and perspectives. Collaboration brings together innovators from diverse fields, allowing innovative insights and solutions to emerge from that diversity. Assessment of collaboration skills usually involves observing how student interacts and contributes to the team, the extent in which way can build effective working relationships with team members who have different backgrounds and views, and ability to respond to feedback and ideas coming from various sources [34].

In addition, collaboration also implies the ability to work across disciplines and an openness to learning from different fields. In assessing collaboration skills, it is essential to look at the extent to which student can demonstrate an interest and willingness to understand the perspectives and needs of others and how well they can integrate different approaches and concepts in the design or problem-solving process. A key challenge in measuring collaboration skills is to see how well a person can navigate complex and

often varied team dynamics and how effectively they communicate and adapt in such contexts. As such, assessing collaboration skills involves observing behavior, evaluating team interactions, and assessing individual communication and adaptation skills.

4. CONCLUSION

Design thinking is not just an additional competency but a must for prospective teachers, along with TPACK competencies at the core of the teaching profession. Studies related to the evaluation framework of design thinking competencies in prospective teachers highlight five main aspects: empathy, feedback seeking, optimism, experimentalism, and collaboration. These components give an idea of an individual's ability to overcome learning challenges and how they design compelling learning experiences and motivate students. By developing design thinking competencies, prospective teachers can align students' needs with innovative and result-oriented learning strategies. The ability to empathize allows them to understand students' needs and perspectives better, while feedback-seeking and optimism help them explore new solutions without fear of failure. Experimentalism encourages experimentation and discoveries in the learning process, while collaboration facilitates productive and inclusive teamwork. By understanding and honing these five aspects, prospective teachers can become effective change agents in creating a dynamic and competitive learning environment.

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