EMI JOURNAL

Research Article

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Received 14 September 2023 | Revised 11 October 2023 | Accepted 17 October 2023

Developing a Conceptual Framework or Private Primary School Academic Management to Enhance Students' Design Thinking Skills

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Abstract

This study aims to develop conceptual frameworks of private school academic management and design thinking skills in primary students. The investigation began with a review of related concepts from literature and research, followed by a synthesis of concepts to form conceptual frameworks for design thinking skills and academic management. The conceptual framework was drafted and then evaluated to confirm suitability by five purposively selected experts, using the Conceptual Framework Suitability Evaluation Form. The data was collected and analyzed using descriptive statistics and content analysis.

The findings indicated that the conceptual framework for private primary schools' academic management to enhance students' design thinking skills consists of two parts that work together: 1) design thinking has five main stages consisting of empathy, defining problem, ideation, prototyping, and testing and thirteen skills as follows: research skill, observation skill, questioning skill, active listening skill, analyzing skill, synthesizing skill, reasoning skill, imaginative thinking skill, brainstorming skill, visualization/illustration skill, construction skill, experimenting skill, and reflection skill; and 2) academic management has four main works including curriculum development, teaching and learning, assessment and evaluation, and educational resources and learning environment development with ten sub-works in total.

Keywords: Design Thinking Skills; Human-centric Approach, Academic Management, Primary Students

Introduction

As the world is rapidly changing due to the advancement of technology, individuals must possess 21st-century competencies, such as knowledge, skills, and mindset, and be prepared for changes that will come in the future. In striving to become a digital, knowledge-based, creative economy, Thailand has included, in its National Strategy 2018-2037 (Office of the National Economic and Social Development Board, 2018), the Twelfth and Thirteenth National Economic and Social Development Plans (Office of the National Economic and Social Development Council, 2016, 2022) and the National Education Plan B.E. 2560-2579 (Office of the Education Council, 2017), the goals and strategies for the next 20 years to enhance national competitiveness by developing and strengthening human capital as well as promoting the development of science, technology, research, and innovation. Along the same line, one of three desired outcomes of education, as stated in Thailand's Educational Standards B.E. 2561 (Office of Education Council, 2019), is that Thai people should be innovative co-creators who have cognitive skills, 21st-century competencies, digital intelligence, creativity skills, cross-cultural skills, interdisciplinary integration skills, and entrepreneurial skills in order to create and develop social and technological innovations to increase value to oneself and society at large. How do we prepare our future generations for those challenges?

One approach to promote innovation is to develop design thinking skills (Luka, 2014). It involves understanding people, identifying needs, generating ideas, prototyping, and testing solutions, corresponding to the four phases of an ideal learning cycle, experiencing, reflecting, thinking, and acting (Beckman & Barry, 2007). Teaching young children design thinking could help them develop a growth mindset and important problem-solving, analytical, and spatial thinking skills, preparing them for their lives. Primary students are at their age where they are excited about learning and have investigate minds to questions about everything they see in the world. Children aged 7-11 years old, or those in Piaget (1964)'s concrete operational stage, start to have a better understanding of logical and abstract thinking (Wood et al., 2001). This is a prime age for fostering design thinking skills as their brains continue to develop; they have become more fluent in expressing their views through verbal and non-verbal cues; and have sufficient skills to use tools to create artifacts. This may be simply started at schools where school-age children spend most of their time learning and gaining experience through learning activities, using various resources and assessment methods as planned in the curriculum. These tasks are part of the academic administration in the school which is the core of developing and enhancing learning for students in all aspects.

Private schools have been the pioneers in the Thai education system and have played a crucial role in providing education to meet the needs of parents and students. They have the advantage of agility, a faster decision-making process, and in many cases, visionary leadership; thus they are able to adapt faster than the public sector in many ways. Therefore, this research focuses on private schools first in the hope that they will pave the way for other schools to provide innovative and valuable education to students. It is important that schools examine their academic management branch of work to see what, where, and how improvements could be made to cultivate essential design thinking skills and enhance students' learning overall.

Research objectives

To develop conceptual frameworks for private primary school academic management and design thinking skills in students.

Review of literature and conceptual framework

The review of literature is divided into two parts, starting with the design thinking concept and followed by academic management.

Design Thinking Skills

Design thinking is a problem-solving approach that originated in the field of design and has since been adopted by a range of industries. Because of its usefulness and wide range of applications, different schools of thought have offered models that systematize their design thinking process, using different terms, sequences, and number of stages. While design thinking is not necessarily a linear process, the author has summarized the main stages of design thinking as shown in Table 1. Regardless of the differences, these models are quite similar as they typically begin with an exploratory phase designed to comprehend the problem to be addressed, then proceed to the idea or solution generation phase, and conclude with a phase of testing or implementing the prototype created through several iterations.

Table 1 Summary of Main Stages of Design Thinking.

Proponents	Main Stages of Design Thinking						
Stanford Design School (Hasso Platter Institute of Design at Stanford, N.D.)	Empathize	Define	Ideate	Prototype	Test		
IDEO (Brown, 2008b)	Inspiration		Ideation		Implementation		
IBM (IBM Design, n.d.)	Observe	Reflect		Make			
Dunne & Martin (Dunne & Martin, 2006)	Generalize		Generate Ideas	Predict Consequences	Test		
SAP (Efeoglu et al., 2013)	Scoping	360° Research	Synthesis	Ideation	Prototyping	Validation	Implementation
University of St. Gallen (Efeoglu et al., 2013)	Need Finding and Instant Expertise	Define Problem	Brainstorm	Prototype	Test		
Joint Method of IDEO and Riverdale School (Efeoglu et al., 2013)	Discovery	Interpretation	Ideation	Experimentation			Evolution

The Stanford Design School model is considered one of the most popular and widely understood as they are referred to in several papers regarding the integration of design thinking in k-12 education (Bush et al., 2018; Ge et al., 2021; Goldman & Zielezinski, 2016; Gwangwava, 2021; Hasso Platter Institute of Design at Stanford, N.D.; Henriksen et al., 2017; Rusmann & Ejsing-Duun, 2022; Shively et al., 2018; Yalçın & Erden, 2021). Therefore, this five-stage model will be adopted as the conceptual framework for design thinking. As design thinking has grown in popularity, practitioners from a variety of fields have begun to apply the approach to their work. Some studies have attempted to understand the competencies or skills required in particular design disciplines, primarily by observing or gathering qualitative data on designers. Kramer et al. (2016) studied the competencies by looking at the methods that a human-centered practitioner might use in their work and categorized them into four categories: cultivated mindsets, specialized disciplinary skills, contextualized tasks, and basic skills. Razzouk and Shute (2012) also have extensively reviewed literature from various sources to gain a better understanding of design thinking characteristics and processes with the hope of applying the design thinking concept to education and proposed a design thinking competency model which represents an operationalization of the design thinking construct. Table 2 shows a synthesis of competencies and skills derived from both studies. From this synthesis and review of literature, the researcher also mapped the

competencies and skills that are used in the five stages of design thinking in order to define the framework.

Table 2 Synthesis of Design Thinking Skills.

No.	Skills	Design Thinking Skills		Design Thinking Process				
		Human-Centered Design Competencies (2016)	Design Thinking Competency Model (2012)	Empathize	Define problem	Ideate	Prototype	Test
1	Active listening	/		/				
2	Observation	/		/				
3	Seek up-to-date resources		/	/				
4	Digging deep	/		/				
5	Clarifying	/		/				
6	Assess resource creditability		/	/	/			
7	Assess resource quality		/	/	/			
8	Identify needs and set goals		/		/			
9	Combine information from different resources		/		/			
10	Employ up-to-date resources		/		/			
11	Defining problems	/			/			
12	Identifying core components	/			/			
13	Identifying key insights	/			/			
14	Identifying known and unknown	/			/			
15	Identifying obstacles	/			/			
16	Identifying patterns	/			/			
17	Reframing	/			/			
18	Prioritizing	/			/			
19	Abductive reasoning	/			/			
20	Inductive reasoning	/			/			
21	Pose argument based on evidence		/		/			
22	Understanding tradeoffs	/			/	/		
23	Persuading	/			/	/		
24	Decision making	/	/		/	/		
25	Generate ideas from information		/			/		
26	Representing ideas visually	/					/	
27	Drawing	/					/	
28	Model/prototype a system		/				/	
29	Create models		/				/	
30	Build theory		/				/	
31	Improvising	/					/	
32	Pivoting	/					/	/
33	Experiment with a system		/					/
34	Breakdown a system		/					/
35	Test models		/					/
36	Reevaluate model		/					/
37	Generate feedback		/					/
38	Critiquing	/						/
39	Modify model and refine		/					/
40	Trust building	/		/	/	/	/	/

No.	Skills	Design Thinking Skills		Design Thinking Process				
		Human-Centered Design Competencies (2016)	Design Thinking Competency Model (2012)	Empathize	Define problem	Ideate	Prototype	Test
41	Record keeping	/		/	/	/	/	/
42	Delegation	/		/	/	/	/	/
43	Explaining in simple terms	/		/	/	/	/	/
44	Facilitating	/		/	/	/	/	/
45	Goal setting	/		/	/	/	/	/
46	Working under time pressure	/		/	/	/	/	/
47	Mentoring	/						
48	Story building	/						
49	Story telling	/						

Based on the synthesis, several competencies and skills are employed in each stage of design thinking. For the purpose of this research, which focuses on primary students, essential skills for each design thinking stage can be summarized in Table 3.

Table 3 Synthesis of Design Thinking Skills.

Design Thinking Stage	Design Thinking Skills	Reference from Table 2
Empathy	Research skill	3-7
	Observation skill	2
	Questioning skill	4-5
	Active listening skill	1
Defining Problems	Analyzing skill	10, 11-16
	Synthesizing skill	8-9, 11, 17-18
	Reasoning skill	19-24
Ideation	Imaginative thinking skill	25
	Brainstorming skill	25
Prototyping	Visualization/illustration skill	26-28, 30
	Construction skill	28-29
Testing	Experimenting skill	31-35, 39
	Reflection skill	36-38

Academic management

Academic management is crucial for the effective operation of schools and students' learning as it ensures that educational programs are effectively administered, academic standards are maintained

and improved, resources are allocated efficiently, and policies are developed and implemented effectively.

Table Shows the scope of academic management work as specified by the Ministerial Regulation on Rules and Procedures for Decentralization of Educational Administration B.E. 2550 (Ministry of Education, 2007) as well as of other academicians, for example, Phuprasert (2001), Wonganutroj (2000), and Vehachart (2007).

Table 4 Synthesis of Academic Management Work.

No.	Scope of Academic Management	Ministry of Education (2007)	Kamol Phuprasert (2001)	Preeyaporn Wonganutroj (2000)	Rungchatchadaporn Vehachart (2007)	Researcher's Synthesis
1	Development and feedback provision to development of local and school curriculum	/				
2	Academic planning	/				
3	School curriculum development	/	/	/	/	Curriculum Development
4	Selection of textbooks for school use	/				
5	Teaching and learning activities in schools	/	/	/		Teaching and Learning
6	Learning process development	/			/	
7	Learning resource development	/			/	Educational Resources and Learning Environment Development
8	Development and use of technology/media for education	/			/	
9	Development of educational media, innovation, and technology				/	
10	Monitoring and supervision	/	/			
11	Educational and career guidance	/			/	
12	Assessment, evaluation, and academic performance transfer	/	/	/	/	Assessment and Evaluation
13	Research in academic development	/	/		/	
14	Development of educational standards and internal quality management	/			/	
15	Promoting academic strengths in communities	/			/	
16	Collaboration in academic development with other educational institutions and organizations	/			/	
17	Promoting and supporting academic work for individuals, families, organizations, agencies, enterprises, and other educational institutions	/			/	
18	Establishing regulations and guidelines for academic work of educational institutions	/				
19	Management of academic professional personnel development		/			
20	Management of academic information and information systems		/			
21	Management of school's academic performance evaluation		/			

To derive a conceptual framework of academic management in order to cultivate the 13 design thinking skills in students, the most relevant academic management works are 1) curriculum development, 2) teaching and learning, 3) assessment and evaluation, and 4) educational resources and learning environment development. The curriculum serves as a masterplan that will guide the "what and how" teaching and learning will help students learn the design thinking skills, how their skills will be assessed, and what type of learning resources and environment should be available to support their learning and skill building process.

Research methodology

Conceptual frameworks of private school academic management and design thinking skills were derived in three steps:

Step 1: Reviewed academic papers, theories, and relevant research from 24 documents for design thinking skills and 29 documents for private school academic management and synthesize conceptual frameworks.

An open-ended form "Document Analysis Form" was used to collect and analyze data from related academic papers, theories, and research. Content analysis and frequency were used to analyze data, which were then summarized in groups according to the researcher's criteria.

Step 2: Experts evaluated the draft of design thinking skills and academic management conceptual frameworks. Five purposively selected experts/academicians in the fields of design thinking and academic management were involved. Each expert must have a doctorate and at least three years of working experience at large organizations or educational institutions.

The "Conceptual Framework Suitability Evaluation Form" was provided to experts. The data was analyzed using frequency distribution and percentage. Comments and suggestions was analyzed by using content analysis.

Step 3: Revised and finalized design thinking skills and academic management conceptual frameworks based on suitability evaluation and suggestions from experts.

Research results

Experts reviewed the suitability of the drafted conceptual frameworks of academic management and design thinking skills. The results and comments are shown in 5.

Table 5 Results of Experts' Suitability Review of Conceptual Frameworks.

Dimensions & Elements (Draft)		Suitable		Unsure		Unsuitable		Comments/Suggestions
		Freq.	%	Freq.	%	Freq.	%	
Design Thinking Skills								
1. Empathy	1.1 Research Skill	5	100 %					• Researcher should provide a clearer operational definition of design thinking. • Researcher should consider adding other skills or wording such as a selfless, psychological understanding of human nature, data collection skill, prioritization skill, critical thinking skill, summarizing or idea crystallization skill.
	1.2 Observation Skill	5	100 %					
	1.3 Questioning Skill	4	80 %	1	20 %			
	1.4 Active Listening Skill	4	80 %	1	20 %			
2. Defining Problem	2.1 Analyzing Skill	5	100%					
	2.2 Synthesizing Skill	5	100 %					
	2.3 Reasoning Skill	4	80 %	1	20 %			
3. Ideation	3.1 Imaginative Thinking Skill	4	80 %	1	20 %			
	3.2 Brainstorming Skill	5	100 %					
4. Prototyping	4.1 Visualization/Illustration Skill	5	100 %					
	4.1 Construction Skill	5	100 %					
5. Testing	5.1 Experimenting Skill	5	100 %					
	5.2 Reflection Skill	4	80 %	1	20 %			
Academic Management								
1. Curriculum Development		3	60 %	1	20 %	1	20 %	• The curriculum development should also include other elements such as contents, guidelines for teaching and learning activities, and guidelines for assessment and evaluation.
2. Teaching and Learning		4	80 %	1	20 %			
3. Assessment and Evaluation		3	60 %	2	40 %			
4. Educational Resources and Learning Environment Development		4	80 %	1	20 %			

Based on suitability results from experts, the adjustments from consultation with advisor and co-advisors, the conceptual framework of academic management to enhance students' design thinking skills is finalized as detailed in:

Design thinking refers to a systematic thinking process in developing solutions to real-life complex problems or designing innovations to improve quality of life. It emphasizes a human-centered approach and multidisciplinary collaboration. From the inner circle represents the design thinking conceptual framework, which consists of five main stages:

1) Empathy means jointly creating a deep understanding of problems, needs, emotions, feelings, behaviors, thoughts, ways of thinking, contexts, ways of living and working, and culture using research skill, observation skill, questioning skill, and active listening skill.

2) Defining problem means collectively interpreting the information gained from the empathy phase and identify the issue to be solved using analyzing skill, synthesizing skill, and reasoning skill.

3) Ideation means collaboratively creating alternatives to solve problems by using imaginative thinking skill and brainstorming skill.

4) Prototyping means together creating a prototype of a solution, whether they are an object, concept, or theory from the chosen idea using visualization/illustration skill and construction skill.

5) Testing means testing the prototype using experimenting skill and reflection skill to develop it for real-life application.

The conceptual framework for **academic management**, represented by the outer rectangles as shown in, consists of four main works and 10 sub-works:

1) Curriculum development refers to establishing curriculum goals, specifying essential skills, setting teaching and learning guidelines, and designing assessment and evaluation guidelines.

2) Teaching and learning refer to preparing lesson plans and carrying out teaching and learning activities.

3) Assessment and evaluation refer to determining assessment and evaluation criteria and assessing and evaluating learning outcomes.

4) Educational resources and learning environment development refer to obtaining or developing educational resources and learning environment, and acquiring or developing educational technology.

Developing new skills involves a combination of clear goals, effective teaching strategies, a constructive feedback system, and a supportive learning environment. These four main academic management works will help educators and students build the 13 design thinking skills through their learning activities.

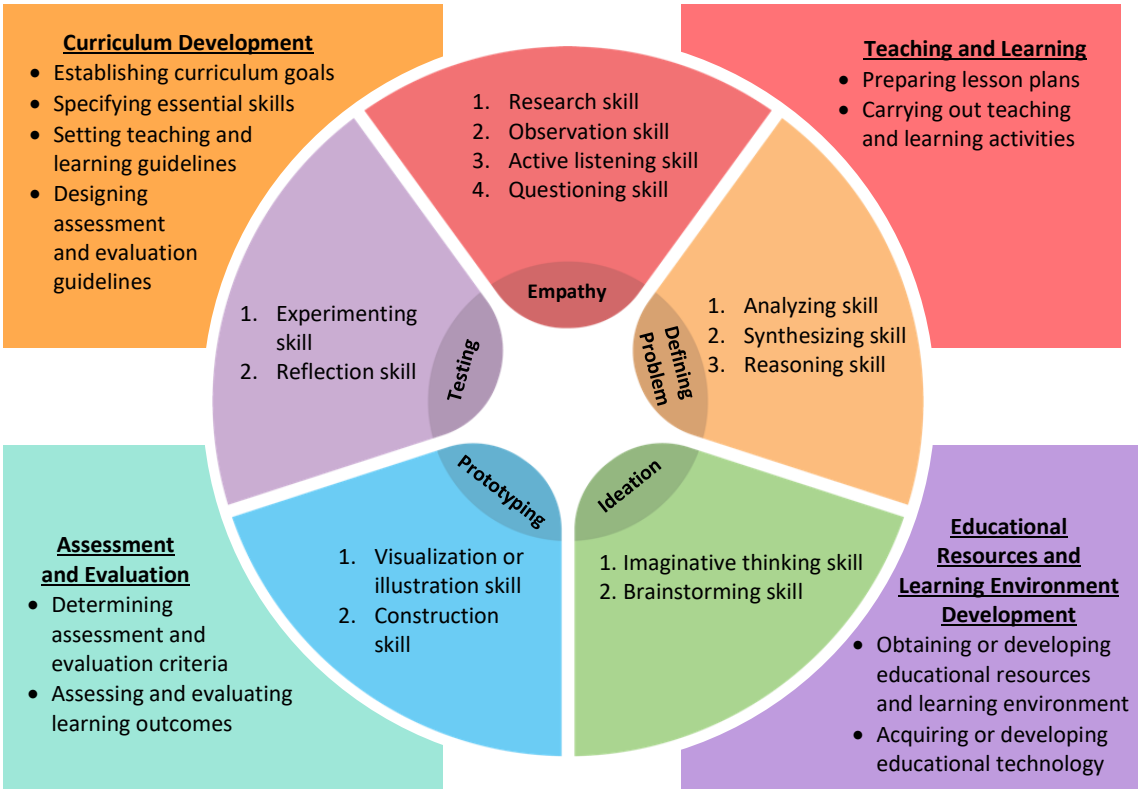

Figure 1 Conceptual Framework of Academic Management to Enhance Students' Design Thinking Skills

Discussion and Conclusion

Design Thinking Skills

Various schools of thought have their own definitions of design thinking; however, a common theme can be observed. Design thinking generally consists of five stages and thirteen skills: empathy (researching, observation, questioning, and active listening skills), defining problem (analyzing, synthesizing, and reasoning skills), ideation (imaginative thinking and brainstorming skills), prototyping (visualization/illustration and construction skills), and testing (experimenting and reflection skills).

From the review of literature, the design thinking process includes a stage of understanding, empathy, or discovery – that is, the step of collecting data and information to make sense of the situation or issue at hand. This data and information do not only include the obvious hard facts, numbers, or verbal communication but also unspoken or unwritten elements such as emotions, attitudes, preferences, values, body language, surrounding contexts, and background. Some studies divided empathy into cognitive empathy (ability to understand other's perspectives), affective empathy (ability to resonate with others' feelings) (Chen et al., 2015; van Dijke et al., 2020), and perceptive empathy (ability to directly perceive other's experiences) (van Dijke et al., 2020). To collect this information, design thinkers may utilize various skills including researching through literature or via using surveys (Kelley, 2014), observation (Shively et al., 2018), questioning, active listening through focus groups (Kelley, 2014) and interviews (Kelley, 2014; Shively et al., 2018). Being more proficient in these skills will help design thinkers gain a deeper understanding of the problem or challenge, which they will need to solve through later stages of design thinking.

To set or define a problem, design thinkers then find, understand, and frame the issue to be solved (Rusmann & Ejsing-Duun, 2022) by analyzing and synthesizing information gained from the empathy stage (Carroll et al., 2010). Real-life problems are ill-defined or wicked as Buchanan (1992) called it. They may need to be broken down into their basic components for deeper and more detailed analysis. At the same time, design thinkers may also benefit from taking a step back and viewing the big picture of many small elements. Patterns, trends, or irregularities may emerge. Designers may then be able to view the problem from a new angle by combining different points, an activity referred to as synthesis by Davis (2011). Inductive, deductive, and abductive reasoning is used throughout the process to frame the problem to be solved. Cross (2006, p. 7) stated that "in order to cope with ill-defined problems, designers have to learn to have the self-confidence to define, redefine and change the problem-as-given in the light of the solution that emerges from their minds and hands."

All design thinking models include the ideation phase. Many design studies have pointed out that during the ideation phase, design thinkers are encouraged to generate many ideas that are different, creative, original, and 'outside the box'. According to Shively et al. (2018, p. 154), "This mode requires students to develop many, different ideas (i.e., creative fluency and flexibility) and encourages them to think of several original solutions. The purpose of brainstorming (e.g., saturate and group) aims to formulate distinct, diverse, and numerous ideas." In addition, before committing to creating a certain solution in detail, design thinkers should be open to unexpected ideas and new possibilities (Carroll et al., 2010; Noel & Liub, 2017).

Developing a prototype is a way to communicate ideas to others, and to receive feedback for improvement in the testing phase (Carroll et al., 2010; Shively et al., 2018). Prototypes could be physical objects constructed from various materials or visualized/ illustrated (Francis et al., 2017) via sketches, 2D/3D drawings, storyboards, diagrams, mind maps, or anything that would externalize ideas. In the design process, design thinkers may create or fine-tune several prototypes based on feedback from the testing phase, until they are right for the problem. It is learning by making or building, aligning with Dewey's (2008) pragmatic learning philosophy in which passive learning is transformed into an active and constructive process through playing with physical materials (Rusmann & Ejsing-Duun, 2022).

The testing stage happens hand in hand with prototyping with the purpose of learning what works and what does not for the specific problem or users (Carroll et al., 2010). Testing may be conducted through simulation or in real-life situations, involving users or stakeholders from various backgrounds and perspectives. Prototypes are usually tested for the functionality (Francis et al., 2017) or usability (Altman et al., 2018), desirability, feasibility, and viability (Brown, 2008a, 2008b). Design thinkers must experiment systematically to get the most useful insights, know how to control variables, record feedback, and analyze results accurately. They also need to be receptive to constructive criticism and reflect on the responses they receive to learn more about the strengths and weaknesses of the prototype. Design thinkers revise the prototype again or may return to the ideation stage to select another solution to prototype and test. The iterative cycle continues until an optimal solution, one that meets the users' needs within the assumptions or criteria defined by users, is found.

Academic Management

To foster design thinking skills in students, school leaders should turn their attention to the academic side, namely the curriculum, teaching and learning, assessment, and educational resources and learning environment development.

A curriculum serves as a master plan for learning that teachers and students will engage with throughout their academic journey. From the literature review, although different curricula had shared different definitions and concepts, they generally included goals or objectives, instructional contents and experience, and assessments. “The scope and structure of content covered in curricula or curriculum frameworks can vary considerably across countries. Common elements of curricula or curriculum frameworks include educational goals/content, guidelines on pedagogy, and guidelines on assessment” (OECD, 2018, p. 11). Thus, the curriculum development for the purpose of this research is composed of four elements: 1) curriculum goals, 2) essential skills, 3) teaching and learning guidelines, and 4) assessment guidelines. As Shively et al. (2018, p. 150) stated, “these goals should guide the development of assessments, which in turn should be used to create learning experiences.” By understanding the different components of a school curriculum, educators can design purposeful and engaging learning experiences that meet the needs of students and prepare them for success in an ever-changing world.

Teaching and learning refer to the activities and experiences that teachers and students engage in, translating the curriculum into practice. Teachers develop lesson plans following the curriculum and organize teaching and learning activities accordingly. Instilling design thinking skills through the five-stage process requires creative ways of teaching and learning with an emphasis on constructivism, learning by doing, integrative learning, and problem-based and project-based learning. The quality of this part of the academic work impacts students’ learning and development of skills.

Assessment and evaluation play a crucial role in teaching and learning, providing valuable insights into students' progress, strengths, and areas for improvement. Teachers need to set appropriate assessment criteria, using operationalized definitions of skills to guide the development of the criteria (Shively et al., 2018). In addition, teachers should consider utilizing various assessment tools and strategies, whether they are formative, summative, diagnostic, or authentic, to holistically evaluate students’ learning. It may be tempted to assess students’ creativity through the prototypes they create; however, Kimbell et al. (1991) in Davis (2011) and Shively et al. (2018) advised that teachers should also recognize their thought processes, and the what, why, and how students have learned along the way.

Finally, we cannot ignore the importance of educational resources and learning environments as they support and enrich teaching and learning experiences. According to UNESCO IBE (n.d.), learning resources are any resource that supports and improves teaching and learning, whether directly or indirectly, including print, non-print, and online/open-access resources. Design thinking, in particular, highly values learning by doing/making and hands-on experiences; therefore, having materials, tools,

and technology for students to ideate and prototype is crucial to igniting their creativity, developing prototypes, and testing their proposed solutions. The learning environment can be defined in various ways. The National Research Council (2000) identifies four learning environment perspectives that are interconnected and mutually supporting one another, namely learner-centered environment, knowledge-centered environment, assessment-centered, and community-centered learning environments. Other educational theorists use the term 'learning environment' to refer to the social, emotional or psychological, and intellectual or pedagogical conceptual environment (Afari, 2013; Cleveland, 2009; Fraser, 2012), and increasingly the physical aspects of the learning environment (Cleveland & Fisher, 2014). Students spend at least 1,000-1,300 hours per year learning with teachers and friends at school and are influenced by their surroundings. With properly designed physical settings, students are given more opportunities to explore and experiment.

In sum, this research will focus on four major elements of academic management work, namely the curriculum, teaching and learning, assessment, and educational resources and learning environment development, that will support the development of the 13 design thinking skills in primary students.

Recommendations

Recommendations for using the findings of the research

School directors and teachers should use the frameworks to design and employ a variety of integrative project-based teaching and learning activities with the use of creative educational learning resources and environment to develop students' design thinking skills in order to equip them with tools for real-life challenges.

Recommendation for future research

1. There should be a study to develop academic management strategies to enhance students' design thinking skills based on the conceptual frameworks by using mixed-method research including both questionnaires and interviews.

2. There should be a study on how to develop teachers' competencies on the design thinking approach, and how to design and facilitate lessons with activities to cultivate design thinking skills in students by using mixed-method research including questionnaires and interviews to derive best practices.

3. In addition to studies on design thinking skills, there should be a study on how to develop a design thinking mindset in students, so they become better design thinkers. R&D research is recommended in order to observe actual results and make future improvements.

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