



BIRZEIT UNIVERSITY

Faculty of Business and Economics

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Design Thinking Implication in Higher Education:

The Role of Design Thinking in Developing Students Competencies

أثر التفكير التصميمي في التعليم العالي:

دور التفكير التصميمي في تنمية كفاءات الطلاب

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Abstract

Higher Education Institutions (HEIs) face challenges in their ability to graduate students with the skills and competencies required in the 21st-century. 21st-century learning is student-centred and emphasizes cultivating students with skills and competencies demanded by the 21st-century markets. Design Thinking (DT), a human-centred approach, provides an opportunity for Higher Education (HE) to integrate 21st-century learning. The research objectives are to explore the application of DT in HEIs and the role of DT in developing students' competencies by introducing a framework for HEIs. Using integrative literature review and structured interviews with experts from interdisciplinary fields in DT, HE, and Sustainable Development; the study analyzed, summarized, and categorized the data from literature review and expert interviews via qualitative analysis methods to find key themes related to HE transformation to achieve students' competencies development as an end. This conceptual study found four major themes related to the transformation of HEIs. These themes are Learning Experience; Learning Partners; Learning Environment; HE Capacity Building. These themes entwined with student-centred learning through DT and introduced "*The Learning 4.0*" framework to achieve students' competencies development. The study also suggested an approach to operationalize the framework.

Reflecting on the research results, DT can be considered as a philosophy embracing human beings' value and prosperity as a whole, introducing a versatile vessel for everyone who strives to design products, services, and experiences, making people's life sustainable and simple. DT promotes self-confidence, entrepreneurial capacity, and capacity building to those involved in the design process.

ملخص الدراسة

تواجه مؤسسات التعليم العالي تحديات في قدرتها على تخريج الطلاب بالمهارات والكفاءات المطلوبة في القرن الحادي والعشرين. يركز التعلم في القرن الحادي والعشرين على الطالب ويؤكد على تنمية مهارات الطلاب وكفاءاتهم التي تتطلبها أسواق القرن الحادي والعشرين. التفكير التصميمي وهو نهج يركز على الإنسان يوفر فرصة للتعليم العالي لتلبية التعلم في القرن الحادي والعشرين. تهدف هذه الدراسة إلى استكشاف تطبيقات التفكير التصميمي في مؤسسات التعليم العالي ودور التفكير التصميمي في تطوير كفاءات الطلاب. باستخدام مراجعة الأدبيات التكاملية والمقابلات المنظمة مع خبراء من مجالات متعددة التخصصات في التفكير التصميمي والتعليم العالي والتنمية المستدامة؛ قامت الدراسة بتحليل وتلخيص وتصنيف البيانات من مراجعة الأدبيات ومقابلات الخبراء عبر طرق التحليل النوعي للعثور على الموضوعات الرئيسية المتعلقة بتحول التعليم العالي لتحقيق تنمية كفاءات الطلاب كغاية.

وجدت هذه الدراسة المفاهيمية أربعة موضوعات رئيسية تتعلق بتحول مؤسسات التعليم العالي. هذه المواضيع هي: تجربة التعلم؛ شركاء التعلم؛ بيئة التعلم؛ بناء قدرات التعليم العالي. تتشابه هذه الموضوعات مع التعلم المتمحور حول الطالب من خلال فلسفة التفكير التصميمي وتقدم إطار عمل "التعلم 4.0" لتحقيق تنمية كفاءات الطلاب. اقترحت الدراسة أيضاً نهجاً لتفعيل هذا الإطار.

بناءً على هذه الدراسة، يمكن عكس مفهوم التفكير التصميمي كفلسفة تتبنى القيمة البشرية وازدهارها، كما وتقدم وعاء متعدد الاستخدامات لكل من يسعى لتصميم المنتجات والخدمات والتجارب التي تجعل حياة الناس مستدامة وبسيطة. أيضاً، التفكير التصميمي يعزز الثقة بالنفس، والقدرة على تنظيم المشاريع، وبناء القدرات لأولئك الذين يستخدمون التفكير التصميمي.

Table of Content

ACKNOWLEDGMENT	III
Abstract	IV
ملخص الدراسة.....	IV
Table of Content	VI
List of Figures	X
List of Tables	XI
Abbreviations	XII
1 Design Thinking: A New Path for Higher Education Development	14
1.1 Background	14
1.2 Research Problem.....	16
1.3 Importance of the Research.....	16
1.4 Research Objectives	16
1.5 Research Questions	17
1.6 Organization of the Research	17
2 Design Thinking as a Concept	19
2.1 Evolution of Design Thinking in Education	19
2.2 Design Thinking as a Mindset.....	20
2.3 Design Thinking as a Process.....	20

2.4 Design Thinking Principles and HEIs.....	22
2.4.1 Evolution principle (Iteration & Double Loop Learning).....	23
2.4.2 Empathy (Human-Centered Approach)	24
2.4.3 Holistic Approach.....	24
2.4.4 Creative Thinking	25
2.4.5 Visual Thinking	26
2.4.6 Principle of Dualistic thinking	26
2.4.7 Collaborative learning.....	28
2.4.8 Prototyping.....	29
2.4.9 Playfulness and Motivation.....	29
2.5 21st-century Learning Competencies.....	30
2.5.1 Frameworks for the 21st-century Learning.....	31
2.5.2 Criticism on the 21st-century Learning Frameworks.....	33
2.6 Design Thinking Contribution in Developing 21st-century Competencies	34
2.7 Design Thinking and SDGs.....	35
2.7.1 Design Thinking at United Nation	36
2.8 Higher Education, Sustainability and SDGs	36
2.9 Design Thinking and Education for Sustainable Development (ESD).....	40
3 Design Thinking: Future of Higher Education in the 21st-century	43
3.1 Challenges of Higher Education in 21st-century Learning.....	43
3.2 The Future of Higher Education in the 21st-century.....	43
3.3 Teaching-Learning Environment in the 21st-century	44
3.3.1 Education 4.0	45

3.4 Design Thinking a Processor for HEIs Organizational Change and Education 4.0.....	46
3.5 Design Thinking: A 21st-century Learning Approach in Higher Education	48
3.6 Design Thinking Around the World.....	50
3.7 Design Thinking Pedagogy and Education	51
3.7.1 Design Thinking Building Effective Teaching and Academic Staff Development	53
3.7.2 Design Thinking in Curriculum Development.....	54
3.7.3 Integrating DT in University Programs.....	57
3.7.4 Integrating DT in Entrepreneurship	58
3.8 d.school: The School of DT	60
3.9 Other Forms of DT: The Case of Aalto University.....	61
3.10 Impact of DT on Students' Learning Experience and Attitudes	62
4 Research Methodology	64
4.1 Research Approach	64
4.2 Research Design.....	65
4.2.1 Integrative Literature Review	65
4.2.2 Research Design: Expert Interviews	70
4.3 Research Analysis: Analysis Methods	72
4.3.1 Qualitative Content Analysis (QCA).....	72
4.3.2 Supplementary Methods of Qualitative Analysis.....	73
4.4 Research Analysis Process	74
5 Content Analysis Findings and Recommendations	77

5.1 What Is DT?	77
5.2 Design Thinking Hone the 21st-centurySkills	78
5.3 Design Thinking: A Tool Developing and Transforming HEIs.....	81
5.4 Framework for Developing HEIs	82
5.4.1 Evolution of the Framework	82
5.4.2 Experts' Point of View.....	88
5.4.3 Learning 4.0.....	91
5.4.4 Approach to Operationalize Learning 4.0 Based on DT	94
5.4.5 Customized Approach for Local Universities.....	96
6 Discussions and Recommendation.....	98
6.1 Discussion	98
6.2 Recommendation.....	99
References.....	100
Appendix A	123
Appendix B	130

List of Figures

Figure 1 Organization of the Research	18
Figure 2 DT Iterative Process (HPI, 2020).	21
Figure 3 DT modes. “d.school”	21
Figure 4 DT principles and HEIs	23
Figure 5 Partnership for 21st-century Skills framework (adapted from P21, 2019)	32
Figure 6 The 17 Sustainable Development Goals (SDGs) (UNDP & COMMITT, 2017).	35
Figure 7 Sustainable Development and DT Framework (Munyai, 2016)	40
Figure 8 Juxtaposing DT on Sustainable Development (Munyai, 2016).....	41
Figure 9 The Framework of Literature Selection	68
Figure 10 Classification of Selected Studies	69
Figure 11 Methodological Framework	75
Figure 12 Data Analysis	76
Figure 13 Themes Developed from integrative Literature Review	83
Figure 14 Experts Professional Profile	89
Figure 15 Experts Response.....	89
Figure 16 Learning 4.0 : Key Themes for HE Development.....	93
Figure 17 A suggested approach to operationalizing the Learning 4.0 Framework.....	95
Figure 18 Customized approach for BZU	97

List of Tables

Table 1 21st-century Learning Formula. Own representation adopted from (Trilling & Fadel, 2009).....	33
Table 2 Pedagogical Characteristics of DT	51
Table 3 Life skills Developed Due to DT Interventions	62
Table 4 Main Keywords for Research and Filtering	66
Table 5 Experts Profile.....	71
Table 6 DT Vs. Trilling and Fadel (2009) Formula P21. (Own representation)	79
Table 7 Themes developed from integrative literature review	82
Table 8 Ranking of Themes Based on Importance (Literature Review)	92
Table 9 Ranking of Themes Based on Relevance (Exper interview)	92
Table 10 Average Relevance/Importance of Themes.....	94

Abbreviations

21st CL– 21st-century Learning

3Ps – People, Process, Place

3Rs – Reading, wRiting, aRithmetic

4Cs skills – Creativity& innovation, Critical thinking& problem solving, Communication, and Collaboration

7Cs skills – Creativity& innovation; Critical thinking& problem solving; Communication& Media Fluency; Collaboration, Teamwork & Leadership; Cross-cultural Understanding; Career & Learning Self-reliance

A4Q– Alliance for Qualification

ADF – Aalto Design Factory

APE – Academic Program for Entrepreneurship

BZU – Birzeit University

CAD – Computer Aid Design

COVID-19 – Corona Virus Disease 2019

CPP – College Prep Program

DBL – Design Based Learning

DT – Design Thinking

DWP – Developing world Prosthetics

EDT – Entrepreneurial Design Thinking

EE – Entrepreneurship Education

ELT – Experiential Learning Theory

ESC – Economic Strategic Committee

ESD – Education for Sustainable Development

EU – European Union

HCD – Human Centered Design

HCI – Human Computer Interaction

HEIs – Higher Education Institutions

HPI – Hasso Plattner Institute

ICT – Information Communication Technology

LSM – Lab Studio Models

MBA – Master of Business Administration

OECD – Organization for Economic Co-operation and Development

P21 – Partnership for 21st-century skills, competencies, or learning

SDGs – Sustainable Development Goals

SDSN – Sustainable Development Solutions Network

SMEs – Small and Medium-sized Enterprises

STEM– Science, Technology, Engineering, and Mathematics

TAK – Tasarım Atölyesi Kadıköy

UNDP – United Nation Development Program

UNESCO – United Nations Educational, Scientific and Cultural Organization

UX – User Experience

VET– Vocational Educational Training

YLP – Youth Leadership Program

1 Design Thinking: A New Path for Higher Education Development

1.1 Background

In a globalized and highly competitive world, companies and organizations are seeking new business with purpose, new ways to innovate with the right ideas to survive in their markets depending on the knowledge of their stakeholders. Moving towards more knowledge-based economies to remain relevant and competitive in the 21st-century is vital for these businesses. Therefore, developing the human capital is becoming necessary; in this respect, Higher Education Institutions (HEIs) play a significant role and must innovate and develop new curriculum to meet the changing needs to remain relevant and competitive. Future generations must have good communication, collaboration, creative and innovative mindsets to respond flexibly to complex problems and manage information to extract and break new ground. Student-centred pedagogies and learning approaches are required to deal with the new era.

In this new context, non-traditional approaches to learning raised as a solution for the inefficient methods. One of these methods is “Design Thinking” (DT), a human-centred problem-solving approach applied in many fields to enhance creativity and innovation. DT is a promising field to enhance and promote HEIs in the 21st-century to foster and develop students’ competencies. DT in HE involves engaging students in the form of project-based learning, problem-based learning, and design-based learning. They work in teams to find and solve problems using DT process, mindsets, and techniques to engage in real-world projects and develop 21st-century skills such as critical thinking, self-directed learning, creativity, problem-solving, communication, and collaboration.

Stanford d.school develops the most recent DT model, consisting of five modes; Empathy, Define, Ideate, Prototype, and Test. The process is cyclical, iterative and non-linear. DT as pedagogy might include civic literacy, cultural awareness, critical and creative thinking, and technical skills (Sharples et al., 2016). Introducing the DT concept in undergraduate education is valuable for cultivating students' innovative consciousness and fostering holistic development. Therefore, colleges, universities and educators have been executing DT in courses to integrate creative thinking and innovative thinking. Moreover, DT has made a significant impact on education for the 21st-century (Huang et al., 2020)

The Global Initiative Partnership for 21st-century skills or competencies known as P21; is a framework for learning skills and themes significant for learning in the 21st-century. P21 has also acknowledged DT as a new teaching-learning approach in the 21st-century emerged in response to future generations' learners (Lor, 2017). According to Carroll (2010) and Rauth et al. (2010), DT applies empathy, problem-solving, rapid prototyping, and a multidisciplinary collaborative approach that teach creativity, creative confidence, and innovative mindset. Such skills are significant according to the P21 framework. Organizations and scholars have used the term "21st-centurycompetencies" or "21st-centuryskills" interchangeably as it describes the set of perquisites of knowledge, skills, literacy and dispositions induced by the 21st century to be successful in the global workplace and life (Germaine et al., 2016). In this research, the same terminology was used. In addition, students' competencies in this research used to refer to the same term. Similarly, the term "HE" refers to "HEIs" and interchangeably used for this research.

Promoting sustainable development in HEIs is vital for their sustainability. Therefore, the Sustainable Development Goals (SDGs) must be integrated into curricula. SDGs are a set of seventeen interrelated sustainable development goals adopted from Agenda 2030 to bring peace

and prosperity to the citizens of the world (UNDP & COMMITT, 2017). According to UNDP, DT is the favoured approach for achieving the SDGs through their worldwide programs because of its Human centeredness and iterative process (UNDP, 2014; UNDP, 2016).

1.2 Research Problem

In the 21st-century, HEIs are challenged by the globalized and high-tech evolved world; current educational methods and techniques are no longer efficient enough in preparing students with competencies they need for the market. The research problem is the ability of HEIs to graduate students with competencies and skills that meet the needs of the job market in the new century.

1.3 Importance of the Research

In HE, DT is relatively new, and under research, limited studies have holistically addressed DT from a pedagogical context or a tool for the constant call of transforming HEIs. There is no consensus agreement about the definition of DT and how it should be taught or used in the HE context to enhance students' competencies for the 21st-century. This study link DT with three interrelated topics significant to HE transformation. HEIs as the provider of learning linked with 21st-century learning skills or competencies (21st CL) known as P21, and sustainable development goals (SDGs). The study contributes in pedagogy development in higher education as it introduces a framework to develop students' competencies and transform HEIs toward student-centred learning.

1.4 Research Objectives

The main objective of this research was to explore DT application in HEI and the role of DT in developing students' competencies. The research planned to find key themes related to

HE transformation to achieve students' competencies development and introduce a framework based on DT to improve students' competencies and hence contribute to the HEI transformation.

1.5 Research Questions

The following questions have been posed to achieve the research objectives;

1. What is DT? Its definitions, process, principles, approaches, applications and use cases?
2. How can DT integrate into HEIs?
3. Why is the 21st CL indispensable? And, it's relation with DT and the development of HE?
4. What is the relation between DT and sustainable development and its relation with the development of HE? And? Implementing the SDGs?
5. Is there an opportunity to transform current HEIs to 21st-century learning through DT?

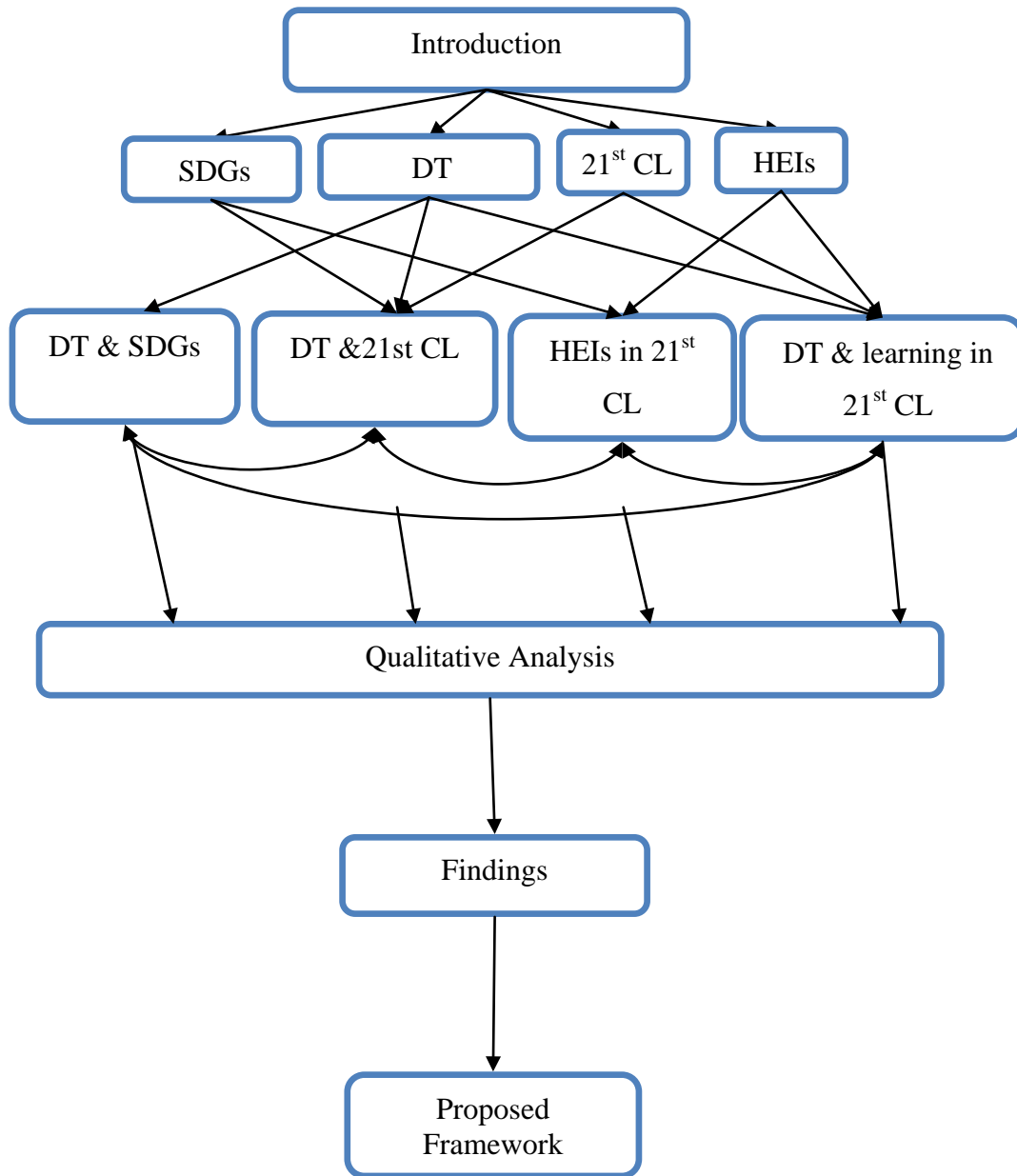
1.6 Organization of the Research

The research is organized in Chapters as follows (see Figure 1);

1. **Chapter One** provided an introduction about the research topics, problems, main objectives and limitations.
2. **Chapter Two** reviewed and discussed the literature related to the evolution of the DT process, mindsets', and principles from the educational context and its relation with 21st-century learning competencies and SDGs.
3. **Chapter Three** reviewed and discussed the literature related to DT and HEIs in the 21st-century context.
4. **Chapter Four** discussed the methodological approach of this research.
5. **Chapter Five** analyzed, introduced findings and proposed recommendations based on research results.

Figure 1

Organization of the Research



2 Design Thinking as a Concept

2.1 Evolution of Design Thinking in Education

The literature review showed that the research momentum about Design Thinking (DT) in design and management has been increased in recent years and still increasing. However, studies about the practice and integration of DT as a teaching-learning approach in HEIs are still minor. DT originated in architecture, design, art and applied in other management fields (Johansson & woodilla, 2009).

Johansson-Sköldberg et al. (2013) introduced five sub-discourses in DT; (1) Creation of artefacts, identify activities that create new things from the activities that deal with reality (Simon, 1969). (2) Reflexive practice, reflection as the core of design and successful activities through which students can reflect to generate solutions (Schön, 1983). (3) Problem-solver design is a two-stage process, problem definition & problem-solving, in which all problem elements identified and analyzed to drive the final solution (Buchanan,1992). (4) Creation of meaning, meaning as the core of the design process (Kirppendorff, 2006). (5) A way of reasoning and making sense of things, DT is a practice activity and abduction reasoning used to create value (Johansson-Sköldberg et al., 2013).

The sub-discourses that identify DT as a reflexive practise, problem-solving, and a way of reasoning and making sense refer to pedagogy as these discourses feature competencies such as problem-solving, critical thinking and innovation that will develop education in general (Luka, 2014).

2.2 Design Thinking as a Mindset

DT is not limited to a selective group; a successful design thinker does not need a design background. The main requirement of DT is the correct mindset that leads the right view from the start to the end. A closed mind will never accept new and non-traditional solutions (Brown, 2008).

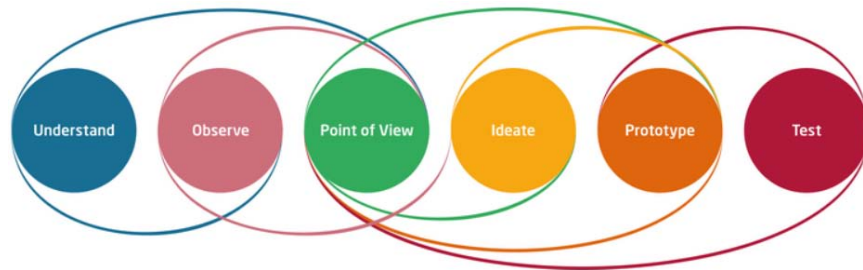
2.3 Design Thinking as a Process

Waloszek (2012) defined the design process as how methods combined in a sequence of actions and steps. Simon (1969) drove seven phases of the DT process, respectively: (1) Define, in which the issue and audience who seek solutions identified. (2) Research; analyze history, problems and opinions about the issue. (3) Ideate; where the needs and wants of the end-user identified after brainstorming. (4) Prototype; Prototypes built to get feedback from different users. (5) Choose; all feedbacks reviewed objectively to select the optimal idea. (6) Implement; the idea is implemented as a project or as a task. (7) Learn, where feedbacks from end-users reviewed for better improvements and learning.

Using the same terminology used in Simon's model, other models of DT created. Brown (2008) introduced DT as a system approach that consists of three spaces known as (3Is); (1) Inspiration, (2) Ideation, and (3) Implementation. However, the institute of design at Stanford, known as (d.school), introduced the most outstanding one (LUKA, 2014). As shown in Figure 2, the DT model consisting of six iterative phases (HPI, 2020).

Figure 2

DT Iterative Process (HPI, 2020).

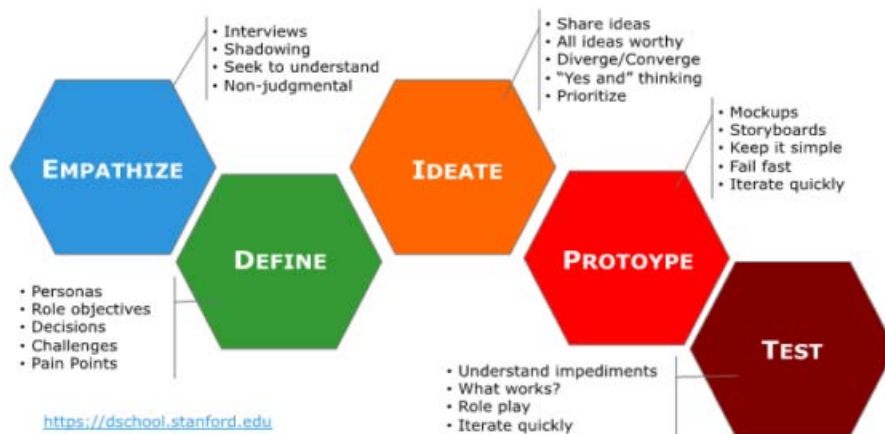


The approach is similar to Buchanan (1992) wicked problem approach, as it combined the phases into two main spaces; problem and solution. The problem space consists of understanding and observing. The solution space consists of ideation, prototyping and testing. According to Efeoglu et al. (2013), DT is a circular process that allows the interaction between the phases, where the “point of view” phase plays the hinge role.

d.school updated its model into five phases instead of the six phases. The five phases model is an iterative process and recognized as design modes which consist of ;(1) Empathize, (2) define, (3) Ideate, (4) Prototype, and (5) Test. Each mode contains many activities, as shown in Figure 3 (Plattner, 2009; Plattner, 2010).

Figure 3

DT modes. “d.school”



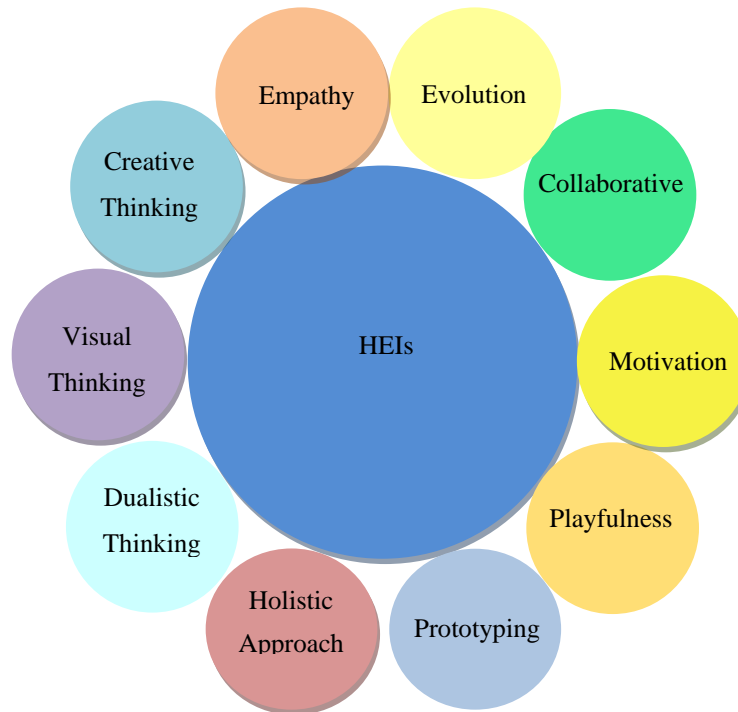
According to "d.school", empathy mode focuses on understanding and observing people's attitudes (into their shoes). Define mode prepares students to be aware of people needs and develop insights. The ideation mode assists students to brainstorm and generate solutions as possible, "thinking out of the box". While Prototyping model allows students to learn from failure and test mode, provide insights on how the proposed model work in practice and collect data from users to refine and improve (Plattner, 2009; Plattner, 2010).

2.4 Design Thinking Principles and HEIs

Cultivating students with 21st-century competencies is becoming necessary to produce qualified, more caring, and entrepreneurial people. In response, HEIs are transforming and demanding urgent changes in curricula and learning methods.

Tschimmel et al. (2015) conducted a DT research project with partners from different European countries to clarify the role of DT in Higher Education Institutions (HEIs) and Vocational Educational Training (VET). In addition, they recognized new approaches to teaching/learning and found that DT is suitable for application in HEIs and VET. They attributed their conclusion to ten principles embedded in the DT approach; the principles are; (1) Evolution, (2) Empathy, (3) Holistic Approach, (4) Creative Thinking, (5) Visual Thinking, (6) Dualistic Thinking, (7) Collaborative Learning, (8) Prototyping, (9) Playfulness, and (10) motivation (Tschimmel et al., 2015) (See Figure 4).

Figure 4
DT principles and HEIs



2.4.1 Evolution principle (Iteration & Double Loop Learning)

The iterative principle of the DT model, as shown in Figure 2, named "Evolution", allows students to loop back to previous phases for a better understanding of wicked problems (Tschimmel et al., 2015). Argyris and Schön (1978) introduced the double loop-learning model to teach people to think more widely about their problems, assumption and beliefs. Double-Loop Learning cultivates people with new information and develops new skills to question disruptive thinking, feeling, and acting to extract knowledge from individuals (Cartwright, 2002).

The interaction between DT and the double loop-learning model is that DT mirrors double loop practice during prototyping and testing; deep reflection required to explore and discover the assumptions that prevent the progress of the design process (Kessler, 2015). Once the error found, assumptions redefined, and a new solution forged.

2.4.2 Empathy (Human-Centered Approach)

Empathy is the ability to experience the feeling, emotions, perceptions, and values of another. Empathize is necessary to engage with the complexity of social responsibility matters regarding sustainability and global issues (Stover, 2005).

The literature review on empathy showed increasing attention toward the necessity of empathy in HEIs. Although students' engagement in volunteer community work has declined in recent years, particularly among engineering students, previous analyses showed that engaging with stakeholders regarding project design and implementation would improve the ability to empathize with others (Bielefeldt & Canney, 2015).

Due to the significant role of empathy in HEIs, Particularly in engineering and STEM-related disciplines, there is a need to shift to pedagogical practices that are more student-centred and experiential learning (Hess & Fila, 2016; Guerra & Guerra, 2018). Hess and Fila (2016) introduced DT as a pedagogical technique to integrate empathy within engineering education curriculums.

Empathy can develop students understanding of others more deeply and becoming more aware and leverage over their expressions and actions, building trusted relationships, partnerships, teamwork, encouraging more active interaction, and successful communication within their communities (Hess et al., 2016; Hess & Fila, 2016; Guerra & Guerra, 2018).

2.4.3 Holistic Approach

Holism is a concept that expresses all the parts of a system as a whole (Akmence et al., 2015). Holism is interested in every person's features; it is about psychological, physical and social perfection. It combines humanism and spiritual philosophy (Schemmann, 2008). The only way to achieve wholeness in education is to balance the factors including physical, mental, soul,

emotions and thoughts equally; a holistic approach can guide education by thinking human as both a subject and object. Thus, improving human beings in all aspects will achieve the ultimate goal of education that is self-transformation (Nakagawa, 2000; Akmençe et al., 2015).

According to Akmençe et al. (2015), holistic thinking has four pillars; (1) learning how to learn, (2) learning to do, (3) learning to live together, and (4) learning to be. These pillars help students gain creativity, responsibility, take risks during problem-solving, empathize, collaborate, and be emotional and intellectual.

A holistic approach is a human-centred approach to balance human needs as a matter and sense. In DT, the holism of the approach noticed in the problem space and solution space. Where multiple factors and layers of complex problems addressed and synthesized to address and define the real problem. At the same time, the solution space seeks the ultimate solution satisfying human desire as a whole.

2.4.4 Creative Thinking

Creative thinking is the ability to create new ideas that are novel and valuable or convert something that already exists into something new (Greenstein, 2012). Guilford (1966) introduced divergent thinking and linked it with creativity by introducing some essential characteristics of creative thinking: originality, fluency, flexibility, and elaboration.

Constructivism and creative thinking as a theory of learning related to instruction to help students engage effectively in problem-solving. Students acquire creative thinking skills and professional skills as they tackle complex problems through problem-based learning as a student-centred approach that engage students in divergent and converging brainstorming to generate different alternatives and introduce the right solution (Awang and Ramly, 2008)

In DT, which is also a problem-solving approach, Mind mapping is one of the most efficient creativity tools used in ideation. Many scholars noticed that Mind mapping is a powerful learning tool for improving and enhancing student creative thinking (Zubaidah et al., 2017; Al-Jarf, 2009).

2.4.5 Visual Thinking

Design and visual thinking expertise are necessary to promote creativity and innovation among HE students. Visual thinking is an instrument used to explore and develop new ideas like those generated from the DT process. Visualization is much like an author using words, even though words visualized too! (Trowsdale et al., 2012).

Language is fundamental to communicate between people worldwide, but it is still inefficient in communicating between teams when representing thoughts and visions. In contrast, the expression "a picture is worth a thousand words" reveals the significance of visual communication. Tools like mental images, representations, schematic diagrams, photography, storyboarding, and guided imagery help design thinkers or visual thinkers to grasp and excel ideas for better understanding and imagining to enhance or substitute the initial visual form with a more detailed one (Alliance for Qualification [A4Q], 2018). Chamorro-Koc et al. (2015) introduced Concept Bombs approaches a design studio tasks that require students to engage in a rapid visual thinking process to generate a conceptual solution to design problems.

2.4.6 Principle of Dualistic thinking

2.4.6.1 Divergent thinking and convergent thinking. Dualism derived from the Latin word duo, meaning two. Dualistic reasoning split thoughts into two opposed aspects (Macfarlane, 2014). Concerning DT, during the brainstorming sessions in the ideation phase, two thinking modes are used. Divergent thinking in which students asked to use their creativity to generate as

many answers and ideas to solve a particular problem. In contrast, convergent thinking utilizes outputs from divergent thinking to create clusters, patterns, and frameworks that will lead to the final solution. (Brown, 2009)

2.4.6.2 Emotional Thinking and Rational Thinking. Tim brown introduced DT as a third way that combines user-centred perspective with rational and analytical research to create innovative solutions. In other words, DT is profoundly human and relies on intuition to identify patterns and generate practical and emotional ideas (Brown, 2009). Empathizing with people to trigger their real problems is the most crucial phase in the DT process. Students will engage with different people with their emotions and feelings to find their needs and wants. These emotional thinking skills of empathizing and dealing with different people will prepare students to be more emotional and social to engage with others for mutual benefits.

According to Richetti and Tregoe (2001), "Rational thinking is "the ability to consider the relevant variables of a situation and to access, organize, and analyze relevant information (e.g., facts, opinions, judgments, and data) to arrive at a sound conclusion". (pp.7-8). Concerning DT, all the information and data processed to create the point of view (POV), followed by the ideation phase in which many ideas are generated and processed rationally. Students must disprove and analyze ideas to identify the best available solution for the design challenges (Dam & Teo, 2019). Emotional and rational thinking will help students take action and decisions in the upcoming situations depending on their interaction and experiences with others in the design process.

2.4.6.3 Intuitive and analytical thinking. Two primary schools of thought control value creation in any organization or business. The first analytical thinking model is the value created based on quantitative analysis using a continuous process of data analyses and information

processing to clear the way for value creation, decision-making, and problem-solving. The second school is intuitive thinking, also known as the art of knowing without reasoning. Unlimited by the analytical processes, the creative instinct of intuition is the main driver for innovation in intuitive organizations. Although intuition drives innovations faster than analytics, intuitive businesses cannot control or systemize their processes due to the random nature of intuitive thinking (Martin, 2009).

Martin (2009) confirmed that successful organizations could not live without these thoughts despite the dualistic nature of these thinking styles. Therefore, he introduced DT as the third school of thought that balance both styles by using abductive logic to create long-term business advantage, extend to the broader world, and generate breakthroughs to move forward.

2.4.7 Collaborative learning

Studies on collaborative learning have found that students embedded in a social network and group work outperformed individual students in the learning process (Rau & Heyl, 1990; Lin et al., 2016). Collaborative learning defined as a student-centred pedagogical approach that allows groups of students to work together towards achieving a common goal, whether a design challenge or a learning challenge; with the potential to enhance accountability, creative thinking, critical thinking, collaboration skills, interpersonal skills and self-monitor abilities (Gokhale 1995; D. Johnson & R. Johnson 2003; Totten 1991; Pun, 2012).

Collaborative learning improves cognitive growth through learning from sensory interaction, learning from challenging group members mentally, and talent. In addition, students learn to see the perspective of others, take on positive attitudes toward rivals, develop higher self-respect and competitive skills required to meet the challenges of the 21st-century. Thus, educators must take responsibility and cultivate students with collaborative skills and creative

thinking to prepare them to be effective and respectful in working with others as creative problem solvers (Pun, 2012). In the same context, Turlíková et al. (2021) introduced a DT approach to address collaboration. Interdisciplinary students are assigned challenges and learn to co-design and co-partner with others to solve these challenges.

2.4.8 Prototyping

Prototyping is one of the fundamental processes in DT. It promotes visual communication, improves learning and understanding by developing and building models that reflect the solution in the most desired expression (A4Q, 2018).

In DT, prototypes are learning tools to extract reliable and valuable feedback and reduce the risk of failure by improving or abandon unreliable ideas. Failure during prototyping and testing may cause relatively significant changes and provide an opportunity for a range of possibilities and creativity. To improve the prototype, convergent and divergent modes used to get closer to the desired solution or change the problem statement, leading to a new problem statement with new ideas and prototypes (UNDP & COMMITT, 2017).

2.4.9 Playfulness and Motivation

In the context of learning, playfulness deemphasizes the need to be perfect. Thus, it increases learners' self-esteem, self-awareness and develops interpersonal relationships through cooperative efforts. Using a playful learning approach to real-life decisions will engage learners to be more likely to learn from each other and accept making mistakes in the process. Therefore, playfulness is essential when learning to work with others and achieve flexible thinking, commitment, and love of learning (Boyer, 1998).

Amabile (1996) indicated that intrinsic and extrinsic motivations could improve people's creativity who are encouraged to work with rational playfulness. The experience of joy and play

will motivate individuals to engage in the learning process and other activities during playfulness. In addition, McClure (1990) said that playfulness helps students control their behaviour, preparing them to be more engaged in the course on different levels.

Many studies have found that playfulness enhances creativity, exploration, behaviour, emotions, collaboration and ideation (Dunn, 2004; Chang, 2013; Kumar et al., 2017). Chang (2013) verified that playfulness is indeed beneficial for individual creative performance. He pointed out that those with high playfulness, who frequently showed attitudes reflecting freedom, voluntary, excitement, humour, and joy in the workplace and relationships, demonstrated greater creativity. Thus, schools and teachers must offer some degree of flexibility and freedom, learn from failure, cultivate playfulness, and foster the expression of humour in the classroom to enhance students' creativity.

The view of creative play as freedom, fun and breaking the rules is beneficial in creating and using playful learning environments to promote academic achievements and analyze cognitive skills. Playfulness can boost the motivation of individuals to be more engaged in the task rather than being depressed (Kumar et al., 2017).

2.5 21st-century Learning Competencies

In the 21st-century, competencies such as; Collaboration, teamwork, problem-solving, risk-taking, creative thinking, and flexibility are highly vital in the workplace. Literature reviews have shown a constant call from scholars in education to modify educational systems at all stages to support and develop 21st-century skills and literacy. Since the role of HEIs is to prepare students for the 21st-century, learning should focus on cultivating the 21st-century learning competencies to help students navigate and participate in the 21st-century (Germaine et al., 2016; HCPSS et al., 2014).

2.5.1 Frameworks for the 21st-century Learning

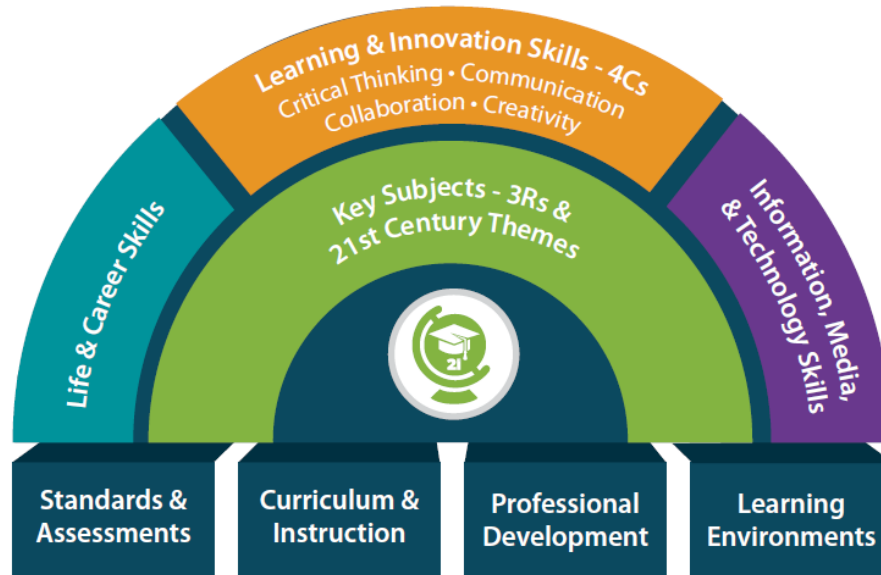
Several frameworks developed to improve 21st-century learning. Voogt and Roblin (2012) conducted a comparative analysis of international frameworks for 21st-century competencies. Public and private sector organizations developed these frameworks, which indicate how society is intensely interested in 21st-century competencies. They found that most 21st-century competencies frameworks strongly agree on the necessity for competencies in collaboration, communication, social/cultural awareness, creative thinking, critical thinking, problem-solving, ICT literacy, and high-quality product development. According to Chu et al. (2016), Trilling & Fadel (2009), and (Voogt & Roblin (2012), The Partnership for 21st-Century Learning (P21) is the only organization that introduces a comprehensive and conceptualize framework for 21st-century competencies.

2.5.1.1 P21: 21st-century Competency Framework and Learning Formula.

P21 is a non-profit organization founded in 2002 by the American business community, education leaders, and policymakers. P21 conceptualized a framework for 21st-century learning skills. P21 framework categorized into four core skills, including; (1) learning and innovation skills, (2) information, media and technology skills, (3) life and career skills, and (4) key subjects-3Rs & 21st-century themes. The framework also demands a support system that incorporates standards, assessments, curriculum, instructions, professional development and learning environments to produce 21st-century learning outcomes (P21, 2019).

Figure 5

Partnership for 21st-Century Skills framework (adapted from P21, 2019)



In order to be successful in the future, students must master the core subject and 21st-century learning themes as described by P21 (2019). Such subjects are; Language arts, World languages, Arts, Mathematics, Economics, Science, Geography, History, Government, and Civics. Since the 3Rs, (reading, writing, arithmetic) serve as the umbrella for these critical subjects. Creativity & innovation, critical thinking & problem solving, communication, and collaboration, known as the (4Cs) are the shorthand of all skills required to succeed in college, career, and life. Furthermore, students must promote a deep understanding of academic content by entwining 21st-century themes into core subjects. 21st-century themes include; Global Awareness, Civic Literacy, Health Literacy, Environmental Literacy, Financial, Economic, Business, and Entrepreneurial Literacy (P21, 2019).

Based on the P21 framework (see Figure 5), Trilling and Fadel (2009) introduced a 21st-century learning formula consist of seven competencies (7Cs): Critical Thinking & Problem-solving; Creativity & Innovation; Collaboration, Teamwork & Leadership; Cross-cultural

Understanding; Communication & Media Fluency; Computing & ICT Fluency; Career & Learning Self-reliance; and the 3Rs competencies (Reading, wRiting and aRithmetic). 21st-century learning outlined in the following formula in Table 1 (Trilling & Fadel, 2009).

Table 1

21st-century Learning Formula. Own representation adopted from (Trilling & Fadel, 2009)

3Rs X 7Cs = 21st-century Learning	
7Cs Skills	3Rs Skills
Critical Thinking & Problem-solving	Reading wRiting aRithmetic
Creativity & Innovation	
Collaboration, Teamwork & Leadership	
Cross-cultural Understanding	
Communication & Media Fluency	
Computing & ICT Fluency	
Career & Learning Self-reliance	

2.5.2 Criticism on the 21st-century Learning Frameworks

Scholars in the field of psychology and education criticize 21st-century competency frameworks. Rose (2009) found that subjects related to aesthetics, play, joy, and imagination were not included in the frameworks regarding education welfare. The ignorance of these subjects referred to the fact that these frameworks were developed mainly by business organizations, which treat education from economic perspectives (resources).

Another interception, the frameworks are not inspired by intellectual virtues such as empathy, modesty, bravery, tenacity, and fair-mindedness. Paul and Elder (2014) found that these intellectual traits are vital in developing critical thinking, which is why such traits must be infused in student thinking to form a better inner voice and better reasoning. While, Finn (2015)

proposed to substitute critical thinking with creative thinking, explicating that creative work includes a critical component associated with creating new things that have value, which leads to the university's central mission that is the creation of new knowledge with a new value.

Furthermore, Warner (2014) suggested that 21st-century learning is not new. These learning skills go back to the 19th century by John Dewey, a proponent of project-based, student-based learning who introduced the social learning theory. In addition, he pointed that Dewey's learning theories are the blueprint of current learning pedagogies. In addition, he claims that technology only can foster social interaction, and any manipulation in the relationship between teachers and students will cause undesirable effects.

The argument between those who approve of the 21st century learning competencies and those who criticize it calls for the need for pedagogical approaches to integrate and support current 21st century learning frameworks.

2.6 Design Thinking Contribution in Developing 21st-century competencies

Reflection and problem-solving are necessary to promote 21st-century learning. Problem-solving involves student engagement in complex design problems, through which students need to employ creative thinking and critical thinking, collaboration, prototyping and teamwork management. Therefore, the educational value of problem-solving is essential for the development of 21st-century competencies. It can also develop students character attributes such as constancy and flexibility (Koh et al., 2015). DT is a human-centred problem-solving approach; students use it as a process to engage in solving design problems. The DT modes are achieving efforts in applying the 21st-century learning dimensions and competencies; Koh et al. (2015) proposed that design episodes contain 21st-century learning dimensions to engage students in the DT process.

Scheer et al. (2012) discussed DT as a constructive learning strategy to produce innovative and creative students passionate about exploration and problem-solving. Furthermore, Rauth et al. (2010) and Scheer et al. (2012) pointed that DT as a holistic approach to design knowledge and learning is efficient in promoting 21st-century learning. It allows participants to work in multidisciplinary teams to solve complex interdisciplinary real-life projects. Moreover; (Sandars & Goh, 2020; Revano & Garcia, 2020) emphasized that DT foster and hone the 21st-century skills required for future careers. Therefore, HE leaders are responsible for initiating educational programs based on DT to prepare students to develop these skills (Revano & Garcia, 2020).

2.7 Design Thinking and SDGs

The UNDP introduced the Sustainable Development Goals (SDGs) in Figure 6, a set of seventeen interrelated sustainable development goals adopted from Agenda 2030 to bring peace and prosperity to the world's citizens by ending poverty and protecting the planet. Countries across the globe can embrace and improve the SDGs to suit their developmental context and enhance the lives of their future generations (UNDP & COMMITT, 2017).

Figure 6

The 17 Sustainable Development Goals (SDGs) (UNDP & COMMITT, 2017).



Adopting a human-centred approach can solve complex problems such as poverty, gender equality, and access to clean water precisely when the people affected by the problem tackle it. Human-centred design is a practical approach because it gives human beings the preference to design what suits their desires and needs (UNDP & COMMIT, 2017).

2.7.1 Design Thinking at United Nation

In 2015, the United Nations Development Programme (UNDP) in the Arab region had launched the Youth Leadership Programme (YLP) to foster the achievement of the SDGs. YLP brought young Arabs to construct and strengthen their creativity and leadership skills by helping them in designing and implementing innovative projects that improve their communities (UNDP, 2016). YLP applied DT to address sustainable development challenges. The program provides these young people with a set of interactive, hands-on learning workshops and mentoring to be more engaged, innovative problem-solvers, and influential leaders of change (UNDP, 2016). In addition, the UNDP used DT in Eastern European countries to bridge the gap between decision-makers and citizens regarding important country issues, such as public services (UNDP, 2016).

UNDP adopted the DT approach to fulfil the SDGs because; It is based on empathy, possible to materialize ideas, combine analysis, and intuition; it involves those who are most affected by a given problem and leads to desirable, feasible, and viable solutions (UNDP & COMMIT, 2017).

2.8 Higher Education, Sustainability and SDGs

Education plays a significant role in the scope of SDGs. Particularly SDG 4, which ensures inclusive and equitable quality education and promotes lifelong learning opportunities for all (UN, 2017). SDG 4 calls universities and other HEIs to drive forces and align with society to introduce sustainable education for their citizens and promote the other 16 SDGs (Filho et al.,

2019). However, barriers to aligning the SDGs in HE curricula attributed to the lack of collaboration networks between universities, government policies and society in implementing sustainable education and sustainable practices on campus; the lack of expert officers to address the lack of sustainability projects; the lack of structures, such as environmental committees (Filho et al., 2017). As well as the lack of support, interest and concern with sustainability issues from top management; lack of training and the difficulty of integrating the SDGs in courses; and the SDGs are recent and not urgent to implement (Filho et al., 2019).

The UNESCO organization calls for Education for Sustainable Development (ESD) to redirect education and help citizens develop new skills and values and the required knowledge and behaviours to achieve sustainable development. ESD integrates sustainability issues, such as climate change, biodiversity and cultural diversity, into learning to create a sustainable future for future generations (UNESCO, 2020). Therefore, the implementation of SDGs in any society or community requires the engagement of all parties. Particularly, HEIs have a significant role in fulfilling the SDGs. They provide the planning and management to educate SDG generations, build capacities for SDG policies and assure that the SDGs embodied in the local agenda. HEIs responsible and globally aware of sustainability must introduce a holistic approach for societal engagement through which they provide their threefold mission of learning, research and services (Filho et al., 2017; Tandon, 2018; Ahmadein, 2019).

HEIs saw as the generator of human resources, who will shape and lead the future of their societies economically, socially and politically. SDSN Australia/Pacific (2017) highlighted methods to integrate SDGs in Higher Education; these methods revolved around academic capacity building, integrating graduate and undergraduate courses based on SDGs, fostering policies to support SDGs education, co-create learning environment with students. Moreover,

support the capacity building of HEIs as a whole to embrace sustainable development across society. Thus, students must prioritize their learning to be more involved in implementing SDGs in their societies and communities to capture relevant solutions, sustainable development skills and know-how such implementation can reinforce society welfare (Tandon, 2018; Ahmadein, 2019; Handayani, 2019).

Such learning will demand revising curriculum including subjects, courses, programs and syllabuses to identify ways to integrate several SDGs into their discipline. Transdisciplinary approaches and flexible curricula are essential when applying to learn for the SDGs. (Tandon, 2018; Ahmadein, 2019).

An application of such learning is in Rhodes University in South Africa; water scarcity seems to be a big problem jeopardizing livelihoods and the farming industry. The students and faculties from different academic disciplines partner and collaborate with the local government, farmers and other Society Organizations to learn and identify various issues related to the main problem. This type of learning qualified Rhodes students to learn about SDGs associated with water, health and welfare as part of their learning (Tandon, 2018).

Another application; The Tor Vergata University of Rome, offers many opportunities for its students to study sustainability issues, acquire sustainability skills through engaging in; themes of innovation, sustainable entrepreneurship, Sustainable Labs, and Education where students converge to their societal needs and drive innovative sustainable solution, leaving beyond their prints for future generation to follow their steps as the promoters of change (Di Gerio et al., 2020)

Di Gerio et al. (2020) pointed out the strategic role of University Top management in engaging the university community toward sustainable development commitment to achieve

cultural change. In addition, the critical role of students and academics in the process recognized by engaging the university in sustainability projects and events to embrace sustainable attitudes and lifestyles inside and outside the campus.

Regarding students competencies, several authors have submitted several sustainable development competencies related to ESD. Lozano et al. (2017) discussed, classified and synthesized them into twelve competencies, as presented (1) Systems thinking; (2) Anticipatory thinking; (3) Critical thinking and analysis; (4) Interdisciplinary work; (5) Justice, Responsibility, and ethics; (6) Collaboration and Interpersonal relations; (7) Empathy and change of perspective; (8) Communication and use of media; (9) Strategic action; (10) Personal involvement; (11) Assessment and evaluation; and (12) Tolerance for ambiguity and uncertainty.

An interdisciplinary approach is required to cultivate students with the required skills to cope and deal with the social, political, economic, biological and physical aspects of environmental problems and develop creative and innovative thinking about sustainable development. Interdisciplinary can promote the ability to address and manage these issues aligned to the expected outcomes when implementing ESD. (Annan-Diab & Molinari, 2017; Howlett et al., 2016)

However, approaching a research problem interdisciplinary is being stubbornly resisted by academics. That is, to change from unidirectional discipline into interdisciplinary. It seems uncomfortable for academics to talk or think across disciplines when viewing a research problem in the context of sustainability (Howlett et al., 2016). Therefore, HEIs are collaborating in the field of sustainable development to propose new learning methods and curricula, promote sustainable life experiences on campus, and provide staff training programs (Filho et al., 2017)

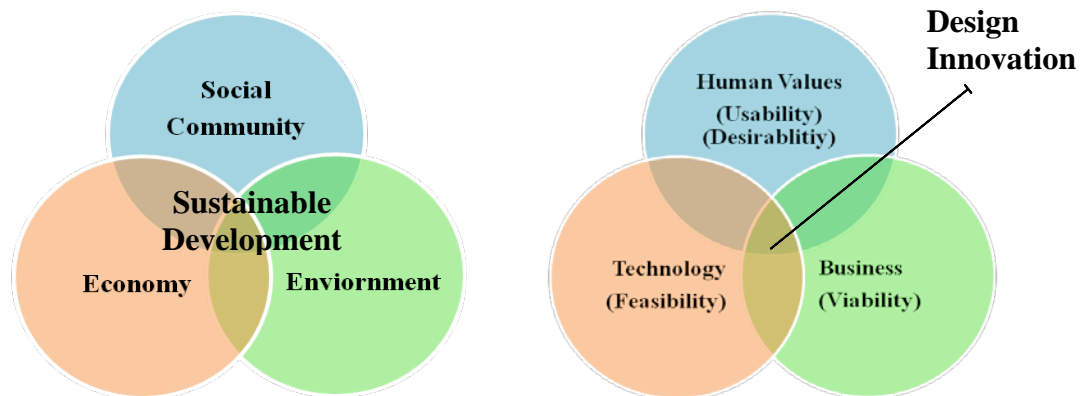
Handayani (2019) and Lozano et al. (2017) identified some learning models used among different universities to integrate sustainable development in the curricula, such as problem-based and project-based learning; interdisciplinary approach; multidisciplinary approach, Transdisciplinary approach. Supporting these learning models with real-world projects will reinforce students' learning experiences. DT as a teaching-learning approach inculcates problem-, project-based learning through the collaborative learning principle, which entails multidisciplinary team collaboration to address multidisciplinary problems related to sustainable development.

2.9 Design Thinking and Education for Sustainable Development (ESD)

The concept of sustainability emerged from realizing that earth resources are limited. Sustainability promotes the development of systems, products and services that are socially environmentally friendly and satisfying user's needs to develop a better society. DT emphasizes the value of understanding both human being and their context through empathy. Moreover, considering people, health, energy, economics, and the environment is necessary when analyzing contextual human-centred techniques to promote sustainable products, services and environments (see Figure 7) (Munyai, 2016).

Figure 7

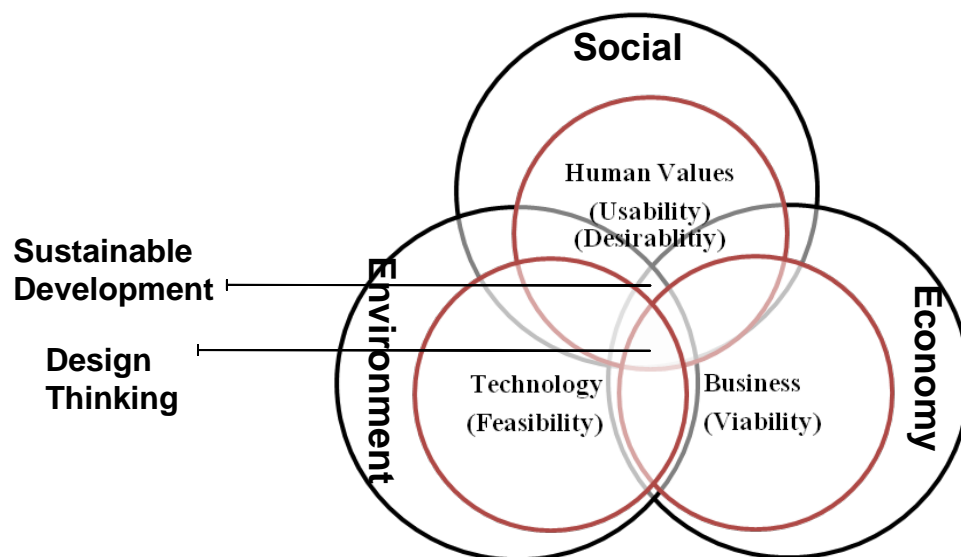
Sustainable Development and DT Framework (Munyai, 2016)



The integration of DT with design for sustainability compiles insights to ensure that the users of systems, products, and services are partners and correlated with the longevity of our natural, social, and economic environments. DT centralized human desirability, technological feasibility, and economic viability, while sustainable development emphasizes society, environment, and economy. Since all are critical to development, combining sustainability with DT will impact and attain sustainability (see Figure 8) (Munyai, 2016).

Figure 8

Juxtaposing DT on Sustainable Development (Munyai, 2016)



Engaging students in learning to address the SDGs will build collaboration skills, critical thinking, and problem-solving skills critical for 21st-century skills. Mansori (2019) introduced a blueprint for problem-based and project-based learning. *Pay attention, Feel connected, Take action* are the guiding principles for learning through sustainable development goals (SDGs). Regarding the learning process, the three principles blueprint is the same as the DT process, where both are human-centred, embrace empathy engagement and take actions.

Educating students using these methodologies will motivate them to develop the confidence, perspective, and personal traits needed to tackle complex problems and challenges (Mansori, 2019). DT introduces multidisciplinary collaboration when groups of students and practitioners from interdisciplinary fields work on projects and problems related to society, the environment, and the economy. Thus, they can learn about the problem from different perspectives and build their solution based on their learning.

DT intervention in university entrepreneurship programs partnering with the industry enhance the business idea and lead to innovative business models in the social, environmental, and economic fields as in the EAN University (Jimenez-Ibañez et al., 2017). In the same context, MIT D-lab partnered with industry and applied DT to address public health needs for low-income countries. Through which students enrich their design experience and international experience (Ranger & Mantzavinou, 2018). At the same time, Clark et al. (2018) observed a highly active and interactive classroom environment and related it to DT. They used active learning and DT to enhance sustainable engineering, where DT introduced creative and innovative solutions for sustainability challenges.

According to Acharya et al. (2021), linking DT with sustainable development and well-being involved multidisciplinary workshop cases. Students participate with partners, stakeholders, and local communities to conduct field visits and develop case problem statements to analyze them and create solutions. Nevertheless, literature work or publications that relate DT with ESD in HE are still scarce.

3 Design Thinking: Future of Higher Education in the 21st-century

3.1 Challenges of Higher Education in 21st-century Learning

Many scholars and academics (e.g. Tschimmel & Santos, 2018; Lor, 2017; Voogt & Roblin, 2012) characterized current society with such challenges as a knowledge society. Which requires changing the educational system in response to societal changes (Tschimmel & Santos, 2018).

Higher Education Institutions (HEIs) must transform due to current educational challenges: (1) Unsustainability of education economics. (2) The rise of ubiquitous learning offers high-quality and low-cost online alternatives to HE (Lor, 2017). (3) 21st-century students are uncomfortable with a learning environment that includes; in-class lectures, memorizing and taking notes from their lecturers (Abas, 2015).

Moreover, 21st-century students are naturally motivated, curious, and digital natives who harness the rapid development in ICT to extract knowledge in a constructivist-learning manner. Therefore, HEIs have an opportunity to innovate and search for new educational models for 21st-century learning, providing a relevant learning experience for effective student engagement (Brown, 2006; Lor, 2017). Furthermore, foster the development of students' competencies in creative thinking, critical thinking, collaboration and communication alongside the other 21st-century competencies.

3.2 The Future of Higher Education in the 21st-century

Technological advancement transformed traditional learning theories to consider using the newest learning technologies in learning and teaching. Connectivism learning incorporates online opportunities to create new knowledge, collaborate, share ideas, experiences, and ideas of a specific view to gain new knowledge and develop students' competencies (Abas, 2015).

The disruptive power of the digital revolution is changing our lives significantly; the internet, mobile devices, and artificial intelligence are increasing the ability to access information and engage in informal learning from anywhere at any time. Thus, eliminating any borders between students and knowledge (Ahmad, 2015; Abas, 2015).

Therefore, academics must reconsider their teaching role and collaborate with students to integrate (ICTs) in teaching methods to seize future opportunities, map individuals' knowledge, and create a unique learning plan (Ahmad, 2015).

3.3 Teaching-Learning Environment in the 21st-century

HE subjected to changes in both curriculum and educational methods. From elite education toward mass, education creating a more educated society will build nations and develop economies locally and globally (Abas, 2015). Consequently, HEIs must transform from being teacher-centred to student-centred to produce graduates with 21st-century competencies. Furthermore, exploring new alternatives and paths to perform and compete in the 21st-century workplace provides a unique learning experience based on student-centred learning (Abas, 2015; Ahmad, 2015).

Academics, scholars and researchers pointed out the importance of student engagement in a learner-centred approach, where the teachers become facilitators and designers of the learning experience to provide practical ways of learning using innovative approaches that are meaningful and playful to students (Abas, 2015; Ahmad, 2015; Alismail & McGuire, 2015).

One of the significant roles of educators is to design a student-centred learning environment and increase student engagement using modern learning technologies and strategies that integrate 21st-century competencies with content knowledge allowing students to engage better in the real world (Alismail & McGuire, 2015).

3.3.1 Education 4.0

Education 4.0 is about utilizing technology-based tools and resources to create new learning environments around students, simulating the work experience and prompting personalized learning by using intelligent learning software's and communication tools to fulfil the industry's needs (Sharma, 2019) as developing students competencies.

Education 4.0 is shifting learning from instructors to students, maintaining their role to support the transition and mentoring learning in the following steps; that is why instructors should not feel threatened by this transition (Fisk, 2017; Hussin, 2018).

Fisk (2017) introduced seven learning characteristics found in Education 4.0; (1) Learning is self-paced, (2) Personalized learning, (3) Freedom of choice, (4) Project-based learning, (5) Field experience, (6) Students design curricula, (7) Independent learning. These characteristics that emphasize student-centred learning are also crossing with DT principles illustrated in the previous chapter.

3.3.1.1 Student-centered learning. Student-centred learning set students' voice at the centre of the learning experience, in which students are the explorers and faculties support them on every step. The application of social-constructivism theory characterizes Student-centred learning. The learning occurred via social interaction between knowledgeable members of the society (teachers & students) to earn social meanings and learn how to apply them in social and cultural contexts (Abas, 2015; Singhal, 2017).

Student-centred learning is an alternative to traditional teacher-centred learning in which teachers are the primary source of knowledge (Abas, 2015; Singhal, 2017). Teachers exert much effort to engage students in the learning process. Many HEIs use teaching-mix-experiential methods, projects, exercises, simulations, games, multimedia to boost learning. Feedback from

students and interaction with the professional industry helps faculty develop meaningful curricula to ensure effective learning (Singhal, 2017).

Student-centred learning varies according to students' interest in learning and the type of discipline and environment in which such learning occurs, amongst other things. Thus, student-centred learning personalizes learning by addressing learning varieties. Students have a critical role in the HE community by choosing their learning course; and participate in curriculum development for a better outcome and draw the best possible learning experience from the HE community (Attard et al., 2010).

HEIs implement learner-centred approaches to education by transforming its scope to produce graduates with 21st-century skills. Students work collaboratively and cooperatively in student-centred classrooms to think, reflect, share, discuss ideas together, inquire, analyze, and solve problems. Students given the preference to shape their courses, there is outclass tasks and use of technology in the course delivery to ensure learning (Attard et al., 2010; Singhal, 2017; Abas, 2015).

3.4 Design Thinking a Processor for HEIs Organizational Change and Education 4.0

As knowledge providers in Higher Education, teachers and educators control and dominate the learning process in HEIs. Therefore, they will resist any external efforts that disturb their comfort zone. Educators practicing traditional educational methods for many years feel uncomfortable or unprepared to apply such technology to student learning. Many of them still mistrust the potential of technology application in student learning or do not know how to integrate technology in their classes (Lawrence et al., 2019).

According to Suciu and Baughn (2016), there is a strong relationship between organizational change and DT processes. They identified vital themes incorporating design into organizational values and practice. These themes mainly included co-creation, visualization, observation, testing, prototyping, and educating stakeholders on the practical application of DT.

HEIs can benefit from DT to drive such change. Educators should use the D-THINK toolkit to create educational scenarios and pathways based on technology to re-design educational methods and attitudes (Tschimmel et al., 2017). Moreover, the toolkit is adaptable and flexible to enhance a positive mindset and drive the required transformation or change regarding Education 4.0.

Another weakness of Education 4.0 is the social interaction challenges mentioned by Lawrence et al. (2019). Educators will spend more time preparing and delivering educational materials and methods than communicating or engaging face-to-face with students. Thus, such practice will push learners into a cybernetic world other than the real world. Using ethnographic methods of DT can prevent the crawling of cybernetics and reverse the technological effect by focusing on students' preference to create a social learning environment, keeping that; technology use is to boost such an environment.

Another issue related to the topic is behavioural change. According to Fabri (2015), there is a clear correlation between DT as a human-centred approach and the creation of behavioural change intervention; he attributed this correlation to the deep-rooted personal nature of human behaviour. Any attempt to change or influence behaviour or maintain adopted one will be successful only if the intervention based on a deep understanding of people's perspectives and attitudes regarding the related issue.

3.5 Design Thinking: A 21st-Century Learning Approach in Higher Education

DT is gaining the attention of HEIs as a teaching-learning approach to solve real-world problems by multidisciplinary teams of students and users. Who engage and interact in projects or programs to create solutions for their societies (Kurokawa, 2013; Dunne & Martin, 2006). Through DT, students take charge of their learning, learning from the professor to the student. With minimum instructional interference, students feel the freedom to reshape their own learning experience and make objective decisions (Miller & Linder, 2015).

Many universities raise awareness of the necessity of curriculum change and develop new learning methods through DT as a student-centred learning approach to support students in acquiring 21st-century skills. DT emphasizes and leverage students' mindsets. Thus, DT classes teach in a culture of play and joy, collaboration and action, experimentation and prototyping, and in-field learning (Thienen et al., 2017).

Thienen et al. (2017) introduce DT as a problem-based learning approach with features that characterize DT education to achieve positive outcomes includes; People, Process, Place, Safety, Sense, and Culture. HPI School of DT (2020) identifies the "3Ps" referred to (People, Process, and Place) as the main pillars of DT work culture.

People: DT fosters radical cooperation among teams. Multidisciplinary heterogeneous teams are preferable. The teacher's role becomes facilitator guiding students, cultivating fun and motivation "verve" to create a playful mood in each mode of the DT process (Thienen et al., 2017).

Process: in DT education, a creative process plays a significant role in creative problem solving (Thienen et al., 2017). According to Matthews and Wrigley (2017), students exposed to learn the DT process from four categories; (1) Human Centred Design; (2) Integrative Thinking;

(3) Design Management; (4) Design as a strategy. These categories have emerged from university programs. The most well-known one is Human-Centred Design.

Human-Centred Design is a human-centred innovation approach focusing mainly on people's needs, where innovation occurs at the intersection between people, technology, and business. This approach promoted by Stanford d.school (5-modes). Matthews and Wrigley (2017) noted that DT is generally based on human-centred principles to design, form the core of all educational programs, and build alliances with design schools to improve university programs.

Place: creative teamwork needs a creative place, through which spaces are variable, adaptable, and flexible. Such spaces could create a relaxable and playful learning environment through which remarkable new ideas grow and evolve (Thienen et al., 2012; Fabri, 2015; Thienen et al., 2017).

In order to fit in the 21st-century learning framework, spaces should be adequately distinct from harmonizing various learning patterns (Tschimmel & Santos, 2018). In the same context, Clark et al. (2018) noted that classrooms consisted of movable tables, seats, and whiteboard walls made in-class activities successful. Therefore, learning spaces are critical when applying DT in Higher Education. Also, Zidulka and Glover (2012) noted that learning environment and culture, including studio space, partnerships, and a wide range of collaborators, are among the requisites of teaching DT effectively.

Molinari and Gasparini (2019) designed a DT workshop and learning spaces to enhance philosophy students' participation in university governance and student-centred learning. They emphasized the dialogical learning space in DT, in which humanities enriched by DT acknowledge human beings as an end and vice-versa.

3.6 Design Thinking Around the World

Governments in developed countries recognize the power of DT to address national issues. For instance, the Danish government supports a cross-ministerial innovation organization that incorporates DT with social science to create innovative solutions for society (Kimbell, 2011).

In the Asia-Pacific region, China, South Korea, India and Singapore have been boosting DT at their universities by designing new programs to cultivate DT (Kurokawa, 2013). In Singapore, the Design Singapore Council confirmed the effectiveness of DT in reshaping Singapore by working with communities and schools alike to infuse design as a national skill (Chin, 2016). Moreover, DT used as a framework for PBL, through which students learn through mentorship and collaboration in multicultural teams solving multidisciplinary case problems focusing on sustainability. Which improved students skills in self-learning, complex problem solving, teamwork, and other skills required in 21st-century learning (Acharya et al., 2021)

In the Arab region, the literature about DT, in general, is scarce. Talal Abu-Ghazaleh University College for Innovation (TAGUCI) conducted a DT workshop as their mission to enhance creativity and innovation among the students (TAG-Org News, 2018).

In Palestine, a design-thinking course conducted at Birzeit University (BZU) for MBA students. Through the class, students learned empathizing, sharing, communicating and prototyping. The success of the course was due to the multidisciplinary students from different sectors. Despite the limited resources to create such a learning environment, the class environment was very respectful and full of harmony, the freedom to choose what to learn and design allowed the ideas to follow easily, this type of learning, known as student-centred learning becoming a trend in 21st-century learning.

3.7 Design Thinking Pedagogy and Education

Teaching and learning theories categorized into three philosophical frames: Behaviorism, Cognitivism, constructivism (Noweski et al., 2012; Fabri, 2015) and recently Connectivism (Siemens, 2005). These learning theories are closely attached to the principles of DT with its focus on empathy, reflection, conceptualization, collaboration, connection and interaction between learners and users, creativity and imagination solution improvement through iterative prototyping.

In the literature, DT pedagogy introduced many characteristics; Table 2 introduces the characteristics that made DT pedagogically meaningful in education.

Table 2

Pedagogical Characteristics of DT

Characteristics	Description
Experimental	This model is similar to Kolb's experiential learning theory (ELT), a model that emphasizes the role of experience in the learning process. The transformation of experience creates knowledge through each stage (Kolb, 1984; Rauth et al., 2010).
Constructive Approach	Provide teachers with the necessary support towards a new teaching method to bridge the gap between demand and reality (Noweski et al., 2012).
Design-Based Learning (DBL)	A model for creativity enhancement, engagement and innovation (Dolak et al., 2013).
Capability Building	Developing a participatory approach towards world issues; developing an open, explorative attitude; developing creative ability; and developing an ethical mindset (Beligatamulla et al., 2019).
multifaceted	Includes Tacit experiences, increasing empathy, reduced cognitive bias, playful learning, flow/verve, inter/multidisciplinary collaboration, productive failure/resilience, surprising solutions and creative confidence (Panke, 2019).

In addition, themes like Authenticity; Personal Transformation/Freedom, and a better future are key utopian themes embedded in DT pedagogy (McLuskie, 2017). DT transforms the current state into a more desirable and compatible one by engaging with students to satisfy their needs and introduce new learning methods to foster students' competencies for the 21st-century.

DT must foster a continual competency building and disposition, making students think about their world as overlapping designs with obstacles as a design challenge. Therefore, students need support from their teachers, while teachers must practice becoming effective facilitators, and all must embrace the nature of DT (Sharples, 2019).

Panke (2019) highlighted seven categories of DT application in the educational context. (1) DT as an instructional design method to develop the course content or teaching material. (2) DT for curricular development. (3) DT as a teaching strategy to achieve subject-specific learning goals. (4) DT a learning goal in and of itself. (5) DT a facilitating tool to support students learning, i.e., mentoring, advising, counselling. (6) DT a design method for process improvement or product development. (7) DT a management approach for leadership and organizational development. In addition, she introduced a new meaning of DT as “a learning studio approach for orchestrating conflicting ideas, identifying singular needs and common goals, making productive use of diverse backgrounds, enhancing empathy, and developing a shared vision” (Panke, 2019, p.302).

Today the principles and practices of DT have been adopted in many educational disciplines such as engineering, medicine, technology, business, management, industry, teacher education and vocational education (Sharples, 2019)

Schallmo et al. (2020) introduced DT as an alternative approach to promoting creativity, communication, and collaboration competencies within interdisciplinary teams. They observed students' experience through hybrid learning format, where students assigned a design challenge from the partnering company and supervised by faculty staff and company representatives. Findings from students' feedback revealed that their experience was knowledge enriched, exciting, engaging, and integrating.

3.7.1 Design Thinking Building Effective Teaching and Academic Staff Development

In particular HE providers, policymakers must have a solid understanding of the most demanded skills in the 21st-century world and know how those skills can effectively be taught to prepare students in HEIs for today's digital world (Kivunja, 2014; Ramakrishna, 2014).

Kivunja (2014) discussed effective teaching and effective teachers in the new pedagogical paradigm that includes the 4Cs. Educators change from the usual way of teaching to more effective ways to revise educational policies and curriculums, and educational programs. Such that educators and students become competent in the 4Cs will increase public awareness about 21st-century learning skills.

Based on Kivunja (2014) literature review, the characteristics of effective teaching and its implication in pedagogy identified by many scholars (e.g. Trilling & Fadel, 2009). From their scholarly work, most effective teaching characteristics are inherently embedded in DT. Moreover, in the new 21st learning paradigm, effective teaching encourages teachers to be more facilitators and shift from direct teaching to student-centred learning (Trilling & Fadel, 2009).

Tschimmel and Santos (2018) discussed the D-Think project, a European Project for Innovating Education Systems. The D-Think project offers a paradigm shift in learning for the 21st-century world, introducing a toolkit through which a holistic change in HEIs and VET could be developed by re-designing curriculums, learning spaces, pedagogies assessment and teacher training. The project introduces DT as a guide to lead educators in finding today's students' needs.

Gachago et al. (2017) identified that eLearning champion academics showed characteristics similar to DT and identified as a DT mindset. Therefore, they suggest fostering a DT mindset in academic staff would facilitate creative confidence among academics and support

more academics in innovating their teaching and learning practices. Whereas Tu et al. (2018) found that DT can improve teaching, creates a favourable teaching environment, and promotes effective interaction between students and teachers. They suggested establishing cross-disciplinary communication and cooperation channels, curriculum adjustment, and training for the teaching team to improve DT teaching methods and participate effectively in design education.

Ramakrishna (2014) drove the attention toward the importance of graduate training programs to support academics that will train and aspire to future generations, entrepreneurs, and start-ups. Alternatively, researchers who work in teams to solve many challenges and problems related to sustainable development. Such training programs require integrative approaches, multidisciplinary and interdisciplinary collaboration, and effective communication. Therefore, there is a need for a holistic approach like DT to train quality graduates and researchers to prepare them for future generations as teachers and educators or as chief officers driving innovative solutions for social challenges. DT overlaps with teaching and learning methods as it embraces human-centeredness in 21st-century learning. Therefore, whether DT understood as pedagogy or not, there is no doubt that it has a significant role in 21st-century pedagogy.

3.7.2 Design Thinking in Curriculum Development

Curriculum change depends on analyzing inputs from the ecosystem of stakeholders involved in education, including students, teachers, school leaders, faculty leaders, parents, national and local policymakers, academic experts, unions, social and business partners (OECD, 2018). OECD studies and other studies showed the contribution of DT in re-designing educational systems through; visualization, mind-mapping, prototyping, and helping to tackle challenges facing the learning paradigm.

Tschimmel and Santos (2018) found that DT is an exciting and powerful tool to plan and develop new curriculums in Higher Education. Similarly, Tschimmel et al. (2017) introduced the D-THINK, a toolkit designed to back up DT to renovate HE curriculums, learning experience, and fostering new skills such as; social intelligence sense-making, design mindset, virtual collaboration and transdisciplinary.

The EAN University in Colombia embraced educational policies to transform HEIs. EAN developed the EANTEC® model, a training program based on DT integrated into all university curriculums to develop entrepreneurial capabilities and experience among students (Jimenez-Ibañez et al., 2017).

Empirical studies in the literature discussed DT as a course design strategy to renovate the HE curriculum offering an innovative tool to design courses. Therefore, it is necessary to empathize with students, identify their learning needs to design university curricula. Thus, capacity building for curriculum designers in DT is necessary to tackle students' emotions to integrate them into the curricula (Lor, 2017).

Willness and Bruni-Bossio (2017) proposed the curriculum innovation canvas created by applying the DT philosophy. The canvas is bridging entrepreneurial principles from business models and experiential learning to craft a scheme catalyzing instructors, curriculum developers, administrators and other stockholders to creatively engage in innovation to generate and implement curriculum innovations in a complex and dynamic context.

Due to its human centeredness nature, DT provides educational designers of medical education with techniques to empathize with learners, address their needs and problems during learning or training. DT used as a strategy to transform from lecture-focused to learner-centred, where educational designers design their courses, learning materials, residency programs, and

teaching methods based on student's engagement and feedback (Gottlieb et al., 2017; Anderson et al., 2017; Sandars & Goh, 2020). In addition, current and future doctors must acquire DT skills, which seems to be a curricular challenge for all medical educators. So, to transform medical education, the focus should be on developing four interrelated subjects in healthcare; DT skills, curriculum, faculty staff, and design-based research and scholarship (Sandars & Goh, 2020).

Obstacles in medical education are highly complex, more extensive in scope, and related to multiple stakeholders. Therefore, DT is a suitable approach for discovering, developing and implementing solutions to address these barriers. The approach includes rapid prototyping, which is very helpful for the rapidly changing COVID-19 environment. Using DT, medical educators can convert the COVID-19 pandemic into an opportunity for positive and sustained change by leveraging technology as part of the process to create educational strategies and programs. As well as enhance existing methods and content through online knowledge hubs, virtual simulations, and technology-enhanced coaching to meet the new situation (Thakur et al., 2020).

Using DT as a curricular strategy entails a flexible methodology for developing the capacities and yielding improvements in the learning process to develop students' competencies. Institution administrators must support professional development through faculty training in cross-disciplinary practice and mentoring; create more flexible educational structures, processes, and cultures, which encourage more collaborative and intentional project-based opportunities across students' programs of study to build student capacities and increase the value and viability of student projects through mentoring and collaboration (Lake et al., 2021). Therefore, they argued that DT could be a versatile resource for supporting more diverse, equitable, and

inclusive high impact pedagogies for preparing students for their professional, civic, and personal lives.

3.7.3 Integrating DT in University Programs

Recently, HEIs are investing in integrating DT in universities programs to promote the development of 21st-century skills. Such integration included programs in engineering education, where DT features merged and integrated into the engineering education curriculum to modify and introduce a suitable learning environment (Saulnier et al., 2015; Taajamaa et al., 2016). However, successful integration of DT in teaching demands change in teachers' thinking. Stakeholders must realize the need for investing in DT to guarantee the sustainability and success of academic institutions (Sharma & Sande, 2020).

In business education, integrating DT as a new approach provide business schools with innovation and problem-solving to remedy deficiencies of business school education by embracing the culture of creative confidence (Kelley & Kelley, 2013; Glen et al., 2014). DT pedagogy in business education, information technology, marketing, and entrepreneurship is student-centred, underlines project-based learning using multidisciplinary cross-functional teams and oriented toward external activity (Glen et al., 2014).

Kovatcheva et al. (2019) introduced The DigiThink (a DT model based on ICT) as an alternative to updating current HEIs educational approaches, enhance entrepreneurial skills, digital skills. Moreover, support students in having a digital start-up business or adding a digital value to traditional ones and confronting current and future challenges. Chouyluam et al. (2021) stated that DT foster learner competencies in entrepreneurship. They proposed a DT model named CDTL (Creative DT Learning) integrated immersive experiential marketing to develop digital entrepreneurship through technology. By applying DT, students learn to understand

customers, co-create a virtual experience in purchasing with customers, and integrate with technology to create and operate new digital businesses.

The d.loft STEM project introduces DT as a 21-century learning approach to middle schoolers. The project enhances the development of mentorships between university instructors and university students and university students and middle schoolers (Carroll, 2015). Harth and Panke (2018) used DT as a conceptual framework and methodological approach to promoting motivation and enthusiasm to develop instructional classes for STEM students. They highlighted the potential of DT in aspiring vocational education in recruitment, instructional design, lesson planning, and learning.

According to Puga (2020), universities built on creativity training programs to boost student creative self-efficacy. As the DT process can be a practical educational approach to incubate such efficacy, the process effectively induces students from multidisciplinary backgrounds to work together within teams and learn from each other.

3.7.4 Integrating DT in Entrepreneurship

Entrepreneurship pedagogy has utilized DT philosophy to create and deliver curriculums to give learners a more productive learning approach to experience and internalize the necessary knowledge and develop entrepreneurship skills. Some of the most common tools and processes utilized in entrepreneurship pedagogy and practice have a DT stem as their backbone (Sarooghi et al., 2019; Lor, 2017; Huq & Gilbert, 2017; Gong, 2020).

Some European universities (As in Finnish universities) respond to the necessity of renewing and bridging the HE and work-life practices to overcome the increasing unemployment rates across Europe by focusing on developing and creating new businesses. These universities designed university programs based on DT methods and introduced them as learning labs.

The objectives of these labs are to re-innovate teaching methods, incubate university students and professionals who access for retraining or creating start-ups, foster effective collaboration through interdisciplinary teams, implement complex projects, develop self-aware professionals, and develop entrepreneurial skills (Karjalainen, 2016; Heikkinen et al., 2016; Lugmayr, 2012).

Universities must have the infrastructure to facilitate DT activities by creating spaces that reflect teamwork-oriented flow for their students and stakeholders. Such infrastructure must have versatility features to provide students with a framework to perform different activities throughout the design process. As well as grow relationships within teams and ventures (Sarooghi et al., 2019; Linton & Klinton 2019; Vaugh et al., 2020)

Lynch et al. (2019) found that DT transforms learning within entrepreneurship education. DT applied to integrate technology and entrepreneurship to discover new entrepreneurial opportunities for technical service. Learning outcomes showed a shift to focus on the users of the technology instead of the technology itself. Therefore, educators and policymakers must be aware of this change when designing and planning entrepreneurship curriculums for science and engineering students.

DT interventions in HEIs promote soft skills, generic skills, entrepreneurial skills (Lynch et al., 2019; Zupan et al., 2014; Linton & Klinton, 2019). Moreover, DT enhances student satisfaction, engagement and graduate learning outcomes through an innovative iterative journey of academic course teams, students, and industry advisors (Zupan et al., 2014; Huq & Gilbert, 2017). Utilizing DT in entrepreneurship education enables experimentation, creativity, and

student-centred learning and emphasis skills and tools that are more applicable for entrepreneurs (Linton & Klinton, 2019).

Von Kortzfleisch et al. (2013) introduced the Entrepreneurial DT® (EDT). The concept of EDT enhances entrepreneurial learning in HE by offering a team-diverse-based approach. Using EDT as a framework to structure courses, teachers facilitate learning programs as projects to promote innovation and creativity among their students and experience-based learning (ED-School, 2020).

The experience of DT at Ljubljana University, as noted by Ellermann (2017), was good evidence of the impact of DT on students and society; it showed how the successful application of DT led to valuable entrepreneurial ideas and shift mindsets. Such success is related to student motivation, qualified teaching staff & teachers' autonomy, top management & policymakers, and preconditioned infrastructure to foster the learning environment. despite the post-socialist mindsets associated with students' parents, one of the significant outcomes was the involvement of university students, schoolers, teachers, and unemployed people in entrepreneurial projects, which indicates that applying DT as a general philosophy shifts mindsets by promoting self-confidence and the "being capable" aura (Ellermann, 2017)

3.8 d.school: The School of DT

The d.school at Stanford University is a well-known school applying and integrating DT as a philosophy where students can learn, work on problems to become design thinkers. In addition, d. school offers workshops for students and Boot camps for executives, start-ups and others to learn DT and practice on real-world problems, at d.school Students can work on projects with companies instead of taking in-class courses (Çeviker-Çınar et al., 2017)

Stanford d.school is the pioneer in using DT as a philosophy (Açar & Rother, 2011; Çeviker-Çınar et al., 2017) in education. d.school goes beyond education to re-design HE and K12 education by emphasizing student-centred learning and introducing tools and methods for both HE educators and K12 educators to design innovative courses and transform teacher-centred education into more student-centred (d.school, 2020).

Diverse teaching teams teach all classes at d.school; these classes vary based on the teaching team's expertise to create and add value to d.school experiences, methodology, content, and pedagogy. d.school is pioneering DT, as a DT fountain introducing it to the world by designing and offering plenty of training and learning specialized based on participants' needs (Çeviker-Çınar et al., 2017).

d.school launched Stanford 2025 project, exploring how institutions have begun to chart new paths through HE evolving environment. The project's outcome is a guide to reimagining the future of HE based on four provocations identified by d.school. These provocations are Open Loop University; Paced Education; Axis Flip; and Purpose Learning (d.school, 2019).

3.9 Other Forms of DT: The Case of Aalto University

Laakso and Clavert (2014) identified DT as skills for the 21st-century. They discussed Design-Based Learning (DBL) as a method for educating 21st-century skills across various disciplines and presented the experience of implementing DBL at Aalto Design Factory (ADF). ADF functions as a platform for multidisciplinary experimental DBL to foster better learning outcomes and co-creation within University-industry collaboration.

Moreover, ADF catalyzes a culture of student-centred learning based on design through collaboration and continuous development within Aalto and the wider society. In addition, ADF offers the infrastructure to foster an open culture of learning, provide students with tools and

equipment for prototyping and DT learning. Furthermore, support teachers to try new methods in their teaching, such as DBL, which involves activities that support DT skills (Laakso & Clavert, 2014).

3.10 Impact of DT on Students’ Learning Experience and Attitudes

According to Miller and Linder (2015), the Successful implementation of DT that creates successful solutions can lead to a change in students' identity. In this very emotional transformation, students believe that they are capable of creating and doing important things. This inference was also noted by Ellermann (2017) in his study about the experience of DT at Ljubljana University as he pointed to the “being capable aura”.

In the literature, DT interventions had an impact on students' skills at different levels. Table 3 show these skills

*Table 3
Life skills Developed Due to DT Interventions*

Life Skills	Developed Skills
Interpersonal skills	Self-awareness, self-management, self-learning; teamwork, conflict management, self-efficacy, self-discovery
Creative thinking	Creative confidence
Empathy	Empathy
Communication skills	Communication skills
Problem-solving skills	Problem-solving, integrative thinking, optimism, experimentation, and innovation
Decision-making skills	Project management, decision-making mindsets and attitude for failing,
Entrepreneurial skills	Entrepreneurial thinking

Appendix A lists the references that pointed to these skills.

Despite the scarcity of empirical studies on the adverse outcomes of applying DT in education, Panke (2019) highlighted these adverse outcomes and suggested that educators should be aware of; the potential challenges when applying DT, monitoring and evaluating results, experiences, and being flexible to adjust their DT practice. She also introduced essential outcomes related to DT limitation and adverse effects such as; misalignment between learning content and DT process, lack of creative confidence, teamwork conflicts, anxiety and frustration, idea creation over evaluation (insufficient time), lack of long-term impact, shallow ideas and creative over-confidence.

For instance, Glen et al. (2015) stated that students who engage for the first time in DT projects could be vulnerable to frustration and confusion; thus, they may converge to a single shallow idea. Therefore, they suggest that instructors should intervene and adjust the team's performance prematurely.

4 Research Methodology

Since the beginning of the 2000s, multiple design thinking models have emerged in design, management, and business. In the context of higher education, design thinking is relatively new. Some of the challenges related to higher education in the 21st-century are; students' engagement and collaboration, instructors' role, teaching-learning approaches, policies, and curriculum development. These challenges canalized the researcher to conduct an in-depth literature review supported by qualitative expert interviews to suggest a framework backboneed by DT to address these challenges to develop students' competencies as an end.

This study synthesizes design thinking knowledge from different fields of education in Higher Education. As the study progressed, it became evident that the literature presents a worthy exploration and synthesis of design thinking methods and tools. From a pedagogical perspective, there is a gap of knowledge on the general design thinking application in higher education and their role in developing student competencies and remedy deficiencies in the higher education systems. This study explicitly focused on analyzing, extracting, summarizing and synthesizing data from integrative literature review and the interviewed experts. The research aims to introduce a learning framework that develops students' competencies, contributing to pedagogy development in higher education. This chapter outlined the methodological approach of this study.

4.1 Research Approach

Scholars and academics from different fields in higher education research and study the design thinking practice. Most of these studies showed the significance of design thinking to redeem the gap between theory and practice.

For example, the Conceptual review of Guaman-Quintanilla et al. (2018) highlighted the role of design thinking in developing students skills, attitudes and learning outcomes demanded by industries of the 21st-century. Therefore, to contribute to understanding and consolidating design thinking practice in higher education and portraying them in a conceptual representation to develop students' competencies and transform higher education in the sense of the demanding 21st-century, the study carried out a conceptual bottom-up research study. It does this by collecting, comparing, analyzing, synthesizing and complementing concepts from the collected data. Accordingly, the researcher implemented qualitative data collection and analysis methods, including an integrative literature review and structured interviews.

4.2 Research Design

4.2.1 Integrative Literature Review

an integrative literature review is a non-experimental design through which researchers systematically and objectively criticize, summarize, categorize, and analyze the study subject by analyzing past qualitative and quantitative research studies about the subject of study to make new conclusions and create new knowledge (Torraco, 2005). An integrative review is a comprehensive and inclusive methodology; it includes qualitative and quantitative research articles (Whittemore & Knaf, 2005).

Influential literature dealing with design thinking in the pedagogical context of higher education institutions, 21st-century learning, and sustainable development were reviewed and analyzed. In addition, the literature discussed learning theories and approaches that might be related to design thinking. Since the literature on design thinking is extensive, the following research questions posed for literature collection.

1. What is DT? Its definitions, process, principles, approaches, applications and use cases?

2. How did DT integrate into HEIs?
3. Why is the 21st CL indispensable? And, it's relation with DT and the development of HE?
4. What is the relation between DT and sustainable development and its relation with the development of HE? And? Implementing the SDGs?
5. Is there an opportunity to transform current HEIs to 21st-century learning through DT?

4.2.1.1 Method of Literature Selection. The literature search was conducted based on search engines like google.com, Google scholar, and online databases such as ResearchGate, Birzeit online database, which provides access to well-known databases (Science Direct, JSTOR, Springer), and other online websites. The literature review included journal articles, conference papers, proceeding papers, and publications (2012-2020). The search used filtering keywords. Relevant studies and publications selected according to the following criteria;

1. Identify research keywords based on the research subject/topic and research questions.

Twelve keywords used through literature search (see Table 4).

Table 4

Main Keywords for Research and Filtering

Subject/Topic	Main Keywords for research and filtering
Design Thinking (DT)	Design thinking pedagogy, Design thinking in Higher Education, Design thinking in curriculum development
Higher Education Institutions (HEIs)	The future of Higher Education Design thinking redesigning Higher Education Case studies and literature reviews of design thinking in Higher Education, Design Thinking in Higher Education.
21 st -century learning (21 st CL)	Learning in the 21st-century. 21st-century learning approaches. 21st-century skills
Sustainable development Goals (SDGs)	implementing SDGs in Higher Education integrating sustainable development in Higher Education

2. The researcher used many resources to collect the literature. The research databases used were: (1) Google scholar; (2) Semantic scholar; (3) ResearchGate; (4) Taylor & Francis, Routledge; (5) Springer; (6) Jstor; (7) Science Direct; (8) Online international journals; (9) Other websites.

3. Filters;

Most recent articles and publications that relevant to the research title, questions, and keywords. The literature search included all publications relevant to the topic between (2012-2020). (Total: 450 publications)

1. The abstract of the more than 450 publications read and reviewed
2. For the main topics/subjects and their intersections. Articles and studies discussing the same topic compared to others provided new information and were included in the study. If not, the researcher chose articles and studies with better Homogeneity.
3. Through literature search (50), older articles and publications were relevant to this study in investigating the evolution of design thinking and its principles in Higher Education Pedagogy and 21st-century learning. Therefore, they included in the study.
4. After the filtering process, the researcher selected more than 200 relevant publications and articles. See Figure 9

Figure 9

The Framework of Literature Selection

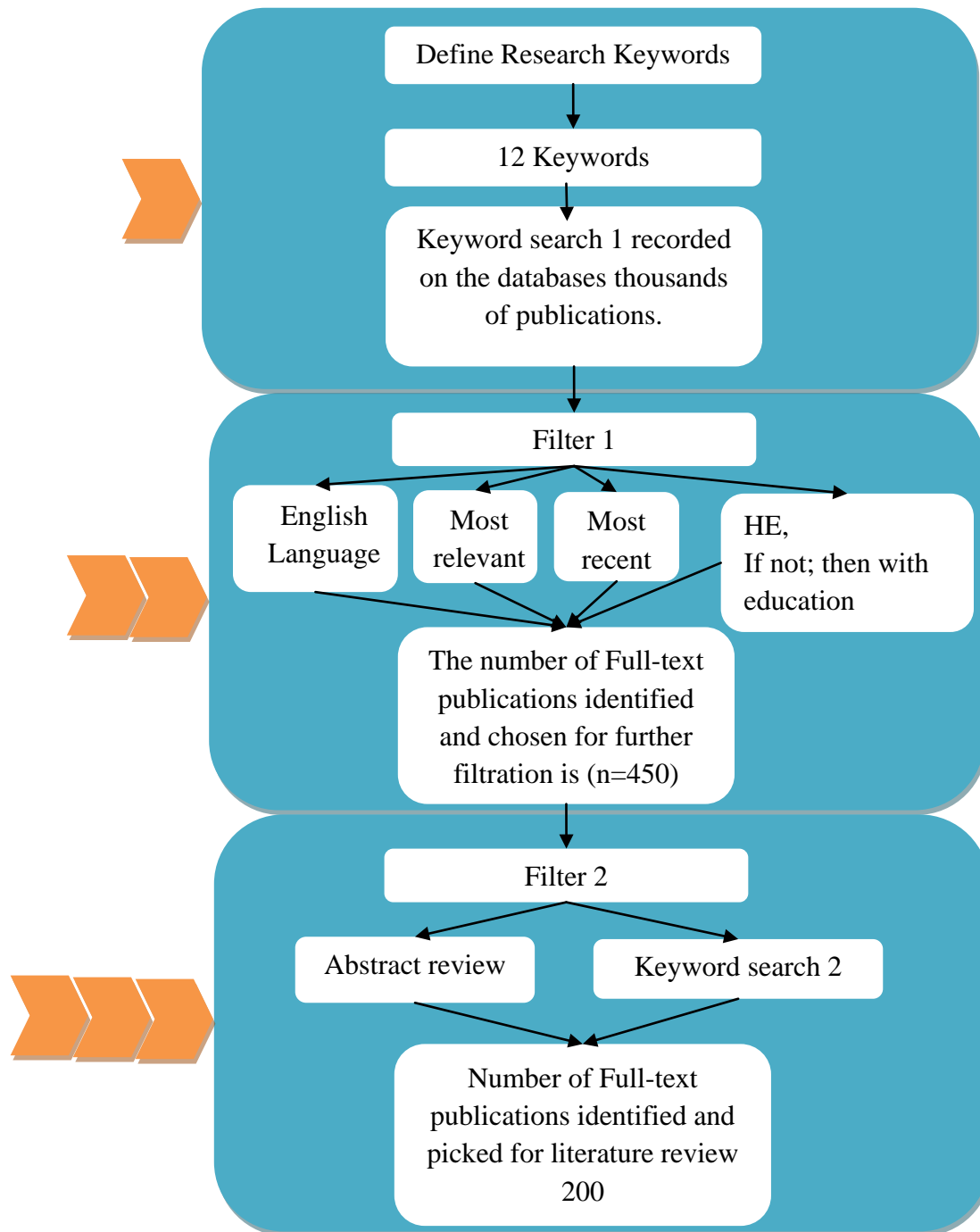


Figure 10

Classification of Selected Studies

Research Title	Main Topic	Sub-Topic	Filter 2: Keywords search	Filter 2	Articles
DT Implication in HE	DT from an educational	Definition Process Principles	DT in pedagogy. DT in HE. DT principles.	Abstract Review	58
	Learning in the	Design thinking, 21 st centurylearning & SDGs	21 st -century learning, frameworks of 21 st -century learning, P21 critics, design		17
	HE in the 21 st - century learning	HE in the 21 st - century learning& SDGs	HE in 21 st century, learning approaches in 21 st century, learning environment, sustainable development in HE, integrating SDGs in		25
	DT for 21 st -century learning, HE, and	DT education in HE & pedagogy DT in Practice	DT as a 21 st centurylearning approach, design thinking features and environment. DT pedagogy.		115

- Classification; as shown in Figure 10, the selected publications were classified according to the research topics.

4.2.2 Research Design: Expert Interviews

ICTs provide qualitative researchers with a unique opportunity for virtual research. Virtual interviews as a form of virtual research enable the researcher to virtually communicate with experts from different countries to share and exchange ideas, experiences, and attitudes. Virtual interviews follow the same logic of qualitative interviewing methods for data collection; it includes structured, semi-structured interviews, unstructured, in-depth interviews, focus groups, and group interviews (Turney, 2008). Comparable interviews are required to analyze the results within interviews and across interviews. Therefore, the researcher followed a structured interview method. This qualitative method involves relatively standard interviewing questions to all participants with the same sequence and equal opportunities to share their thoughts (Firmin, 2008). Structured interviews designed using a set of pre-prepared closed-ended, limited-response questions or open-ended questions to aggregate data and extract information from the participants' professional opinions and attitudes about study-related issues (Lune & Berg, 2017). The interview questionnaire in Appendix B consists of four main parts

1. General information about the experts
2. Design thinking relationship with higher education, 21st-century skills, and SDGs
3. The relevancy of the suggested themes in creating a new approach/framework based on DT for improving students' competencies can also encourage the transformation of HE
4. Expert feedback and recommendation on the suggested themes

4.2.2.1 Sampling. To conduct expert interviews, a criterion established to choose the experts' sample. The expert must have at least one of the following:

1. They have design thinking experience as coaches, trainers, and teachers
2. They play a role in design thinking within the context of industry-academia

3. They have access to higher education development, industry, and society.

Non-probability sampling is a standard method in qualitative research where researchers chose the sample according to a pre-established criterion. Snowball sampling is a common technique in non-probability sampling (Saumure & Given, 2008) and preferred for locating hidden populations (Morgan, 2008). Snowball sampling uses a small pool of initial participants as informants to refer to other potential participants who fulfil the pre-established selection criteria and share a relevant interest in the study (Saumure & Given, 2008; Morgan, 2008). Therefore, the researcher chose this technique for sampling. Using this technique, the interview questionnaire was distributed to experts from local and global HEIs; only thirteen experts responded to the questionnaire and interviews. Table 5 shows the profile of those experts.

Table 5

Experts Profile

Expert	Gender	Major Discipline	Institution
E1	Female	Design	Mindshake
E2	Male	Design	Arcadia University
E3	Female	Engineering	University of Brasilia (UnB), Brazil
E4	Female	Interdisciplinary	University of Amsterdam
E5	Female	Business	University of Gävle, Sweden. Affiliated Linnaeus University, Sweden
E6	Female	Interdisciplinary	HPI
E7	Male	Engineering	NGATE, ANU
E8	Male	Engineering	Al-Quds University
E9	Male	Interdisciplinary	The University of Jordan
E10	Male	Engineering	Birzeit University
E11	Male	Engineering	KFUPM
E12	Male	Interdisciplinary	Inter pares associates ltd
E13	Female	Social Sciences	Birzeit University

4.3 Research Analysis: Analysis Methods

Narrative methods are gaining popularity, and diaries and journals as valuable qualitative tools in social sciences and other disciplines. When little attention is devoted to a subject, and the study seeks to extract new data from first-person experiences, Journal is a valuable tool to use. Thematic or content analysis methods usually used when analyzing journal entries. This form of coding constructs categories and themes from the journal entries. Qualitative researchers analyze the journals seeking connections, patterns, issues, and reactions (Smith-Sullivan, 2008). This research employs analysis methods to select, categorize, analyze and synthesis the content within literature and expert interviews. A mix of qualitative analysis methods was used, including Qualitative Content Analysis, Thematic Analysis, and Conceptual Ordering and then managed the data visually using post-it notes and memo notebook.

4.3.1 Qualitative Content Analysis (QCA)

Content analysis is a research method for eliciting valid inferences from textual data to their context to provide new insights, knowledge, facts, and a practical guide to action (Krippendorff, 1980). In qualitative research, content analysis is interpretive, requiring the careful reading of a text. The content analysis approaches consider that text is open to subjective interpretation, reflects multiple meanings, and is context-dependent (Julien, 2008). The output of these inferences and interpretations is concepts, categories, or themes which can be extended to create models, conceptual structures and conceptual maps describing the subject under study (Elo & Kyngäs, 2008). Content analysis is commonly used for analyzing a wide range of textual data, including interview transcripts, recorded observation, documents, and responses to open-ended questions to produce categories or themes (Julien, 2008).

There are two approaches for content analysis; deductive and inductive. The latter is being suited to the needs of this study. Inductive content analysis performed to create concepts, categories and themes from textual data; it is suitable for use when the study subject undefined in previous studies or when prior knowledge is segmented. The process includes the following phases: Preparation, organizing, and reporting the results to answer the research questions (Elo & Kyngäs, 2008).

Content analysis is very flexible, providing a systematic analysis of a wide range of textual data (Julien, 2008). It is a conversation between the researcher and their data. During analysis, the researcher prepares, reads, organizes, integrates, and forms categories and themes by carefully comparing the similarities and differences between coded data to produce data abstraction that indicates potential relevancies on the theoretical level. His task is to read through each sentence of the raw data and determine whether each sentence is relevant to the research questions (Kyngäs, 2020). Additionally, it is vital to revise previously identified categories to split or combine them, resolving inconsistencies since it may be relevant to more than one category or theme the text repeatedly analyses (Julien, 2008).

4.3.2 Supplementary Methods of Qualitative Analysis

In this study, qualitative content analysis (QCA) used as the basis of data analysis in conjunction with thematic coding and analysis, conceptual ordering, and using concept mapping as a tool to cluster, extract themes, and make sense of the data to create the proposed learning framework.

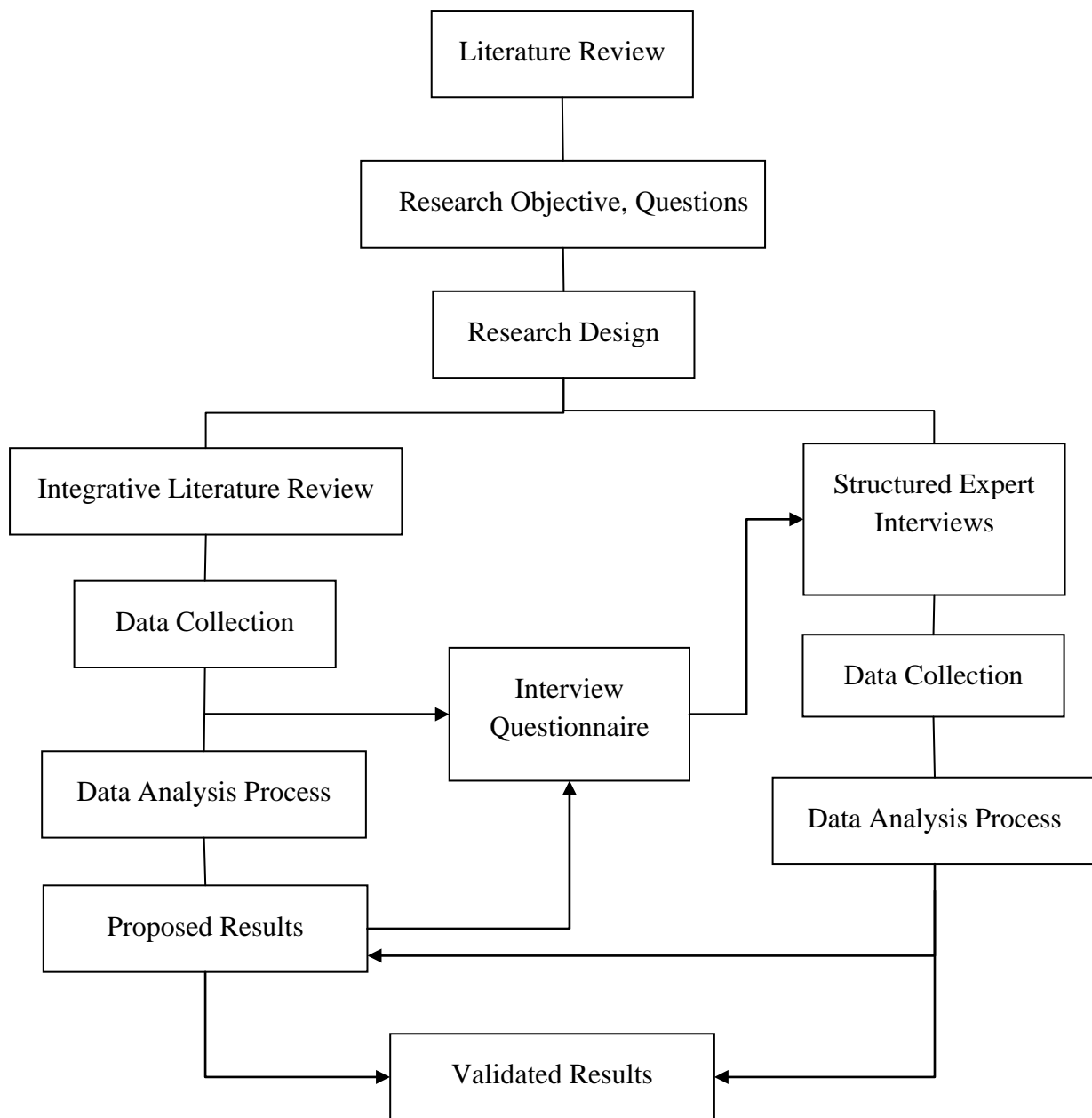
Qualitative data are segmented, categorized, summarized, and re-constructed in thematic coding and analysis to capture significant concepts within the data. In thematic coding, the researcher set a list of themes known to be found in the data because those themes were

explicitly included in data collection through interviews. Codes may also come from the review of the literature or professional experience (Ayres, 2008). Conceptual ordering is a method of organizing data into discrete categories based on assessing the underlying meanings to categorize similar data into groups and then develop themes. Conceptual ordering introduces two methods of data analysis: within-case and cross-case. Conceptual ordering use matrices as a tool to view possible connections among themes, identify similarities and differences, and identify occurrences of change (Leech & Onwuegbuzie, 2008). This research relied on both methods for data analysis within the literature using matrices, and the same followed in the analysis of expert interviews.

4.4 Research Analysis Process

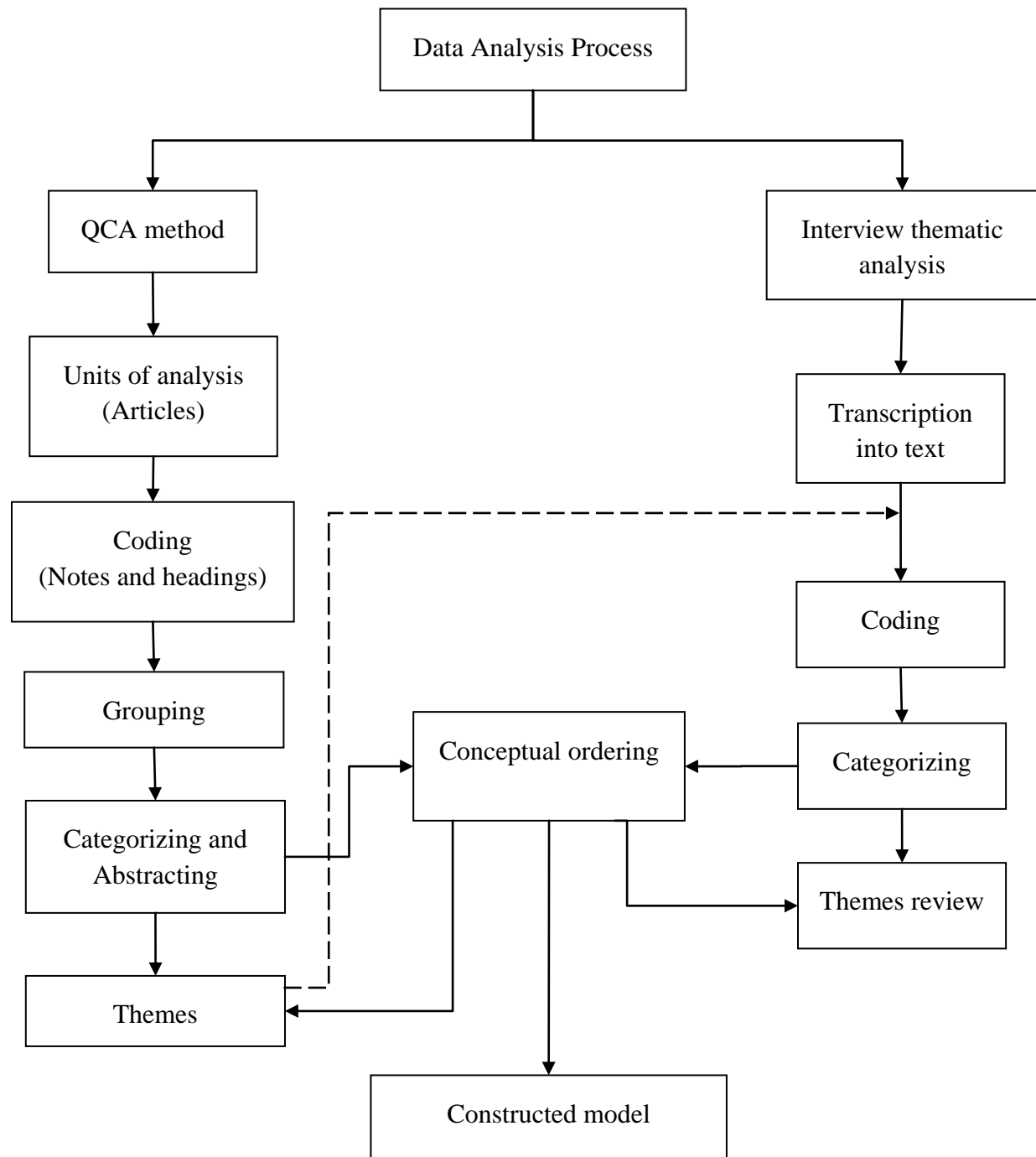
This section illustrates the implemented analysis processes to introduce the proposed learning framework, "The Learning 4.0 STEPs" framework. The following methodological framework in Figure 11 illustrates the approach to the validated results through the data analysis process. The data from the interviews analyzed to reflect the results of the finding from the integrative literature review.

Figure 11
Methodological Framework



The following diagram in Figure 12 showed the overall data analysis process implemented during the research study.

Figure 12
Data Analysis



5 Content Analysis Findings and Recommendations

This chapter analyzes and discusses the data from integrative literature review and expert interviews to answer the research questions.

5.1 What Is DT?

Based on the literature review, DT defined or recognized mindsets, a process, a learning approach, a tool for curriculum development, a pedagogy, attitude, a capacity-building tool, a utopian theme, and a skill. In addition, feedbacks from expert interviews approved these characteristics. DT concept merging psychology (empathy) with science (solution); therefore, it is unique for understanding humans' psychological behaviour from a scientific perspective. Creativity and innovation are entangled; such correlation is essential in driving the evolution of the current world; DT encapsulates a philosophy that foster and interwoven this interrelation to create a human-centred driver of future evolutions.

Since these characteristics share one common goal, which is human development, therefore, DT can be considered a philosophy embracing human beings' value and prosperity as a whole, introducing a versatile vessel for everyone who strives to design products, services, and experiences, making people's lives sustainable and simple. DT is a multidisciplinary practice; however, when diverse disciplines engage in design thinking, they may find their understanding of the process differs based on cultural diversities and the approach itself.

5.2 Design Thinking Hone the 21st-century Skills

Today the workplace is demanding graduates with 21st-century skills. 21st-century learning embraces student-centred learning to promote 21st-century skills among 21st-century students. Literature reviews have shown that DT is a human-centred holistic approach used in HEIs to foster students' creativity, innovation & problem solving, critical thinking, collaboration and communication (i.e. 4Cs skills). Moreover, DT develops personal traits, emotional intelligence; risk-taking; prototyping; self-learning and entrepreneurial thinking. All these competencies are critical to the 21st-century. Likewise, the interviewed experts emphasized DT as a methodology to hone 21st-century skills. Remarkably, the 4Cs. For instance, "Expert E4 said"; "I believe that DT methodologies will allow a better understanding of how to entangle the 4Cs productively in a constant dynamic between praxis, theory, researcher and non-academic people". In addition, "Expert E10 said" that "there is overlap and synergy between DT and 21st-century skills. DT as a methodology help curriculum developer, educators to address and develop problem-solving skills and empathy skills among students".

Therefore, the DT principles (as discussed in Sections 2.4 & 2.6) promote 21st-century skills. Furthermore, some researchers pointed that DT transcends and hones these skills (Sandars & Goh, 2020; Revano & Garcia, 2020; Sharples, 2019). Table 6 illustrates the learning competencies embedded in the DT principles compared with the 21st-century learning formula introduced by Trilling and Fadel (2009) (i.e. P21), considering the criticism on 21st-century learning frameworks.

Table 6

DT Vs. Trilling and Fadel (2009) Formula P21. (Own representation)

DT Principles (Tschimmel et al., 2015)	Trilling & Fadel (2009) P21	Missing subjects 21st-century framework (Critics point of view)
Evolution; Iterative and Double-Loop Learning	—	—
Empathy; Social Responsibility; Modesty, Caring, Communication, Understanding Others	Cross-cultural Understanding	Empathy as intellectual trait
Creative Thinking; Inspiration & Creativity	Creativity & Innovation	—
Visual Thinking; Visual Communication, Media, ICT Instruments, Imagination	Communication & Media Fluency Computing & ICT Fluency	Imaginations
Collaborative Learning; Collaboration Skills, Accountability, Critical Thinking, Cognitive Growth, Interpersonal Skills & Self-Monitor	Critical Thinking, Problem-solving, Collaboration Teamwork, Leadership Career, Learning Self-reliance	—
Prototyping; Visual Communication, Learning By Doing, Cad & Ux Skills	Communication & Media Fluency Computing & ICT Fluency	—
Playfulness & Motivation; Freedom, Voluntary, Humour, Joy, Excitement, Commitment, Flexibility	—	Play & joy
Holistic Approach; Holistic Thinking, Emotional & Intellectual	—	—
Dualistic Thinking; Divergent & Convergent, Emotional & Rational, Intuitive & Analytical	—	—

It seems that DT goes beyond the 21st-century learning frameworks by introducing additional traits pointed out by the critics of the learning frameworks. According to Sharples (2019), DT enhances innovation and transcends 21st-century skills to foster empathy, civic

literacy, cultural awareness and risk-taking. As a new pedagogy, the major challenge in applying DT is to find a procedure to align it with curricula and examination systems.

In the context of sustainability awareness, the intersection between design thinking, SDGs, HE development noticed in the concept of ESD. This concept integrates sustainable issues related to the SDGs to foster and develop new skills using DT as a multidisciplinary holistic approach. Groups of students and practitioners from interdisciplinary fields work on projects and problems related to society, the environment, and the economy to develop solutions with purpose. In partnership with universities, UNDP uses the DT approach to implement SDGs as it embraces empathy and involves users affected by the problem (UNDP, 2016; UNDP & COMMITT, 2017).

Some HEIs embrace Sustainable development and prioritize students learning toward implementing SDGs in their society or worldwide to capture relevant, sustainable development competencies related to ESD. (Lozano et al., 2017) synthesized 12 competencies related to sustainable development, which are similar to those generated when implementing design thinking. (See Chapter 2, section 2.8, P.25). Moreover, most of the experts' emphases on DT approach to integrating SDGs in HEIs. "Expert E6 mentioned":

We designed a program called the 'Pathfinder Program' which was purely built on and designed following a DT approach, and the program itself is about solving a real-life challenge inspired by one of the SDGs. Students will be working for a purpose and will be given knowledge through the process by customizing their learning components based on the challenge/project at hand.

Moreover, "Expert E8," said that "DT and SDGs are compatible, DT is a tool to achieve the SDGs, for instance, to solve poverty, you need to understand the problem that caused

poverty, and this is what DT is”. In contrast, one expert questioned DT as a tool to achieve SDGs. “Expert E2 mentioned” that “DT can, but does not always, achieve or care about sustainability”. However, he also said, "I suggest "sustainability" can be part of design thinking. But what we define as successful design, DT and sustainability changes in a different culture, communities, states and countries”.

5.3 Design Thinking: A Tool Developing and Transforming HEIs

Through analysis of expert interviews and literature review, both suggest that current HEIs must develop their structure in the sense of DT to foster 21st-century skills among their students. HEIs, as the providers of future employees, are transforming their curricula and teaching methods toward student-centred learning to develop students' competencies. DT used as a backbone for curriculum development programs and teaching tools to foster student-centred learning in many cases.

In the literature, DT recognized as a student-centred approach integrated into curriculums to boost problem-based, project-based, and design-based learning where multidisciplinary teams of students engaged in the process and teachers become mentors and facilitators of learning. Furthermore, DT introduced as a pedagogical tool to provide capacity building for teachers to become facilitators and mentors, to design and develop curricula toward student-centred learning, and as a tool to re-innovate teaching methods.

In the same manner, Expert interviews showed a consensus agreement about integrating DT at HEIs as a tool or a methodology to improve HEIs in building students' competencies and educators' capacities. “Expert E8 said” that:

DT and 21st-century skills are integrated; DT is a tool for implementing 21st-century skills and a set of skills as well. However, capacity building of educators to develop their

teaching techniques and create new ones based on DT is required to develop these competencies among students.

Furthermore, "Expert E1 also said"; "HEI educators need to redesign several parts of their institutions, from the pedagogical framework to new teaching/learning methods and spaces. They are not only knowledge creators, but also knowledge and learning facilitators".

5.4 Framework for Developing HEIs

Reviewing related research results and literature and synthesizing many studies and expert interviews, the researcher has built an operational framework for developing and transforming HEIs.

5.4.1 Evolution of the Framework

The researcher conducted an integrative literature review and used a mixed analysis method of qualitative content analysis, conceptual ordering, and thematic analysis. The researcher has applied an in-depth literature analysis of more than 200 articles searching for variables that significantly impact HE development. These variables were then introduced into themes. After many processing and data synthesis processes, the themes were compacted into ten themes, as shown in Table 7 and Figure 13.

Table 7

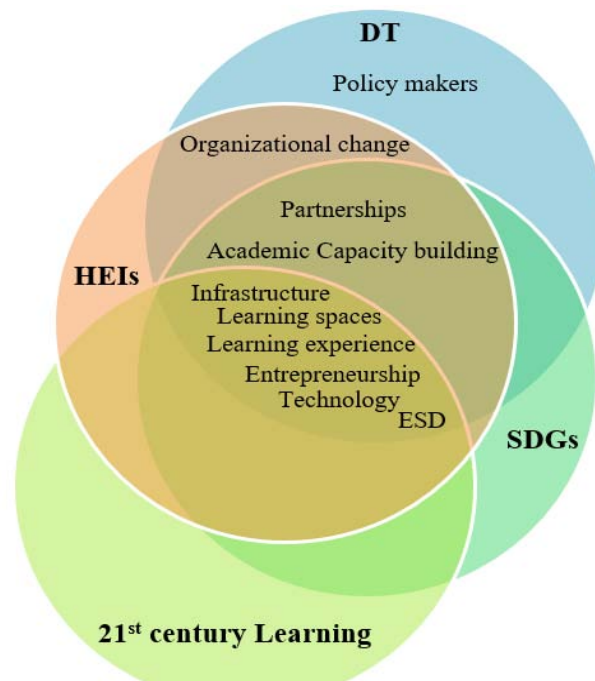
Themes developed from integrative literature review

Developed Codes	Developed Themes
Workshops, labs, multicultural, field trips, case challenges, problem-based, project-based, design-based, student-centred, learner-centred spaces, studio space, playful, maker-space, innovation centres, DT pro-spaces.	Learning space
Infrastructure: movable tables and chairs, whiteboards, monitors and displays, design labs, creativity labs,	Learning infrastructure

Developed Codes	Developed Themes
Technology tools (ICTs), communication tools, technology-based tools, integrate technology in classes, ubiquitous learning.	Learning technology
Multidisciplinary, interdisciplinary, SDGs, sustainable development, collaboration, sustainable solutions, sustainable entrepreneurship, sustainable education, environmental problems, environmental education	ESD
Co-creation, co-design, collaboration, partners, engage with other, co-partner, societal partners, industrial partners, community engagement	Partnership
university top management, ministers, university administration, aware of the change, understand needs, invest, support	Policy Makers
Curriculum development, change, transform, redesign HE, renovate Higher Education curriculum, and replace educational methods, paradigm shift, teachers thinking.	Organizational Change
Teacher training, learn to empathize with learners, academic staff development, training and support, guidance for educators and instructors to become facilitators and mentors, facilitate creative confidence among academics.	Educators Capacity Building
Develop entrepreneurial capabilities among graduates, foster entrepreneurial learning, improve students' ideas, and transform entrepreneurship education.	Entrepreneurship
students are the explorers, improve teamwork, successful communication, improve students life skills, promotes effective interaction between students and teachers, build student capacities, increase and enhance student engagement in teamwork, foster social interaction, promote motivation and enthusiasm for self-learning, fosters innovations and self-confidence, improve student's authentic learning and practical experience, foster an open culture of learning, support students learning for 21st-century learning.	Learning Experience

Figure 13

Themes Developed from integrative Literature Review



Next, the ten themes are introduced as follows:

5.4.1.1 Theme One: Learning Experience. Based on the literature, DT is considered a learning approach that impacts the student experience. To the extent, it enhances learning, students' attitudes and contributes to developing their new mindsets and skills, e.g., creativity, compassion, emotional learning competencies, critical thinking, collaboration, empathy. Tschimmel et al. (2017) found that:

Design thinking can be the primary approach to develop educational content as it focuses on developing educators' and students' creative confidence engaging them in challenges that focus on promoting empathy, developing attitudes toward action, boosting ideation, increasing metacognitive awareness and fostering active critical problem-solving. It provides a relevant contribution to the construction of meaningful experiences for the educator and the learner. (p. 75).

Appendix A lists the full references that pointed to this theme.

5.4.1.2 Theme Two: Partnerships. DT requires collaboration within the teams which develops a collaboration culture among students and encourages a collaborative learning process. At this level, engagement is not only on the students' level but also with their communities and the industry. The theme is referred to as Partnerships. Appendix A lists the full references that pointed to this theme.

5.4.1.3 Theme Three: Learning Spaces. As Tschimmel and Santos (2018) said, "In order to fit the 21st-century learning framework, spaces should be sufficiently diverse to accommodate different learning styles" (p. 212). Successful learning activities and learning outcomes that reflect on students learning are linked to the flexibility of learning spaces. The DT process involves flexible, adaptable learning spaces that support student engagement. Appendix A lists the full references that pointed to this theme.

5.4.1.4 Theme Four: Learning Infrastructure. Learning infrastructure is vital to achieving a successful student engagement, design and facilitate student learning. DT as a learner-centred approach requires a versatile infrastructure that supports student learning. For instance, according to Laakso and Clavert (2014), at ADF:

The building houses both somewhat more formal and informal spaces for team activities, such as brainstorming, team building and meetings, including a fully equipped kitchen that can be freely used by anyone. Design Factory provides tools, facilities, and staff support for various phases and levels of prototyping, from Legos and CAD to CNC milling, painting, electronics, and woodwork. (p. 8).

Appendix A lists the full references that pointed to this theme.

5.4.1.5 Theme Five: Learning Technology. Learning technology is referred to as ICT, online-learning, digital, communication, and HCD. DT as a teaching-learning approach

harnesses technology as a learning discipline, a learning skill, and a learning tool to create virtual learning environments, enhance learning methods, and learn how to use technology as a space for innovation. Thakur et al. (2020) said that:

Design thinking can accelerate the development and implementation of solution prototypes through inspiration, ideation, and implementation. Digital technology can be leveraged as part of this process to provide care and education in new or enhanced ways. Online knowledge hubs, video conference-based interactive sessions, virtual simulations, and technology-enhanced coaching for health care providers are potential solutions to address identified issues. (p. 1)

Appendix A lists the full references that pointed to this theme.

5.4.1.6 Theme Six: Education for Sustainable Development (ESD). Sustainable development entails an emphasis on society, the economy, and the environment. Some universities are using new learning methods and pedagogies to integrate sustainable development into the curricula. As a human-centred approach, DT can integrate ESD in HEIs and support student learning on sustainable development by introducing an interdisciplinary approach. Multidisciplinary teams combined to holistically solve complex problems and find sustainable solutions that are community desirable, environmentally-technologically feasible, and economically viable. Munyai (2016) pointed that "DT merged with design for sustainability combines insights to provide a means whereby users of products, services and systems become inseparable partners in ensuring the longevity of our natural, social, and economic environments" (p. 307). In addition, Munyai (2016) noted the following:

While sustainable development focuses on society, the environment and the economy, DT focuses on human desirability, technological feasibility and

business viability which are all critical to development. When the sustainability principles are combined with the DT methodology can have more impact on promoting and achieving sustainability. (p. 308)

Appendix A lists the full references that pointed to this theme.

5.4.1.7 Theme Seven: Organizational Change. Since HEIs are organizations that provide and create knowledge as well as human capital. “Practices associated with DT can help address the demands placed on those undertaking organizational change.” (Suciu& Baughn, 2016, p. 788) Many researchers have explicitly or implicitly introduced DT as a strategy for exploring new alternatives regarding 21st-century learning and transforming HE curricula, learning, and its scope toward student-centred learning to achieve transformational impact personally and renovate HE institutions. Therefore, the theme is referred to as Organizational Change. For instance, Suciu & Baughn (2016) said that:

Design processes applied to organizational change provide shared experiences as those involved in the change gather an understanding of needs, create a shared vision, and engage in ongoing experimentation to refine their innovation. The demands for innovation and change in today's organizations are endless. Design processes provide a means for ongoing adaptation and revitalization (p. 792).

Appendix A lists the full references that pointed to this theme.

5.4.1.8 Theme Eight: Educators Capacity Building. 21st-century learning emphasized the need to transform teachers' roles and train them to become effective facilitators, designers, and mentors of student-centred learning. As Beligatamulla et al. (2019) said, “After an in-depth analysis of three educators’ experiences of DT pedagogy in the HE context, we arrived at one super-ordinate theme: DT pedagogy sensed as capability building for everyone”. (p.

103) DT introduced as a pedagogical tool providing teachers with a suitable environment to transform their mindset and build their capacities to innovate their practices in teaching and learning. Appendix A lists the full references that pointed to this theme.

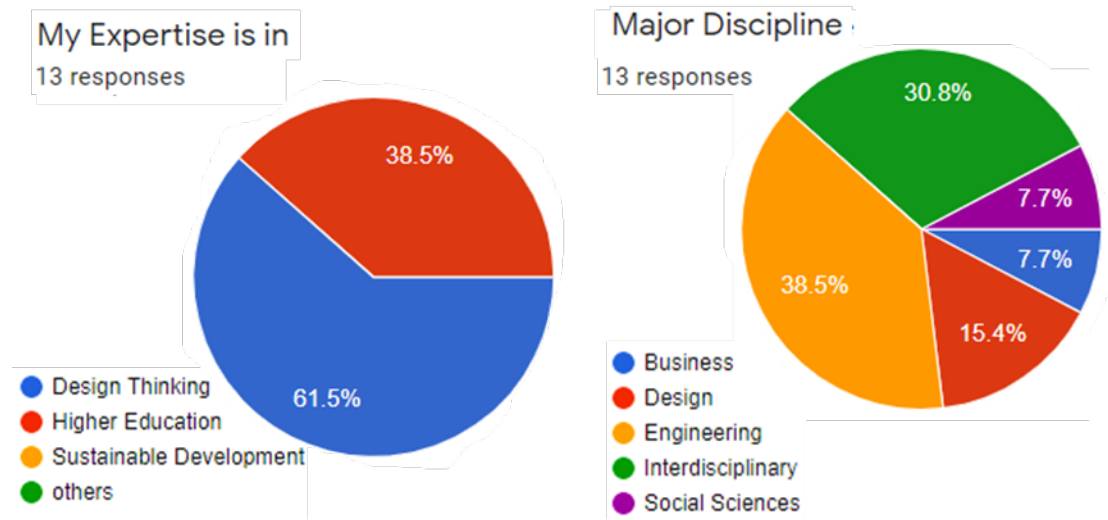
5.4.1.9 Theme Nine: Policy Makers. According to Kivunja (2014), "It is essential that policymakers, across all nations, and in particular HE providers, have a firm understanding of the skills most in-demand in the 21st-century Digital World" (p. 37). On the top management levels, some HEIs sought DT as the driver for change and innovations to design learning strategies in HE and develop curricula to boost life skills and competencies related to 21st-century learning. Moreover, "For successful integration of DT in teaching, it requires a shift in thinking orientation in teaching fraternity and the stakeholders must recognize the need for investment in this process to assure long term and sustained success of the Academic Institutes." (Sharma & Sande, 2020, p. 199). Appendix A lists the full references that pointed to this theme.

5.4.1.10 Theme Ten: Entrepreneurship. HEIs integrated DT in curricula to foster entrepreneurial capabilities among HE students and transform entrepreneurship education. "DT changes the way of entrepreneurship education. It can be used as a new teaching approach to entrepreneurship education, which effectively improves the learning effect of entrepreneurship education" (Gong, 2020, p.163). Appendix A lists the full references that pointed to this theme.

5.4.2 Experts' Point of View

The researcher conducted structured interviews with thirteen experts from different HEIs and cultures and asked them to view the ten themes. Figure 14 shows the expertise and disciplines of the interviewed experts.

Figure 14
Experts Professional Profile



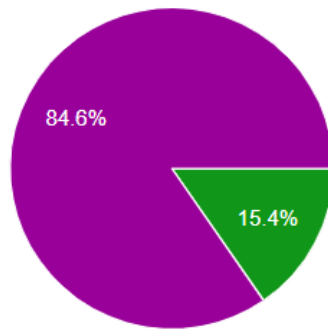
Most experts emphasized the relevance of these themes on improving HEIs to develop 21st-century skills among students. Figure 15 shows experts' responses on each theme.

Figure 15
Experts Response

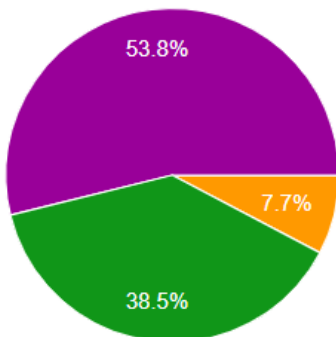
Learning Experience

Note:

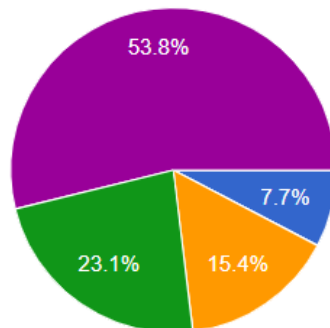
- Not Relevant at all
- Slightly Relevant
- Somewhat Relevant
- Fairly Relevant
- Completely Relevant



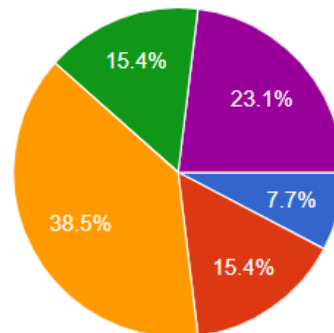
Learning Space



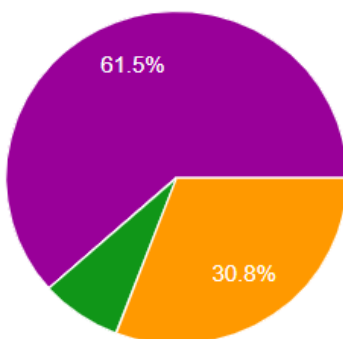
Learning Infrastructure



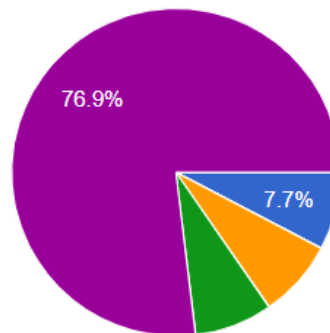
Learning Technology



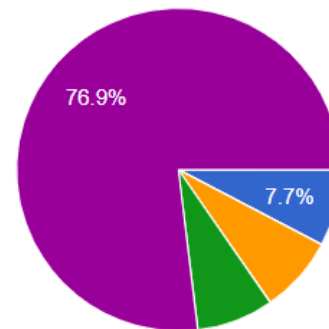
Entrepreneurship



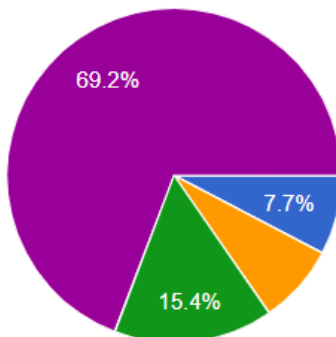
ESD



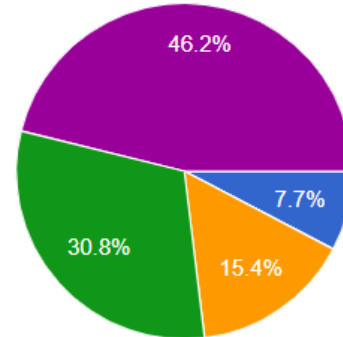
Partnership



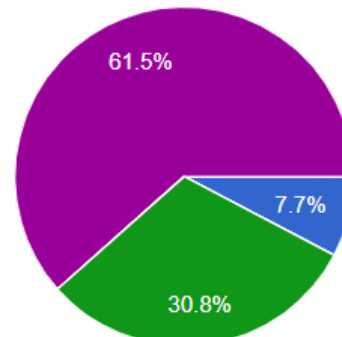
Policy Makers



Organizational Change



Educators' Capacity Building



Experts were also asked about their views on these themes integrated into a framework backboneed by DT to develop HEIs and improve students' competencies. The majority of experts approve of such a framework. Expert E6 said, "I am curious to hear more about the 'framework' itself". Expert E10 commented, "Great! It should be integrated in curricula". Furthermore, some Experts suggested adding additional themes, mainly Experts E2 & E6, who suggested adding the cultural context of teachers and students. Other experts suggested exerting efforts to raise awareness about DT's potential on the top management levels to change the hierarchical structure of HEIs and improve educators' skills and teaching methods.

The researcher conducted a thematic analysis of the conducted interviews and found that most of these interviews pointed to sub-themes or categories related to the ten themes introduced in the previous section. The related themes are; Learning Experience, Educators' Capacity Building, Partnership, and ESD. In addition, the experts' viewed Entrepreneurship as part of the Learning Experience theme that could develop students' competencies.

5.4.3 Learning 4.0

Using conceptual ordering methods, the researcher re-organized the themes from literature and interviews to find similarities and connections among them. Similarities were found among the following themes; learning spaces, learning infrastructure, learning technology. He re-categorized them into a significant theme and named it Learning Environment. In the same manner, connections found between Organizational Change, Cultural Context, and Educators Capacity Building. Those were re-categorized into HE Capacity Building. Partnership and Policy Makers and ESD re-categorized into Learning Partners. Furthermore, Entrepreneurship integrated into the Learning Experience theme. The researcher re-constructed the ten themes into

Four major themes; Learning Experience, Learning Environment, HE Capacity Building, learning Partners.

Table 8

Ranking of Themes Based on Importance (Literature Review)

Rank	Themes	Average Importance (Percentage)
1	Learning Experience	71
2	Learning Partners	60.75
3	Learning Environment	44
4	HE Capacity Building	44

Table 9

Ranking of Themes Based on Relevance (Expert Interviews)

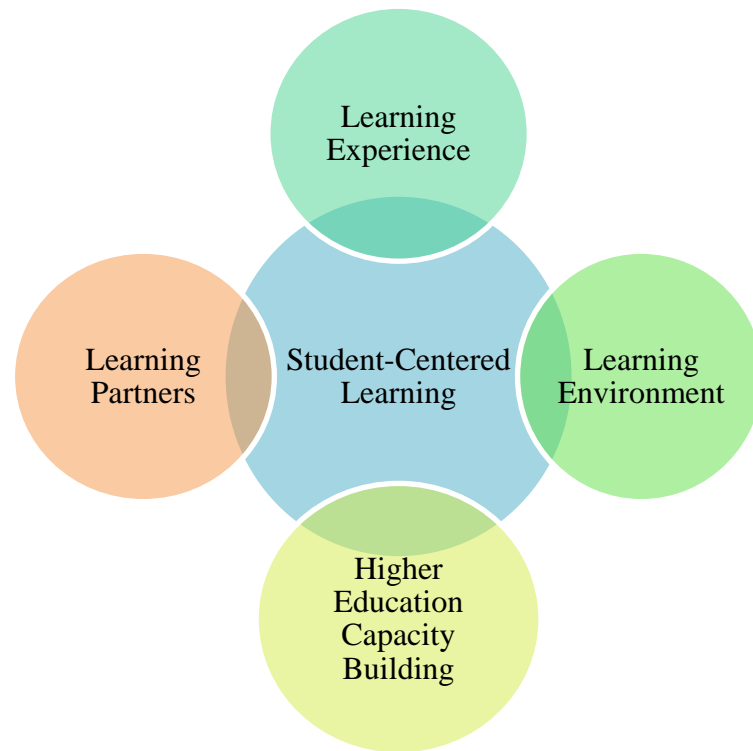
Rank	Themes	Average Relevance (Percentage)
1	HE Capacity Building	84.65
2	Learning Experience	84.6
3	Learning Partners	84.6
4	Learning Environment	69.23

Tables 8 shows the ranking of themes based on their importance and frequency in the integrative literature review. While table 9 shows the ranking themes based on their relevance in experts interviews.

Current HEIs must be aware of key themes that found to be related to their transformation to become Higher Learning Institutions. Therefore, based on DT philosophy, the research introduces learning 4.0, an operational framework that integrates student-centred learning with the key themes through DT, see Figure 16.

Figure 16

Learning 4.0 : Key Themes for HE Development



5.4.3.1 Learning Experience 4.0 is the experience students acquire through DT when engaging in a student-centred learning process supported by HEIs, learning partners, and a learning environment. Where they gain and develop 21st-century competencies as an output of this experience.

5.4.3.2 Higher Education Capacity Building 4.0. It is the process of building capacities within HEIs at all levels to infuse DT through the institution, including; top management, educators, and curriculum developers, to design and re-innovate curriculums, teaching methods, and courses toward student-centred learning

5.4.3.3 Learning Partners 4.0. These are innovation networks and entrepreneurs whose role is to support sustainable learning through fostering students' societal engagement, learning

environments, and learning educators. These networks include; societal partners, policymakers (university top management), learning organizations, alumni, and business incubators.

5.4.3.4 Learning Environments 4.0. It is a student-centred learning environment providing students with a versatile infrastructure with tools and spaces that promotes: Technology use, including Machine learning, Artificial intelligence, Internet of things, ubiquitous learning, wearable computing devices, learning platforms; DT pro-spaces (Variable, Adaptable, Flexible); and field experience to support lifelong learning. It should look like students second home and more.

5.4.4 Approach to Operationalize Learning 4.0 Based on DT

Based on DT, the researcher introduces an operational framework to develop HEIs toward student-centred learning as a requirement to develop students' competencies related to the 21st-century. Table 10 shows the ranking of key themes according to the overall average of relevance/importance from experts and literature review analysis.

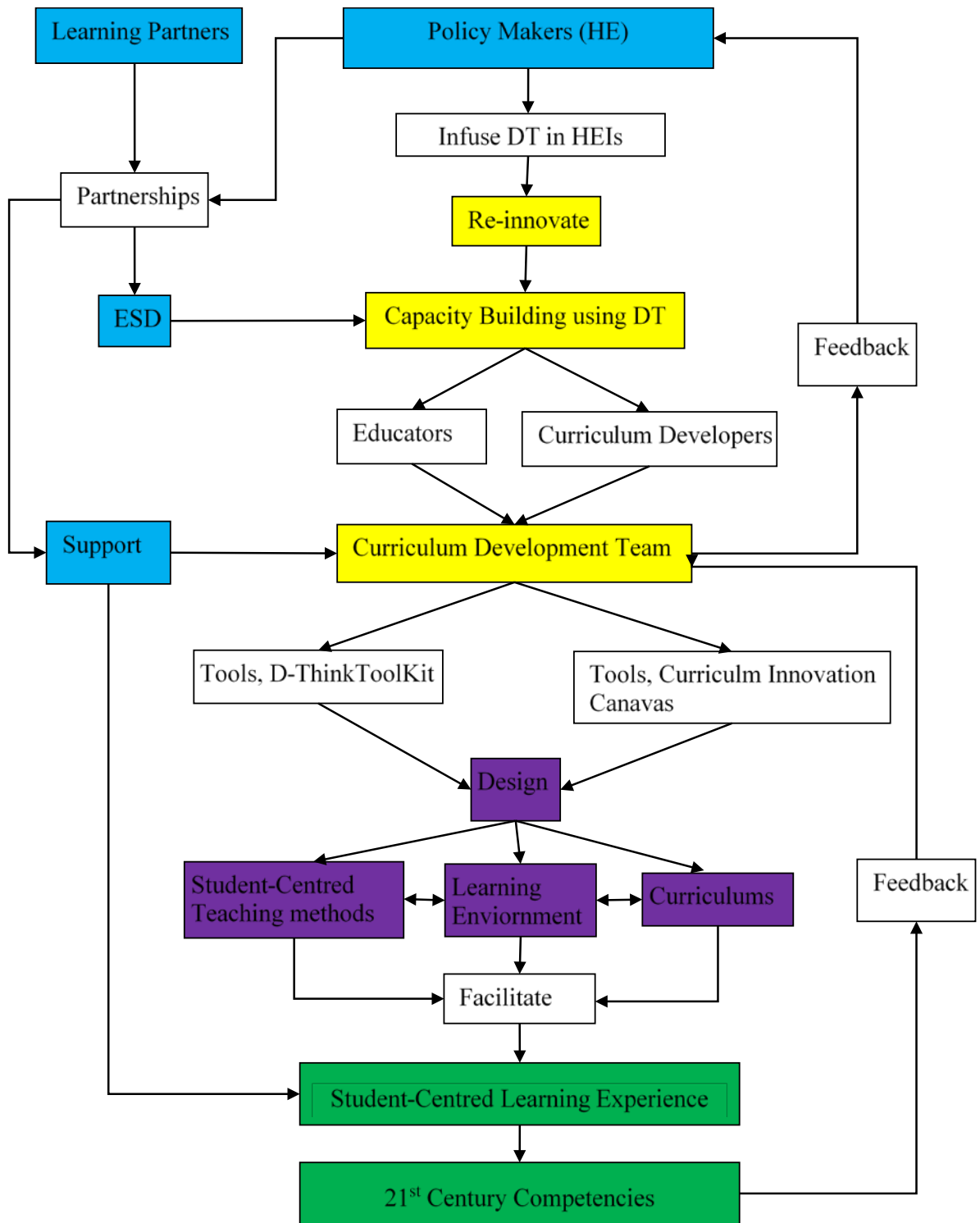
Table 10

Average Relevance/Importance of Themes. (Colors correspond to colours in Figure 17)

Rank	Themes	Relevance (Experts interviews)	Importance (Literature review)	Average of both
1	Learning Experience 4.0	84.6	71	77.8
2	Learning Partners 4.0	84.6	60.65	72.625
3	HE Capacity Building 4.0	84.65	44	64.3
4	Learning Environment 4.0	69.23	44	56.6

Figure 17

A suggested approach to operationalizing the Learning 4.0 Framework

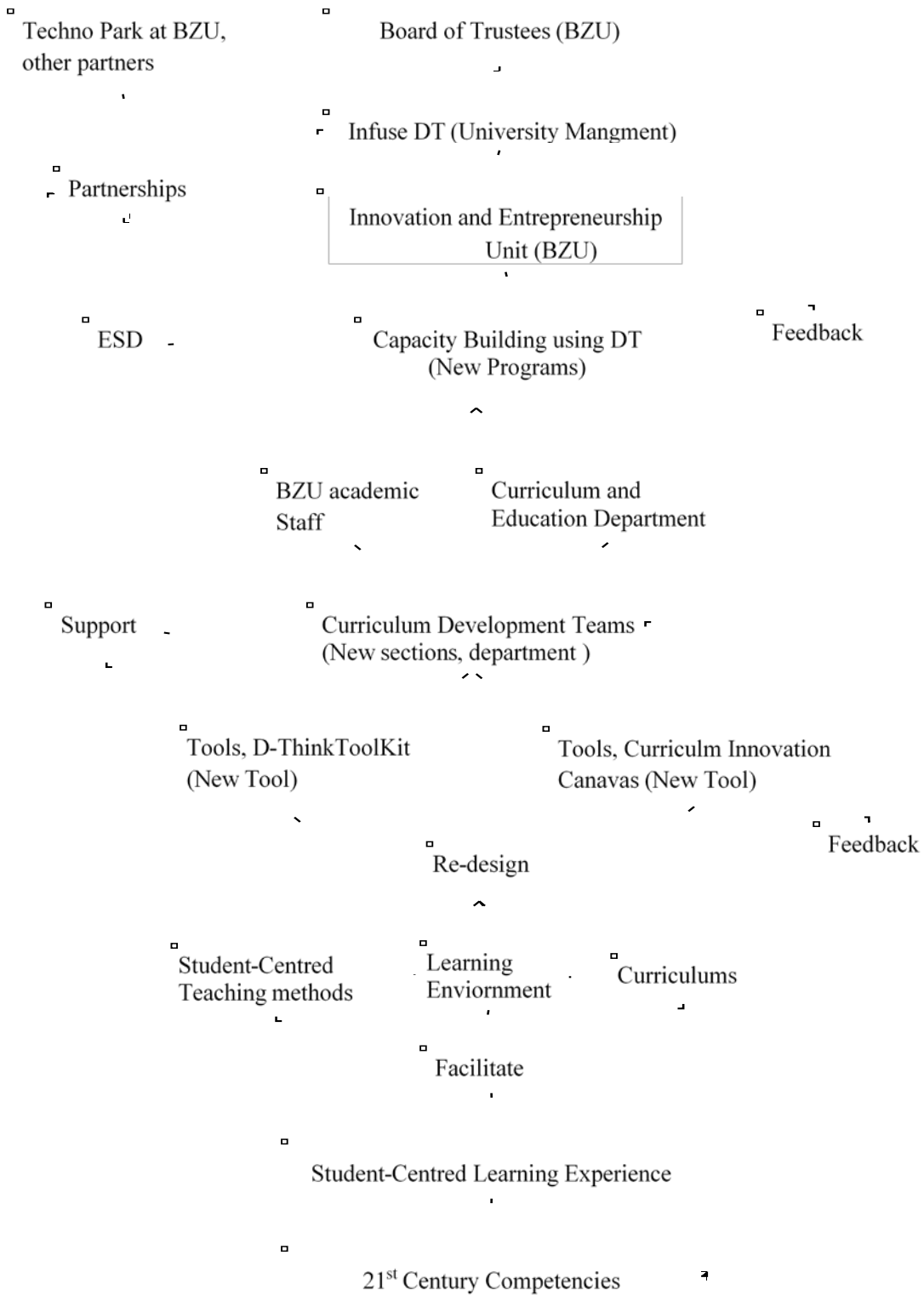


As shown in figure 17, the approach consists of two loops; the upper loop involves partnerships with learning partners to promote capacity building in HEIs. At the same time, the bottom loop involves the design and facilitation of a student-centred learning experience with the support of learning partners to develop students' competencies as an output. Therefore, developing students' competencies requires implementing a top-bottom developing process through HEIs to gain fruitful results.

Taking Birzeit University (BZU) as an example, Figure 18 shows a customized approach for local universities to infuse DT and develop HE within Palestinian universities. The customized approach calls for new programs, sections, departments and tools to integrate within university systems to redesign educational systems and develop students' competencies. DT capacity building for the academic staff will provide them with new tools to understand their students. Within curriculum development teams (new department), BZU academic staff can design and implement their courses in collaboration with curriculum developers. Therefore; University management must be aware of these adjustments to redesign students' learning experience and develop their capacities.

Figure 18

Customized approach for BZU



6 Summary and Recommendations

6.1 Summary

One of the challenges facing HEIs is their ability to graduate students with the skills and competencies required in the 21st-century. 21st-century learning is student-centred and emphasizes cultivating students with skills and competencies demanded by the 21st-century. Design Thinking (DT), a human-centred approach, provides an opportunity for Higher Education (HE) to integrate 21st-century learning. This research explored the application of DT in HEIs and the role of DT in developing students' competencies by introducing a framework for HEIs. The framework was built based on four key themes related to students' competencies development. These themes were developed by implementing an integrative literature review and expert interviews from interdisciplinary fields in DT, HE, and Sustainable Development. The data were analyzed, summarized, and categorized via qualitative analysis methods such as; content analysis, thematic analysis and conceptual ordering. The developed themes are Learning Experience; Learning Partners; Learning Environment; HE Capacity Building. Through DT, the developed themes entwined with student-centred learning and introduced "*The Learning 4.0*" framework to improve students' competencies. Based on feedback from the expert interviews and empirical evidence within the literature, this research introduced an approach to operationalizing the proposed framework.

6.2 Reflecting on DT

There is no consensus agreement about the definition of DT and how it should be taught or used in HEIs context. Most of the research studies agree that DT can develop 21st-century skills and beyond. However, studies regarding DT as a pedagogical tool to transform HEIs are rare. Nevertheless, raising literature recently highlighted DT as a pedagogy to improve classes,

curriculum, educators, and student learning. In the same context; some studies dealt with cases in which DT have been used as the backbone of some learning labs such as EMMI; NAMU, and DEVLAB, which seems to be as mini universities representing the vision of future transformation, through which it grows to replace and remedy current educational methods.

Some Criticism on DT that its tools are not well defined and introduce plenty of tools without a guide of how these tools can be best practiced to avoid confusion and ambiguity. Other than that, DT, in its nature, embraces ambiguity and uncertainty when exploring the environment around. Particularly in 21st-century learning, students expected to have such characteristics. Being vulnerable to experience a new learning environment and expressing confusion and frustration is normal in DT. It provides mentorships and facilitation support to address such experiences that students will become more adaptable in such situations.

6.3 Recommendation

This study introduces a theoretical operational framework for HEIs development to foster a student-centred learning experience. The proposed framework was built based on an in-depth literature review and the experience of interviewed experts. The researcher recommends the following:

1. Conducting further research on implementing DT in HEI
2. Conducting experimental research to test the proposed framework
3. DT implementation is a top-bottom process. Therefore, the role of education policymakers in transforming HEIs must be clarified to re-arrange and develop the eco-system of HE in Palestine.
4. HEIs must invest in applying DT at all levels and focus on building new partnerships that support students' competencies.

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Appendix A

Ten Themes Matrix

The following table shows the ten themes that were developed based on integrative literature review. The researcher abbreviated the themes as follows;

LE- Learning Experience

LS- Learning Space

LI- learning Infrastructure

Partnership-P

Organizational Change- OC

ECB- Educators' Capacity Building

PM- Policy Makers

E-Entrepreneurship

ESD- Education for Sustainable Development

LT- Learning Technology

In addition the researcher used (0 or 1) to refer to the existence of the theme in the analyzed articles. Where; (0) doesn't exist and (1) exist.

Appendix A

Ten Themes matrix

Theme Author name	LE	LS	LI	P	OC	ECB	PM	E	ESD	LT
Koh et al. (2015)	1	0	0	0	0	0	0	0	0	1
P21 (2019)	1	0	0	0	0	0	0	0	0	1
Voogt & Roblin (2012)	0	0	0	0	0	0	0	0	0	1
Chu et al. (2016)	1	0	0	0	0	0	0	0	0	1
Munyai (2019)	0	0	0	0	0	0	0	0	1	0
Mansori (2019)	1	0	0	0	0	0	0	0	1	0
UNDP (2014)	0	0	0	0	0	0	0	0	1	0

Theme Author name	LE	LS	LI	P	OC	ECB	PM	E	ESD	LT
UNDP (2016)	0	0	0	1	0	0	1	0	1	0
UNDP & COMMITT (2017)	0	0	0	0	0	0	0	0	1	0
Jimenez-Ibañez et al. (2017)	1	0	0	1	1	0	1	1	1	0
Ranger & Mantzavinou (2018)	1	0	0	1	0	0	0	0	1	0
Clark et al. (2018)	1	1	1	0	0	0	0	0	1	0
UNESCO (2020)	0	0	0	0	0	0	0	0	1	1
Filho et al. (2019)	0	0	0	0	0	1	0	0	1	0
UN (2017)	0	0	0	0	0	0	0	0	1	0
Filho et al. (2017)	0	0	0	1	0	0	0	0	1	0
Tandon (2018)	0	0	0	1	0	0	0	0	1	0
Ahmadein (2019)	0	0	0	0	0	1	0	0	1	0
Di Gerio et al. (2020)	0	0	0	0	0	0		1	1	0
Handayani (2019)	0	0	0	0	0		0	0	1	0
SDSN Australia/Pacific (2017)	0	0	1	0	0	1	0	0	1	0
Lozano (2017)	1	0	0	0	0	0	0	0	1	0
Howlett et al. (2016)	1	0	0	1	0	0	0	0	1	0
Abas (2015)	1	0	0	0	1	1	0	0	0	1

Theme Author name	LE	LS	LI	P	OC	ECB	PM	E	ESD	LT
Ahmad (2015)	1	0	0	1	1	1	0	0	0	1
Alismail and McGuire (2015)	1	0	1	0	0	1	0	0	0	0
Sharma (2019)	1	0	1	0	0	0	0	0	0	1
Attard et al. (2010)	1	0	0	1	1	0	0	0	0	1
Singhal (2017)	1	0	0	1	1	0	0	0	0	1
Brown (2006)	1	0	0	0	0	0	0	0	0	1
Lor (2017)	1	0	0	0	1	1	0	1	0	1
Thienen et al. (2017)	1	1	1	1	0	0	0	0	0	0
Matthews & Wrigley (2017)	1	0	0	1	0	0	0	0	0	0
Trebell (2009)	1	0	0	0	0	0	0	0	0	0
Laurillard (2012)	1	0	0	0	0	0	0	0	0	0
Tsai et al. (2013)	1	0	0	0	0	0	0	0	0	0
Guaman-Quintanilla et al. (2018)	1	0	0	0	0	0	0	0	0	0
Sharples (2019)	1	0	0	0	0	1	0	0	0	0
McLuskie (2017)	1	0	0	1	1	0	0	0	0	0
Tschimmel & Santos (2018)	1	1	1	0	1	1	0	0	0	0
Gachago et al. (2017)	1	0	0	0	0	1	0	0	0	1

Theme Author name	LE	LS	LI	P	OC	ECB	PM	E	ESD	LT
Tu et al. (2018)	1	0	0	1	0	1	0	0	0	0
Willness& Bruni-Bossio (2017)	1	0	0	1	0	0	1	1	0	0
Panke (2019)	1	0	0	0	0	0	0	0	0	0
Tschimmel et al. (2015)	1	1	0	0	1	0	1	0	0	1
Tschimmel et al. (2017)	1	1	0	0	1	0	0	0	0	1
Gottlieb et al. (2017)	1	0	0	0	1	0	0	0	0	0
Anderson et al. (2017)	1	0	0	1	1	0	0	0	0	0
Saulnier et al. (2015)	1	0	0	0	0	0	0	0	0	0
Taajamaa et al. (2016)	1	0	0	0	0	0	0	0	0	0
Taajamaa et al. (2013)	1	0	0	0	0	0	0	0	0	0
Bhatnagar &Badke- Schaub (2017)	1	0	0	0	0	0	0	0	0	0
Kelley & Kelley 2013	1	0	0	0	0	0	0	0	0	0
Glen et al. (2014)	1	0	0	0	0	0	0	1	0	0
Van Der Sanden and De Vries (2016)	1	1	0	1	0	0	0	0	0	1
Culén (2015);	1	0	0	0	0	0	0	0	0	0
Kovatcheva et al. (2019)	1	0	0	0	0	0	0	1	0	1
Carroll (2015)	1	0	0	1	0	0	0	0	0	0

Theme Author name	LE	LS	LI	P	OC	ECB	PM	E	ESD	LT
Harth & Panke (2018)	1	0	0	1	0	0	0	0	0	0
Karjalainen (2016)	1	0	1	1	1	0	0	1	0	0
Heikkinen et al. (2016)	1	0	1	1	1	0	0	1	0	0
Lugmayr (2012)	1	0	1	1	1	0	0	1	0	0
Sarooghi et al. (2019)	1	1	1	1	0	0	0	1	0	0
Ellermann (2017)	1	0	1	1	1	1	1	1	0	0
Huber et al. (2016)	1	0	0	1	0	0	0	1	0	0
Zupan et al. (2014)	1	0	0	1	0	0	0	1	0	0
Von Kortzfleisch et al. (2013)	1	0	1	1	1	0	0	1	0	0
Huq & Gilbert (2017)	1	0	0	1	0	0	0	1	0	0
Lynch et al. (2019)	1	0	0	0	1	0	0	1	0	1
Laakso & Clavert (2014)	1	1	1	1	0	0	0	1	0	0
Çeviker-Çınar et al. (2017)	1	0	0	1	0	0	0	0	0	0
d.school (2020)	1	1	1	1	1	1	0	1	0	1
DesignIT Project (2018)	1	1	1	1	1	1	0	1	0	1
Tsalapatas et al. (2019)	1	1	1	1	0	1	0	1	0	1
Molinari & Gasparini (2019)	1	1	0	1	1	0	0	0	0	0

Theme Author name	LE	LS	LI	P	OC	ECB	PM	E	ESD	LT
Thienen et al. (2012)	0	1	1	0	0	0	0	0	0	0
Zidulka& Glover (2012)	0	1	1	1	0	0	0	0	0	0
Linton &Klinton (2019)	1	0	1	1	0	0	0	1	0	0
OECD (2018)	0	0	0	1	1	0	1	0	0	0
Suciu &Baughn (2016)	0	0	0	1	1	0	0	0	0	0
Fabri (2015)	1	1	0	0	1	0	0	0	0	1
Gilbert et al. (2018)	0	0	0	0	1	0	0	0	0	1
Brown (2008)	0	0	0	0	1	0	0	0	0	0
Dunne & Martin (2006)	1	0	0	1	1	0	0	0	0	0
Kurokawa (2013)	1	0	0	1	1	0	0	1	0	0
Beligatamulla et al., (2019)	0	0	0	1	0	1	0	0	0	0
Kivunja (2014)	0	0	0	0	0	1	1	0	0	0
Ramakrishna (2014)	0	0	0	0	0	1	1	0	0	0
Trilling & Fadel (2009)	0	0	0	0	1	1	0	0	0	0
Chin (2016)	0	0	0	1	1	0	1	0	0	0
Rive &Karmokar (2016)	1	1	0	1	0	0	0	0	0	1
Acharya et al., 2021	1	0	1	0	0	0	0	0	1	0
Turlíková et al. (2021)	0	0	0	1	0	0	0	0	0	0
Chouylum et al. (2021)	0	0	0	0	0	0	0	1	0	1

Theme Author name	LE	LS	LI	P	OC	ECB	PM	E	ESD	LT
Gong (2020)	0	0	0	0	0			1	0	0
Lake et al. (2021)	1	0	1	0	0	1	1	0	0	0
Sandars & Goh (2020)		0	0	0	1	1	0	0	0	0
Raymond (2020)	1	0	0	0	0	0	0	0	0	0
Puga (2020)	1	0	0	0	0	0	0	0	0	0
Sharma & Sande (2020)		0	0	0	1	0	1	0	0	0
Revano & Garcia (2020)		0	0	0	0	0	1	0	0	0
Miller and Linder (2015)	1	0	0	0	0	0	0	0	0	0
Huang et al. (2020)	1	0	0	0	0	0	0	0	0	0
Vaugh et al. (2020)	0	0	1	1	1	0	1	0	0	0
Schallmo et al. (2020)	1	0	0	1	0	0	0	0	0	0
Akram et al. (2020)	0	1	0	0	1	0	0	0	0	0
Thakur et al. (2020)	0	0	0	0	1	0	0	0	0	1

Appendix B

Structured interview questionnaire

“Design Thinking Application in Higher Education:
The Role of Design Thinking in Developing Students Competencies”

Introduction

The research viewed design thinking (DT) as a promising field to enhance and promote Higher Education (HE) Institutions (HEIs) and help HEIs in its transformation in the 21st century to foster and develop students’ competencies.

The research suggests a new learning approach based on design thinking, which is a human-centred problem-solving approach applied in many fields to enhance creativity and innovation. DT in HE involves engaging students in a form of project-based -, problem-based -, and design-based learning. In such context, students work in teams to find and solve problems using DT to engage in a real-world project and that will give the students the opportunity to develop the marketable skills for their future careers.

On one hand, marketable skills are based on the 21st Century skills such as critical thinking, self-directed learning, creativity, problem solving, communication and collaboration. On the other hand, the sustainability awareness vision is integrated into the approach which focuses on SDGs within courses and projects.

Dear Expert;

We kindly ask your professional opinion about the main themes/dimensions in the suggested new approach of DT in developing students’ competencies and as a base for transforming HEIs.

1. Please select an interview date?
2. Please select an interview time (GMT Time Zone)
3. Please provide us with your email for confirmation

Thank you in advance for your opinion, comments and time.

Part 1: General Information

- 4. Expert' s Name_____
- 5. Gender: Male Female
- 6. Major Discipline: 1. Business 2. Design 3. Engineering 4. Interdisciplinary 5. Others_____
- 7. My Expertise is in: 1. Design Thinking 2. Higher Education 3. Sustainable Development 4. Others _____
- 8. Institution _____
- 9. Contact Info (e.g. Email) _____

**Part 2: Design thinking (DT) relationship with higher education, 21st-centuryskills, and
SDGs**

- 10. Do you think that DT can be a base for a new approach or framework for HEIs providing them with new learning methods/approaches to defend their position as knowledge creators? Please elaborate
- 11. New students' skills are needed in HEIs. HEIs have to act quickly to integrate these marketable skills to the system (i.e. 21st-century skills). Such as; creative thinking, critical thinking, communication and collaboration (4Cs). Do you think that DT can transcends and hones these competencies? Please elaborate
- 12. Sustainable Development Goals (SDGs) are important to be integrated into the educational process. HEIs are integrating SDGs within its structure and curriculum to promote sustainability awareness among higher education students. Do you think that DT is a suitable approach to integrate SDGs to bring the sustainability focus to students' minds? Please elaborate

Part 3: The relevancy of the suggested themes in creating a new approach/framework based on DT for improving students' competencies which can also encourage the transformation of HE?

In this part, we introduce suggested themes/ dimensions of the DT approach to develop students' competencies and hence encourage the HE transformation. The themes are extracted from in-depth literature study and using qualitative content analysis.

From your expertise, to what extent do you find these suggested theme/dimension are relevant or not relevant to create a new approach based on DT for improving the students' competencies which can encourage the transformation of HE?

Learning Experience and Entrepreneurship

13. Theme 1: Learning Experience. DT interventions has impact on the student experience and in the extend it enhances learning, students' attitudes, and contribute to developing their new mindsets and skills.E.g., passion, emotional learning competences, critical thinking? Comments?
14. Theme 2: Entrepreneurship. DT integrated in curricula to foster entrepreneurial capabilities among HE students and transform entrepreneurship education to HEI? Comments?

Learning Environment

15. Theme 3: Learning Space. Successful learning activities and learning outcomes that reflect on students learning are linked to the flexibility of learning spaces and DT process which involve flexible, adaptable learning spaces that support student engagement? Comments?

16. Theme 4: Learning Infrastructure. Learning infrastructure is vital to achieve a successful student engagement, design and facilitate student learning. DT as a learner-centered approach introduce a versatile infrastructure that support student learning? Comments?
17. Theme 5: Learning Technology. DT harness online-learning, digital, communication, and HCD to create virtual learning environments, enhance methods of learning, and learning how to use technology as a space for innovation? Comments?

Learning Partners

18. Theme 6: Education for Sustainable Development (ESD). Sustainable development entails emphasis on society, economy, and environment. Some universities are using new learning methods to integrate sustainable development in the curricula. As a human-centred approach DT has the potential to integrate ESD in HEIs and support student learning on sustainable development by introducing interdisciplinary approach where multidisciplinary teams combined to holistically solve complex problems and find sustainable solutions that are community desirable, environmentally-technologically feasible, and economically viable? Comments?
19. Theme 7: Partnership. DT requires collaboration within teams which develops collaboration- culture among students and encourages collaborative learning process as a team. At this level, engagement is not only on the students' level but also with their communities and the industry. The theme is referred to as Partnerships through university, industry, and community? Comments?
20. Theme 8: Policy Makers. University management seeks DT as the change driver to innovation and to new design strategies in HE by developing curricula to boost life skills and competencies related to 21st century learning? Comments?

Higher Education Capacity Building

21. Theme 9: Organizational Change. HEIs are organizations that provide knowledge and learning. Introducing DT as a strategy for exploring new alternatives regarding to 21st century learning and encouraging the HE transformation curricula, learning, and its scope toward student-centered learning to achieve transformational impact on the personal level and renovate HEIs? Comments?
22. Theme 10: Educators Capacity Building. 21st century learning emphasis on the need to transform teachers' role and train them to become effective facilitators, designers, and mentors of student-centered learning. DT introduced as a pedagogical tool to provide suitable environment for teachers to transform their mindset and teaching role to innovate their practices in teaching and learning? Comments?

Part 4: Feedback and Recommendation on Themes

23. From your expert point of view, do you think that there is/are any missing themes that have to be integrated to the approach or themes that have to be excluded?
24. How do you view the new approach which is made of the 10 themes backbone by DT to improve students' competencies to encourage the HE transformation?

Thanks for your participation