The Implementation of Design Thinking in Education: Will it Serve the Purpose?

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Abstract
The swift advancement of technology makes the challenges we face more difficult daily. Design Thinking or DT is the most efficient approach for tackling these wicked problems. DT has been identified by industries as an indispensable skill in the twenty-first century. Even though DT has been utilized broadly in industries, there is still an inadequate number of DT implementations in education, particularly in Malaysia. One of the explanations is because of stakeholder impressions. Stakeholders continue to have reservations and negative attitudes toward DT. This concept paper will explore the implementation of DT in education and the factors affecting the stakeholders' refusal to implement it. The main argument for opposition to bringing DT into education is the convenience of utilizing the traditional problem-solving method rather than this novel approach, which is viewed as difficult to implement. Although DT is resource-intensive, it has its own sustainability because the approach is more flexible and can be revised based on the user's requirements. Hence, DT is more resource-economical than the traditional method. Confusion and misunderstanding about the execution of DT also contribute to educators' passive attitudes. DT is believed to be a privileged approach, yet the truth is it belongs to everyone. There is also the query of whether the local culture affects the implementation of DT. While the practice of DT is flexible and adaptable, it is crucial to consider Malaysia's cultural context while incorporating it into the education system so that it is effectively assimilated and resonates with students' diverse cultural backgrounds. DT is a theory that must be actively reinforced in schools to develop an empowered youth in the 21st century. DT is far greater than merely an approach to solving problems; it is a mentality that ought to be embraced in every aspect of life.

Design Thinking: The Prelude
"Everyone is a designer if they devise courses of action aimed at changing existing situations into preferred ones "- Herbert Simon (1996).
    It has been embedded as humans in our nature to seek something new and keep changing our preferences. Since ancient times, humans evolved with the aim to have better living conditions in every aspect from accommodation to economic activities and lifestyle. The Fourth Industrial Revolution (IR 4.0) is the perfect example of how humankind strives constantly to have a bright future and even proves that the sky is not a limit. In recent decades, we have seen a breakthrough in the economic field due to the rapid development of technology, engineering, and communication resulting from the basic instinct of humans

to advance for a better life. When talking about IR 4.0 we cannot escape from associating it with the use of robotics. Robotics is an innovation inherent in the research of artificial intelligence. The founding father of artificial intelligence, Herbert Simon (1969) defines anyone who embarks on a specific journey with the goal of creating a preferred environment over the existing ones as a designer's way of thinking (Henriksen et al., 2019). Johansson-Sköldberg et al (2013) describe the designer's way of thinking as a problem-solving approach which often refers to Design Thinking. In recent years, academicians have discussed Design Thinking in a profound way due to its exclusivity to IR 4.0. Therefore, Design Thinking has emerged as a significant branch of knowledge.

Design is a common term, and it is not something unheard of in public, especially in Malaysia. This term has been used for a long time and is widely used in various fields such as fashion, architecture, and engineering. Despite its long history of usage, the definition of design is still debated among scholars because there is no absolute definition that can be used to represent this term. Love (2000) in her article "Philosophy of Design: A Metatheoretical Structure for Design Theory" states that theorizing about design goes beyond the paradigm in which design is practiced. The design does not belong to one discipline or a specific field. There are various disciplines related to design such as Design Methodology, Philosophy of Design, Sciences of Design, and obviously, Design Thinking which is also one of the important sub-disciplines in Design Theory. Since design has a vague definition, Design Thinking also has an ambiguous interpretation.

Numerous scholars have laid out different interpretations of Design Thinking from past studies. The well-known interpretation without using the term Design Thinking itself comes from Herbert Simon (1969) which is a systematic approach to solving obstacles existing in real life and turning them into preferred ones (Girgin, 2021; Henriksen et al., 2019; Johansson-Sköldberg et al., 2013; Koh et al., 2015; Yuan & Wu, 2021). By focusing on the concept of 'existing' and 'preferred', Design Thinking managed to distinguish itself from the Pure Sciences process since Pure Sciences usually cares more about how matters really are while Design Thinking focuses on how matters expect to be and comes up with solution or prototype to achieve the intended objective. The next term has a significant presence in defining Design Thinking, as a 'wicked problem'. Peng & Kueh (2022) describes the wicked problem as a series of ill-defined predicament where it is challenging to establish the root and often comprise a large group of stakeholders with high complexity. The elaboration of wicked problems by Buchanan (1992) becomes the underlying concept of the next prominent interpretation of Design Thinking which is the step-by-step methodology consisting of two phases. The first phase is an analytical path of problem definition, then subsequently, a synthetic sequence of problem solutions that will be used when dealing with ill-defined disputes prevailing in real life (Henriksen et al., 2019; Johansson-Sköldberg et al., 2013; Luka, 2020; Tschimmel & Santos, 2019; Yuan & Wu, 2021).

While there are many definitions out there from prior research, Cook & Bush (2018) still argue that there is no clear and ultimate definition of Design Thinking. All scholars have their own interpretation of Design Thinking, which suits their research's purpose the most. For the sake of discussion, this concept paper adopts the interpretation of Design Thinking from the past study by Johansson-Sköldberg et al. (2013) titled *"Design Thinking: Past, Present and Possible Future"*. According to a critical analysis study conducted by Johansson-Sköldberg et al (2013), Design Thinking from a theoretical perspective can be referred to; 1) as the creation of artifacts, 2) as a reflective practice, 3) as a problem-solving activity, 4) as a way of reasoning, and 5) as the creation of meaning. This perspective aligns with the viewpoint of Tim Brown,

the CEO of the design agency IDEO, among one of the pioneer organizations that introduced Design Thinking to the community. Brown interprets Design Thinking as a human-centered approach to solving uncertainty and complex problems by proposing an innovative solution or idea and developing a prototype for these discoveries (Girgin, 2021). Thinking like a designer can change the way an organization develops its products, services, processes, or strategies. Design Thinking brings together reasonableness from a human point of view by maximizing the use of technology and viability from an economic aspect. It also allows individuals who are not trained in the field of design to use Design Thinking as a creative approach to deal with various challenges in life.

Once we have a clear definition of Design Thinking, the next thing to ponder is how to implement it. Luka (2020) in her article refers to the process of Design Thinking as the way in which methods are incorporated into a series of actions, events, or steps. In the same article. Luka (2020) mentioned there were seven stages of Design Thinking, to begin with as introduced by Simon in 1969. The seven stages are as follows; 1) Define, 2) Research, 3) Ideate, 4) Prototype, 5) Choose, 6) Implement, and &) Learn. Simon's philosophy of the Design Thinking process laid the groundwork for later researchers and inherent countless models from it. One of the established models is the one introduced by Hasso Plattner Institute (HPI) also known as The Iterative Design Thinking Process Model (Polat & Bayram, 2022). This model classifies design thinking into two main groups: the problem and solution phases. The problem phase contains understanding, observation, and point of view while the solution phase consists of ideating, prototyping, and testing. Through the Design Thinking approach, there is an interaction between the problem phase and the solution phase that connects each process directly and indirectly. The unique nature of this approach allows practitioners to move freely from one process to another or backtrack to a previous process depending on current requirements. This exclusive trait of Design Thinking is what we call iterative, and it is the main reason why this model is also known as The Iterative Design Thinking Process.

Simon in 1969 pioneered the study of characteristics that explain the specific nature of Design Thinking (Johansson-Sköldberg et al., 2013). Although Simon personally did not state the term Design Thinking clearly in his study, his cognitive approach to the decision-making process and his definition of design as the transformation of an existing situation to a desired situation is often referred to by next researchers in study related to Design Thinking. Figure 1 shows the general characteristics of Design Thinking summarized from a few prior studies like Hennessey & Mueller (2020), Johansson-Sköldberg et al. (2013), Luka (2020), and Micheli et al. (2019). The general characteristics of Design Thinking that have often been a topic of discussion are a human-centered approach, empathy, holism, iteration, collaboration, curiosity, constructiveness, openness, ambiguity, and non-judgemental.
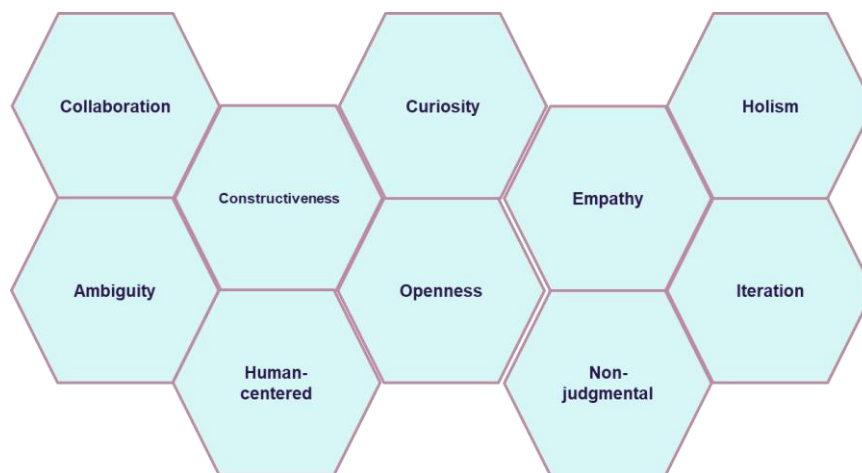
Figure 1: The general characteristics of Design Thinking summarized from past studies.

The Design Thinking approach is based on human-centered instead of technology-centered or solely depends on the existing methods. Human needs, desires, wishes, abilities, and limitations become the focal point from the early stage of the Design Thinking stage and throughout the process. Therefore, the practitioner of this approach needs to be empathetic in understanding the problems faced by the user to produce the best solution for the intended purpose. When understanding the occurring problem, the practitioner will welcome all sorts of views and inputs, hence there is a need for openness and non-judgment in the Design Thinking process to prevent bias from happening. Finding a solution through Design Thinking also emphasizes the collaboration of various stakeholders with different backgrounds to provide a multidisciplinary approach which will lead to the creation of innovation or out-of-the-box solutions. Design thinking is also said to be a constructive strategy because it is a solution-centered approach to finding the most ideal answer or output for the problem at hand. The typical problem-solving process will be asking; what is the solution but with Design Thinking the question will be; what might be the best solution for the future? So, the curiosity of the practitioner plays an important role in both the problem phase and solution phase of the Design Thinking model to yield the most ideal solution.

However, Design Thinking also has the nature of ambiguity. The ambiguity here means that there is no absolute answer or fixed solution in the Design Thinking approach. One problem can have many possibilities for its solution. There will be a sea of possible answers with the Design Thinking approach and the chosen solution must meet the requirements and capabilities of the parties involved by prototyping and testing the solution. There will be no concern if the chosen solution later does not meet the expectations of the stakeholders. Since Design Thinking is an iterative process, the practitioner can freely move and backtrace the solution phase to the problem phase and revert the solution to meet the user's requirement. In conclusion, Design Thinking is a holistic process because it is a continuous process, has its own sustainability and it includes a very broad context for the practitioners and stakeholders.

Many studies for instance Hoople et al. (2020), Prapulla et al. (2022), and Tschimmel & Santos (2019) revealed that a person who can practice Design Thinking in their problem-solving expertly will have high adaptability and could survive the harsh competition of the 21st

century. Milovanovic et al. (2021) proposed Design Thinking as a new approach to be integrated into the school's environment since it is unavoidable because students must be prepared for occupations that have not yet been created, for technologies that have not yet been invented, and to solve social issues that have not yet been anticipated. This remark by Milovanovic et al. (2021) ought to serve as a powerful motivation for the execution of Design Thinking in the educational environment. Therefore, in recent years, various educational institutes around the world have integrated Design Thinking into their curriculum. The finding from Yalcin (2022) states the Design Thinking approach has been conducted at different levels of education, from higher education to primary school students. However, the question arises as to whether the implementation of Design Thinking in education will serve its desired purpose.

Design Thinking: A Glimpse into The Educational Landscape.
Let us take a glimpse at how Design Thinking started before we delve further into Design Thinking in the educational world. It all started when Rowe (1987) used the term design thinking for the very first time when he published his book entitled "Design Thinking". However, according to Luka (2020), the concept of Design Thinking has existed for years since the early 1960s along with the growth of the discipline of creativity in the field of psychology. A well-known figure in the technology field at that time, Herbert Simon begun to study the characteristics that describe design thinking in 1969. The 1980s saw the era of the emergence of human-centered design and design-centered business management as stated by Donald Schon (1983) in his book titled "The Reflective Practitioner: How Professionals Think in Action". Then in 1991, the first symposium was held at Deft University, Netherlands. This symposium aims to gather researchers who are interested in Design Thinking. In the early 90s, a design consultant company called IDEO was established. IDEO became the first design company to give the public access to their design process, design methods, and design thinking model and in the following years IDEO became a major contributor to the growth of Design Thinking especially in the field of education (Polat & Bayram, 2022). The transition period from the 20th century to the 21st century led to rapid growth in the field of Design Thinking with the production of various scholarly materials debating about Design Thinking (Henriksen et al., 2019; Johansson-Sköldberg et al., 2013; YALÇIN, 2022). This viewpoint is aligned with the study of systematic literature review by Panke (2019) which disclosed there were 70% of articles have been published from 1994 to 2015 discussing "Design Thinking in Education".

The establishment of *d.school* in 2004 by Stanford University became a cornerstone for the establishment of Design Thinking in the pedagogy arena (Wrigley & Straker, 2017). At first, the Design Thinking curriculum was taught by *d.school* to students as a general innovative approach to technical and social problems. Many design and business companies at that time introduced Design Thinking as a problem-solving approach hence *d.school* was built to provide a place for people to learn about Design Thinking officially. In Malaysia, Design Thinking was first introduced to the public as an educational program by Genovasi Malaysia in April 2012 (Noh & Karim, 2021). Genovasi adapted the Design Thinking model from *d.school* and aims to train public and private companies on how to apply Design Thinking as a problem-solving approach. The main principles behind Design Thinking which emphasizes creativity and innovation attracted the attention of the Minister of Education at that time to integrate it into the school curriculum. This intention is aligned with the government's vision to improve the quality of the education system to be more in line with the needs of the 21st century.

Although Genovasi is the institute that officially introduced Design Thinking in Malaysia, the fact is that the Design Thinking approach has long been exposed to students, especially engineering students and art students at the higher education level. For example, the School of Mechanical Engineering, University Science of Malaysia (USM) has revealed Design Thinking to their engineering students indirectly through the subject of Engineering Design. Their students are trained to solve problems that exist in the community by producing an innovative prototype using steps in the Design Thinking process.

Findings from Panke (2019) show that the Design Thinking model is more than just a curriculum to be learned by students, it also can be used by teachers as a teaching and learning strategy and when planning a lesson. The concern surfaces on how to implement Design Thinking when planning a lesson. As per the research of Yuan & Wu (2021), there are challenges in integrating the Design Thinking approach with planning a lesson if the learning outcome is not fully identified at the early stage. Hence, it is vital for teachers to have a better understanding of the Design Thinking strategy before using it. The flow of the Design Thinking approach in planning a lesson can be explained in more detail by using a situation where a Computer Science Teacher is asked by the school's administrator to develop a teaching and learning module. The first phase, which is the Empathy Phase, is a phase to understand the problems at hand. During this phase, the teacher can use various ways to understand the problems faced by students such as conducting a dialogue session with students or discussions with other teachers. The next phase, which is the Identify Phase, is to identify the cause of the problem and the objective for the solution. There is no absolute solution to a problem, and not all solutions are appropriate to practice in Design Thinking because they must be adapted to the needs of the user. The needs or problems encountered can be concretely defined through the formulation of questions that begin with "How can the teacher...?". Therefore, the module built is based on a specific and detailed question for example, how can the teacher involve students in active learning classes so they could show more interest in learning the theory behind Computer Science?

Moving on to the next phase which is the Ideate Phase where brainstorming is used to produce creative innovations to solve the problems identified in the second phase. This phase should involve different stakeholders like the community or people in related industries. For example, a software engineer can share his experience and provide awareness about the importance of learning ICT topics for a future career. The teacher can get some valuable input and inspiration from this experience sharing. So, it will be a great help to the teacher in providing a more effective learning impact to students. The fourth phase, which is the Prototype Phase, is the development of materials outputs, or innovations that can be used as a solution to problems identified. In this phase, the teacher has started to develop a teaching and learning module that suits the student's needs and meets the learning objectives. The last phase, which is the Testing Phase, is where verification is carried out to validate the prototype built. Once the module is successfully completed, the teacher can use the module in the lesson. At the end of the lesson, students will be asked to answer reflection questions and give feedback, so that, the teacher can determine the effectiveness of the module. Any weaknesses and shortcomings can be improved from time to time to upgrade the quality of the module.

Based on the explanation given, it can be concluded that the Design Thinking model which was initially introduced for business management and technical purposes is also practical to be used in education. According to Noel et al. (2019), the implementation of Design Thinking strategies has a great impact on empowering students' learning and

improving the quality of education itself. This argument is in line with the findings by Hennessey & Mueller (2020) which state that the Design Thinking process has helped teachers discover that they have the responsibility to be agents of change. Design Thinking gives teachers a powerful tool for creating meaningful innovation in education. Realizing the importance of the Design Thinking model to the field of education, IDEO (2012) has published a module entitled "*Design Thinking for Educators*" which explains the phases of Design Thinking in detail. Also in that module, IDEO has introduced a specific Design Thinking model for educators to use in designing their own teaching and learning processes.

Researchers from Colombia, Crites & Rye (2020) have conducted an exploratory case study titled "*Innovating Language Curriculum Design Through Design Thinking: A Case Study of a Blended Learning Course at A Colombian University*" based on the implementation of Design Thinking in the planning process to transform language curriculum which carried out by university administrators. Although curriculum reform is a top-down initiative, with the use of this strategy, the curriculum design process becomes a bottom-up process with collaboration between all group members. The study found that the curriculum design using the Design Thinking approach resulting an innovative and high-impact outcome because it was created together by group members consisting of different backgrounds, educational experiences, teaching philosophies, and work styles. While Culver et al. (2022) found that the collaboration of large group members with different kinds of backgrounds contributes to the delay of the decision-making process. Since all the members have their own expertise and experiences, they show a slight resistance to compromising each other suggestions and ideas. The same issue arises according to Retna (2016) when implementing Design Thinking as a problem-solving approach among students. Teachers as the participants of this study revealed that the biggest hurdle in implementing Design Thinking especially for first-year secondary students is to get them to work in a team. The conflict emerges when they get non-favourite friends as their teammates and teachers must go the extra lengths to de-conflict the issue. However, the numerical findings from Guaman-Quintanilla et al. (2022) show otherwise. In this study, the quantitative data show that the implementation of Design Thinking in learning activities enhanced collaborative skills among students and improved their teamwork. This finding is congruent with past studies of Arnab et al. (2019), Balakrishnan (2022), and Sándorová et al. (2020) which mentioned the favorable influence of Design Thinking on students' teamwork.

Hennessey & Mueller (2020) with their study titled "*Teaching and Learning Design Thinking (DT): How Do Educators See DT Fitting into the Classroom?*" have collaborated with experts and a target group of educators to explore the level of teachers' understanding of the Design Thinking process. The research was also conducted to find out educators' perceptions of the appropriateness of implementing Design Thinking in their classrooms. The results of the study show that most educators have some basic knowledge about Design Thinking and there are some educators who are skilled in practicing Design Thinking because of the exposure to STEM-based subjects. Although they admit that there are a few constraints that will be faced such as in evaluating and assessing the performance of students, the teachers have a positive attitude towards the implementation of design thinking in the classroom. Meanwhile in Malaysia, according to Noh & Karim (2021), the implementation of Design Thinking is still vague among the educators. Although the Malaysia Education Blueprint 2013-2025 has outlined the implementation of a problem-solving thinking development model that supports the epistemological shift through Design Thinking in producing a high-quality learning environment to meet the needs of Industrial Revolution 4.0, the findings show a lack

of empirical studies regarding the application of Design Thinking and its implementation in the context of education in Malaysia. However, it is different abroad. Various studies regarding the use of Design Thinking as a strategy in applying empathy, problem-solving, prototyping, and multidisciplinary collaborative approaches in teaching creativity, and building creative confidence and innovative minds have been conducted. Noh & Karim (2021) also found a lack of awareness among teachers about the importance of Design Thinking practices in achieving the educational goals of Industrial Revolution 4.0. In addition, the findings show that 45% of teachers never practice creative thinking and another 70% of teachers state that they only occasionally practice creative thinking in their teaching. Creative thinking plays an important role because it is one of the basic characteristics and main elements in the Design Thinking approach, but if teachers as implementers do not practice it, the goal of Industrial Revolution 4.0 education to normalize Design Thinking will not be achieved.

Arne van Oosterom, the founder of Design Thinkers Group often mentioned in his talks that Design Thinking is a mindset, not a toolkit or a series of steps (Tom Allen, 2017). The right mindset is the bottom line to the successful implementation of Design Thinking in education. The implementation of Design Thinking in principle does not only refer to the systematic process of problem-solving alone, rather it includes the paradigm of Design Thinking as a mentality that needs to be practiced in everyday life. This perspective aligns with the findings of the study by Henriksen et al. (2019). She also mentioned in her study the importance of Design Thinking as a mindset among teachers and learners to bring one's best ability to make an impactful transition to the world. Even though Design Thinking has been used intensively and widely in almost all industries from business, engineering, art, healthcare, and even tourism, there is still a lack of implementations of Design Thinking in education especially in Malaysia. One of the reasons is because of the perceptions of stakeholders. Stakeholders still have doubts and unfavourable perspectives regarding Design Thinking. The prominent queries are, 1) Why we must change from the traditional problem-solving approach to unconventional Design Thinking? and 2) Is Design Thinking appropriate to all? The conclusions drawn from the studies of Hennessey & Mueller (2020), Hoople et al. (2020), Kayembe & Nel (201), Léger et al. (2020, Milovanovic et al. (2021) Noh & Karim, (2021), Panke (2019), Polat & Bayram (2022) and Retna (2016) are consistent with this viewpoint. The implementation of Design Thinking is also said to be affected by the cultural view of the executor (Hoople et al., 2020). Hence, this concept paper will explore the implementation of Design Thinking based on these three arguments.

Design Thinking: New Versus Traditional

Have you ever wondered why a doctor could treat two of his patients who show almost-like symptoms with a different kind of treatment? Yet, a teacher must do a standardized test and give the same treatment to all his students while each student has their own diversity. This practice has been firmly grounded in the educational world since time immemorial. The Dark Ages in European countries were successfully overthrown through the First Industrial Revolution (1.0 IR) was which started by Britain between the 18th and 19th centuries (Kayembe & Nel, 2019). The economic policy of communities at that time evolved from agricultural to machinery. Many factories were built due to the booming of machinery industries. Do you notice how the table arrangement in the traditional school is so much like the production plan in the factory? In a nice and straight row line. So, the sole purpose of education during that era is to prepare the youngster to be responsible workers in those factories.

A traditional school based on Koh et al. (2015) is referred to as a school that practices uniform tests and implements standardized curricula for all. Students are taught to memorize and replicate established knowledge and solve a repetitive problem. The typical tools used in teaching and learning are textbooks and the whiteboard. The established structure of the traditional educational system is based on the idea that knowledge is mostly fixed and comprises a core body of information that every individual should comprehend. This core knowledge base is believed necessary for individuals to effectively contribute to society. Furthermore, knowledge distribution has typically been organized in a hierarchical fashion, adapted to meet students' different developmental characteristics. The acquisition of knowledge is mostly aided by teacher-led education. However, these assumptions are currently being scrutinized and questioned.

As the Fourth Revolution Industrial arose, different requirements emerged. The specific features of the Fourth Revolution Industrial are quantum computing, artificial intelligence, robotics, bioengineering, nanotechnology, blockchain technology, and cryptocurrency (Kayembe & Nel, 2019) The old version of education that is solid, straightforward, and repetitive is no longer sensible in the 21st century. In accordance with Carneiro (2015), 21st-century education is more ambiguous, changeable, innovative, and sustainable. The conventional education system should transform and adapt the characteristics of 21st-century education to enhance the quality of education. Carneiro (2015) in her study titled "Learning: The Treasure within – Prospects for Education in the 21st Century" summarized the transformation of the traditional approach into the new approach in education. In traditional education, the main principle is to provide initial education for a lifetime but for 21st-century education, the objective is to accommodate flexible learning throughout life. Education becomes more sustainable for the learner. Previously, education dealt with fragmented knowledge for solving a direct and straightforward problem. Meanwhile, in the 21st century, the challenges encountered is an ill-defined problems or wicked problems that require holistic knowledge to solve them. This viewpoint aligns with the study by Kayembe & Nel, 2019).

The Design Thinking model is the best approach to achieve the objectives of 21st-century education because Design Thinking ticks all the requirements as described by Carneiro (2015), which is that 21st-century education should be more ambiguous, changeable, innovative, and sustainable. This perspective is congruent with the results of the study by Prapulla et al. (2022). The findings from this quantitative research show that Design Thinking has a high percentage to be chosen as the preferred technique for enhancing 21st-century education. His study also mentioned the reasons respondents choose Design Thinking because of its features like solving an ill-defined and unsolved problem, improving user experience, and creating innovative solutions. Since there are different features between traditional education and 21st-century education, hence, there will be differences in the characteristics of traditional educators and educators who implement Design Thinking. Tschimmel & Santos (2019) described a traditional educator as someone who has a deep understanding of what students have to learn according to the curricula while a Design Thinking educator is someone who has a deep understanding of learners' needs and dreams. Hence, Design Thinking educators gravitate toward designing specific learning lessons for every class and promote Design Thinking to their students. Meanwhile, traditional teachers habitually lead students to become familiar with textbooks and emphasize academic skills as stated by Noh & Karim (2021).

Conversely, Noh & Karim (2021) mentioned that teachers who are teaching with a Design Thinking mindset will be applied a culture of prototyping and experimentalism as their teaching and learning strategy. This project-based approach is usually resource-draining if not implemented correctly. This perspective is aligned with the finding from a study by Retna (2016) titled "Thinking about "design thinking": a study of teacher experiences'. The Design Thinking process is excessively time-consuming, and this hampers students' preparation for examinations is one of the findings obtained from this research. This research is a case study conducted at a public school in Singapore that has just implemented Design Thinking as a problem-solving approach for two years. Design Thinking has been taught to students as a systematic framework enabling students to resolve problems, foster creative ideation, and develop solutions that align with the requirements of people. Singapore's education system is strictly examination-based and therefore such an answer is expected. The drill of examination-based education is to train students to solve problems that have been prepared based on the curricula and these problems are often repetitive questions. Hence, the traditional problem-solving approach is a more straightforward, relatively simple, quick-stage approach and saves time compared to the Design Thinking approach.

According to (Léger et al., 2020), students who practice typical problem-solving approaches tend to produce more habitual technical solutions whereas students who implement the Design Thinking approach in their problem-solving process can generate out-of-the-box solutions which more feasible for a diverse group of users. The Design Thinking method is not only applicable to a diverse group of people, but it is also suitable to be implemented in various problem situations, especially in this 21st century where most of the problems faced are wicked problems or ill-defined problems. The traditional problem-solving strategy which is a consistent and one-way approach is not appropriate for use when dealing with wicked problems. The appealing feature of Design Thinking when dealing with wicked problems is that Design Thinking acknowledges the problem's unpredictability and proposes an adaptable remedy to that uncertainty. The conclusions drawn from the studies by Peng et al. (2022) and Promsiri et al. (2022) are consistent with this viewpoint where Design Thinking is the most appropriate method to be applied when dealing with wicked problems compared to traditional problem-solving methods.

Design Thinking: A Privileged Approach.
Even on a cursory inspection, just what design thinking is supposed to be is not well understood, either by the public or those who claim to practice it"
 (Micheli et al., 2019)

Since d.school was established in 2004, it has been almost two decades of Design Thinking implementation in the field of education as a curriculum taught to students. In addition, the rapid competitiveness of IR 4.0 especially in the use of artificial intelligence which is relatively close to Design Thinking caused most of the educational boards in the world to re-organize their education system. Certainly, there must be the perception that Design Thinking is no longer an uncommon practice in education and that everyone is used to employing it as a problem-solving strategy. Nonetheless, Çiftçi & Topçu (2020) remarked that there are limited studies on the implementation of Design Thinking in education. This suggests that educators are still hesitant to apply Design Thinking despite findings from literature reviews by Panke (2019) showing how infrequently bad results are reported in Design Thinking case studies. Design Thinking has a solid reputation in terms of implementation records, which should be

the major reason for scholars to gear up and begin to explore Design Thinking in education more actively.

Based on the findings from the case study conducted by (Retna, 2016), teachers were found to have skepticism about Design Thinking. Teachers have strong opinions that Design Thinking is not for all students, and it is more suitable to be implemented for high-achieving students. This viewpoint aligned with the study by Avcu & Er (2020). The high-achieving students or so-called gifted students are taught programming using Design Thinking. While programming is still a quite difficult and complex subject even for the gifted student, with the help of Design Thinking it became easier to learn. Following the completion of the Design Thinking activities, students reported in interviews that they appreciated the Design Thinking activities, even though they had minor disagreements with team members throughout the process. Following their participation in the Design Thinking process, students created the traits of a good designer based on their Design Thinking experiences, concluding that a good designer should be able to work in a team and be a courteous person. Even as gifted students, they still have a few setbacks during the implementation of Design Thinking, yet they overcome them and gain valuable lessons that can be used in their future careers.

In view of the finding from Avcu & Er (2020) which stated Design Thinking is suitable for gifted students, Harden & Moore (2019) and Su Cheong et al. (2023) had different points of view in which Design Thinking is equally appropriate for students with impairments and low-achieving students. The quantitative finding from Su Cheong et al. (2023) demonstrated that the proposed framework based on Design Thinking can boost average and low achievers' academic performance with the goal of improving learning satisfaction and enhancing creativity among students. The framework is designed to utilize thinking skills, communication, and creativity which are the major characteristics of Design Thinking and used as a tool in 21st-century learning. The learning experiences. Students' learning experiences become more meaningful when they employ Design Thinking, and this boosts students' enthusiasm for discovering new knowledge since Design Thinking activities that require a lot of communication and cooperation among group members make them feel relaxed and less anxious.

Meanwhile, Harden & Moore (2019) take a further step forward by implementing Design Thinking as a teaching and learning strategy for students with learning disabilities. Involving students with disabilities in a participatory Design Thinking process is a practical strategy to build an effective and adaptive learning tool that they may use alongside students without disabilities. Before integrating students in participatory design, this study wants to know how students with no prior formal expertise in Design Thinking interact in the process and how to create activities to best encourage this participation. The findings show how accessible, considerate, and constructive idea-sharing may result in a more sophisticated and innovative design prototype. This finding contradicted teachers' belief in Retna (2016) where Design Thinking is only suitable for high-achieving students whereas it's also convenient for students with learning disabilities.

Another concern that educators have regarding Design Thinking is that it is exclusively meant for students in Science, Technology, Engineering, Art, and Mathematics (STEAM). "Our students are not STEAM stream" is one of the responses obtained from teachers as stated in Retna (2016). This response supports the claims by Micheli et al. (2019)where even the teacher as the executor of Design Thinking did not have a clear and deep understanding of what Design Thinking really is. Although several studies about Design Thinking have incorporated students with STEAM backgrounds, Design Thinking does not entirely belong to

STEAM students. This perspective is congruent with the results of the studies from Sándorová et al. (2020) and Hews et al. (2022) which also contrasted findings from Retna (2016). The study by Sándorová et al. (2020) was conducted to determine the feasibility of implementing Design Thinking into the teaching and learning of non-STEAM-based disciplines. Design thinking has long been widely used as a teaching method in architecture courses as well as economics-related courses. However, in recent years, Design Thinking has shown great potential for its applicability not only in the field of technology but also in the field of services like tourism. The findings of the study show that the use of this strategy as a teaching method in the tourism course received positive and constructive feedback from lecturers and students. Design thinking is not only a suitable and modern method to educate future managers in the field of tourism but also beneficial for students to use in their jobs later.

The conclusions drawn by Sándorová et al. (2020) is consistent with the observation found by Hews et al. (2022). Queensland University of Technology (QUT) equips its Law undergraduate students with a set of adaptable mindsets and approaches for handling legal difficulties in novel and creative ways by incorporating Design Thinking into their curriculum and introducing the subject as Design Thinking and Law. The growing acknowledgment of the positive impacts of Design Thinking in the legal profession, as well as the established market demand for graduates with these abilities and experience, give compelling grounds for establishing design thinking as a vital component of traditional law curricula. By incorporating Design Thinking into legal education, law schools may prepare graduates to be well-positioned for the future of work, which should lead to better legal prospects for all. Based on Hews et al. (2022), students have provided excellent input about Design Thinking and Law, and alumni have indicated high demand for their legal design abilities and experience. Learning about Design Thinking has inspired students, who assert, "The incorporation of Design Thinking into Law has empowered us with the notion that there are viable legal alternatives yet to be uncovered and that we are capable of being the ones who discover them."

Retna (2016) stated that inadequate learning facilities to accommodate Design Thinking practice is also one of the reasons that caused teachers reluctant to implement it. In teachers' defence, cutting-edge technologies, or at least computers and the internet are a must during the implementation of Design Thinking in class. Noel et al. (2019), on the other hand, demonstrated that advanced technology is not essential for applying Design Thinking and that Design Thinking activity can be conducted even in remote regions without internet access. During this study, a specific curriculum based on Design Thinking has been built to be applied to students throughout the summer camp which encourages students to become thinking citizens, agents of change, and social critics. The unique features of Design Thinking activity such as the open-mindedness of the design projects and possibilities for evaluation and criticism, establish spaces for equity pedagogy. To point out, Design Thinking settings are student-centered and dialogue-centered, encouraging debates about relevant challenges and solutions. Interactive discussions are encouraged between students and trainees during the summer camp. The problems were prompted by the local setting and suggested by students and community members. Students successfully use Design Thinking strategies to actively identify problems through dialog sessions and brainstorming using Post-it notes and students thrivingly propose innovative solutions to community problems. The findings of the study show that students are more in control of their learning and that this student-centered strategy successfully fosters critical awareness and social development among students even with limited resources. In summary, Design Thinking is not a privileged approach owned by

one group only or an exclusive strategy that requires advanced technology in its implementation, instead, Design thinking is a holistic approach that is suitable for all, and it makes no difference what your intellectual quotient is or whether you have MacBook or not.

Design Thinking Implementation: Unveiling the Impact of Local Culture

While other countries have actively applied Design Thinking in education, Malaysia appears to be taking a back seat in this regard. According to Noh & Karim (2021), the limited number of studies on Design Thinking in Malaysia demonstrates that the use of Design Thinking in education is still unfavourable. The percentage of teachers who are unaware of and overlook the vital role of Design Thinking in education for creating a competitive generation towards IR 4.0 is significant, and while educators are aware of its importance, they lack the necessary knowledge and abilities to implement it. In addition to the teacher's role as an implementer, local culture also plays an important role in the implementation of Design Thinking in education. Hoople et al. (2020) emphasized the importance of culture in pedagogy in their study through the integration of Design Thinking with Culturally Sustaining Pedagogies (CSP). CSP is referred to as a learning approach that seeks to preserve cultural diversity as part of the social purpose of educating. The learning approach employed should be appropriate to the local culture to make the lesson more relevant because students will readily accept new knowledge provided if references representing their culture are presented. The way people look at a problem is based on their perspective built up throughout their upbringing and this is mostly influenced by their family culture and the local culture they live in.

Malaysian culture has the potential to have an impact on the implementation of Design Thinking in education. Design thinking is a methodology that fosters creativity, invention, and problem-solving abilities, and it can be shaped by cultural influences, especially Malaysian characteristics. Malaysia has a diverse culture with a blend of Malay, Indian, Chinese, and indigenous influences. Cultural values, attitudes, and norms can influence the way Design Thinking is perceived, taught, and practiced in schools. Based on Abu Bakar et al. (2018), there are four shared cultural characteristics among multi-ethnic communities in Malaysia which are 1) collective culture, 2) respect for authority, 3) cultural sensitivity, and 4) relationship-based approach. These four characteristics can be used to describe the impact of Malaysia's culture on the implementation of Design Thinking in education.

Malaysian culture is collectivist in general, prioritizing community and group harmony. Since early education, students have been exposed to group activities. Students have been given access to community activities beyond their school walls, such as group activities for cleaning their living compound which is famously known in Malaysia as "*gotong-royong*". In an educational context, this may influence the way Design Thinking is approached, with more emphasis on collaborative teamwork and group problem-solving rather than an individualistic approach. As a result, Malaysian students have no difficulty engaging in group activities, which is a key component of the Design Thinking approach. Respect for authority and elders is a deeply ingrained cultural trait in Malaysia. This may influence how students and teachers engage during Design Thinking tasks, with students being less willing to criticize authority figures or express opposing viewpoints, thereby reducing the exploratory and autonomous nature of Design Thinking. When engaging in design thinking activities, teachers must reassure students that they are in a safe environment that allows them to express their thoughts. For this reason, in Design Thinking, educators serve as facilitators rather than executors with authority, which causes uneasiness among students when they express their opinions.

The cultural diversity and sensitivity to cultural norms in Malaysia can affect the selection of Design Thinking activities and challenges. Educators may need to be careful about planning inclusive activities that respect the cultural sensitivity of students from various origins. Teachers should learn more about the various ethnic backgrounds and different beliefs of their students to assist teachers when designing the Design Thinking activities. Malaysian culture places great importance on cultivating relationships and trust. This may have an impact on how Design Thinking is taught, with a focus on developing connections, trust, and empathy among students and teachers, all of which are critical components of the Design Thinking process. For example, before initiating a group activity when implementing the Design Thinking approach, the teacher may arrange an ice-breaking session first. Ice-breaking sessions will allow students to establish relationships and trust among group members, making it easier for them to collaborate as a group.

Malaysian culture could shape how Design Thinking is contextualized in the local setting. Educators may need to customize and localize Design Thinking approaches and processes to accord with the local culture and setting, making them more appropriate and approachable to Malaysians. This perspective is congruent with the results of the studies from Fekih Zguir et al. (2022), Hoople et al. (2020, and Liarakou et al. (2021). The implementation of Design Thinking in previous studies has been re-engineered to customize with the local settings. The findings show that the potential of Design Thinking could be utilized to the maximum when integrating the approach with local culture. While the concept of Design Thinking is a versatile and adaptable method, it is critical to take into account the cultural context of Malaysia while applying it in the education system to ensure it is effectively incorporated and resonates with students' cultural backgrounds. This may entail making necessary adaptations to instructional techniques, activities, and challenges in line with Malaysian cultural values and norms.

Design Thinking: The Closure

The rapid development of technology and the explosion of information make the activities of the global community increasingly competitive both in terms of economics and other social activities. The problem faced is no longer as simple as it used to be. The issues we face become trickier and more complicated every day. This "wicked problem" is now viewed as incompatible with traditional problem-solving techniques. The best approach to resolving the "wicked problem" is Design Thinking. Design Thinking has been around for 60 decades, so it's hardly a brand-new concept. Due to its usefulness and ability to address problems of the twenty-first century, Design Thinking is now becoming a growing trend. The disciplines of engineering, architecture, fashion, management, and business have all made extensive use of design thinking. Therefore, teaching students Design Thinking has been deemed to be an essential skill. Design Thinking can be taught as a curriculum, but its applications go well beyond that. Design Thinking has also been successfully used as a strategic tool in planning and forming the curriculum for other subjects.

Many academics have chosen to study Design Thinking in the academic realm. Based on the favourable outcomes obtained via previous studies, Design Thinking implementation is also viewed as having significant promise in education. However, there is still a lack of studies related to the implementation of design thinking in education. The primary explanation for the resistance to incorporating Design Thinking in education is the comfort of using the old approach as opposed to the new method, which is perceived as hard. Confusion and misunderstanding regarding the implementation of design thinking also contribute to a

passive reaction among educators. While Malaysia's education reformation plan has made Design Thinking a significant component of its strategy, Malaysia is still perceived as taking a backseat. There is also the concern of whether the local culture influences the implementation of the Design Thinking approach.

The demands of the generation at the time must be considered when tailoring education. Traditional schools were established basically to meet the needs of industry in the era of the first revolution. At the time, the issue was simpler and more constrained. Along with the changing times, the problems faced also evolve. Problems in the twenty-first century are increasingly complicated and require collaboration between different disciplines. Design Thinking is therefore seen to be more appropriate for use in solving 21st-century problems. Although Design Thinking is claimed to be resource-draining, in the long run, this method has its own sustainability because it is more adaptable and can be altered based on the user's desires. Because of the sustainability of this approach, Design Thinking is more resource-efficient than the traditional problem-solving approach.

Misconceptions arise among teachers regarding the implementation of Design Thinking. Teachers have the misconception that Design Thinking is only appropriate for gifted kids. Furthermore, teachers have a prejudice that Design Thinking must only be used in STEAM-related disciplines. Teachers' refusal to use Design Thinking is often influenced by an absence of high-technology resources. Design Thinking is a holistic approach that is flexible to different kinds of consumers and can be used in various circumstances. Design Thinking is not only suited to high-achieving students but also for all students, regardless of academic achievement level. It is also feasible for students with disabilities to utilize this method. Design Thinking can be used anywhere, whether urban or rural, using a MacBook or simply a pencil and paper. Confusion develops in the implementation of Design Thinking because teachers are not given proper exposure to and explanations of the genuine notion of Design Thinking. The government should focus on providing training and materials that teachers and prospective teachers can use as a reference when adopting Design Thinking.

The successful adoption of Design Thinking is also influenced by local culture. Humans act or make decisions based on the knowledge they have obtained for themselves. This knowledge develops because of experience and knowledge acquired since childhood, and it is shaped by how familial culture, school culture, and local culture interact with one another. Malaysia is well-known for its multi-racial and multi-religious population. The distinctive characteristic of this multi-racial Malaysian society is that they have a common quality that serves as the foundation for the establishment of local culture and race unity. The shared characteristics are collective culture, respect for authority, cultural sensitivity, and a relationship-based approach. Integrating local culture while using Design Thinking can help to make this approach more easily accepted and then implemented in daily life by Malaysia's diverse community.

Design Thinking is a notion that must be emphasized in education to cultivate a competitive generation in the 21st century. Since students must be prepared for occupations that have not yet been invented, for technologies that have not yet been developed, and to solve social issues that have not yet been anticipated, Milovanovic et al. (2021) raised Design Thinking as an innovative approach to be incorporated in the school's environment. This should serve as an inspirational force for the successful implementation of Design Thinking in the context of teaching and learning. Policymakers, teachers, parents, society, and students themselves must embrace Design Thinking with an open arm to welcome it as a new skill that

must be mastered. Design Thinking constitutes more than simply an approach to solving problems; it is a mindset that should be cultivated in everyday life.

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