Abstract
The pandemic has created challenges in all sectors of the economy and education. Traditional teaching approaches seem futile in the new context, thus the need to constantly reinvent the delivery to meet the fast-paced changes in the education domain. Hence, Design Thinking (DT) is an alternative approach that might be useful in the given context. DT is known to be a human-centric approach to innovative problem-solving processes. DT could be employed in the delivery process to develop twenty-first-century skills and enhance creativity and innovation, in an attempt to identify alternative solutions. The study explores the role of design thinking (DT) mindset in innovative delivery among teachers. It enhances and facilitates innovative content delivery by leveraging creativity. The study targeted 131 teachers from primary and secondary schools in Malaysia. Data was collected through an online survey and was analyzed using SmartPLS to establish relationships between DT and Innovative Delivery in schools. The data was further analyzed to seek co-relations between the DT steps and the successful transformation of content delivery by teachers. The study established a framework for the application of design thinking for teachers as the primary support in developing activities for their students. The outcome of this study will help fill the gap towards creating an interesting method of delivery in schools and constantly innovating the method to suit the evolving generation. It provides an in-depth reason as to why students are not interested in the teacher’s lessons which, in turn, affects their performance. This insight is crucial for the Ministry of Education and policymakers to enhance teachers’ ability to innovatively deliver content to students.
Keywords
Design thinking, innovative teaching, 21st-century teaching, Malaysian schools, innovative delivery

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Introduction
We are living in unprecedented times. The COVID-19 pandemic coupled with the continuous onslaught of digital technologies has acerbated the level of volatility, uncertainty, complexity, and ambiguity (VUCA), across various sectors. The education sector is not spared and remains a target for greater industrial shifts and repositioning in the context of remaining relevant. To this end, even schools are subject to changes—failure to innovate and offer the state of curriculum and pedagogy puts extreme pressure on students in their quest to become employable at later parts of life. As such, to ensure the education systems keep abreast with changes, strategic and practical shifts in the delivery of educational content is crucial. Failure to do so could result in longer term socioeconomic consequences.

In this paper, we posit that innovative delivery of educational content is required to ensure students can truly benefit from the learning outcomes set out in schools. Therefore, we propose precursors such as having empathy, rejuvenated thinking process, curriculum enhancement and gamification of lessons that can lead to innovative delivery of lessons. This includes examining the role of design thinking (DT) in generating innovative delivery of educational content.

There are various definitions of design thinking. According to Oxford Languages1, the word ‘design’, a noun, refers to “a plan or drawing produced to show the look and function or workings of a building, garment, or other objects before it is made”. This definition implies that ‘design’ relates to any form of idea that is put forth either in the form of sketch, model, or better still as a full-blown prototype before the final product or model is developed. The second word, ‘thinking’, a noun, refers to “the process of considering or reasoning about something,” according to Oxford Languages2. The keywords based on this definition are reasoning and process. DT therefore can be defined as a systematic or a structured approach to developing something, initially as a model or prototype, before a final version is built. We need to understand nevertheless that when people build or develop something, it is often done to solve a real-world problem. As such, DT is often defined as a systematic and structured approach to solving a problem based on design.

The inherent ideas beneath DT are not new. Nevertheless, DT presents an organised way of including innovative thinking and creativity in organisations. To be able to derive the inspirational values of DT, highly specific tools and techniques are used that are usually presented in a simplified manner. DT is able to solve problems using a user-centric collaborative method3. Stanford University’s design school (dSchool) established a five-step DT process4, which is summarised in Table 1.

DT when institutionalised as an inherent culture in schools, could lead to innovative teaching and learning processes. Specifically, DT has the potential to cultivate empathy, lead to a growth mindset (new thinking processes), and lead to curriculum enhancement in the form of gamified learning.

Empathy
Empathy as a core of every DT project, one outcome of successful DT applications is the ability to encourage a culture that gives everybody a chance to express themselves freely. Empathy in the classroom context refers to the teacher-student interaction. Empathy shows the connection of what a teacher thinks or knows about their students and what they do to provide the necessary response to the students’ needs5. This is also needed as teachers are the ones who arrange learning experiences for their students. Teachers are able to do so by providing feedback to their students. According to Mueller and Dweck6, students who are praised and given feedback based on their efforts (instead of intelligence) are more likely to show an interest in mastery and tend to seek challenges when attempting to achieve their learning goals. These students can think out of the box as they are under the impression that their performances can be improved7.

Thinking process
Innovative and creative thinking is the product of DT’s ideation. The thinking process closely relates to the Growth Mindset Theory by Dweck8. Students with a growing mindset tend to learn through persistence, failure, and different strategies.

Table 1. Phases of design thinking based on the understanding of Stanford School.

<table>
<thead>
<tr>
<th>DT Phase</th>
<th>Brief Explanation</th>
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<tbody>
<tr>
<td>Empathy</td>
<td>The most vital step in DT. Design thinkers are given a design challenge to understand the emotional attachment and pain points of customers towards a problem or challenge. The findings from this step will naturally lead to the second step called ‘define’.</td>
</tr>
<tr>
<td>Define</td>
<td>This step requires design thinkers to focus on getting deep into the problem from the customer's viewpoint. They will then spend some time to come up with specific perspectives. In addition, they will also suggest some game-changing propositions to the problem based on insights or intuitions.</td>
</tr>
<tr>
<td>Ideate</td>
<td>This step allows design thinkers to come up with as many ideas as they can in order to address the issue or problem which has been defined. Ideate is similar to brainstorming sessions.</td>
</tr>
<tr>
<td>Prototype</td>
<td>The step where ideas are translated into tangible manifestations. The prototype may not necessarily be a tangible product as it could also be a simulation, campaign, or mockup (this depends on the challenge at hand).</td>
</tr>
<tr>
<td>Test</td>
<td>This final step in DT emphasises on the importance of pitching the idea to indemnified target groups. This is followed by the gathering of feedback. The solution is either launched to the market or is reworked until it is deemed to be suitable for market launch.</td>
</tr>
</tbody>
</table>
Additionally, students are able to overcome challenges given to them by practicing and using setbacks as a form of motivation. Implementation of innovative teaching strategies such as collaborative learning, using real-life problems to address issues, and experimentation also contribute to the thinking process. According to the Cambridge Learning Attributes Guide, the thinking process is a powerful tool which not only requires knowledge and understanding of a subject matter but also the students’ willingness to question it. By ensuring that students are provided with materials that enable them to challenge the subject matter they will be able to express their own understanding and opinions on it.

Gamifying lessons
Prototyping in DT leads to a new form of learning, which in this context refers to gamification. Gamifying lessons enables teachers to establish a casual learning environment whereby students are able to challenge themselves via fun online games. According to Hakak et al., students are given tasks or “missions” with varying levels of difficulty and they are required to complete them within a short time frame. They are also given the chance to repeat the “mission” if they fail to achieve the goal. This allows students to analyse and correct the mistakes made, which in turn encourages them to build a positive attitude towards learning. Eleftheria et al. believe that the use of gamification provides students with a comprehensive understanding of the subject being taught and it increases their engagement and enjoyment in the learning process.

Curriculum enhancement
Curriculum enhancement is the product of testing from DT. The materials provided in an enhanced curriculum should allow students to deeply reflect the topic at hand and provide them with the opportunities to make connections between other subjects and topics as well. Additionally, the curriculum should look beyond testing. Assessments in the form of evaluating students’ points of view and their observations are important as this shows the process of their progression. Teachers are also advised to consider implementing more group work and interactive lessons which builds on what students already know. From there, students are able to apply existing knowledge and add value to new knowledge.

As such, this paper aims to answer the following research questions:
1. Is there a relationship between DT and innovative delivery of teaching content in schools, specifically using the stage called empathy?
2. In addition to DT and empathy, what role does new thinking process, curriculum enhancement and gamification of lessons play towards similar aspirations?

Hence, the fulcrum of the study’s objectives is:
1. To determine if DT in the form of empathy leads to innovative delivery of curriculum
2. To examine if DT can lead to new forms of thinking processes and thus lead to innovative delivery of curriculum
3. To assess whether DT does lead to innovative delivery of curriculum, by promoting curriculum enhancement and gamified approach to teaching and learning.

Methods
This research is purely quantitative whereby online survey was used as a means of data collection. **Table 2** depicts the design...
elements used for this study. Questionnaires were carefully prepared with the anonymity of the respondents safeguarded (See underlying data). This was ensured as no personal data identifiers were collected. Additionally, an ethics approval was obtained before recruiting participants for the survey. From primary and secondary Malaysian schools, 200 teachers were invited to participate, however only 131 teachers responded. The items were adopted and adapted from various theories and previous studies conducted by Mueller and Dweck, Dweck, Hakak et al., Eleftheria et al. and Gipps. They were measured using the 5-point Likert scale, ranging from strongly disagree (1 points) to strongly agree (5 points). The odd Likert scale to give the survey respondents a choice to respond neutrally, was included. This was done to obtain evidence about a theme by adding a neutral response option for the respondents to select, should they refrain from selecting an answer from the two extreme choices. The scale offers five answer options. Table 2 depicts the research design components and their respective rationalizations.

Data analysis
The data for this study was analysed using the SmartPLS 3 software.

Measurement model evaluation
The measurement model evaluation is required to affirm the reliability and validity of the research model. The data attained from the questionnaires (See underlying data) were used to structure the measurement model of this study (Figure 1).

Indicator reliability is assessed by ensuring that the factor loadings for each item is above 0.708. However, there is a satisfactory threshold whereby the values of each item do not necessarily have to be above 0.708. Table 3 affirms that the loadings for each item fall within the satisfactory value, thus indicator reliability is present. Internal consistency reliability is determined by the composite reliability (CR). As depicted in Table 2, the CR values for each construct are well above
from the analysis. The structural model depicted in Figure 2 is attained after a non-parametric bootstrapping using a sample of 5,000 was conducted. Before assessing the path coefficient of this study, the coefficient of determination ($R^2$) is explained. The value of $R^2$ for this study is 0.627, which falls under the moderate category. This means that 62.7% of the total variance in Innovative Delivery is explained by Empathy, Thinking Process, Curriculum Enhancement and Gamifying Lessons.

The path coefficient for this study is depicted in Table 5. For the beta value to make an impact to the research model, the value must be at least 0.1 whereas the t-statistic has to be greater than 1.645 at an alpha level of 0.05 in order for it to be significant. Table 3 confirms that curriculum enhancement, gamifying lessons and thinking process have a significant positive influence in enhancing innovative delivery. However, empathy does not have a significant positive influence in enhancing innovative delivery.

Discussion and conclusion
The study showed that the thinking process, gamifying lessons, and curriculum enhancement have positive significance for innovative delivery. However, the variable empathy was not supported and did not show a positive significant relationship. The absence of empathy among teachers can affect the educational process adversely. Empathy is an essential advantage that can assist teachers by enhancing the driving factors on students’ behaviour. Thus, the link between teachers’ empathy and innovative teaching is essential and since the hypothesis for this study pertaining to empathy is not supported, it means that Malaysian teachers in predominantly primary and secondary schools lack empathy, which indirectly creates a large gap or power distance between students and the teachers themselves. This situation further enhances inability to deliver dry and uninteresting teaching and learning material which leads to hatred and disinterest among students in the subject. The current pandemic has made students more productive, independent, and proactive in being responsible for their learning. As such, the overall results of the Sijil Pelajaran Malaysia (SPM) 2020 or the Malaysian Certificate of Education, which is a national examination taken by all students, are reflective of these new paradigms.

<table>
<thead>
<tr>
<th>Table 4. Discriminant validity matrix.</th>
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</thead>
<tbody>
<tr>
<td><strong>Constructs</strong></td>
</tr>
<tr>
<td>Curriculum Enhancement</td>
</tr>
<tr>
<td>Empathy</td>
</tr>
<tr>
<td>Gamifying Lessons</td>
</tr>
<tr>
<td>Innovative Delivery</td>
</tr>
<tr>
<td>Thinking Process</td>
</tr>
</tbody>
</table>

AVE: Average Variance Extracted; CR: Composite Reliability
Table 5. Beta value, t-statistics, p-value, and hypothesis decision.

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Beta</th>
<th>T-Statistic</th>
<th>P-Value</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curriculum Enhancement --&gt; Innovative Delivery</td>
<td>0.268</td>
<td>2.842</td>
<td>0.005</td>
<td>Supported</td>
</tr>
<tr>
<td>Empathy --&gt; Innovative Delivery</td>
<td>0.108</td>
<td>0.962</td>
<td>0.336</td>
<td>Not Supported</td>
</tr>
<tr>
<td>Gamifying Lessons --&gt; Innovative Delivery</td>
<td>0.396</td>
<td>3.917</td>
<td>0.000</td>
<td>Supported</td>
</tr>
<tr>
<td>Thinking Process --&gt; Innovative Delivery</td>
<td>0.204</td>
<td>2.116</td>
<td>0.034</td>
<td>Supported</td>
</tr>
</tbody>
</table>

T-value significant at ≥1.645; P-value is significant at < 0.05
fifth-form secondary school students in Malaysia. have shown a sharp rise in passing and grades as compared to previous years\(^1\). This also indicates that teachers are no longer seen as mere content providers and knowledge givers, but as facilitators and support during difficult times. The lack of empathy among teachers must be addressed if teachers are exposed to DT workshops during their formal training and periodically as part of their learning development programme. The outcome of this study shows the aspects which need to be addressed by the Ministry of Education as well as the teachers in Malaysia. In addition, the outcome of this study may also assist in producing teachers who are well rounded in terms of mastering various teaching skills.

**Ethics approval**
The Research Ethics Committee (REC) of Multimedia University has granted the ethics approval for this research with the approval number EA2232021.

**Data availability**

**Underlying data**
Figshare: Enhancing innovative delivery in schools using design thinking

DOI: 10.6084/m9.figshare.1487187\(^9\).

This project contains the following underlying data:
Data file 1. The data attained from the questionnaire. This file is to be opened using the SPSS software.
Data file 2. Questionnaire used for this research.

Data are available under the terms of the Creative Commons Zero “No rights reserved” data waiver (CC0 1.0 Public domain dedication).

**Author contributions**
Sharmini Gopinathan was responsible for the conceptualization, supervision, methodology and data analysis. Anisha Haveena Kaur assisted in the conceptualization, investigation, and data analysis. R. Kanesaraj Ramasamy provided resources for this study and explained the findings of the research. Murali Raman also provided the resources for the study (specifically for Design Thinking) and assisted in the direction of this research. All authors were part of the writing process. Sharmini and Anisha took on the responsibility to address comments by the reviewers.

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**References**

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