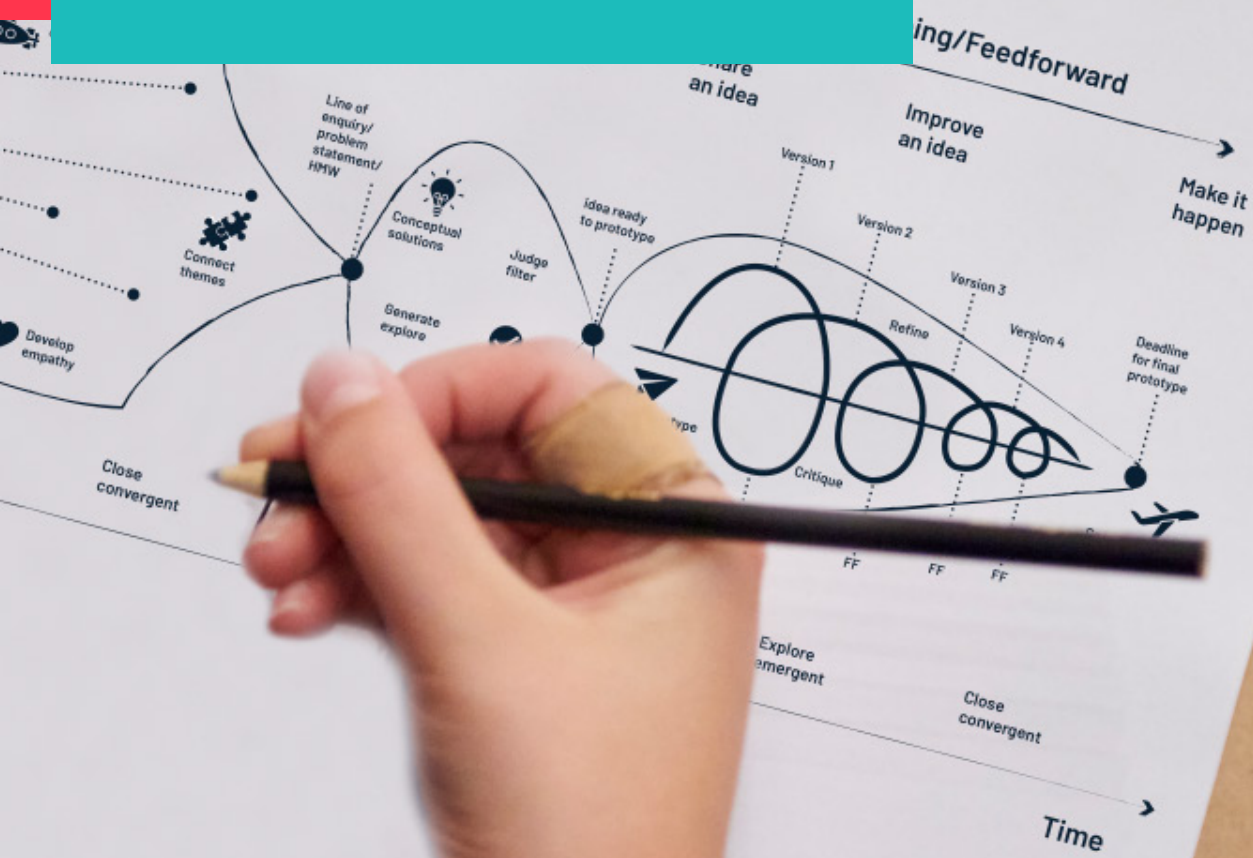


Design thinking for learning (DT4L) Research evaluation

Foreword



A human approach to complex challenges

Independent Schools Victoria's engagement with the concept and practice of design thinking – and the research presented in this report – pre-date COVID-19. But, in a way, the value of that involvement has been confirmed by the extraordinary challenges and stresses that schools have faced during the pandemic.

Design thinking, as this report spells out, is a way of navigating through uncertainties, using a human-centred approach. Even now, as we hopefully navigate out of COVID, those uncertainties remain, and new ones will emerge.

Design thinking is a process that involves defining a challenge, empathising with others, brainstorming ideas – and developing ways of dealing with the challenge – to produce a solution. It focusses on humans, as designers and beneficiaries of the process.

Think of the multiple practical and human challenges schools confronted this year: ensuring the health and safety of staff and students; navigating through complex and shifting official advice and direction; communicating with anxious parents; maintaining administrative processes and physical infrastructure; ensuring financial viability; devising online methods of teaching; and, above all, ensuring students continue to learn and grow.

It's likely many organisations, including schools, applied design thinking as they wrestled with the complex problems they've faced in 2020.

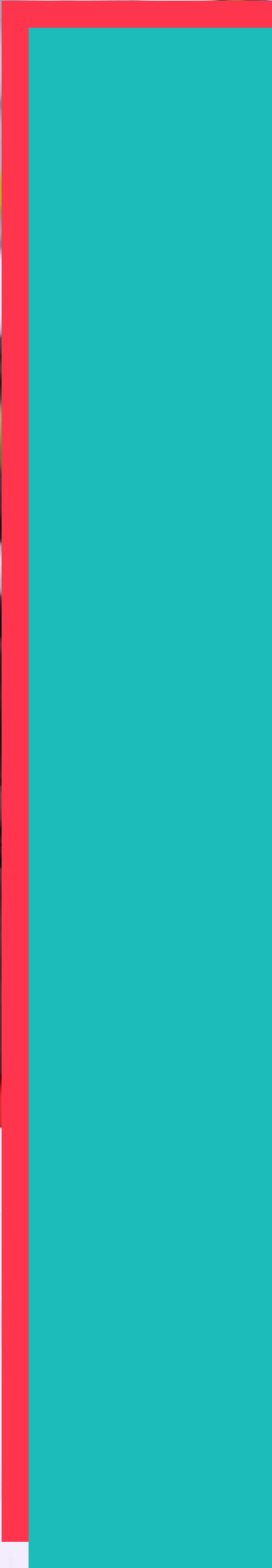
This report outlines the challenges and successes of a three-year design thinking program conducted by ISV, involving staff from 23 Member Schools. Overwhelmingly participants say the process has been positive for them, their students and their colleagues.

It confirms ISV's commitment to working in support of schools on innovative projects that bring enduring benefits.



Michelle Green

Michelle Green
Chief Executive
Independent Schools Victoria



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Executive summary

Design thinking emerged from the architecture and engineering fields in the 1950s to address human, technological and strategic innovation needs. It was based heavily on methods and processes that designers use, but eventually evolved to drive innovation in other industries including management, marketing, healthcare, and software and technology solutions. It became a model for innovation based on human-centered observation and prototyping to better address a vast range of issues.

In education, the term was initially associated with the way designers think but, more recently, it has been used alongside other constructivist approaches that emphasise authentic learning such as problem-based, project-based and inquiry-based learning. Design thinking is both a process and a mindset to enhance learning and promote creative thinking, confidence, collaboration and communication skills.

This report provides an analysis and evaluation of the Design Thinking 4 Learning (DT4L) program, a co-designed initiative by Independent Schools Victoria (ISV) and NoTosh. The DT4L program explored design thinking as a model of inquiry and aimed to create an active community of schools that can influence, implement and realise more open-ended, student-led learning.

A total of 23 schools have participated in four iterations of this program since 2017, with each iteration averaging six schools. In each iteration, teams of up to five teachers from each school participated in three full-day incubator sprint workshops. The program aimed to provide educators an opportunity to come together with their team to explore teaching and learning practices.

Participating schools were asked to support their teachers to engage in touch points, share feedback and deliver the final project presentation. Throughout the project, online coaching and an in-person coaching visit were made available.

ISV employed a mixed-methods research design combining both quantitative and qualitative components to address the following evaluation objectives:

- understand participants' experience of the incubator workshop and project implementation
- diagnose participants' needs and identify areas for improvement, and
- evaluate program outcomes and impact.

Quantitative research was conducted for each project iteration where participants completed an online survey at least six months after their incubator workshop. Case study interviews were also conducted in several schools during the program and at least two years after the implementation of design thinking in those schools.

Participants across all quantitative surveys indicated they 'Strongly agree' or 'Agree' that the project has had a positive impact on themselves (84 per cent), their students (83 per cent) and their colleagues/school (79 per cent). The findings from both quantitative research and case studies were consistent. The impact of the DT4L project among students, teachers and schools is promising and it extends beyond the project.

More than half of all participants indicated that design thinking would be 'Extremely useful' or 'Very useful' in their work. One of the biggest impacts observed among teachers were changes in teaching pedagogy, particularly in relation to incorporating a model of inquiry in the classroom using design thinking. The results of this evaluation show that teachers were more confident and willing to step out of their comfort zone as the project has given them a platform to reflect on their teaching practice and creatively collaborate with their peers. In addition, some schools have used design thinking to identify learning that matters, and teaching and assessment that works in their school's context. This has resulted in changes in deep rooted teaching practice.

Among students, the most significant impact observed throughout the evaluation were improvements in metacognition knowledge and skills. As students immersed themselves in the design thinking process, they spent more time reflecting on their learning and applying their knowledge in a variety of settings.

“As design thinking provides a safe space for students to fail, they became more willing to communicate their thoughts and ideas, and to provide and receive constructive feedback.”

Among teachers and students, the DT4L project has encouraged visible thinking and resilience, increased confidence and encouraged soft skills such as communication, collaboration and time management. All participating schools agreed they had achieved their stated objectives to a certain extent.

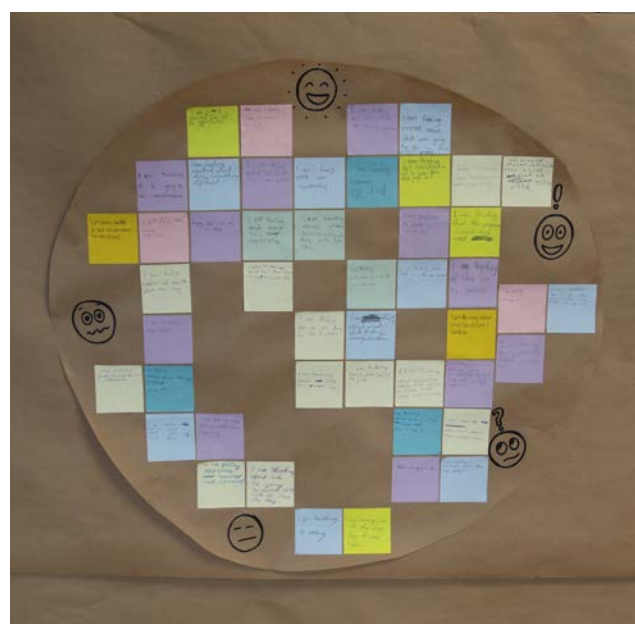
Some challenges specific to design thinking included difficulty understanding the concept, lack of ability and resources to introduce design thinking in the school and a lack of guidance in creating a suitable project for students. Some participants also noted an inability to guide students in the non-linear design thinking process, particularly the synthesis stage, and difficulty implementing design thinking in certain subjects and across curriculum.

The research highlights that how the project is planned, introduced and implemented influences the project impact. In addition, further statistical analysis shows a positive correlation between the ease of implementation and the perception of project's impact.

Key recommendations

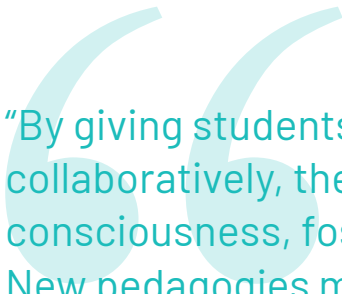
The following are some of the key recommendations to support effective design thinking in schools:

- As design thinking requires a broad commitment to change in both administration and mindset, identifying how it can be integrated in the school's curriculum and a readiness among teachers and students are important. Schools can consider receiving further support from design thinking facilitators for this.
- Schools embarking on a design thinking project could develop a clear framework to clarify the design thinking process and its intended outcomes. This would allow teachers to unpack the design thinking principles and use these to create projects relevant to student needs.
- Gaining leadership support is one way to ensure sustainability of the project. This would provide sufficient time, resources and freedom to unpack, experiment and implement design thinking concepts and projects.
- Schools embarking on design thinking could create a design thinking community via professional learning communities (or other learning-oriented alternatives) for teachers to explore and collaborate using design thinking to develop strong instructional practices that align with their school's direction.
- Teachers could consider creating design thinking projects based on real world problems with audiences, particularly for schools that are implementing design thinking for the first time with their students.



A brief literature review





“By giving students real-life problems to solve collaboratively, they gain a communal and global consciousness, fostering responsible citizenship. New pedagogies must stay relevant to cope with future demands.”

(Whitby, 2007)

The twenty-first century brings with it a complex set of dynamic circumstances. These need to be considered when developing pedagogy to ensure students have the skills to access emerging careers. Historically, pedagogies were generally teacher centered. Teachers transferred knowledge to classes of students of the same age, in standardised classroom settings, with a ‘we know the solution’ approach. This preoccupation with content – where the focus is on a student’s proficiency to absorb the information, not only has the potential to leave many students disengaged, but can be counter-intuitive to the needs of the twenty-first century (Marks, 2017; Gee, 2005, as cited in Razzouk and Shute, 2012; Whitby, 2007).

Recent pedagogies that have evolved over the last few decades suggest that teaching should be student-centered, challenge-based and socio-critical. They must promote lifelong learning and prepare students to cope competently in the world.

Design thinking definition and history

The concept of design thinking developed initially in the architecture and engineering fields, from a need to solve complex ‘wicked problems’ in a dynamic and ever-changing environment (Buchanan, 1992). Horst Rittel, a design theorist and university professor used the term wicked problems in the mid 1960s, to describe complex and multi-dimensional problems. He formulated a new approach that was non-linear and one that required a collaborative methodology and a deep understanding of humans (Dam & Teo, 2020; van der Linden, Lacerda & Aguiar, 2011).

References to design thinking can be found back in the 1950s and 1960s, with Buckminster Fuller, a systems theorist and designer calling the 1960s the ‘design science decade’ (Dam & Teo, 2020). The Conference on Design Methods, held in London in 1962, marked the launch of design methodology as a field of inquiry, which based the design process on objectivity and rationality (Cross, 2001; van der Linden et al., 2011).

The 1970s and 1980s saw the concept gain momentum, with Herbert Simon, a cognitive psychologist contributing to the principles of design thinking. He introduced methodologies such as rapid prototyping and testing through observation. Around the same time, Robert H. McKim, best described as an artist and engineer, looked at problem solving using various aspects of visual thinking and design methods – ideas now used to underpin design thinking methodology (Dam & Teo, 2020).

Although designers had been studying the process we now know as design thinking for a long time, the phrase design thinking was only popularised in 1991 by academic Peter Rowe when he referred to it as the ways in which designers approach design problems (Gestwicki & McNely, 2012). At this stage, design thinking began to receive increased attention from other disciplines such as business and education, promoted in part by IDEO (a global design and innovation company) and Stanford University (Goldman & Kabayadondo, 2017).

Design thinking in education

While design thinking has been widely and successfully used in industry for many decades, it is an emerging addition to the education sector, particularly for schools and their pedagogy. To confront the sometimes failure-averse culture of the classroom and to address the social and economic challenges students will face in the future, schools may need to consider changing traditional ways of thinking (Gilbert, Crow & Anderson, 2018).

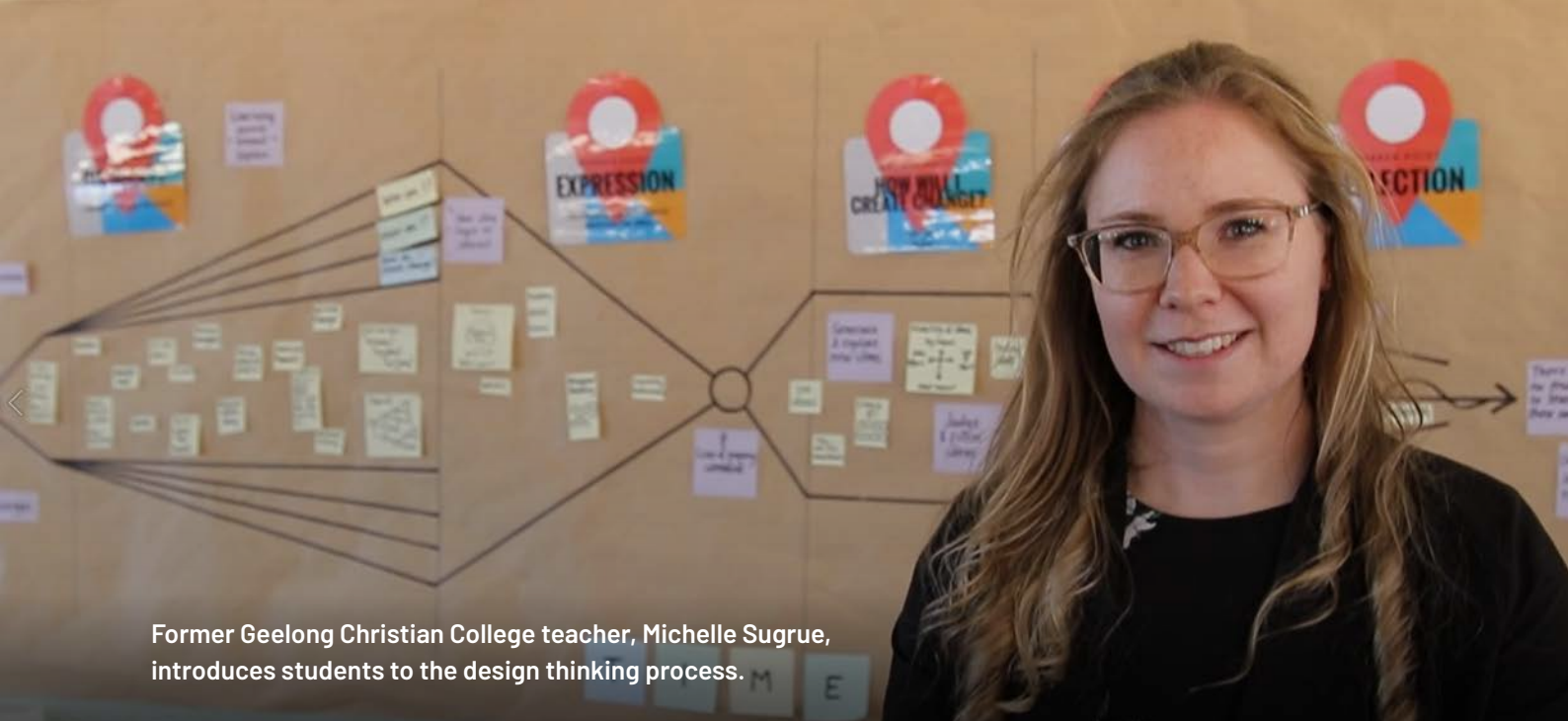
Design thinking is a future focused learning tool that empowers students to change their social and environmental contexts through design. Its framework involves seeing the world in a solution focused way and providing the confidence to solve problems, which encourages critical thinking and creativity. Today, design thinking stands alongside other constructivist approaches that emphasise authentic learning such as makerspaces, STEAM, computational thinking, problem-based learning, project-based learning and inquiry-based learning (“design thinking”, n.d., “Te Kete Ipurangi”).

There is a growing amount of literature on the impact of design thinking methodologies in schools. Goldman and Kabayadondo (2017) believe that design thinking will “bring to life new kinds of inquiry for teachers, learners, and classrooms” (p.4), as it deals with complex problems that are equally technical and socially complex. In their edited book *Taking design thinking to school: how the technology of design can transform teachers, learners, and classrooms*, they bring together many contributors and highlight a number of case studies that use action-oriented approaches to reframe kindergarten to year 12 teaching and learning.

Their overall conclusion from the research is that there is significant potential for the design thinking process to contribute to students’ metacognitive and social skills, as well as learning in the core subject areas. They found that participants developed creative confidence during the design thinking process, and that students who would otherwise be silent and disengaged found their voice.

Scheer, Noweski and Meinel (2012) believe design thinking could act as a bridge between constructivist learning and its practical implementation. In their research, they undertook a three-day case study into the effects of design thinking, which included a class of 125 grade 10 students and 12 teachers and coaches. Using the Inventory of Social Competence questionnaire to evaluate the study, they concluded that design thinking can indeed serve as the missing link. They found participants recorded a positive experience of the process, leading them to conclude that design thinking facilitated interdisciplinary projects and approached complex phenomena in a holistic constructivist manner. Congruent with the works of Goldman and Kabayadondo (2017), they also found the design thinking process promoted metacognitive skills and competences, essential for learning and working in the twenty-first century.

Design thinking and innovation or entrepreneurial skills also appear to complement each other, with several studies finding clear links between the two concepts. Zupan, Nabergoj and Cankar (2018, p.893), for example, posed the question ‘How did teachers use design thinking as a methodology for teaching the entrepreneurial mindset to adolescent students?’.



Former Geelong Christian College teacher, Michelle Sugrue, introduces students to the design thinking process.

They studied 146 seventh and eighth-grade students aged 12–14 and 20 teachers (two per class) from 10 Slovenian schools where teachers used the design thinking method to facilitate hands-on student projects. Their study concluded that the ‘design thinking method is an effective pedagogical approach to teaching entrepreneurship education in elementary schools and developing young students’ entrepreneurial mindset’ (p.898). They found that the students’ learning was, to a large extent, self-regulated, meaning they were internally motivated thus demonstrating metacognitive skills.

Huq and Gilbert (2017) also looked at entrepreneurship in education and its possible transformation through design thinking in the tertiary sector. This was a three-year project to enhance their entrepreneurial pedagogy development. Their study concluded that ‘a critical outcome of this design and delivery process is the reduction of barriers between students and teachers and the impact this has on creating a shared learning journey’ (p.155). They also reported greater student engagement and satisfaction, and an improvement in learning outcomes as a result of the integration of a design-driven pedagogy delivered in an open and constructivist environment.

These empirical studies validate that design thinking is a justified method for developing the essential skills students will need in the future. In these studies, the holistic, student-centered, challenge-based approach of design thinking has led to increased student competency in dealing with complex transdisciplinary issues.

In the face of rapid social and economic change, schools will need to continually revise teaching pedagogies and learning styles to enable opportunities for innovative learning. Over the years, the skills underpinning effective learning capabilities have evolved. According to the OECD Skills Outlook 2017, to succeed in the future and to specialise in the most technologically advanced industries, an individual will need the right mix of relevant skills (OECD, 2017). Skills that can be acquired through the design thinking process such as communication, collaboration, problem solving, creativity and innovation were highlighted by the Melbourne Declaration on Educational Goals for Young Australians as keys to becoming successful learners (Melbourne Declaration on Educational Goals, 2008).

At the heart of design thinking is a culture that values continuous learning, collaboration, growth, confidence and experimentation. The potential is there for design thinking to transform aspects of the traditional curriculum into a contemporary pedagogy where learning is engaging, meaningful and modern.

“At the heart of design thinking is a culture that values continuous learning, collaboration, growth, confidence and experimentation.”

Background



This program was introduced to Victorian Independent schools over the past three years to use design thinking as a method for inquiry-based learning. The evaluation of this program explores how design thinking was implemented in the school, its challenges and limitations. It also investigates whether and how design thinking could bring the skills needed to solve the 'wicked problem' of school education.

In recognition of the vast changes in skills needed for the future of work and beyond, Independent Schools Victoria (ISV) has offered design thinking projects exclusively to ISV Member Schools. Co-designed by ISV and NoTosh, the Design Thinking 4 Learning (DT4L) program aimed to create an active community of schools that would become high-paced incubators of design thinking practice and establish classrooms as innovation labs.

A total of 23 schools participated in four iterations of this program since 2017, with each iteration averaging six schools (see Appendix 1). In each project iteration, three full-day incubator sprint workshops were held at ISV's office, facilitated by a presenter from NoTosh. Teams of up to five members from each school were established, including a school leader in each team such as a Deputy, Head of Teaching and Learning or Head of Curriculum.

The overall structure of the workshops consisted of:

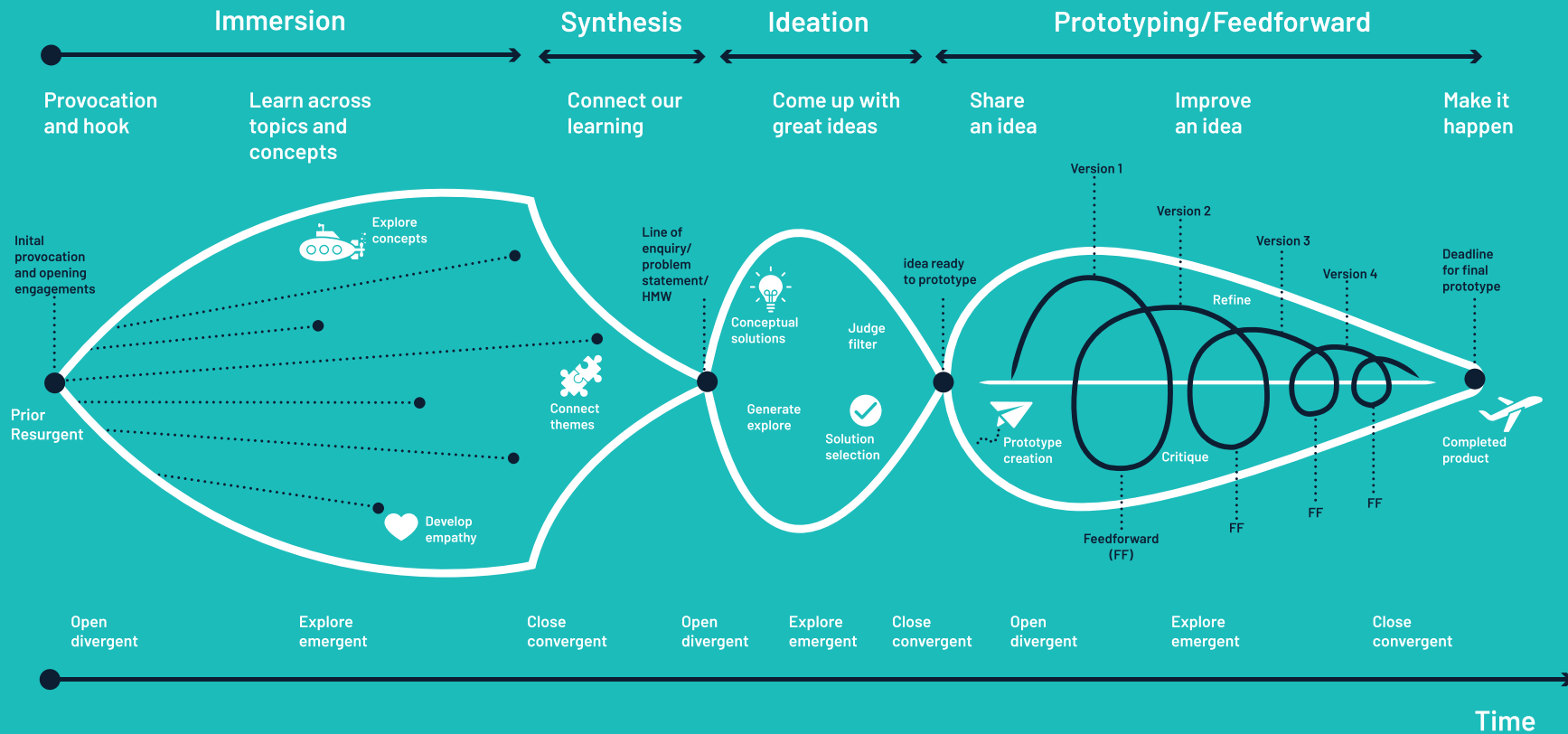
- First day incubator sprint workshop – followed by a design sprint over four weeks with in-school coaching support.
- Second incubator sprint workshop – followed by a design sprint over four weeks with in-school coaching support.
- Third incubator sprint/pitch workshop – teams presented their projects to the other teams, and school leaders from each school was invited to attend.

Participating schools were asked to support their teachers to engage in key touch points, share feedback and deliver the final project presentation. ISV and NoTosh offered online coaching and an in-person coaching visit throughout the project.

This action research-based project aimed to give teachers an opportunity to become adept at using design thinking as a model of inquiry in classrooms and throughout the school. Its objective was to encourage a pedagogy that creates a student-centred learning culture in schools, where students are able to challenge the status quo, 'problem find' and solve problems with ingenious flair.

During the workshop, teachers learned new ways to effectively and creatively engage students in their learning by creating innovative, manageable ideas. Figure 1 (p.16) depicts the five stages of design thinking taught during the workshops.

The Problem Finders: Process Map



The design thinking stages and some tools within each stage:

Immersion

How do we get ideas rolling?

- Questioning, observation, listening, empathy
- Provocation, SQUID (sequential question and insight diagram)

Synthesis

How might we rethink teaching and learning in our school?

- Overview, pattern recognition, problem finding
- Highlight key insights, hexagonal thinking, long shot

Ideation

How do we know what's going to work in real life?

- Open, divergent, encouraging, nascent ideas – idea generation and judgment
- 100 ideas in 10 mins, voting and filtering, safe bet, long shot
- Crazy Eights – sketching eight ideas in eight

Prototyping

Have we done what we set out to do?

- Communicate, draw – don't always write
- Post-it note, sketch, paper prototyping

Feedforward

What do we do with all this information?

- Help make thing better, challenge and support
- Communicate, critique, iteration
- Make – pitch – share – make again (repeat)

Overview



Evaluation objectives and questions

ISV adopted several types of evaluation at different stages of the program, which aimed to:

- understand participants' experience of the incubator workshop and project implementation
- diagnose participants' needs and identify areas for improvement
- evaluate program outcomes and impact

The evaluation sought to answer the following key research questions:

1. How is design thinking implemented in schools, and what learnings eventuate in each design thinking stage?
2. What are the enablers and barriers in implementing design thinking?
3. What are the perceived challenges and characteristics of an effective design thinking curriculum?
4. How has the DT4L project impacted teachers, students and schools in the short-term?
5. How has the DT4L program continued to impact students, teachers and schools in the mid to long-term?

Research design

ISV employed a mixed-methods research design combining both quantitative and qualitative components to address the evaluation objectives. Below is a summary of research conducted since 2017.

2017

- Observation and interviews during project implementation
- Quantitative survey (DT4L 2017 cohort)

2018

- Quantitative survey (STEM DT4L 2018 cohort)
- Observation and interviews during project implementation
- Quantitative survey (DT4L 2018 cohort)

2019

- Quantitative survey (DT4L 2019 cohort)
- In-depth case studies

Quantitative research methodology and sample

Quantitative research was conducted for each project iteration, where we invited all participating teachers to complete an online survey at least six months after their incubator workshop to allow them time to implement the project in their school. All quantitative data and open-ended responses from the survey was analysed using Q Statistical Research Software.

The survey was developed to understand participants' experience of the program, identify enablers and barriers in implementation and measure the project's short-term outcomes. The research findings were used to improve the next iteration of the project. Therefore, there were slight variations in the delivery of each iteration as research feedback was used to refine the project's structure and communication strategy.

This table shows the reporting name used in this research report for each project's iteration.

Project name/ project iteration	Period	Research reporting name/ cohort
Iteration 1.0	Incubator workshop (Term 1 2017)	DT4L 2017
STEM DT4L	Incubator workshop (Term 4 2017 and Term 1 2018)	STEM DT4L 2018
Iteration 2.0	Incubator workshop (Term 4 2017 and Term 1 2018)	DT4L 2018
Iteration 3.0	Incubator workshop (Term 4 2018)	DT4L 2019

This table shows the total number of participants who completed the survey for each cohort.

	DT4L 2017	STEM DT4L 2018	DT4L 2018	DT4L 2019
Total number of participants (N)	30	26	29	30
Sample size/ surveys completed (n)	23	17	23	15

The following section of the report details the consolidated survey findings for all cohorts across the years.



Quantitative research findings



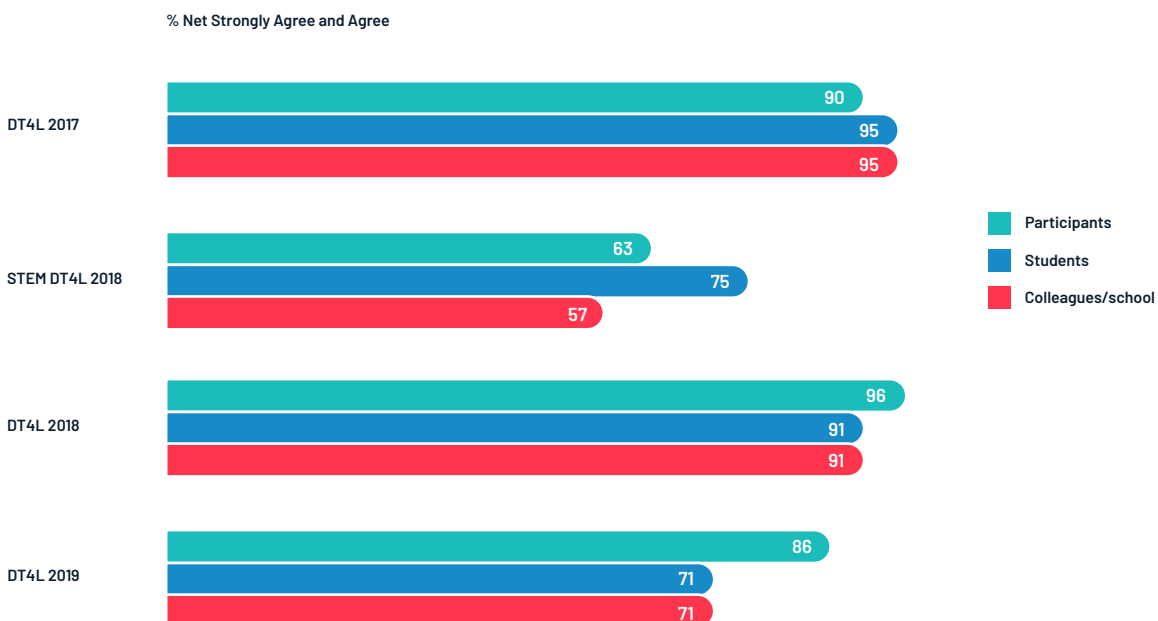
How has the DT4L project impacted teachers, students and schools in the short-term?

Overall, the program achieved its objectives in having a positive impact among participants, students and schools. Quantitative survey findings across cohorts showed a significantly high proportion of participants indicating they 'Strongly agree' or 'Agree' that the project has had a positive impact on themselves (84 per cent), their students (83 per cent) and their colleagues/school (79 per cent). Figure 2 depicts the proportion of participants who indicated this in each cohort.

There were differences in the level of impact between cohorts due to the varying attributes of the program across the years and differences in participating schools. Some of these attributes include the use of different facilitators for the incubator workshop, the focus on STEM in 2018 and the continued partnership with design thinking coaches in certain schools. Comparison between cohorts will not be discussed in this report.

The following section discusses the impact of the project among participants, followed by students and colleagues/school.

Figure 2: Quantitative survey findings



0. How strongly do you agree or disagree with the following statements? [The Design Thinking 4 Learning Project has had a positive impact on [me], [my students], [my colleagues/school].

*Note: 'Students' and 'colleagues/school' were asked as one question in 2017 DT4L.

(DT4L 2017 n=21, STEM DT4L 2018 n=16, DT4L 2018 n=23, DT4L 2019 n=14).

How has the DT4L project impacted teachers?

Participants have a high regard of the design thinking process whether they have implemented it in their school. As seen in Figure 3 more than half of all participants in all cohorts indicated that design thinking would be 'Extremely useful' or 'Very useful' when asked how it might impact their work.

What was the most useful aspect of design thinking and why?

More than 80 per cent of participants in all cohorts had implemented design thinking in their school at the time of the survey. Among those who had implemented design thinking, the majority found that the prototyping phase was most useful (43 per cent), followed by synthesis phase, in particular hexagonal thinking (21 per cent), and the immersion phase – in particular SQUID (16 per cent).

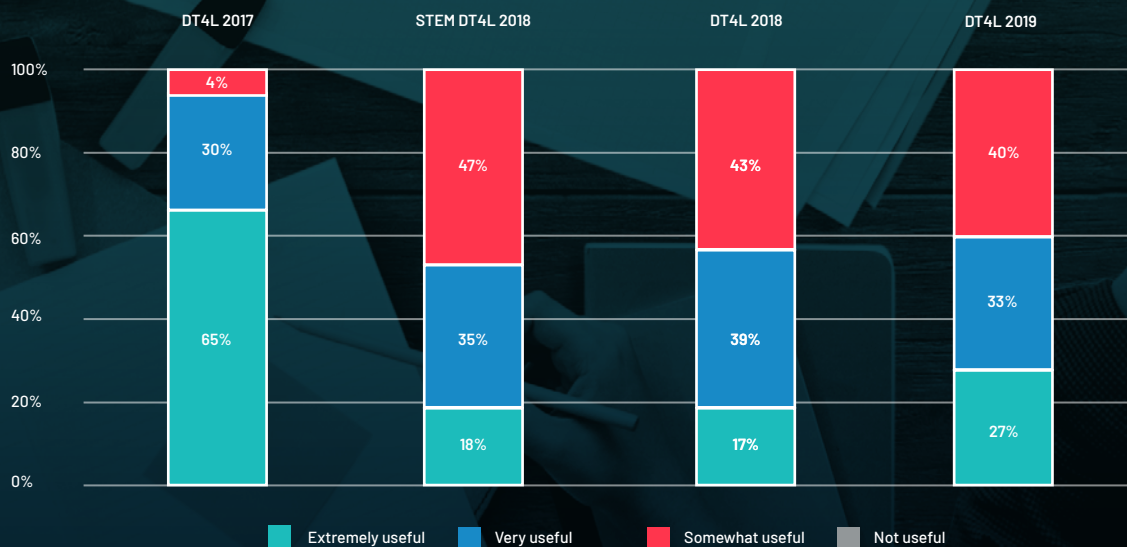
The following verbatim response further elaborates why participants found design thinking useful.

"Students have used crazy eights and prototyping in our projects as a means of inspiring creativity and risk taking. Crazy eights was useful in encouraging participation amongst all members of a group." (DT4L 2019)

"Pitching/prototyping as a fast-paced concept for refining, reflecting and sharing big ideas. Kids respond really well to the SQUID to help them identify what they need to investigate next." (DT4L 2017)

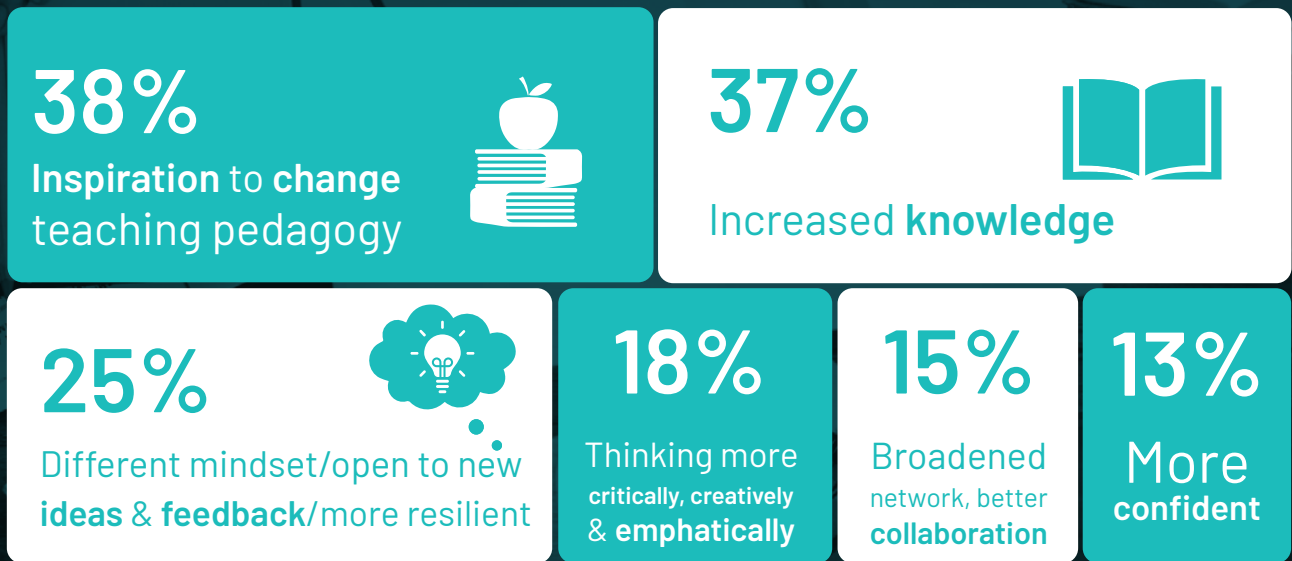
A solid 84 per cent of participants across cohorts either 'Strongly agree' or 'Agree' that they saw a positive impact on themselves.

Figure 3: Perception of design thinking's usefulness



Q. How useful would design thinking be in the work that you do? (2017 DT4L n=23, 2018 STEM DT4L n=17, 2018 DT4L n=23, 2019 DT4L n=15).
Question asked among all participants, whether or not they have implemented design thinking.

Figure 4: Coded open-ended responses for positive impact observed among participants



Q. What positive changes have you observed in yourself? This question was asked only among those who 'Strongly agree' or 'Agree' that the project has had a positive impact on themselves. Total sample (all cohorts): Unweighted; base n = 60 Percentages may not add up to 100 since each response can be assigned to multiple categories.

The majority (38 per cent) were more inspired to change their teaching pedagogy, followed by 37 per cent who indicated that they had an increased knowledge of new tools and strategies (particularly relating to inquiry), and 25 per cent who said they have changed their mindset and their perception of new ideas and feedback.

Most participants saw a positive change in their teaching pedagogy, including how they approach planning, teaching and assessing to deepen student learning. The following feedback from participants demonstrates the ways in which their knowledge and teaching pedagogy has changed:

"(I am) better equipped with a range of strategies to support student creativity and learning." (DT4L 2019)
"Design thinking has been cemented as part of our teaching and learning framework with our Learning Design Leaders, which is very helpful." (DT4L 2019)

Participants also found an increase in confidence in their work and a higher willingness to step outside

their comfort zone.

"I have developed more creative confidence and have an expanded repertoire of strategies to move a project forward." (STEM DT4L 2018)

Participants reported stronger leadership skills and improved collaboration among their peers. Some also indicated that the project helped to boost their confidence to lead others.

"I have been able to show and lead others in my school and in my design thinking team ways of approaching tasks to how they may have done it in the past." (DT4L 2018).

"Greater consensus amongst own staff in support of initiatives that harness design thinking." (DT4L 2019).

The impact of design thinking among teachers was evident. Participants mainly reported growth in their teaching pedagogy, higher confidence, collaboration and leadership skills.

How has the DT4L project impacted students?

A considerably high proportion of participants (83 per cent) across cohorts either 'Strongly agree' or 'Agree' that they saw a positive impact among their students.

The majority indicated that their students were thinking more visibly and creatively and that they have taken ownership of their own learning due to an increased confidence to approach problems (29 percent respectively).

As students listened, participated, brainstormed and adapted through the design thinking process, their thinking became more visible to themselves, their peers and their teachers.

This is evident through the qualitative comments to the survey, including the following comment indicating that students have taken more time to reflect on their learning:

"Their reflections on their own learning and the development of collaborative skills improved markedly from what we used to see. Their engagement in difficult concepts was much higher than what we saw last year, and they seemed more confident in working through challenges." (DT4L 2018)

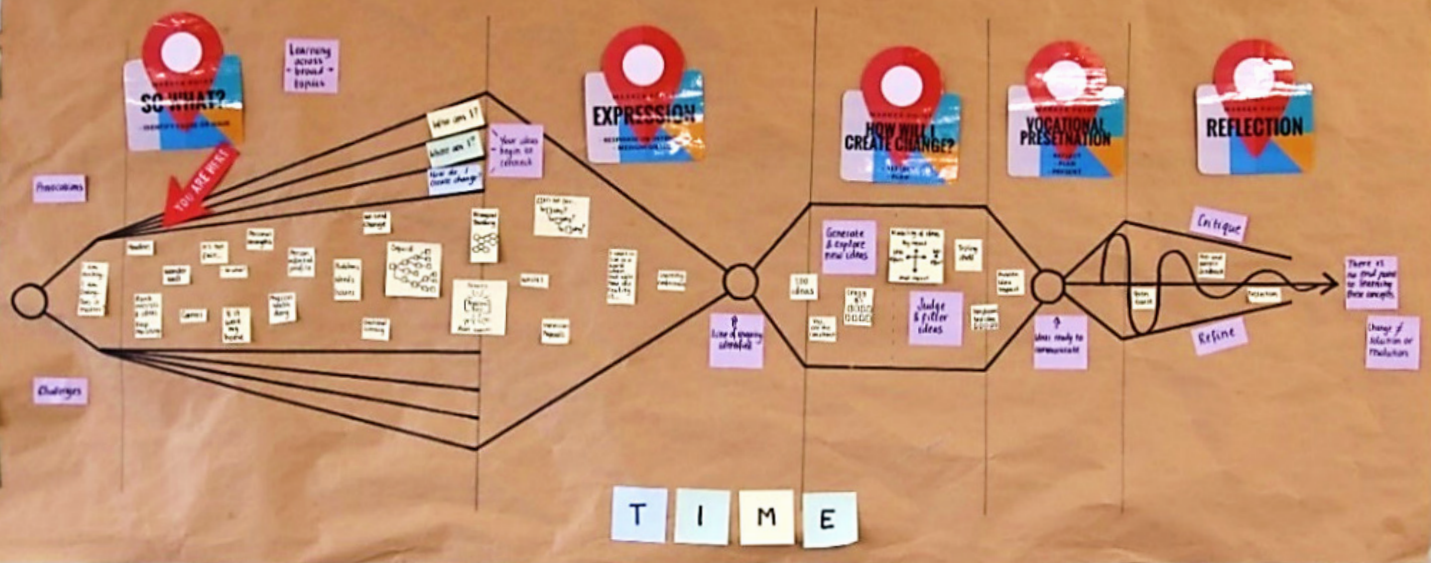
One of the biggest impacts observed by teachers in relation to their students was an increased ability to organise and communicate their thinking.

Figure 5: Coded open-ended responses for positive impact observed among students



Q. What positive changes have you observed in your students? This question was asked among those who Strongly Agree or Agree that the project has had a positive impact on their students.
 Total sample (all cohorts): Unweighted; base n = 56
 18% of comments were categorised as 'Other responses'.

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"My students feel very supported within the process, they used the thinking around the room to help develop their ideas. The final projects they produce are a much better reflection of their learning rather than "cookie cutter" finished artworks." (DT4L 2017)

As a result of this increased ability, teachers felt that students were more experimental and had started taking increased ownership of their learning.

"They generally seemed much more engaged and stimulated. They were more able to adapt to changes. They were more enthusiastic about presenting work. They were taking it upon themselves to extend their learning." (STEM DT4L 2018)

According to the teachers who participated in the program, students' enhanced learning outcomes revolved around having a growth mindset. They were seen to take initiatives and stretch themselves even when things were not going as planned. There is also evidence that the design thinking process deepened students' metacognitive skills (such as reflecting, evaluating and expressing their thoughts). These metacognitive skills fostered self-efficacy and agency and allowed teachers to address student challenges and extend their thinking.

How has the DT4L project impacted the school?

A considerably high proportion of participants (79 per cent) across all cohorts found that the DT4L project had a positive impact among their colleagues or school. Participants found that the project enabled their colleagues to be more open to new ideas and more willing to be involved in new initiatives (32 per cent). The opportunity to conduct design thinking has also improved collaboration among their peers and students at some schools (20 per cent).

Analysis of the open-ended comments in the survey show that colleagues' openness to receiving and providing feedback was seen as a significant positive outcome of this project.

"Colleagues feel like they are being listened to. They are finding value in quicker meetings, getting their thoughts on the wall and being able to come back, re-visit and build on ideas." (DT4L 2017)

Collaboration throughout the design thinking project has also strengthened relationships in schools, which encouraged shared learning among colleagues and students.

"It has allowed a group of committed staff to meet together regularly to talk about projects we could envisage and work on that might have a positive impact on the school." (DT4L 2018).

Table 1: Coded open-ended responses for positive impact observed among colleagues/school

	% number of mentions
More open to new ideas/willingness to share ideas or be involved	32%
Better collaboration with teachers and students	20%
Implemented strategies/tools and design thinking framework	18%
Better understanding and support in design thinking	18%
Buy-in/ more positive and enthusiastic	14%
Changes in how meeting was conducted/ better conversations	11%
Positive changes to the curriculum/develop new programs in the school	9%
Broader thinking/ unstructured thinking	7%
Higher level of student engagement	5%

0. What positive changes have you observed in your colleagues/school? This question was asked among those who Strongly Agree or Agree that the project has had a positive impact on their colleagues or school.

Total sample (all cohorts): Unweighted; base n = 56

11% of comments were categorised as 'Other responses'.

Percentages may not add up to 100 since each response can be assigned to multiple categories.

Conclusion: Short-term impact

As a result of an increase in collaboration and shared learning, teachers were collectively more confident to apply the design thinking framework across disciplines and in future initiatives.

“Our school has the opportunity to scale up into the development of fully interdisciplinary and transdisciplinary projects, as we have successfully prototyped a range of projects already.”
(STEM DT4L 2018)

“(The project provides) a framework in which to implement future initiatives across our school using the design thinking model.” (DT4L 2017)

Overall, the project had a positive impact on a school level. The increased collegial culture has driven a sense of empowerment to raise the bar of excellence in the school. These verbatim responses further elaborate this point:

“I think it (the DT4L project) has really empowered us to feel like we can make a positive change at our school.” (DT4L 2018)

“Growth in understanding the power of design thinking projects to shift the focus from ‘what’s good for me’ to ‘what’s important for us’.” (STEM DT4L 2018)

In conclusion, the survey findings show that participants in the DT4L project were highly satisfied. They saw the benefits of the design thinking process in their work. They particularly liked activities such as hexagonal thinking, crazy eights and SQUID as it encourages critical thinking, collaboration and inquisitive mindsets.

There was a strong positive perception of the project’s impact on participants, their students and their school. Participants found that they had changed their methods of teaching, particularly using design thinking as a method of inquiry in the classroom. They observed changes in the way they plan, teach and assess due to the new skills they acquired. Participants were also more confident and willing to step out of their comfort zone to lead and collaborate with their colleagues.

The most significant impact observed among students were changes in the way they think and reflect on their learning. As part of the design thinking process, students became more empathetic and willing to communicate their thoughts and ideas, receive feedback and to experiment various prototypes. The DT4L project has encouraged visible thinking, resilience, collaboration and increased confidence among students.

The culture of design thinking has also permeated within deep structures in the school. Participants reported better collaboration and creative thinking among staff, as well as a greater willingness to share ideas or be involved in the design thinking framework. Participants found that they had better conversations with their colleagues and, collectively, were more confident and committed to make a positive impact in the school.

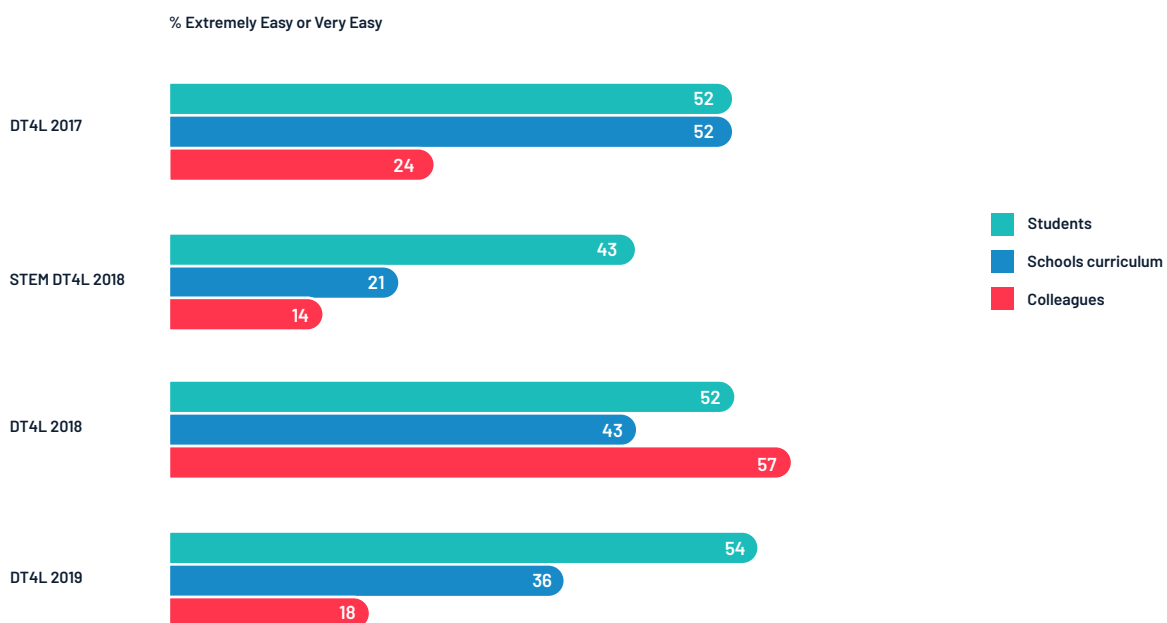
What are the enablers and barriers in implementing design?

On average, participants found it easiest to implement design thinking with their students, followed by implementing it in the school curriculum and with their colleagues.

Half of all participants across cohorts found it 'Extremely easy' or 'Very easy' to implement design thinking with their students. Implementing design thinking within the school's curriculum was seen to be slightly more challenging, where 38 per cent found it 'Extremely easy' or 'Very easy' to implement. Implementing design thinking with colleagues was perceived the hardest (only 28 per cent across cohorts found it 'Extremely easy' or 'Very easy' to implement).

The perceived ease of implementing design thinking differed across cohorts. For example, participants in the DT4L 2018 cohort found it easiest to implement design thinking with their colleagues, compared to implementing it with students or in their school's curriculum.

Figure 6: Proportion of participants who indicated it was 'Extremely easy' or 'Very easy' to implement design thinking with students, colleagues or within the school's curriculum.



Q. How would you rate the ease of implementing design thinking in the following?

- Students (i.e. engendering design thinking in students, promoting creative thinking in students, etc.)
- School's curriculum (i.e. when creating lesson plans, design thinking-based projects, etc.)
- Colleagues (i.e. facilitating a collaborative relationship and learning, brainstorming problems, etc.)

Total sample; Unweighted; base n = 21 (DT4L 2017), n=14 (STEM DT4L 2018), n=21 (DT4L 2018), n=11 (DT4L 2019)

What are the enablers in implementing design thinking with students?

Table 2 shows the coded open-ended responses across cohorts for enablers in implementing design thinking with students.

Having clear protocols and guidelines and having supportive colleagues were the main factors behind a successful implementation of design thinking with students (35 per cent and 26 per cent respectively). Extensive planning prior to implementation was perceived as important, such as developing protocols and outlining learning outcomes. As elaborated by a teacher in the STEM 2018 cohort:

“Building clarity around the process/steps. We created a Google Slides to keep the process on track and to have some stimulus to refer to if groups were confused about what to do. We wrote short statements explaining what kind of thinking/outcome we were aiming for at each stage.”

Across cohorts, willingness to try something new and take ownership of implementing design thinking encouraged a collegial effort in implementing the project (13 per cent).

“Having a team of staff with the same focus, control over courses that encompass design and engineering.”

“Working in a strong, collaborative and creative team of change agents lead well by an innovative and committed leader.”

In general, most participants found that it was easy to implement the DT4L project with their students. The main driver behind a successful implementation was the establishment of a clear protocol and learning outcomes for each design thinking stage. Those who found it easy to implement design thinking with their students had the help of their colleagues, which suggests that collective effort among staff is advantageous for a successful implementation.

Table 2: Coded open-ended responses for enablers in implementing design thinking with students

	% number of mentions
Building clarity/ protocols, create stimulus, develop learning outcomes, resources, strategies	35%
Supportive colleagues - with the same aim/ willing to try something new/ takes ownership/ collaborate	26%
Student's willingness, ownership of learning	13%
Time to implement, plan	9%
Teachers modelling desired behavior/ teacher's confidence	9%
Feedback (from facilitators and students)	9%

Q. What has helped you the most in implementing design thinking with your students? This question was asked among those who indicated it was Extremely Easy or Very Easy to implement with students.

Total sample (all cohorts): Unweighted; base n = 23 *Note: This question was not asked in 2017

9% of comments were categorised as 'Other responses'

Percentages may not add up to 100 since each response can be assigned to multiple categories.

What are the barriers in implementing design thinking with students?

Table 3 shows the coded open-ended responses across cohorts for barriers or challenges faced in implementing design thinking with students.

Lack of time to implement or integrate design thinking in the school's timetable was the biggest barrier to implementing the project with students (31 per cent), followed by a resistance in students to try something new or to change their mindsets (25 per cent).

The design thinking process requires students to think creatively and critically, and to receive and provide constructive feedback. Encouraging this culture of thinking and getting students to step out of their comfort zone proved difficult for some participants.

"We need to work on developing a culture of thinking with our students. It may be the case that students are expecting to receive information, rather than follow a process and think about some possible solutions, make connections and analyse information."

"Students are resisting the change based on past levels of 'spoon-feeding' the students. Students are resistant of being part of the process."

A minority of participants felt that more guidance, materials or resources to implement design thinking would have been useful (9 per cent). The following comment from a participant in the 2018 cohort highlighting some of these barriers:

"One thing that would have been really useful was more activities to take away and use in the classroom. In the business of life as a teacher it is hard to find the time to recall and re-write activity guidelines for my own classes and other staff. The other main barrier is the disjointed nature of much of the timetable - not having significant periods of time to devote to project-based learning makes it difficult to implement DT4L in authentic ways."

Overall, the main challenges in implementing design thinking with students were lack of time to plan and conduct design thinking projects in the classroom, and difficulty in changing mindsets.

Table 3: Coded open-ended responses for barriers in implementing design thinking with students

	% number of mentions
Lack of time (to implement, to brainstorm ideas, to 'fail' in prototypes, timetabling issue)	31%
Changing mindsets/resistance	25%
Not suitable for all students (i.e. learning disorder, different learning stage, large student cohort)	16%
Lack of guidelines to teach students/ lack of rigour/ lack of ability to assess students	9%
None	22%

0. What have been some of the barriers or challenges faced in implementing design thinking with your students? This question was asked among those who indicated it was Somewhat Easy or Not Easy to implement with students.

Total sample (all cohorts): Unweighted; base n = 32

Percentages may not add up to 100 since each response can be assigned to multiple categories.

What are the enablers in implementing design thinking in the school's curriculum?

Table 4 shows the coded open-ended responses across cohorts for enablers in implementing design thinking in the school's curriculum.

Having collaborative colleagues, and support from facilitators and the leadership team were the main driving factors in implementing design thinking successfully in the school's curriculum (47 per cent and 27 per cent respectively).

The following comments further elaborate this point: *"Supportive leadership team that want curriculum to be more meaningful for students and based on skills rather than content."* (STEM DT4L 2018)

"Having time with the team and NoTosh in a space outside of school to explore design thinking in depth." (DT4L 2019)

Overall, implementing design thinking within the school's curriculum, such as creating design thinking-based projects and lesson plans was challenging for many participants. Those who found it easy to implement the project received sufficient support from their colleagues and leadership team, and also guidance from design thinking facilitators to guide them with integrating design thinking within the school's curriculum.

Table 4: Coded open-ended responses for enablers in implementing design thinking in the school's curriculum

	% number of mentions
Committed and collaborative team/ colleagues willing to try new ideas	47%
Facilitator's support and modelling of techniques	27%
Leadership support	20%
Time and opportunity to implement/ plan	13%
Shared learning with other schools	7%

Q. What has helped you the most in implementing design thinking in your school's curriculum? This question was asked among participants who indicated it was Extremely Easy or Very Easy to implement design thinking in the school's curriculum.

Total sample (all cohorts): Unweighted; base n = 15 *Note: This question was not asked in 2017

Percentages may not add up to 100 since each response can be assigned to multiple categories.

What are the barriers to implementing design thinking in the school's curriculum?

Table 5 shows the coded open-ended responses across cohorts for barriers or challenges faced in implementing design thinking in the school's curriculum.

Among participants who found it 'Somewhat easy' or 'Not easy' to implement design thinking in the school's curriculum, lack of time was the number one barrier (45 per cent), followed by difficulty integrating design thinking in the school's timetable and curriculum (29 per cent), and lack of leadership support (26 per cent). The following comments highlight some of these barriers:

"Time - to plan, and to give students time to learn the process." (STEM DT4L 2018)

"It's easy to implement design thinking in discrete projects that occur after the reporting period is finalised, but it is harder to implement within the regular curriculum due to the constraints of the timetable and curriculum requirements." (DT4L 2019)

Some participants also indicated that it was difficult to explain the benefits of design thinking and its process to their colleagues (18 per cent). They specified that it would have been useful if they were given guidance and instructions about the design thinking process.

"The tools we were exposed to were engaging and valuable however I was not able to implement them all as we were given no breakdown or instruction about the tools. Would have liked to have more guidance with the activities." (DT4L 2018)

Overall, the main barrier in implementing design thinking in the school's curriculum was a lack of time to plan and implement the project, which was driven by a lack of buy-in from the leadership team and colleagues. Participants also lack the expertise to 'sell' the design thinking idea to their colleagues and leaders as they have insufficient design thinking materials/ resources.

Table 5: Coded open-ended responses for barriers in implementing design thinking in the school's curriculum

		% number of mentions
Lack of time	NET	45%
	Lack of time (general)	18%
	Lack of time to plan and implement	21%
	Lack of time to meet with colleagues	5%
Difficulty/inability integrating design thinking in a large school/ curriculum/ timetable		29%
Lack of leadership support/ staff resistance		26%
Lack of resources, tools and materials or expertise to explain design thinking in the school		18%
Administrative issue		5%
Difficulty assessing progress/report		5%
Getting students on board		5%
Lack of space		3%
Not suitable for certain students (i.e. on the spectrum)		3%

0. What have been some of the barriers or challenges faced in implementing design thinking in your school's curriculum? This question was asked among those who indicated it was Somewhat Easy or Not Easy to implement design thinking in the school's curriculum. Total sample (all cohorts): Unweighted; base n = 38
Percentages may not add up to 100 since each response can be assigned to multiple categories.

What are the enablers in implementing design thinking with colleagues?

On average, only 28 per cent of participants across all cohorts found it either 'Extremely easy' or 'Very easy' to implement design thinking with their colleagues.

Table 6 shows the coded open-ended responses across cohorts for enablers in implementing design thinking with colleagues.

Implementation with colleagues was easier when other teachers were willing to collaborate and take ownership of implementing design thinking in their own classrooms (38 per cent) and when teachers were given time and space to plan and implement design thinking (31 per cent). The following verbatim responses demonstrate participants' views:

"Setting aside time. Colleagues being willing."
(DT4L 2018)

"Time to meet and share ideas and curriculum links."
(DT4L 2018)

Some participants also indicated that their colleagues were more willing to collaborate when they were given sufficient resources (25 per cent):

"(We have created) a bunker with planners, achievement standards and resources in a central area that are easily accessible in our PLC meetings." (DT4L 2018)

Similar to the findings in relation to implementing design thinking within the school's curriculum, willingness and commitment from colleagues to be involved in the project are important. This is also highly influenced by the expanse of leadership support and buy-in of the design thinking framework.

Table 6: Coded open-ended responses for enablers in implementing design thinking with colleagues

	% number of mentions
Willingness to try new things/ to collaborate/ take ownership	38%
Time and space to collaborate, implement	31%
Use of protocols, framework, strategies	25%
Colleagues developed new skills/ found design thinking useful	13%
Leadership support	6%

Q. What has helped you the most in implementing design thinking with your colleagues? This question was asked among those who indicated it was Extremely Easy or Very Easy to implement with their colleagues.

Total sample (all cohorts): Unweighted; base n = 16 *Note: This question was not asked in 2017

Percentages may not add up to 100 since each response can be assigned to multiple categories.

What are the barriers in implementing design thinking with colleagues?

Table 7 shows the coded open-ended responses across cohorts for barriers or challenges faced in implementing design thinking with colleagues. When asked what some of the barriers or challenges were in implementing design thinking with their colleagues, the majority indicated a lack of time to implement and plan design thinking (50 per cent), followed by resistance from colleagues and lack of buy-in and support (32 per cent).

The following comments further illustrate participants' feedback on the lack of time for planning, implementing and unpacking design thinking as a concept with their colleagues.

"It is time consuming and there are many elements and stages - it is not always straight forward. It also takes time and some worry about its rigour and what is assessed as the end product." (STEM DT4L 2018)

"Lack of planning time. These are really big mind shifts that take dedicated commitment to pursue. So rarely do schools afford staff the time to invest in this in a way that does it justice." (DT4L 2017)

"A barrier is teacher confidence and understanding of the process, as they sometimes don't want to try things if they don't understand them fully in theory first. Some staff don't understand how it is relevant to them in their discipline/area." (STEM DT4L 2018)

Further analysis showed that there was a positive correlation between the ease of implementation and perception of the project's impact, where participants who found it easier to implement design thinking also rated a higher impact score. This indicates that implementing design thinking successfully is important to reap the benefits design thinking has to offer.

Table 7: Coded open-ended responses for barriers in implementing design thinking with colleagues

		% number of mentions
Lack of time	NET Time	50%
	Time (general)	16%
	To implement/ experiment	11%
	To plan	9%
	Unpack the design thinking process/ communicate concept	14%
Colleagues' resistance/ lack of confidence/ lack of buy in and support		32%
Inability to integrate in current curriculum, timetable/ competing priorities		18%
Colleagues unaware of the potential benefits of design thinking and its process		16%
Participant's inability to explain how it works/ lack of resources		11%
None		11%

0. What have been some of the barriers or challenges faced in implementing design thinking with your colleagues? This question was asked among those who indicated it was 'Somewhat easy' or 'Not easy' to implement design thinking with colleagues.

Total sample (all cohorts): Unweighted; base n = 44

Percentages may not add up to 100 since each response can be assigned to multiple categories.

Conclusion – the enablers and barriers in implementing design thinking

Overall, participants across cohorts found that it was easiest to implement design thinking with students, followed by their school's curriculum and then among colleagues.

The ease of implementing design thinking with students was mainly influenced by having a clear framework and protocol of the process and building clarity with colleagues and students. Having supportive colleagues with the same mindset and enthusiasm, and time to implement design thinking also contributed to the success in implementing design thinking with students.

Similarly, successful characteristics in implementing design thinking in the school's curriculum include having committed and collaborative colleagues and time to integrate design thinking among other competing school priorities. Participants also found that receiving support from facilitators to explore design thinking in depth and having a supportive leadership team were important to introduce and continue the design thinking approach in the school.

Implementing design thinking with colleagues was the most challenging for participants in the program. Being given the opportunity and time to plan and unpack the design thinking process with colleagues were reported to be extremely important as design thinking garners a broad commitment to change. The ability to implement design thinking successfully was strongly influenced by leadership support and a culture within the school to explore and experiment.

While there were some polarising views across cohorts on the ease of implementing design thinking, the key attributes for a successful integration include:

- leadership support to establish a design thinking culture
- time and resources for staff to unpack the design thinking process, to plan and implement in class
- a solid framework and plan to integrate design thinking in the curriculum beyond the project
- willingness among colleagues and students to learn, challenge their thinking routines and step out of their comfort zone.

Quantitative research conclusion

In conclusion, although participants found it challenging to implement with their colleagues and within their school's curriculum, the DT4L project was a success across cohorts. Participants who received sufficient support from their leadership team and colleagues were more likely to report a higher impact among their school community.

Undeniably, the design thinking process was regarded as highly useful as it encouraged active engagement among teachers and students. The nature of design thinking enabled authentic learning and emphasised engagement, dialogue and creative thinking. The increased ownership of teaching and learning also led to a higher motivation to raise the standards of excellence in participating schools. The overall survey findings showed that the DT4L project had a positive impact on students, teachers and the school in the short-term.

Case study research



Case study research methodology

Case study research was conducted to provide a deep dive into the introduction of design thinking in schools, what each stage looked like, the perceived challenges and their implications. The case study research also explores the project’s mid to long-term impact among the school community. In summary, the case studies aimed to address the following research objectives:

- understand how design thinking was implemented
- assess the project’s mid to long-term outcomes
- identify characteristics of an effective design thinking curriculum.

The case studies were conducted in two phases. Observations and interviews during the project’s implementation were conducted in the first phase. This enabled ISV to capture the experience of teachers and students, and to identify any variation in different settings to inform future intervention strategies.

The second phase involved conducting approximately an hour-long, in-depth interview with each school two years after project implementation. This enabled a deep dive into variation and unique outcomes in individual school settings, and to evaluate the program’s impact beyond the project. Findings from the quantitative survey and phase one of the case studies were used (where available) to guide the development of the second phase of interviews in each school.

Semi-structured interviews were conducted to collect comparable information from all case study schools.

The table below details when, how and with whom the interviews were conducted in each randomly selected school. Research design varies in each school due to the time and consent schools had given to participate in this research.

Case study schools	When	Who	How
Christian College Geelong (DT4L 2017)	Interviews during implementation	Interviews conducted with students and teachers in the DT4L project	Face to face interviews, video recorded
	Interview beyond DT4L project	Interview conducted with DT4L project leader	Face to face interview, audio recorded
Westbourne Grammar (DT4L 2018)	Interview beyond DT4L project	Interview conducted with DT4L project leader	Face to face interview, audio recorded
Kilvington Grammar (DT4L 2018)	Interviews during implementation	Interviews conducted with students and teachers in the DT4L project	Face to face interviews, no recordings taken
	Interview beyond DT4L project	Interview conducted with DT4L project leader	Face to face interview, audio recorded

DT4L project objectives in schools

There were similar intentions for introducing the DT4L project across schools. These schools intended to strategically change how they teach and learn by using design thinking as a structured framework to address twenty-first century demands. Their main objectives for this project was for students to acquire contemporary skills such as critical and creative thinking, collaboration and metacognition. Schools also sought to better equip teachers with the skills and confidence to re-invigorate their teaching pedagogy to incorporate an inquiry model through design thinking. The overarching aim at all schools was to develop a working teaching and learning framework that runs across disciplines and curriculum.

Please refer to this link for detailed information on how design thinking was introduced and implemented in each school, including their experiences and perceived impact throughout the design thinking process and beyond.



Case study findings

While the case study schools have introduced and implemented the project to varying degrees in their school context, there were common themes that emerged from the analysis of this study.



Read the school's case study report at is.vic.edu.au/design-thinking

How has the DT4L program continued to impact students, teachers and schools in the mid to long-term?

The impact of the DT4L project varies across the case study schools. Overall, all project leaders interviewed agreed that they have achieved their stated objectives and their school has continued using the design thinking framework and tools in teaching and learning. This is a positive outcome for the project and points to the value and suitability of design thinking in an education setting.

The most significant impact observed among students were improvements in metacognition knowledge and skills. Students were seen to spend more time thinking, reflecting on their learning and applying their knowledge in a variety of settings. They have become more strategic in the way they learn and own their learning. Students have continued using creative thinking skills to explore and generate ideas, and logical/divergent thinking to critically analyse their ideas to solve a problem. They were able to articulate their thoughts clearly and use constructive feedback to improve themselves.

All three schools reported that their students were more confident in approaching challenges and that teachers have seen improvements in students' soft skills such as collaboration, communication and time management. The project has promoted an immersive learning environment, a growth mindset and a love of learning among students.

Among teachers, one of the biggest impacts observed were changes in their teaching pedagogy – particularly in incorporating a model of inquiry using design thinking. Teachers learned to be 'facilitators', shifting the focus from teacher to student-directed learning. All schools reported that teachers were more confident in unpacking the curriculum as the project has given them a platform to reflect on their teaching practice and the skills to redesign the classroom.

In addition, the project has allowed teachers to work collaboratively to reframe their students' learning journeys and identify gaps to enable targeted teaching. Teachers in all case study schools have continued using design thinking in their work, in conversations and meetings with their peers and students. All three schools reported that they have continued using design thinking to address challenges in the classroom, create units of inquiry and redesign the curriculum to a certain extent. Furthermore, some schools have ventured into other design thinking projects to embed the design thinking framework in their school.

The introduction of the DT4L project in these case study schools has encouraged a culture of collaboration, continuous improvement and empowerment among teachers to increase the standard of excellence in their school. A design thinking mindset was evident among students and teachers in these schools – a mindset that embraces empathy, challenges, innovation, iteration and optimism.

What are the perceived challenges?

Schools faced different challenges resulting from how they introduced and implemented the project. Some challenges were common struggles experienced when introducing any new program in a school, while others were unique to the design thinking project.

The following is a summary of the challenges these schools faced:

1. The design thinking concept was hard to grasp for teachers who were not in the project team. As a result, they were less invested because they could not see the potential benefits.
2. As design thinking is explorative in nature, teachers who were primarily focused on efficiency, processes and mandated standards found it hard to implement design thinking.
3. Teachers struggled to employ design thinking across curriculum, disciplines and year levels due to differences in curriculum and subject delivery. Two out of three schools found that design thinking is not suitable for certain subjects such as History and English as they believed these subjects cannot be taught following a model of developing prototypes.
4. Some teachers felt that the design thinking project was not suitable for students with disability, such as those with autism spectrum disorder. Some of these students found it overwhelming to be involved in the plethora of collaborative activities with their peers.
5. Some teachers struggled to frame the design question which led to a design thinking project that was too broad and ambitious.
6. Teachers struggled the most in the synthesis stage, which required them to guide students to hold on to their ideas without jumping into a final solution to solve the problem.
7. Finding the time to plan and dedicate time to the project within the timetable was difficult.
8. Although there was a high level of engagement among students during the project, they were less engaged afterwards, as they would fall back into their normal routines.

Although some of these challenges may seem inevitable, they can be mitigated if the right strategies are in place. The following section looks at how schools can anticipate, avoid and mitigate some of these challenges.

Recommendations

This section details the criteria to support the adoption of design thinking in schools, which can be replicated in similar contexts. These points are inferences from observation and analysis on how participating schools have employed design thinking, the challenges they face and their implications.

1. Identify school's culture and prepare mindsets

Schools that took the time to identify their own culture and readiness among students and teachers were more likely to implement design thinking successfully. This pre-planning stage is of utmost importance. Thinking critically and carefully about the applicability of design thinking is time well spent, given that it requires the space and time for experimentation, and a mindset to challenge assumptions and provide feedback.

Design thinking is not grade driven, but product driven. Learning is part of the process rather than being assigned at the end of a project. Each design thinking activity reshapes the experiences of teachers and students themselves in profound ways.

Those who have a fixed mindset about what they perceive as the 'right' solution, and those who perceive grades to be the ultimate measures of learning, will struggle to implement design thinking in the classroom.

Focusing first on mindsets, before jumping into the design thinking process, is important to identify whether a teacher or student is prepared to both observe and act on opportunities and challenges. Students will need to be ready cognitively as design thinking requires one to think from multiple perspectives and use insights to solve problems in an unconventional manner. A school culture that aligns with the design thinking attributes will more likely embrace a design thinking project. Such attributes include using the "What if..?" or "How might we..?" statements to continuously improve, generating opportunities for feedback and learning from mistakes.

Approaching design thinking with a growth mindset is important because it is both a process and a mindset. It constantly requires us to unlearn what we know and to learn anew. Teachers will also need to have the support of parents for design thinking to be truly effective. Educating parents about design thinking and communicating any changes in teaching pedagogies will help parents manage expectations and further facilitate a growth mindset in their child.

"Students need to be taught the entire design thinking process at the start so they can have a mental map on how to accomplish tasks and what they can expect at each stage."


2. Introduce design thinking effectively in schools

Equally important to promoting mindsets and skills to engage in design thinking is how it is introduced to teachers (particularly those who did not attend the design thinking training) and students. There is a need to clarify and articulate the design thinking principles for teachers without relevant experience and to explore the assumptions of the models both implicitly and explicitly. Teachers need the time to unpack the design thinking principles, and to learn how they can benefit from knowing and using these principles in their own context. In addition, understanding its potential pitfalls and challenges prior to implementation will help teachers manage their expectations.

A good approach is to emphasise the thinking aspect of the project aims, rather than seeing it as a fixed methodology or processes teachers will need to incorporate in their teaching moving forwards. The five stages of design thinking are already broadly known in the field of teaching, hence it does not offer teachers a groundbreaking way to think about their practice. However, it offers a way to frame and find consistency of best practice teachers are already familiar with. Unlike other management or design tools such as Six Sigma, the design thinking process is non-linear and requires iteration and imaginative rigour. Those who approach and adopt design thinking as a “popular education trend” to fit in the school’s curriculum will struggle to grasp the concept and see its potential benefits.

Design thinkers use empathic processes to understand needs and experiences. This necessary first step is important for teachers to explore their students’ learning journeys and immerse themselves in how students experience the school or programs. This allows teachers from STEM to Social Studies to produce a roadmap that defines challenges, goals and steps to address challenges in the classroom. With this insight, it is easier for teachers to identify the learning they would like students to achieve from a design thinking project, and thereby create projects that are relevant to student needs.

As teachers become proficient in design thinking, they naturally become better able to teach students how to use design thinking as a problem-solving process. When looking at the evidence produced through this evaluation, it is clear that students need to be taught the entire design thinking process at the start so they can have a mental map on how to accomplish tasks and what they can expect at each stage. This is important so they can go back and forth smoothly in the design thinking non-linear process. Students would also need to understand the learning outcomes of a design thinking activity. To encourage deeper understanding, a design thinking consultant or a practising designer can be invited to the school so students can learn design thinking directly from expert practitioners.



“As design thinking requires a broad commitment to change, it is important to reframe and justify why the school aims to adopt design thinking and how it aligns with the school’s existing direction.”

3. Gain leadership support

Schools that reaped the most benefit from the DT4L project were those that had support from their leadership team. Teachers who were satisfied with the project and expressed a desire to motivate and innovate were those who were given the freedom to experiment and the psychological safety to amend their teaching practice.

The schools that continued using design thinking beyond the DT4L project were those that had committed leaders to oversee the entire project. Leaders themselves will need to explore the design thinking capabilities, its limitations and demands it places on the school to some extent, to be able to oversee the program. As design thinking requires a broad commitment to change, it is important to reframe and justify why the school aims to adopt design thinking and how it aligns with the school’s existing direction. With the support of the leadership team, teachers are more likely to collaborate and agree on what is essential to the outcome at every phase. Transition is more likely to happen if the change is properly managed.

4. Collaborate via Professional Learning Communities (PLCs)

While leadership support is central to achieving transformational change, it is important to avoid a top-down approach especially when changes are to be made to the curriculum. The introduction of PLCs for design thinking can encourage changes in deep rooted teaching culture. Design thinking requires a school-wide effort and continual commitment. It also requires pedagogical shifts and in-depth planning to introduce, implement and evaluate a design thinking project for continued success. Teacher collaboration is critical to explore and analyse variation in current practice and to develop strong instructional practices, skills and understanding.

The PLC team leaders may be assigned to attend design thinking training and to bring back the learning to their team. This enables empowerment among team leaders as they become design thinking champions in their school, holding responsibility to ensure the sustainability of the project and guide their team throughout the project.

In addition, assigning cross-disciplinary team members in each PLC can enable multiple perspectives to evaluate the success of possible solutions and discourage groupthink. However, it is important that PLC team leaders clarify to all team members that all skills (design and non-design) and mindsets are equally important to ensure all voices are heard.

5. Create authentic, real-world projects

Schools that created real-world design thinking projects and involved real audiences were more likely to see students engage throughout the project. Real-world application not only connects the course content to the outside world, but also makes it more comprehensible for students. When students are encouraged to apply their learning to real-world contexts, the learning process and its content becomes more meaningful for them.

Picking the right design thinking topic is important to enable engagement and deep learning among students. A topic should be broad enough for creative freedom (a topic that is too narrow restricts experimentation) but narrow enough so it is manageable (a topic that is too broad will seem daunting). It is therefore important for teachers to identify their student's breadth of knowledge, experience and thinking skills in the pre-planning stage to generate a design thinking problem that is relatable and realistic to solve. This is particularly important for schools that are implementing design thinking for the first time with their students. As such, schools can take on "low-hanging fruit" projects as a starting point for students to benefit from the design thinking process and mentality, before proceeding to a more challenging project.

To further encourage authentic learning, teachers can provide the opportunity for students to co-create their own design thinking project and instruct students to plan and take ownership of it. This allows students to design a solution that meets the expectation of their own learning needs. The evidence collected throughout this evaluation suggests that such personalisation and autonomy will boost students' motivation and determination to complete the activities within the project. Teachers can also provide reflection questions and rubric for students to self-assess their learning during and beyond the project. This encourages students to critically think about their own learning processes, their strengths and weaknesses, and how they can apply what they learned in other contexts. It also enables teachers to use this insight to further facilitate student learning.



Conclusion

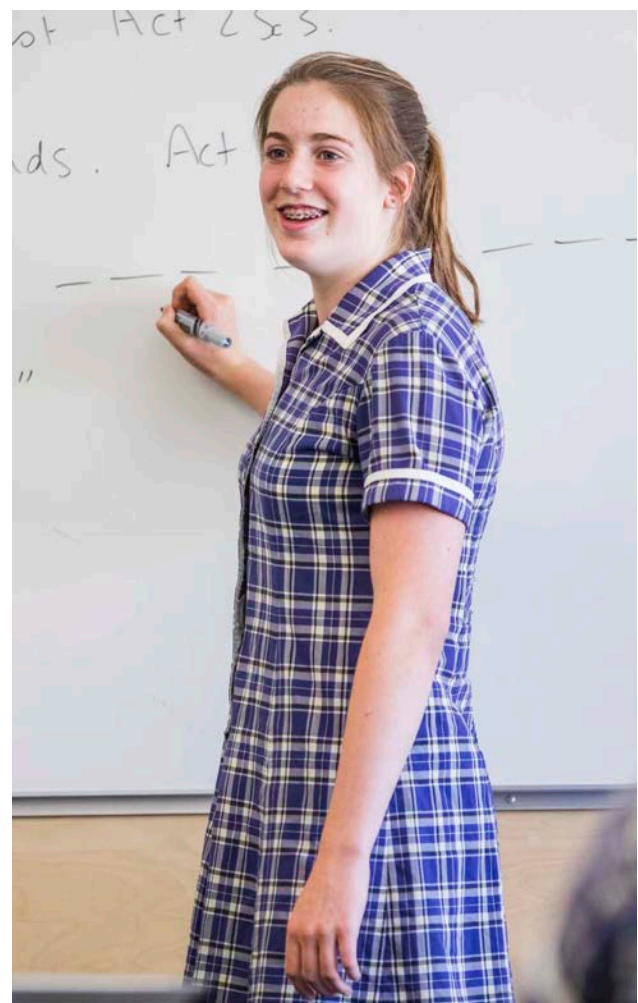


Overall, the evaluation of the DT4L program shows that participating students, teachers and schools have benefited from the implementation of design thinking.

Both quantitative research and case study findings show that participants who have benefited from the project emphasised a change of mindsets in students and teachers. The project has challenged beliefs about mistakes and failures and has encouraged an innovative growth mindset that sparked confidence and motivation to do better. The application of design thinking has given both students and teachers a foundation to use various thinking skills and soft skills (such as collaboration and communication) to challenge the status quo and co-create change. The value derived from this project will continue to have greater value in the long-term.

Participating schools faced different challenges when implementing the project. The main barriers found in both the quantitative research and case study research were a lack of time to plan and implement the project, lack of leadership support, difficulty in understanding design thinking and integrating it within the school's curriculum, and resistance from other teachers and students.

The evaluation found that how the project is planned, introduced and implemented influences the extent of project impact considerably. It highlights some of the essential criteria in supporting an effective design thinking project in schools. Some of these recommendations include securing commitment at all levels by gaining leadership support and creating PLCs, clarifying design thinking principles to enable targeted learning throughout the project, identifying readiness among teachers and students, and tackling design thinking projects with real world applications.



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Appendix

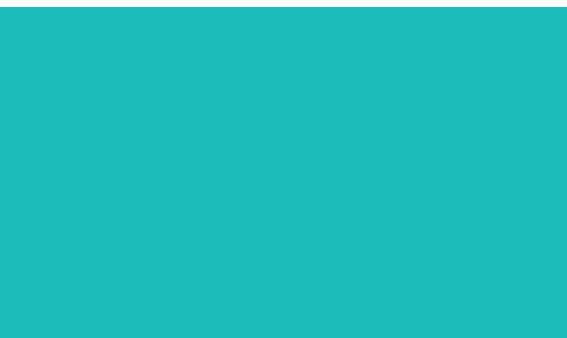
POW
Now

chat

Appendix 1: Participating schools

The table below shows the schools that participated in each DT4L project iteration since 2017.

Iteration 1.0 (Incubator workshop - Term 1 2017)	
1	Brighton Grammar School
2	Overnewton Anglican Community College
3	Southern Cross Grammar
4	Lauriston Girls' School
5	Christian College Geelong
6	Ivanhoe Girls' Grammar School
Iteration 2.0 (Incubator workshop - Term 4 2017 and Term 1 2018)	
1	Westbourne Grammar School
2	Carey Baptist Grammar School
3	Kilvington Grammar School
4	Shelford Girls' Grammar
5	Balcombe Grammar School
6	Al Siraat College
DT4L STEM (Incubator workshop - Term 4 2017 and Term 1 2018)	
1	Caulfield Grammar School
2	Brighton Grammar School
3	St Leonard's College
4	Sacre Cœur
5	Newhaven College
Iteration 3.0 (Incubator workshop - Term 4 2018)	
1	King David School
2	The Hamilton and Alexandra College
3	Strathcona Baptist Girls Grammar
4	The Knox School
5	Waverley Christian College
6	Belgrave Heights Christian School



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