SUTD, Singapore
Virtual Ideation Challenge

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Student cohort	Location	Timing	Activity type	New or existing	Hands-on element
56	100% online	100% synchronous	Extra-curricular	New activity	None

1. Overview

The Virtual Ideation Challenge (VIC) was a two-day extracurricular activity where current and incoming SUTD undergraduates connected with clinicians from the regional hospital to tackle key technological challenges facing Singapore's fight against Covid-19.

Held over a weekend in July 2020, the VIC was a 100% online activity delivered as a partnership between SUTD and a team of clinicians from the Covid-19 response team at Changi General Hospital (CGH). Participating students – taken from across all SUTD disciplines and years groups – were divided into teams, with each tackling one of 14 'case scenarios' devised by the CGH clinicians. The scenarios articulated 14 key challenges by faced across the three major phases of the clinical and public health response to Covid-19 in Singapore: pre-pandemic (preparations for a pandemic); ongoing pandemic response (the pandemic response) and post-pandemic (the 'new normal').

The opening sessions exposed students to the context for the VIC, with webinars from CGH clinicians, as well as videos and 360 degree interactive photographs from CGH wards and local foreign workers dormitories, which saw rapid transition of Covid-19 during the early weeks of the pandemic. From there, the Challenge took a highly structured approach to guide students through the ideation process step-by-step over the two days. Online support and facilitation for the student teams was provided by group of graduate mentors and 21 CGH clinician mentors. At the close of the two days, teams presented their ideas and ideation process to a judging panel via a 5-minute online pitch.

2. Distinctive features of the activity

Thomas' diagram of the distinctive features...

3. Review of activity

The review of the Virtual Ideation Challenge drew upon one-to-one interviews with 10 individuals: two university leaders in teaching and learning; the two co-leads of the activity from SUTD; two clinician mentors from CGH (one of which was the activity coordinator from CGH); the coordinator of the graduate mentors; and three student participants.

Taking interviewees' experiences and perspectives together, outlined below are the key **success factors**, **challenges faced** and **advantages of the online delivery** of the Virtual Ideation Challenge.

3.1. Success factors

Interviewee feedback and reflections pointed to four factors that underpinned the success of the Virtual Ideation Challenge:

1. **'virtual immersion' in the challenge context:** student participants were offered a unique access to the national Covid-19 environment, from both public health and clinical perspective, with exposure to the 'front line' of Singapore's response in both the hospital wards and foreign workers dormitories. This immersion in the clinical context, together with targeted support offered by the clinical mentors, was pivotal to the students' progression in this time-limited activity and supported the development of insightful and innovative solutions. Interview feedback made clear that this access and mentorship also underpinned high levels of student engagement and focus, despite many working with previously unknown team-mates in an online environment.

2. **on-demand, flexible support offered to participants:** participants spent the majority of the two-day challenge working in Zoom break-out rooms with their team. Given that more than half of participants had yet to start their formal studies at SUTD, a lack of clarity on both the design process and the challenge deliverables presented a real risk for teams in this time-limited activity. However, interview feedback suggested that the on-demand facilitation offered by the graduate mentors allowed teams to call for support as and when needed. Facilitators offered both practical support, but helped students to consider the types of mindset and approach that might help them to tackle the challenge.

3. **close working relationship between SUTD and the regional hospital (CGH): the** Virtual Ideation builds on an established and close working relationship between SUTD and CGH, which has already seen the development of a new undergraduate healthcare and engineering track. The trust built through this relationship, as well as a pre-existing understanding of constraints and opportunities offered by each partner, appears to have been pivotal to the rapid development of this activity and its ability to secure so many clinical mentors.

4. **significant levels of pre-planning:** the Virtual Ideation Challenge was devised and designed in a very short time period: in the three period prior to its launch. Despite this rapid turn-around, significantly levels of time had been dedicated to planning and preparation for the activity. For example, in addition to training of the graduate mentors, rehearsals were held with clinician mentors and activity judges to identify and resolve any technical issues and ensure that all contributors understood the challenge context, the scoring rubrics, and the structure of the two days. The organisers also prepared back-up versions of all presentations, in case of network

problems and even located organising committee members in different parts in Singapore to mediate the risk of internet connectivity issues in a localised area.

3.2. Challenges faced

Interviewee feedback pointed to two key challenges faced in the delivery of the activity; plans are in place to tackle each of these issues in any future iterations of the activity:

- **lack of breaks in the two-day schedule:** although the activity scheduled two half-hour breaks for lunch each day, in reality, team-working and mentoring sessions expanded out to fill the two days. Unsure of when mentors or event organisers might check-in on teams, students were often left unsure when they were able to takes breaks from their screen. As a result, most teams continued to be logged on throughout both days, without taking formal breaks, leaving many very tired at the close of the activity. For future iterations of the activity, organisers plan to embed mechanisms by which teams are able to take structured breaks from working without penalty to their access to mentoring support.
- **omission of hands-on, prototyping opportunities**: hands-on learning and prototyping are core features of the SUTD education, features which are highly valued by current and prospective students alike. It is therefore perhaps not surprising that participants pointed to the lack of a prototyping element as a major constraint of the Virtual Ideation Challenge. While embedding a hands-on element was understood not to feasible for the 2020 activity, particularly given the three-week development window available before launch, plans are in place to support prototype development for future iterations of the activity.

3.3. Advantages of online delivery

Interviewee feedback suggested that the online nature of the Virtual Ideation offered a number of important advantages to the activity organisation and student learning, beyond what might have been possible it the activity was held face-to-face.

The key benefit was the ability to secure a group of 21 clinicians – each of whom was engaged in the testing, prevention and treatment of Covid-19 in Singapore – to play an active role in this synchronous activity, through offering information, support and mentorship to the student participants. As many interviewees notes, it would not have been possible to secure the time of this group if they had been required to travel to the SUTD campus to make these contributions. With clinicians connecting remotely from home, work or while travelling, the online nature of the activity facilitated such real-time connection.

Interviewees also pointed to a number of other benefits of the activity's online delivery. For example, the ways in which teams were able to connect with design mentors – through the messaging app Telegram – allowed them to benefit from targeted support as and when it was needed, with mentors able to join the team almost immediately after they requested help. Some also noted that the online nature of the activity supported ongoing sharing of learning between teams, with students benefitting from accessing the questions posed by peer teams through the messaging app and learning from the responses given by mentors and organisers.

4. Activity details

4.1. Structure of the two days

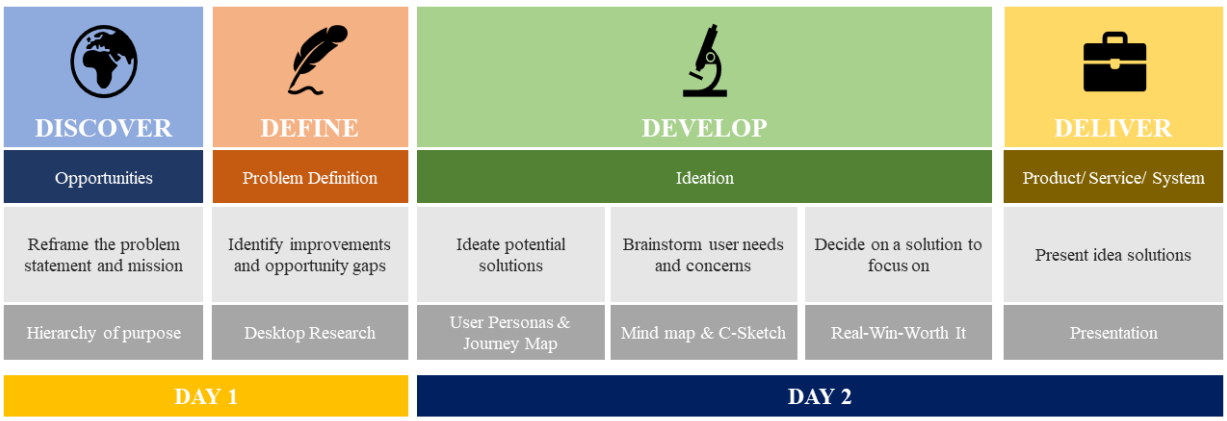
Structured around the '4D' (or 'Double Diamond') design process, the two day activity is divided evenly across the four stages of Discover, Define, Develop and Deliver:

1. Discover The opening session, on the **Saturday morning**, exposed students to the environment and challenges at the front-line of Singapore's response to Covid-19 to set the stage for the Challenge. Activities included: a panel from CGH provided perspectives from by the hospital and public health perspectives; videos highlighting particular challenges in hospital wards, testing programs and in worker dormitories; an interactive virtual tour of the wards and workers dormitories. Students were also given a 40 minute 'crash course' in design methods and the ideation process, which was particularly targeted at the 'future' SUTD students , who had not yet experiences the SUTD approach to design. At the end of the session, students were introduced to the 14 different 'case scenarios', each articulating a key challenge facing Singapore's pandemic response.

2. Define During the second session, on the **Saturday afternoon**, teams select their preferred challenge (allocated on a first-come-first-served basis) from the 14 'case scenarios' given. Teams then reframe the problem statement for their challenge, identify existing solutions and define their team mission. As well as on-demand facilitation from graduate mentors, clinical mentors also connected with the teams to provide further information and answer any questions they may have about their challenge context.

3. Develop The third session, on the **Sunday morning**, teams used user personas and journey maps to explore the challenge from a user perspective and develop a range of possible solutions. Teams then selected and developed their preferred solution, which they were able to discuss with their clinical mentors.

4. Deliver In the final session, on the **Sunday afternoon**, teams developed and delivered a five-minute pitch of their challenge, design process and idea. The pitch was delivered to a panel of judges which included the chairman of medical board of CGH, SUTD leadership and the director of the SUTD entrepreneurship centre. As each team tacked a different case scenario, the final session exposed participating students to 14 different challenges and solutions across all three pandemic phases: pre-pandemic, ongoing pandemic and post-pandemic. Similar to the opening 'discover' session, attendance at these presentations was open to the whole SUTD and CHG communities.



4.2. The challenge

Teams were asked to select one 'case scenario' and associated problem statement from 14 options presented by CGH clinicians around the theme: "**Re-imagining healthcare in the time of Covid-19**". Case scenarios were allocated to teams on a first-come-first served basis, such that all challenges were being tackled by one team. The 14 case scenarios posed by the clinicians spanned the three key stages of a disaster response cycle:

Pre-pandemic	Five 'case scenarios' were taken from the pre-pandemic stage, which focused on mitigation and preparedness. One sample case scenario and problem statement are given below: ***Case scenario:*** *International surveillance of emerging infectious diseases is an important component of public health function. There is growing evidence that a new virus is showing regional spread in one part of the globe. The impact on Singapore needs further clarity.* ***Problem statement:*** *How might we use technology to monitor and assess the significance of potential infectious disease outbreaks in other countries?*
Ongoing pandemic	Five 'case scenarios' were taken from the current pandemic stage, which focused on the response. One sample case scenario and problem statement are given below: ***Case scenario:*** *Many patients have presented to public hospitals with fever, coughing and acute respiratory distress. Their chest X-rays and CT scans show lung changes typical of COVID pneumonia. Within a few days, ICUs are swamped with patients who are deteriorating and require endotracheal intubation for mechanical ventilation. The national stockpile of ventilators is inadequate to meet this surge in demand. Hard choices have to be made.* ***Problem statement:*** *How might we design a triaging tool to select which patients to intubate and ventilate, and who not to? How might we convince clinicians that tool can make better "life and death" decisions than them?*
Post-pandemic	Four 'case scenarios' were taken from the post-pandemic stage, which focused on the recovery and the 'new normal'. One sample case scenario and problem statement are given below: ***Case scenario:*** *The development of vaccines seems to be a constant catch-up game where respiratory viruses e.g. influenza virus, coronavirus, are concerned. This is mostly due to the rapid mutation rate of such viruses.* ***Problem statement:*** *How might we pre-emptively design a "perfect" vaccine even before a disease outbreak begins, while ensuring that the vaccine is affordable by most countries? (After all, until all of us are safe, none of us are safe.)*

4.3. Deliverables

The final deliverable – presented by student teams at the close of the two days – was a **five minute online pitch** which outlined the team's case scenario, their design process, their idea/solution and the team's future plans. Four judging criteria were adopted for these presentations:

- Solution fit**:** *does the proposed solution address the problem and user needs effectively?*
- Innovation**:** *does the solution present a creative and original approach to solving the problem, that is also feasible and implementable?*
- Design-thinking**:** *how well has the team used the design-thinking framework (discover, define, develop, deliver) to inform their solution?*
- Presentation**:** *how well is the team able to articulate their proposal and engage the audience?*

In addition, teams were asked to prepare a **short report**, which brought together the five interim deliverables that teams submitted over the course of the two days:

refined problem statement;

team mission;

existing solutions to the problem statement;

user personas;

user journey map.

The Challenge was extra-curricular and non-credit-bearing for the students' undergraduate studies.

4.4. The teaching team

The team engaged in the development and delivery of the Virtual Ideation Challenge included:

- 2 course leads from SUTD and 2 clinical leads from CGH
- 21 clinical mentors from the Covid-19 response team at CGH
- 5 graduate mentors from SUTD, including one coordinator
- webinar speakers, judging panel, and organising committee, including leaders, innovators and clinicians from both SUTD and CGH

Graduate mentors had all participated in SUTD's Innovation By Design courses, and had all attended a training session prior to the VIC. Based on this briefing, the two major areas of focus for the graduate mentors when engaging with the teams was:

- **students' mindset:** ensuring that teams understand what is expected of them throughout the VIC, and (in particular) that they are punctual and play an active and positive role in their team's activities;
- **team progress:** ensuring that teams are clear about the goals and deliverables for the VIC and keep on track throughout the two days.

Graduate mentors were provided with a written briefing – the 'Facilitator's Toolbox' – which outlined the key priorities for facilitation, the detailed schedule for the two days, and the key team deliverables.

4.5. Participants

Around half of the 56 participants were 'future' SUTD students, due to start their undergraduate studies in September 2020. Students were given the option to form their own teams. The remaining participants were allocated to teams based a pre-activity survey of students' prior experience with the design process and their personality profile. It was required that all teams must contain at least one current student (who therefore had participated in SUTD's "Introduction to Design" course and had prior experience of undertaking design projects).

4.6. Technology used

The following applications and technologies were used in the delivery of the four key phases of the Virtual Ideation Challenge:

1. Discover	• Zoom was used for the webinar sessions, with student participants hidden from view except during the Q&A sessions, where they were able to ask questions using the 'chat' function; • 360 degree immersive cameras were used to allow students to explore the environment at the CGH emergency room and at workers dormitories.
2. Define & **3. Develop**	• Zoom breakout rooms were provided for each student team; • all students were invited to join a private channel of the messaging platform Telegram, which allowed teams to ask questions or seek help from mentors or activity organisers in real time. Telegram was also used to Issue instant messaging reminders to the teams about various project deadlines; • Google Folders were used as a design toolkit for student teams, with information on the activity schedule, deadlines and templates for each of the challenge deliverables.
4. Deliver	• Zoom webinars for the team presentations; • Google Folders tor the submission of final reports from each team.

5. Institutional context

5.1. Educational approach and vision in educational technology

Established in 2009 in collaboration with MIT, SUTD is a specialist design and technology university, catering to a select intake of around 500 undergraduates per year. A defining feature of the university is its multidisciplinary, active and student-centred educational approach, which is underpinned by team-based problem solving and collaboration. All undergraduates are based on campus to support access to dedicated team working and prototyping spaces, and to advance peer-to-peer learning. As such, remote, online learning is not a feature of in SUTD's current and future educational vision.

However, educational technology and the development of cyber-physical systems – as tools to allow students to explore new ideas, deepen their learning and offer individualised learning while on campus – play a major role in the university's educational vision for the future. Drawing on strategic external partnerships in educational technology, SUTD is investing significantly in AI, data analytics, robotics and AR/VR. Early developments already rolled out in the curriculum include the use of AI and VR/AR in the teaching of Mathematics [web-link] and AR/VR Architecture studio modules. New initiatives in the pipeline include.... The university points to the willingness of its faculty to embrace a non-traditional and constantly evolving curriculum as a major strength in its capacity to advance innovations in educational technology in the future.

5.2. Approach to 'emergency teaching' during Covid-19 restrictions

During the two-month 'circuit breaker' period of total lockdown across Singapore, during April and May 2020, SUTD's programs moved entirely online. Since that time, while the majority of its undergraduate education has continued to be delivered remotely, limited prototyping, supervision and group activities have returned to campus, albeit under stringent social distancing restrictions.

Initial barriers to SUTD's emergency online learning (as reported by students) typically related to internet connectivity and home environments that were unconducive to learning. Despite the early challenges, however, faculty reported high levels of student engagement in online team-based activities, which was largely attributed to the opportunities for peer-to-peer connection and interaction that these experiences provided.

In its immediate response to the Covid-19 restrictions and shift to online learning in March 2020, the university shipped IT devices to faculty (such as Wacom tablets, iPads Pros, microphones, webcams) to support their capacity to develop and deliver online courses from home. Faculty were also offered training in the use of some of the key applications adopted for this online offering, including MS Teams, Hiverlab (for AR/VR activities) and ClassPoint (to integrate student feedback and interactivity into presentations). SUTD currently supports a variety of platforms for synchronous and asynchronous teaching, including:

- **synchronous**: video meeting and collaboration platforms (e.g. Zoom, MS Teams, Lark, Google Suite for Education, Blackboard Collaborate); live streaming platforms (e.g. Twitch); platforms to advance student participation (ClassPoint, Sli.do and Piazza);
- **asynchronous**: screen recording (PowerPoint) and content creation (eDimension).

The major challenge faced by SUTD, however, has been in the remote delivery of its hands-on and collaborative project-based activities, particularly in guiding students through the collaborative design

process, the development and construction of physical prototypes, and the showcasing of project outputs. Since March 2020, the university has developed and rolled out a number of new online solutions that target these particular areas. Examples include team-based games (such as multi-player logistic simulation games hosted on a remote server and gamified virtual labs to teach cell biology) and e-exhibitions (such as virtual showcases of students' product design solutions, including for Capstone projects [see example?]).

5.3. Impact of Covid-19 restrictions on future educational strategy

While SUTD's fundamental emphasis on hands-on collaborative problem-solving and innovation remains unchanged, the Covid-19 restrictions have accelerated the university's plans for the development of cyber-physical systems to support its on-campus learning. In particular, the period of emergency teaching has fast-tracked SUTD's work to develop digital twins and AR/VR content as substitutes for physical systems and prototypes. Their experiences during this period have also underlined the distinctive culture and educational approach of the university and its student community, which is reflected in the ways in which such technologies would be accessed and used; this has galvanised SUTD's ambition to pursue bespoke, rather than off-the-shelf, educational technology solutions in the future.

[add about how SUTD is applying lessons learnt from the period of online learning....?]

[add: formation of new policies: learning outcomes...?]

5.4. Reasons for selecting Virtual Ideation Challenge as a case study

As a self-contained two-day activity, held in June 2020, the Virtual Ideation Challenge was the first fully online experience offered by SUTD to take students through the full design process. With student participants spanning all SUTD year-groups – including the 'incoming' cohort yet to matriculate – the experience allowed faculty to trial and reflect upon how best to scaffold each stage of the design process and support student engagement, progression and learning in the online environment. The university also exploited the remote nature of the activity to embed its most ambitious integration of external stakeholders into an undergraduate project to date: building on existing partnerships with the regional hospital, the Virtual Ideation Challenge incorporated extensive input and mentorship from clinicians on the front line of Singapore's response to Covid-19 to inform the thinking and decision-making of participating teams.