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STATE OF DESIGN EDUCATION IN SINGAPORE – INSIGHTS FROM DESIGN EDUCATION SUMMIT 2018

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Abstract

This study aims to understand the main issues in design education and discuss solutions. We conducted two workshops on the state of implementation of design in the Singaporean education system at the Design Education Summit, a conference for educators. We found that the main issues were the inclusion of design education within curriculum and change of stakeholder mindsets. Several solutions were discussed, such as ways to introduce design as part of the organization culture. We summarize results into action items and recommendations.

Keywords: design education, design methods, design thinking

1. Introduction

Design is viewed not only an important tool for fostering business and technological innovation but also as a vital approach in education. In Singapore, a top national level report advises to 'Infuse Deign into the national skillset' as one of the five strategic thrusts; and to 'Cultivate creativity and design sensibilities from pre-schools to secondary levels' as a key recommendation (DesignSingapore Council, 2016).

In literature, several studies have discussed Design and Design Thinking (DT) as theoretical frameworks for education (Kirschner, 2015; Norton and Hathaway, 2015; Oxman, 2004; Lugmayr et al., 2011). Design is considered as an accessible structure to think creatively about educational problems (Henriksen et al., 2017) and curriculum renewal (Melles et al., 2012). Studies have outlined the potential of design for all students, from primary to university level (Grammenos and Antona, 2018; Melles et al., 2015). In design-based curricula, students are expected to gain skills such as collaboration, problem solving and empathy.

Although the value of Design education is understood, its open-ended, project-based nature makes it notoriously difficult subject to teach and assess. Furthermore, design tends not to be a teaching specialisation. There are currently various efforts aiming at finding appropriate and efficient ways for introducing design at schools, e.g. 'Taking DT to Schools' (Carroll et al., 2010), but many - particularly, at primary and secondary school level - are largely piecemeal. There are very few studies into the educators' perspectives and experiences of design education. A notable exception is (Retna, 2016) who studied design thinking in a classroom in two secondary schools in Singapore. Given the importance of design as a strategic competence, there is a significant need to consider the systematic implementation of design in the educational system, in this case the Singaporean education system. Our research questions are:

1. What are the main issues in the current state of design education in Singapore?
2. What are the similarities and differences in issues across levels/types of education?
3. What are possible solutions?
4. What are the recommendations to promote design education in the Singaporean education system?

In this paper, we present findings from two workshops conducted with Singaporean educators on the implementation of design in their education system, as part of a two-day conference, the Design Education Summit. Although our focus is on the Singapore system, we believe the findings are relevant for the introduction of design education in other countries.

2. Singaporean education system

Singapore's compulsory education system consists of six years of primary school, for students aged 7-12 years. Secondary school is for four or five years, depending on the path taken, for students aged 13-16 or 17 years. Post-secondary education includes technical/vocational and academic education. The Institutions of Technical Education (ITE) award the Nitec (National ITE Certificate), which gives access to Polytechnics. The Polytechnics and Art Institutions (age 16-19) award Diplomas. Access to universities requires a Diploma or an A-Level awarded by Junior Colleges (age 16-19) (Lee and Chin, 2017).

3. Design education summit workshops

The Design Education Summit was a two day conference for Singaporean educators, organized by DesignSingapore Council (Dsg) in partnership with SUTD-MIT International Design Centre (IDC), on November 1-2, 2018. The Summit was intended to provide a platform for educators from different types of educational institutions in Singapore to network and exchange ideas on the adoption of design in education. The main objectives of the Summit were: (1) to discuss the evolution of design skills and the need for educational institutions to respond and prepare the workforce for the future, and (2) to formulate directions and action items to introduce design education throughout the education system.
On Day 1 of the Summit, a two-hour hands-on "Micro-DI Experience" set the scene by guiding the participants through the Discover, Define, Develop and Deliver phases of the IDC's Design Innovation (DI) process. Workshop 1, organized as the last segment on Day 1, focused on "Issues & Challenges, and Solutions". Workshop 2, organized on Day 2 of the event, focused on "Directions and Actions". Both workshops used the aforementioned DI process. The workshops involved working in subgroups and sharing of outcomes in larger groups. Workshop results were documented by participants and facilitators. The authors summarized the results into action items and presented these at the closing session of the event.

3.1. Participants

A total of 214 participants attended the Summit, representing 64 educational institutions (around 17% of all educational institutions in Singapore and 19 other institutions ranging from private companies to government representatives (e.g. the Ministry of Education). The gender distribution, designations and affiliations of participants are given in Figure 1.

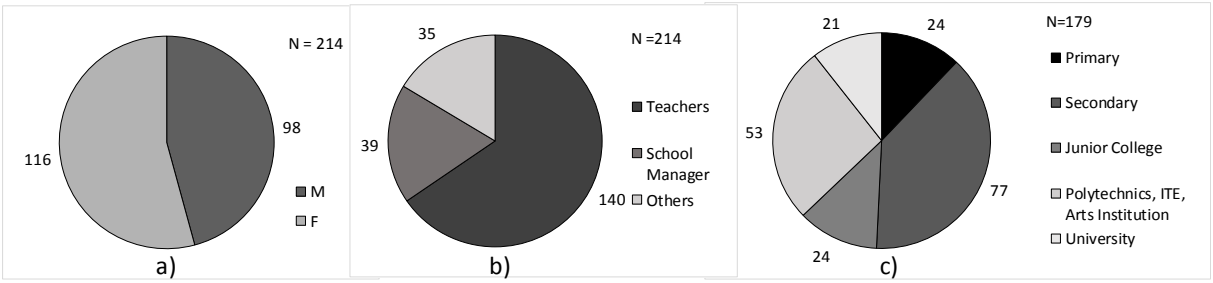

Figure 1. Design education summit participant characterization a) Gender distribution b) Designation of participants c) Affiliation.

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Workshop participants were grouped using the following criteria: (1) type of educational institution (2) level of experience in design and its application (to ensure diversity in each group); (3) institution (to distribute participants from the same institution). Representatives of companies and government institutions ("others") were evenly distributed over the groups, based on their interest as expressed in their registration form. The maximum number of participants per group was 18. The resulting 13 groups are shown in Figure 2.

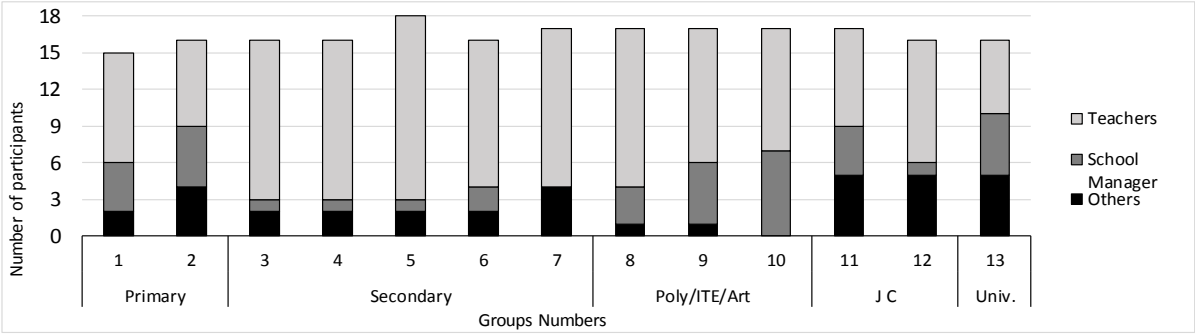

Figure 2. Workshop groups composition by participant occupation

Figure 3 shows the distribution of the participants in each group in terms of their experience with design Almost 9% of participants did not know about design at all before the Summit, 23% had some knowledge but never really used it, 32% had applied design tools and methods, and 35% were teaching design. On average, the groups with representatives of technical/vocational educational institutions (Poly/IT/Art) had more experience with design, the academic Junior Colleges far less.

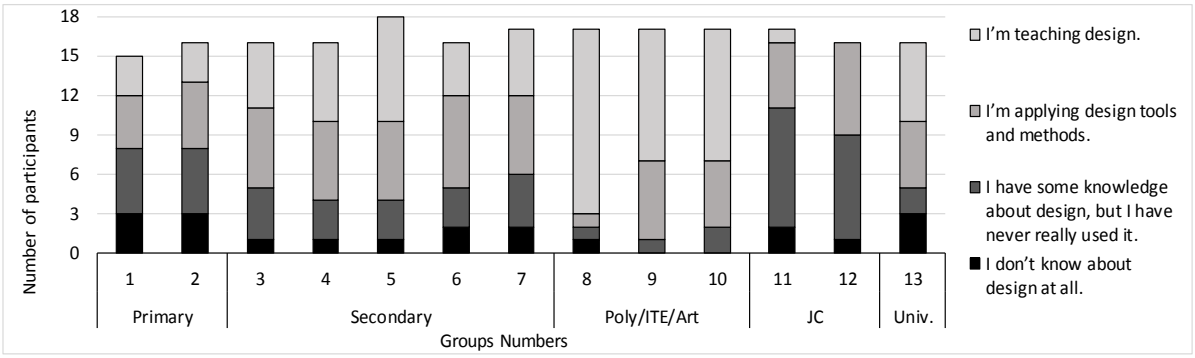

Figure 3. Workshop groups composition by experience in design and its application

3.2. Workshop organization and activities

Each group was assigned a table with a facilitator, handouts for documenting the activities, and flip-charts. A chairperson chosen from each group. A moderator introduced the methods, guided the participants through the phases of the process, and ensured timely completion of workshop activities. Figure 4 shows the workflow.

3.2.1. Discover needs & issues, using interviews and voting

Participants were asked to form pairs, interview each other and use the handout to note down: what the interviewee liked about the design education at their institution; the issues and challenges they faced (existing situation), their needs (desired situation), and the issues and challenges they expected in addressing these needs. At the end of the activity, the issues and challenges of the existing and desired situations were shared within the group, collected on flip-charts and prioritized.

3.2.2. Define problems, using how-might-we statements

For this activity, each group was split into subgroups of 3-4 participants. The issues and challenges that were given the highest priority in the previous activity were distributed over the subgroups.

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Participants had to reframe the issues and challenges, and formulating the problem(s) in the form of How-Might-We statements (HMW).

3.2.3. Develop ideas, using brainstorming and voting

As the last activity of Workshop 1, the subgroups used brainstorming to find solutions for each HMW statement. They were asked to elaborate on the solution by adding the "form" in which this solution could be realised. For example, "Engagement sessions" as a possible solution, could take the form of "focus group discussions", "briefings", "sharing success stories". At the end of this phase, each subgroup shared their HMW statements, proposed solutions and forms with their group, documented these on flip charts, and prioritized these using voting. The group results (HMWs, solutions, forms) were documented in handouts.

3.2.4. Deliver solutions, using real-win-worth evaluation and voting

At the start of Workshop 2, participants were given the time to recap the previous work, and add additional solutions and forms if desired. To eliminating solutions that are unlikely to be successful, the subgroups used the Real-Win-Worth-it (RWW) method (Ulrich and Eppinger, 2012) to determine for each solution-form pair of a HMW statement, whether the solution-form was realistic. The solution-form pairs that passed the three questions, were shared with the group, documented on flipcharts and prioritized, using 3 votes per participant.
The authors used these results to formulate a list of action items, presented at the closing session of the summit.

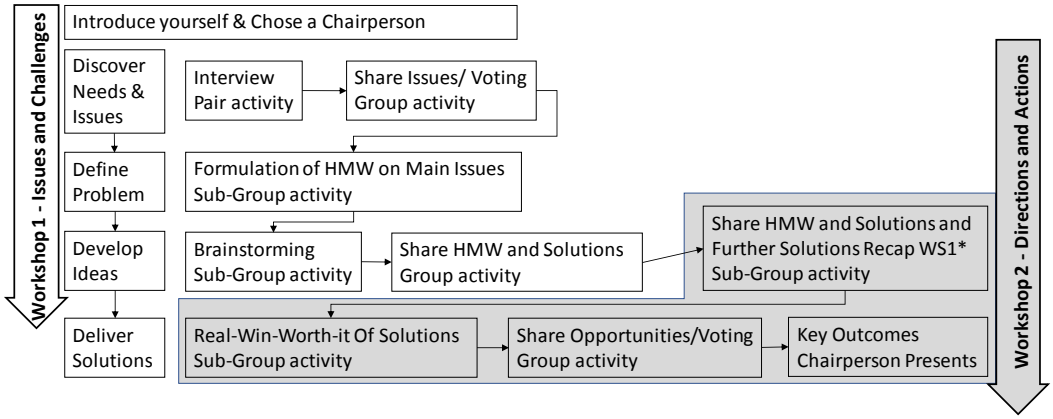

Figure 4. Workshops flowchart. (*WS1: Workshop 1)

4. Results and discussion

All workshop results (issues & challenges, HMW statements, solution-form pairs) were categorized as: (1) **Pre-implementation phase**, that pertain to planning design education, raising awareness, (2) **Implementation phase**, that pertain to actualizing design education, such as teaching design, or the (3) **Post-implementation phase**, that pertain to enhancement of design education, such as improving and branding design education)

4.1. Issue & challenges

The groups generated 91 issues and challenges. Figure 5 shows the numbers for each group, categorized according to implementation stage. Examples are given below. Both Primary school and Junior College groups are concerned about pre-implementation and implementation issues and challenges, indicating an early stage of design education, as confirmed by Figure 3. Secondary school groups mention issues and challenges related to each implementation phase, indicating differences in the level of implementation in the different schools. Poly/ITE/Art groups only referred to implementation and post-implementation issues and challenges, indicating a more mature design education. The University group only addressed issues and challenges in the implementation phase.

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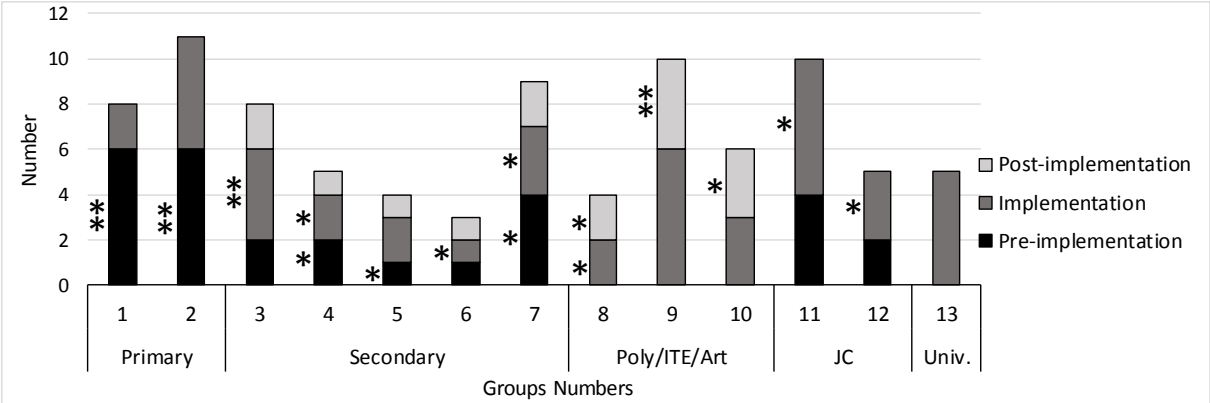

Figure 5. Number of issues & challenges per group and education type, and the implementation phases to which they relate (* refers to the problem statements that were eventually pursued, see Section 3.2)

Pre-implementation phase

- The issues and challenges of the Primary school groups concerned the curriculum as a whole e.g.: *"Infuse Design Thinking to develop the curriculum"*; *"Integration with existing curriculum (without adding on top)"*. Secondary school and Junior College (JC) groups focused on specific aspects e.g.: *"Limited Curriculum Time"*; *"Ownership of structures/programs?"*.
- Primary school groups expressed concern for the *"age appropriateness"* of design education and mentioned the challenge to ensure a curriculum that provides *"joy of learning"*.
- An issue frequently mentioned by Primary, Secondary and JC groups was that of buy-in, e.g.: *"Hindrances to Whole-School Approach - Culture shift requirements"*, *"basic common understanding of value of DT"*.
- JC groups emphasised the mindset, e.g. *"Willingness to be daring"*.
- Primary, Secondary and JC groups referred to the need of design competencies and support, e.g.: *"Teachers' unreadiness to join design education"*; *"How do we apply design thinking principles?"*.
- The University group was concerned about the general deficit of available competency: e.g. *"How to find the right faculty to teach design"*.

Implementation phase

- With the exception of the University group, all groups considered time an issue, e.g.: *"Limited Curriculum Time"*, and *"Finding time for meeting with stakeholders to explore their needs"*.
- An issue frequently mentioned by Secondary, Poly/ITE/Art and JC groups was the student mindset, e.g.: *"Fixation"*, *"Safe environment to fail & explore creativity?"*, "*Looking at the bigger picture"*.
- Most Secondary groups expressed the challenge of instilling empathy in the students, e.g. *"Empathy – How to teach/quantify"*.
- The wish of support for educators was mentioned across the groups, but not prioritized. E.g. *"Too many non-teaching commitment and responsibilities."* (Poly/ITE/Art) and *"Creating the right environment to cultivate design education"* (Univ.).

Post-implementation phase

- Both Secondary and Poly/ITE/Art groups were primarily concerned with assessment, e.g.: *"How do you assess and evaluate creativity?; Being able to accurately evaluate the level of creativity; Do we even need to evaluate?"*.
- Both Secondary and Poly/ITE/Art groups also noted the need of design competencies, but did not prioritize this, e.g.: *"Consistency in instruction"*; *"Lack of manpower to teach design"*

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The issues and challenges of implementing design education mentioned by the participants were wide ranging, from supporting students developing the right mindset, to organisational issues and buy-in of stakeholders, including parents. Common challenges across the types of institution were the integration into the existing curriculum, the availability of trained educators, and the understanding of the importance of design as a way of addressing problems by the many stakeholders. Clear differences can be observed too. These can be explained by the level of implementation of design in the institution, which is related to the type of education (with the post-secondary, Junior Colleges starting to introduce design, and the post-secondary Polytechnics, ITE and Art schools already having extensive experience in design education) and the participant's expertise in design thinking (Figure 3). The learning objectives, curriculum structure and content of each type of education also explains some of the differences, such as the age appropriateness of the material for Primary schools.

4.2. Problem statements - how might we

Each of the 13 groups generated problem statements in the form of How-Might-We-statements (HMW) by discussing and reframing the prioritized issues and challenges: 35 HMWs were documented, of which 19 were prioritized by the groups to be pursued in the ideation phase. Figure 5 shows each pursued HMW as "*" next to the related implementation phase. E.g. Group 4 formulated 5 issues and challenges, and formulated two HMW's, one related to a pre-implementation issue and one to an implementation issue.

As Figure 5 shows, pre-implementation related HMWs were only selected by Primary and Secondary groups. Implementation HMWs were selected by all groups except Primary groups. Post-implementation HMWs were selected only by the Poly/ITE/Art groups. The selected HMWs highlight the most pressing issues, as can be seen by the HMWs selected by Primary and JC groups: both only listing issues and challenges related to pre-implementation and implementation phases, yet Primary groups opted to formulate pre-implementation related HMWs, whereas JC groups formulated implementation related HMWs.

Pre-implementation phase

- The problem statements of Primary and Secondary groups pertained to call for involvement and change of mindsets of a variety of stakeholders. Primary group: *"HMW encourage teachers to adopt Design Thinking?"*, *"HMW change the mindset of the stakeholders?"*. Secondary group: *"HMW influence the mindsets of parents to be more process-driven instead of results orientated"*, *"HMW create mindset shift in teachers to embrace DT?"* and *"HMW motivate teachers/leaders to adopt design thinking?"*.
- The Primary groups also formulated problems related to design for education, *"HMW use Design Thinking to improve the delivery of the curriculum (i.e. deepen learning, students' experiences, arriving at your 'ideal' classroom experience, students having the necessary attributes)?"* and culture *"HMW promote a strong Design Thinking culture in the spirit of 'Joy of Learning(JOL)'?"*

Implementation phase

- All problem statements in this category related to supporting students in their learning and empathy building. Secondary groups: *"HMW help participants develop empathy and competency in and through DT?"*, *"HMW Broadening Students' Perspectives"*, *"HMW motivate students? (to adopt Design Thinking)"*, *"HMW teach students to be empathetic and take perspectives of others?"*, *"HMW support learners to collaborate, question and empathize?"*. The more technical Poly/ITE/Art groups: *"HMW create an environment for students to experiment? (w/o fear of being judged)"*. The academic JC groups: *"HMW incorporate failure (fail cheap & fast) as part of the teaching process"*, *"HMW boost courage to take risk?"*, *"HMW increase their information to put in effort when they study?"*.

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Post-implementation phase

- Only Poly/ITE/Art groups selected problem statements related to this phase. They were concerned about stakeholder buy-in, *"HMW Build stronger societal acceptance for design education?"*; efficiency, *"HMW use technology to improve productivity/efficiency?"* and assessment, *"HMW improve assessment for design education?"*

As mentioned earlier, the problem statements represent the most pressing issues. Again, a difference in type of institution can be observed, which is related to the level of introduction, the related experience of the educators, and the focus of the education (general, technical, academic). The HMW statements clearly reflect how the educators consider the introduction and implementation of design education less an issue of curriculum, teacher training in design methods, or availability of teaching material, but far more an issue of changes in mindsets, teaching and learning. Educators are looking for ways to change the mindset of the various stakeholders, including students and parents, and for pedagogical approaches suitable for teaching and assessing the types of skills and competences involved in design. A particular problem that was highlighted in the workshops and the Q&A sessions after the presentations and panel discussions was: how to embrace and incorporate failure as an important and positive part of the learning process, and create an environment that allows experimentation without immediate judgement. In particular, the Junior Colleges, being the direct path to university, reported a pressure to deliver results. Therefore, incorporating failure as a creative learning measure was considered high-risk.

4.3. Solutions

A total of 158 solution-form pairs (hereafter called solutions) were generated by the participants for the selected HMW problem statements, ranging from 3 to 18 solutions per group. Examples are given below using the format *'solution → form'*. Figure 6 shows the categorisation of the solutions. All groups, except the JC groups, proposed pre-implementation solutions. All groups proposed implementation solutions. Only Secondary and Poly/ITE/Art groups proposed post-implementation solutions.
Although an issue, challenge or related problem statement may concern a particular implementation phase (see Figure 5), addressing it could involve solutions related to other phases, e.g. in order to address the cause of the problem. Group 8, for example, focused on post-implementation HMWs (Figure 5), but the solutions concerned both implementation and post-implementation phases (Figure 6).

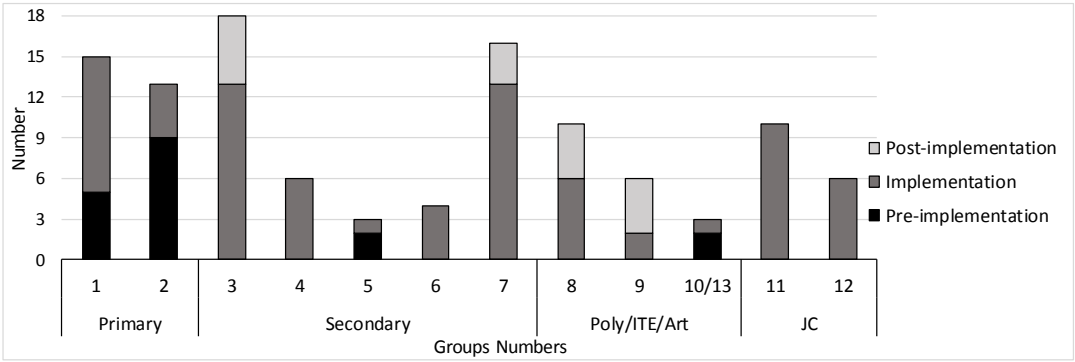

Figure 6. Number and phase of Solutions after RWW per group and school type

Pre-implementation phase

- Primary and Secondary groups focused on ways to start design education, e.g.:
  - *"Pilot with a group/subject → Experiment with topic/level/subject "*,
  - *"Start small → Apply for subjects/ domains with low stakes"*.
- Primary groups suggested sharing experiences and teacher support, e.g.:
  - *"Inform teachers about Design Thinking → Learning from schools that have started Design Thinking journey"*,
  - *"Leadership support (critical to building a pervasive culture) → Ensure sustainability"*.

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- Poly/ITE/Art groups suggested solutions to change mindsets, e.g.:
  - *"Media exposure → Providing more media exposure for creative industries, designers"*.

Implementation phase

- All groups mentioned solutions to support student learning, e.g.:
  - *"Provide more opportunity for failure → Create avenues to showcase learning process"*,
  - *"Encourage students to come up with modifications based on good mistakes in classroom, assignment/tests → Peer Marking (with empathy)"*.
- Primary groups focused on sharing experiences, e.g.:
  - *"Sharing positive experiences to inspire others (Community approach)"*.
- Secondary groups focused on buy-in and support, e.g.:
  - *"Involving external parties → Parental Support (interviews)"*,
  - *"Establish a partner to assist with matching students with service enterprises → forming relationships"*.
- Poly/ITE/Art groups focused on teacher support, e.g.:
  - *"Efficient attendance marking system → Facial recognition, from APP or camera in the room"*.
- JC groups focused on embracing failure, e.g.:
  - *"Creating safe environment (Lowering the stakes) → Gamification"*,
  - *"Normalizing failure (be ok with vulnerability) → Social proofing"*.

Post-implementation phase

- Secondary groups focused on changing mindsets and on teaching support, e.g.:
  - *"Involving external parties → Showcasing exemplar projects/schools. Get the school excited about design projects."*
- Poly/ITE/Art groups refer to assessment, e.g.
  - *"how valuable or desirable is the design"*.

  and to scaffolding student learning, e.g.:
  - *"Self-discovery (discover one's interest and passion through out of classroom learning) → Self-initiated /negotiated projects"*.

The solutions proposed by the Primary groups show the wish for a careful, experimental approach to introducing design education and for support from management and other more experienced educators (community of practice). One particular concern for this group was the age appropriateness of available material. The solutions of the Secondary groups suggest different levels of implementation at the institutions - those at an early stage wish to start on a small scale, others express a desire to try out new approaches and involve practice. The more experienced Poly/ITE/Art groups propose solutions for assessment and encouraging self-efficacy, and even a dedicated design school at secondary level. The Junior Colleges focus on helping educators to "change the narrative" about failure, encourage risk taking and ensure the necessary safe environment. Together the solutions provide a rich spectrum of ways in which design education could be introduced, implemented and extended beyond the classroom.

4.4. Action Items

All groups presented their identified issues and challenges, the selected HMW problem statements, and the solutions that were deemed real, winners, and worth the effort. The authors summarized the results into the following action items:

- Change mindsets and ensure leadership support to convince others.
- Promote a greater involvement of parents.
- Foster partnerships with enterprises, alumni and media.
- Integrate design in the curriculum, by linking with or integrating design into other courses.

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- Initialize pilot projects for the introduction of Design in curriculum (start small).
- Set up a professional learning community, e.g. a platform to share experiences and materials.
- Offer appropriate teacher training (not just limited to design process and methods)
- Encourage experiential learning, to develop empathy in students
- Motivate students through self-initiated projects and out of classroom learning.
- Develop safe learning environments and approaches to encourage experimentation, risk taking, and constructive failures.
- Re-think assessment and embrace failure.

The solutions and the action items show that the implementation of design education as integral part of Singapore's design education requires support within the institution, among the institutions, from the parents, from practice, and from the government agencies responsible for education.

5. Conclusions

The two workshops conducted at the Design Education Summit aimed at identifying and sharing issues and challenges of implementing design in Singapore's education system, jointly formulate the main problems, propose solutions, and derive action items. The analysis of the workshop results provided the following answers to our research questions, stated in section 1:

- The most commonly reported issues and challenges across the institutions are the inclusion of design education within the curriculum, the support needed (training and sustained support), the change of mindsets across all stakeholders, and assessment of design learning. (Section 3.1)
- The level of implementation of design education and the expertise of the participants are related to the type of institution (primary, secondary, etc) and type of education (academic/technical), and led to differences in prioritization of the issues and challenges, and in main problem statements (Section 3.1).
- The solutions (Section 3.3) generated by the participants emphasized the need for mindset changes, for a culture and environment that allows risk-taking and views failure as important drivers of learning, for stepwise introduction, and for ways to teach, encourage and assess typical design skills and competencies. The solutions also show the wish to introduce design as part of the institution's culture, and to form communities of practice. The derived action items highlight the necessity to involve different stakeholders (Section 3.4).
- Therefore, to promote design education in Singapore, we recommend the following:
  - To create working groups, by level/type of education and implementation phase, to pursue a more focused discussion on the proposed actions items;
  - To initiate a country wide investigation and debate on design education, on design as teaching specialisation and on the integration of design into other parts of the curriculum;
  - To support the development of teaching material addressing the issues raised - in particular on boosting risk taking and embracing failure as a creative way of learning - and suitable for the particular level and type of education;
  - To support design training for teachers of different specialisations and school management;
  - To promote design inside and outside of schools as a mindset, as a way of addressing issues and challenges.

There are several limitations to this study. Firstly, our study only involved a limited number of educators who attended the Design Education Summit workshops in 2018. Another limitation is that participants' statements about design education, as reported in this paper, are their personal opinions, and cannot be considered as representative of the state of design education in their institutes. Nevertheless, it may be noted that most issues raised in this paper are inherent to the subject of design and its challenges as an educational discipline. The issue that may be more pronounced in Singapore is the need for a creative, positive way of interpreting failure. Singaporean educational system, in general is considered an early adopter of organizational developments (Retna, 2016) and is seen as a results-

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driven culture, as highlighted by our workshop participants. With this being the primary exception, we believe that the issues we found are largely typical of those faced by design educators in other parts of the world. We have also presented the solutions in the original form, without further evaluation.

Our future work includes a detailed analysis of all documented issues, challenges, problem statements and solutions that were collected, and not only those that were prioritized by the groups. Discussion with the relevant agencies on the action items and our recommendations has commenced.

To our knowledge, our study is the first carried out at this scale, that investigates the issues of an entire educational system from primary to university level. By outlining the issues involved in the inclusion of design in education and by summarizing solutions deliberated by educators, this study makes a valuable contribution to the development of design education.

Acknowledgments

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