Reimagining Teacher Education through Design Thinking: A Mixed-methods Analysis

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Introduction

The study reported in this paper examines an under-researched aspect of design thinking (DT) in teacher education. While DT has popularized for responding to the needs of 21st century teaching and learning, there have been very few attempts to gauge the voices of teachers as non-designers and how they master the related knowledge, skills, and attitudes of DT. To illustrate this, Retna (2016) notes that very limited empirical evidence has navigated teachers' voices throughout the implementation process and endeavored to respond to this gap. There is also a wider issue here about how teacher education institutes prepare for a 21st century teaching force that can respond to uncertainties and with this in mind the current paper draws on the voices of 24 pre-service teachers at a leading university in Asia.

Through understanding this important learning process of facilitating DT workshops we hope to show how pre-service teachers, as non-designers confront the challenges and show development in the important mindsets associated with DT. There is a lack of attention invested in such process (Diefenthaler et al, 2017) and the current paper seeks to better understand it.

Theoretical perspectives

Design thinking and its significance

Designerly way of practice from professional designers has a longer tradition than design thinking (Cross, 2011). Design thinking (DT) is an application of this desingerly way of practice for non-designers and it has become popular because of the Stanford design school's model (Plattner, 2010). While there are variations in definition, DT is generally defined as a human-centred approach to respond to complex or 'wicked' problems in the world (Rittel & Webber, 1973). It is a complex, creative and iterative process that involves 'discovery, interpretation, idea generation, experimentation, evolution and refinement' and has been widely applied in both industry and academia (Diefenthaler et al, 2017).

According to the Stanford design school (Plattner, 2010), there are five important iterative steps for DT: empathize with the related stakeholders, define the problem, ideate ideas for solutions, prototype a solution and test the prototyped solution. There are several salient aspects about such DT process. First and foremost, it involves creativity and curiosity to explore possible solutions for a complex problem (Brown, 2009). Also, all these solutions bear in mind the ultimate needs of the end users and thus empathy is highlighted and reinforced in this DT process (Dorst & Cross, 2001). The ability to ideate, synthesize and review a solution differentiates an expert design-thinker from a novice one and nurturing this important ability helps solve real complex and ill-defined social issues and respond to an unknown future (Razzouk & Shute, 2012).

DT and education

Teaching has always been challenging not to mention with the rise of global pandemic and all the inequities issues that it brings (Parker et al, 2021). How DT can be employed to nurture a responsive teaching force for the 21st century remains a critical question for the teacher education institutes. As many aspects of DT are in alignment with the constructivist approach, DT is highly applicable in education (Retna, 2016). For instance, when DT is adopted as a pedagogy, it is beneficial to promote creative problem solving and teamwork (Carroll et al, 2010). When DT is incorporated as a curriculum design, the iterative process is always emphasized in the learners' experiences (Gleason & Cheerez, 2021) and also its interdisciplinarity (Parker et al, 2021). DT as a very thoughtful process has huge potential in teacher education.

However, existing research related to DT in K12 environment is very limited (Parker et al, 2021) regardless of the growing significance (Panke, 2019). Out of those available empirical evidence, most of them focus on students' experiences (Hennessey & Mueller, 2020) and students' learning outcomes (Chamberlain & Mendoza, 2017). Teachers are designers of learners' experiences (Carlgren, 1999) and therefore, it is important to understand teachers' perspectives and their experiences of it (Hennessey & Mueller, 2020). Some efforts have been observed in teacher educators who apply DT in their instructional design to nurture pre-service teachers a wide range of skills including problem-solving (Govindasamy & Kwe, 2020), empathy and being flexible to uncertainties (Henriksen, et al, 2020).

Teachers as non-designers, with regard to the great potential of applying DT across curriculum, little attention has been given on the process of growth – how DT are nurtured and developed into teachers' repertoire of skill set (Diefenthaler et al, 2017). As suggested by Koh & Chai (2016), this dynamic process needs to be unpacked. It is crucial to investigate both the experiences of pre- and in-service teachers in learning such approach (Henriksen, et al, 2020). Echoing what Parker et al (2021) suggest that adopting DT in teacher education has only just commenced, the authors attempt to respond to this important research gap through exploring and unpacking pre-service teachers' process of learning DT through facilitating DT workshops with secondary school students and contribute to a wider conversation in fostering a 21st century teaching force. As such, the current study aims to respond to the following research question:

> *What are the significant trajectories that pre-service teachers go through when involved in facilitating DT workshops?*

Method

Context and participants

The current study stemmed from a larger 3-year cross-university project supporting co-curricular DT workshops at secondary schools in Hong Kong (Authors, 2021) with the central focus on pre-service teachers' learning process. The voluntary participants were 24 pre-service teachers enrolled in a credit-bearing experiential learning course and received training on DT and facilitating reflective learning for secondary school students (13 males and 11 females ranging from 18 to 21 years old). Then they became group facilitators for secondary school students who were participants of these DT workshops. All the DT workshops were instructed by experienced designers whereas pre-service teachers would serve as group facilitators; they had to facilitate 8 – 10 two-hour sessions of DT workshops and guide secondary school students to do reflection in each session. The participants had never taken any DT courses or training prior to the programme.

Data source and analysis

A conversion mixed design is adopted in the current study (Teddlie & Tashakkori, 2006) so as to understand the process of change among the pre-service teachers in facilitating secondary school students' DT workshops. Data source for the study included researchers' observations, debriefing sessions with the participants after each school workshop (total number of sessions = 27) and the participants' submitted reflections at two time points (Figure 1). Because of the word limit, the current data source will focus only on the submitted reflections at the two time points. Ethical approval was obtained at institutional level.

Student participants were asked to submit written reflections on their understanding of design thinking and the most significant learning in the course. Data analysis involved several stages and an iterative approach was adopted to undergo three important stages of data coding and data reduction: open, axial and selective coding across the reflective data (Strauss & Corbin, 1998). Iterative analysis was performed separately among the team till consensus was reached in the final coding framework.

The research team then achieved data integration through data transformation. The qualitative data is transformed into quantitative counts and analysed (Fetters, Curry & Creswell, 2013). The qualitatively-produced themes will be statistically translated into variables by independent sample t-tests so as to understand the process of change (Sandelowski & Barroso, 2006).

To ensure the trustworthiness of the data analysis, we follow the strategies included prolonged engagement and debriefing (Creswell & Poth, 2016). From the first input session to the last submission of post-programme reflection, students' work extended throughout one full semester (four full months). The research team also conducted regular debriefing sessions.

Findings

*Due to word limit, more extracts and themes will be shared in the presentation.

The purpose of this study is to understand the significant trajectories of learning process among pre-service teachers' facilitation in DT workshops. The qualitative findings help understand the salient aspects of learning among these pre-service teachers whereas the quantitative findings inform us the process of change across time.

Qualitative analysis

Five meta-themes emerged from the qualitative analysis at both time points (see table 1). They are teaching, learning & facilitation, perception on DT, perception on reflective learning, social innovation & authenticity, and affective aspect. Our findings highlighting the significance of facilitation in DT aligns with the literature that 'successful' facilitation in DT relies on facilitators' ability to guide students and provide feedback on the DT process (Yilmz & Daly, 2016). Extract 1 (time point one) and 2 (time point two) of the same student illustrate this and extract 2 also indicates the significance of facilitating teamwork. The most basic role for a facilitator is to encourage dialogues among the participants and then to work collaboratively towards an end solution (Mosely et al, 2018).

> *Extract 1*
>
> *"**Interaction between the facilitator and students was an important element** in the workshop. Therefore, **some open-end questions** provided to the student when they got some challenges on*

*some topics. Sometimes, the teacher can point out the key features of things and set a role model. It helped students increase in the ZDP….. **The facilitator also provided some feedback and shared the related experiences with them according to their interest and needs**. After some reflective activities, students could reflect wider and deeper on the knowledge they gained and their performance." (#02; time point one)*

Extract 2

*"After a few lessons, the students became active learners as I actively ask them to share design ideas with each other, and encourage them to cooperate and interact with each other.…. During this process, I understand that the **role of the teacher is not to provide answers immediately** like spoon feeding them **but to guide students to think step by step**. Students can find out the answers and their abilities can be out of teacher's expectations, if we provide them answers before they started to think, this will limit their imaginations…… I also asked them to share their opinions with other students, so that all students can participate in the discussion and worked as a team, therefore they can solve the problem very quickly. **If student worked as a team, they can get a better outcome effectively**." (#02; time point two)*

Insights and action plan repeatedly appeared across sub-themes (table 1) reconfirmed the huge potential and applicability of DT in education. These pre-service teachers develop insights and action plans that they can apply what they learnt through the DT process. This is the solid evidence for the transformative power that DT brings to the teaching force. The student demonstrated an empathy and genuine care towards the society which is crucial as they also need to understand the needs of their students (Shively & Palilonis, 2018) and it is also an important 21st century mindset.

Quantitative analysis

Quantitative data further revealed a significant difference was reported in the theme of social innovation & authenticity and teaching, learning & facilitation when comparing two time points. Significant growth for pre-service teachers in the context of social innovation and growth moment across time was observed. Recognising students' growth moment (Extract 3) reflects the critical trajectories that pre-service teachers been through when facilitating DT as non-designers. These are important insights for teacher educators. Also, examining their transformative understanding in social innovation further informs teacher educators on how to prepare pre-service teachers to approach innovation. These are crucial findings for teacher education institutes.

Scholarly significance

The growing demands and expectation on teachers in 21st century teaching and learning implies that teachers need a wide range of skills to respond to students' needs (Phusavat et al, 2018). We need a teaching force that is open and responsive to uncertainties. The current study bridges a very important research gap about pre-service teachers' perspectives and particularly the process of implementation that is always 'overlooked' in applying DT in education (Retna, 2016). Our findings highlight the important learning process among pre-service teachers as non-designers in facilitating DT workshops and confirm the

transformative power of DT in nurturing a 21st century teaching force who are reflective and understand the significance of social innovation.

References

Authors (2021).

Brown, T. (2009). *Change by design: How design thinking transforms organizations and inspires innovation*. New York, NY: HarperCollins.

Carlgren, I. (1999). Professionalism and teachers as designers. *Journal of curriculum studies*, *31*(1), 43-56.

Carroll, M., Goldman, S., Britos, L., Koh, J., Royalty, A., & Hornstein, M. (2010). Destination, imagination and the fires within: Design thinking in a middle school classroom. *International Journal of Art & Design Education*, *29*(1), 37-53.

Chamberlain, L., & Mendoza, S. (2017). Design thinking as research pedagogy for undergraduates: Project-based learning with impact. *Council on Undergraduate Research Quarterly*, *37*(4), 18-23.

Creswell, J. W., & Poth, C. N. (2016). *Qualitative inquiry and research design: Choosing among five approaches*. Sage publications.

Cross, N. (2001). Designerly ways of knowing: Design discipline versus design science. *Design Issues, 17*(3), 49–55.

Cross, N. (2011). *Design thinking: Understanding how designers think and work*. Oxford New York by Berg.

Diefenthaler, A., Moorhead, L., Speicher, S., Bear, C., & Cerminaro, D. (2017). Thinking and acting like a designer: How design thinking supports innovation in K-12 education. *World Innovation Summit for Education.* Retrieved from: https://designthinking.ideo.com/resources/thinking-acting-like-a-designer-how-design-thinking-supports-innovation-in-k-12-education

Dorst, K., & Cross, N. (2001). Creativity in the design process: co-evolution of problem–solution. *Design studies*, *22*(5), 425-437.

Fetters, M. D., Curry, L. A., & Creswell, J. W. (2013). Achieving integration in mixed methods designs—principles and practices. *Health services research*, 6(48), 2134-2156.

Gleason, B., & Cherrez, N. J. (2021). Design Thinking Approach to Global Collaboration and Empowered Learning: Virtual Exchange as Innovation in a Teacher Education Course. *TechTrends*, *65*(3), 348-358.

Govindasamy, M. K., & Kwe, N. M. (2020). Scaffolding problem solving in teaching and learning the DPACE Model-A design thinking approach. *Research in Social Sciences and Technology*, *5*(2), 93-112.

Hennessey, E., & Mueller, J. (2020). Teaching and Learning Design Thinking (DT): How Do Educators See DT Fitting into the Classroom? *Canadian Journal of Education/Revue Canadienne De l'éducation, 43*(2), 498–521.

Henriksen, D., & Richardson, C. (2017). Teachers are designers: Addressing problems of practice in education. *Phi Delta Kappan*, *99*(2), 60-64.

Henriksen, D., Gretter, S., & Richardson, C. (2020). Design thinking and the practicing teacher: Addressing problems of practice in teacher education. *Teaching Education*, *31*(2), 209-229.

Johnson, Z. (2016). Teachers as designers of context-adaptive learning experience. In *Taking design thinking to school* (pp. 144-160). Routledge.

Koh, J. H. L., & Chai, C. S. (2016). Seven design frames that teachers use when considering technological pedagogical content knowledge (TPACK). *Computers & Education*, *102*, 244-257.

Mosely, G., Wright, N., & Wrigley, C. (2018). Facilitating design thinking: A comparison of design expertise. *Thinking Skills and Creativity*, *27*, 177-189.

Panke, S. (2019). Design Thinking in Education: Perspectives, Opportunities and Challenges. *Open Education Studies, 1*(1), 281–306.

Parker, M., Cruz, L., Gachago, D., & Morkel, J. (2021). Design Thinking for Challenges and Change in K–12 and Teacher Education. *Journal of Cases in Educational Leadership*, 24(1), 3 - 14.

Phusavat, K., Hidayanto, A. N., Kess, P., & Kantola, J. (2019). Integrating Design Thinking into Peer-Learning Community: Impacts on Professional Development and Learning. *Journal of Workplace Learning*, *31*(1), 59-74.

Plattner, H. (2010). Bootcamp bootleg. *Design School Stanford, Palo Alto*.

Razzouk, R., & Shute, V. (2012). What is design thinking and why is it important? *Review of Educational Research*, *82*(3), 330–348.

Retna, K. S. (2016). Thinking about "design thinking": A study of teacher experiences. *Asia Pacific Journal of Education*, *36*(sup1), 5-19.

Rittel, H. W., & Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy sciences*, *4*(2), 155-169.

Sandelowski, M., & Barroso, J. (2006). *Handbook for synthesizing qualitative research*. Springer.

Shively, K., & Palilonis, J. (2018). Curriculum development: Preservice teachers' perceptions of design thinking for understanding digital literacy as a curricular framework. *Journal of Education*, *198*(3), 202-214.

Strauss, A. L., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory (2nd Ed.)*. Thousand Oaks, CA: Sage Publications.

Teddlie, C., & Tashakkori, A. (2006). A general typology of research designs featuring mixed methods. *Research in the Schools*, *13*(1), 12-28.

Yilmaz, S., & Daly, S. R. (2016). Feedback in concept development: Comparing design disciplines. *Design Studies*, *45*, 137-158.

Figure 1. Data collection for the current study

Time point 1:
Data collection

Time point 2:
Data collection

Training:
Input sessions on DT and facilitating reflective learning

Facilitation:
School DT workshops (first 3 – 4 sessions)

Participants submitted first piece of reflections

Facilitation:
School DT workshops (5 – 8/ 10 sessions)

Participants submitted post-programme reflections