

OPTIMISING DESIGN THINKING EXPERTISE DEVELOPMENT

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ABSTRACT

Design Thinking constitutes an array of principles, perspectives and practices that can be used to design solutions to ill-defined and complex problems. In this paper, we report on the development and evaluation of a learning and teaching environment that was intended to help first year university students develop design thinking expertise. The environment included a Design Thinking curriculum.

A critical realist paradigm position informed the conceptualisation and development of both the learning and teaching environment and the research-based evaluation process. This perspective created a focus on the curriculum, learner and teacher mechanisms that potentially influence students' learning and the contextual factors that might activate, enhance or constrain these mechanisms. The application of this framework is illustrated with reference to students' development of one key Design Thinking attribute – an empathetic mindset.

Key Words: Design Thinking Expertise, Constructivist Pedagogy, Experiential, Authentic and Cooperative Learning

1. INTRODUCTION

Design Thinking can be defined as a meta-disciplinary, human-centred framework for innovation (Lindberg 2010). Innovation or creativity is called for, along with framing and research, when problems are ill-defined and complex (Lindberg 2010). The framework encompasses a broad range of principles, approaches, methodologies and methods for thinking and practicing (Brown 2009).

Evidence of an increasing interest in and uptake of Design Thinking is reflected in general publications, research literature and educational programmes (Kimbell 2011; Melles 2011). The latter includes university-level programmes, and several researchers now advocate teaching Design Thinking to students who are undertaking programmes beyond those explicitly associated with 'design'. For example Lloyd, (2013) states that "designers, specifically equipped to resolve complex problems in their work, and taught to do so in discursive studio-based contexts, provide a model for education in other professional

environments" (p. 750). We concur with this view and believe that Design Thinking should be viewed as a 'generic graduate attribute' that will be beneficial for all students.

This research contributes to a relatively small, but growing, body of rigorous research on the learning and teaching of Design Thinking.

In the following sections we (a) outline key critical realism perspectives, (b) describe the learning and teaching environment from these perspectives, (c) summarize a 'design thinking expertise framework' that identifies attributes and capabilities that we associate with the accomplished design thinker, (d) the learning and teaching approach, (e) present the research questions methodology and methods, and (e) present selected findings from the second iteration of the action research.

2. CRITICAL REALISM

Critical Realists have an ontological belief in a 'real' world that is both differentiated and stratified (Smith 2012), such that it is perceived to consist not only of events, but objects or structures that have powers of generating events and effects (Easton 2009). These powers are expressed through mechanisms. Effects arise due to the interaction between structures, mechanisms and contextual factors (McEvoy 2006).

From this perspective, students are conceived as structures that have properties that provide them with powers/mechanisms that can enable learning to occur and the achievement of particular learning outcomes. The activation of learning-related mechanisms will be contingent on properties of the student (e.g. their cognitive maturity) and other contextual factors. The latter include activation of the mechanisms of other structures (e.g. teacher mechanisms, curriculum mechanisms, faculty and institutional mechanisms). Critical realism emphasises the complexity of phenomena and their relationships.

Brown (2009) contends that "learning is better understood, not as a process grounded in empiricist or idealist conceptions of knowledge, but as emergent from ontology; a phenomenon emergent from an ensemble of mechanisms" (p. 6). From this perspective, learning environments are seen as episodic and complex assemblages of causal mechanisms and contextual factors that activate or constrain learning (Brown 2009).

Retroductive analysis is central to a critical realist research approach. Retroduction involves a process of posing transfactual questions such as, 'what essential conditions of reality must exist for this research object to be possible?' The asking of such questions moves the researcher's thinking beyond empirical data to consider and postulate underlying structures, causal mechanisms and contextual factors (Crawford 2010).

3. CRITICAL REALISM AND LEARNING AND TEACHING ENVIRONMENTS

Using a critical realist approach, a conceptual model was developed to describe the entities/structures within the learning and teaching environment (Figure 1). This environment is conceived of as an open and complex system, with entities, mechanisms and contextual factors (including attributes and properties of entities), all potentially influencing students' development of Design thinking expertise. The model identifies the students, teacher (lecturer) and the curriculum as key entities in this research. Other entities or structures such as department, school and university, while important were not included in the analysis.

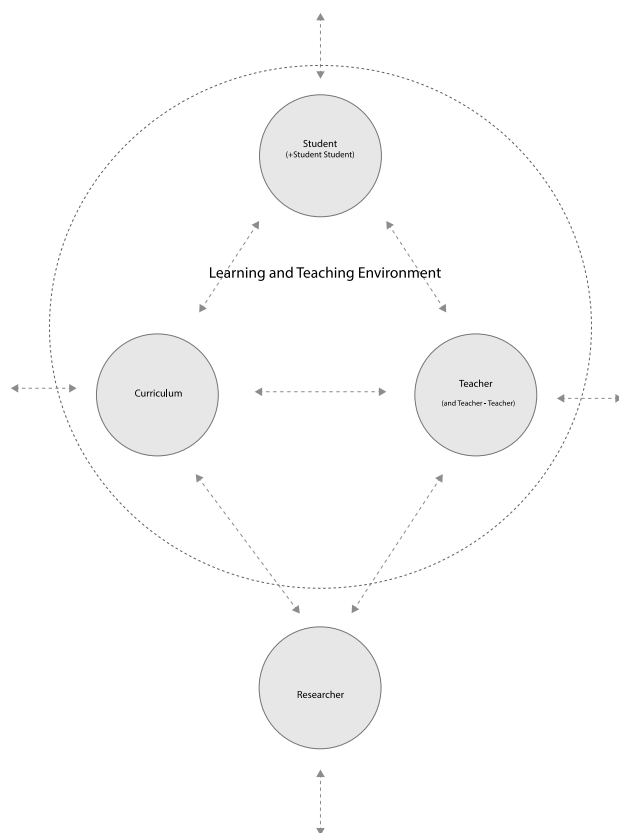


Figure 1: Model of Learning and Teaching Environment Used in the Research

4. DESIGN THINKING EXPERTISE FRAMEWORK

The framework is based on a revision of Bloom's (1965) taxonomy of educational objectives, which identifies outcomes for learning, teaching and assessing (Anderson et al. 2001). Thus, five domains of Design Thinking expertise were identified: Affective, Knowledge, Cognitive, Sensorimotor and Social Learning. These domains have also used in other conceptualizations of design thinking (Anderson 2001; Cross 2010; Cross 1994; Dorst 2004). Within each of the domains, key student attributes and capabilities were identified, mapped and described (Figure 2).

A novice to expert framework (Dreyfus 1986; Brenner 2004) was also used to identify

outcomes that would be appropriate for students who were being introduced to design thinking and for their succeeding development.

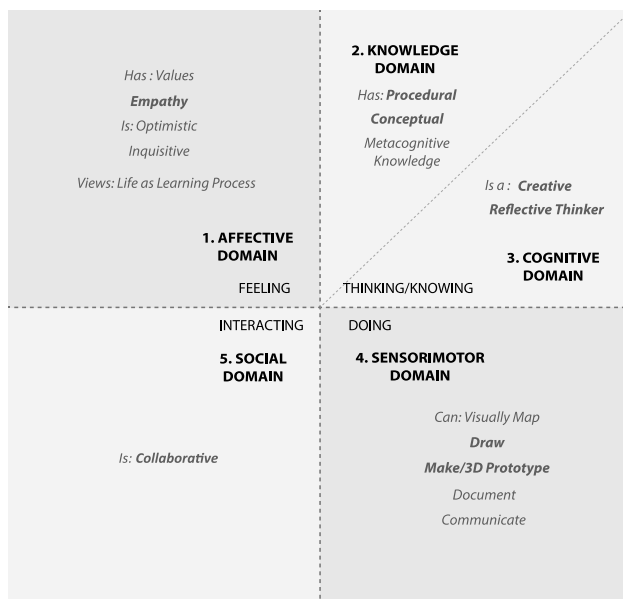


Figure 2: Design Thinking Expertise Framework

5. DESIGN THINKING CURRICULUM

The curriculum development process involved conceptualising and designing a detailed 12-week teaching plan including a six-stage Design Thinking process model (Figure 3), learning goals, structured session plans, presentations, learning activities, project brief, assessment criteria and deliverables. A wide variety of learning activities, from structured to semi-structured and independent and self-directed, were planned and a high level of student-tutor interaction and discussion was envisaged. A detailed Design Thinking Methods resource was also developed to accompany the curriculum.

Integral to the development was the identification and development of key-learning goals and an assessment framework. The learning goals were based on the Design Thinking expertise framework and were also developed into assessment rubrics, and a self-reflection tool for students.



Figure 3: Model of the Design Thinking Process Developed for the Curriculum

From a critical realist perspective, a curriculum has mechanisms that when activated can influence students' learning. These mechanisms may control, guide, sequencing, prioritize, legitimate etc. circumstances and events that influence learning. The mechanisms are latent. There will be curriculum properties and other contextual factors that influence the likelihood that these mechanisms will be activated, enhanced or constrained.

Based on a review of existing Design Thinking education models and an observational visit, the Stanford University d.school 'Bootcamp' workshop model was identified as the most appropriate foundation and model for the development of the initial learning and teaching environment. The Stanford University, d.school, located in Hasso Plattner Institute is well recognised internationally for developing and incorporating Design Thinking in its programmes.

The 'Boot Camp' workshop model:

Is recognised as a successful education model, and has been adopted/adapted by a range of educational organisations. The d.school overall has a high level of recognition as an international leader of Design Thinking knowledge and education (in professional education, undergraduate and postgraduate education and in primary and secondary [K12] education);

Uses a conceptualisation of Design Thinking that closely matches the researchers own conceptualisations. For example Design Thinking is a trans-disciplinary framework for innovation, is underpinned by definable mindsets and other expertise capabilities;

Is also underpinned key Design Thinking process and methods;

Generally aligns to the early (beginner to advanced beginner) levels of the Design Thinking Expertise;

Uses a session-by-session workshop structure, which can be relatively effectively translated into a university learning context; and

Is underpinned by a number of appropriate experiential learning approaches and frameworks identified in the research.

Six key learning theories, frameworks and constructs correlating to the d.school 'Bootcamp' workshop approach were identified and explored to help inform the development of the learning and teaching environment. These are summarised below (Table 1).

| Theory/Framework | Correlation to the d.school 'Bootcamp' Workshop |
|----------------------------------|--|
| Constructivist | Has an educational approach that is very student-centred, informal, with authentic, purposeful and contextual learning; |
| Experiential | Is experiential, including learning through participating in activities and undertaking practical work, summarised as 'learning by doing'. |
| Authentic | Closely related to professional contexts (such as facilitated by professional designers), and underpinned with an authentic 'real-world' wicked problem. |
| Problem and Project-based | Centred on a clearly structured project, with a problem that needs to be explored 'solved' using Design Thinking. |
| Co-operative | The project is entirely based around cooperative/collaborative learning including group and team work, with some elements of individual self-reflection and learning; and |
| Workshop | Structured into stand-alone sessions with a mixture of very clearly timed and controlled learning events (lectures, videos, discussions, activities, reflection etc.). Each session seen as standalone event underpinned by good learning resources. |

Table: 1 Key Learning Theories, Frameworks and Constructs Correlating to the d.school 'Bootcamp' Workshop Approach

6. RESEARCH QUESTIONS, METHODOLOGY AND METHODS

The research addresses the following questions:

1. How can Design Thinking and Design Thinking expertise be conceptualised in the context of undergraduate university education?
2. What is an ideal Design Thinking learning and teaching environment, and enactment process?
3. What are the significant outcomes including recurring patterns and tendencies (for example what worked effectively and what was problematic) in relation to:
 - a. How the learning and teaching environment was enacted;
 - b. How the learning and teaching environment was perceived and experienced by the students; and
 - c. What learning outcomes were achieved.
4. What curriculum, student and teaching mechanisms are in play within (and beyond) the learning and teaching environment, and how do they influence student's learning outcomes (development of Design Thinking expertise)?
5. What contextual factors are in play, and how do these increase or decrease the likelihood of the learning mechanisms being activated.
6. Based on the findings of above, how can the ideal learning and teaching environment be enhanced and optimised?

The research incorporates an action research methodology (Bryman 2007;Bradbury 2003), which is very compatible with a critical realist paradigm position (Coghlan 2007). An 'ideal' Design Thinking learning and teaching environment was developed, enacted and evaluated. Findings from the initial enactment lead to revision of the ideal environment, which was in turn implemented and evaluated. Three research action cycles occurred.

The following diagram (Figure 4) describes an example of one action research cycle used in this research.

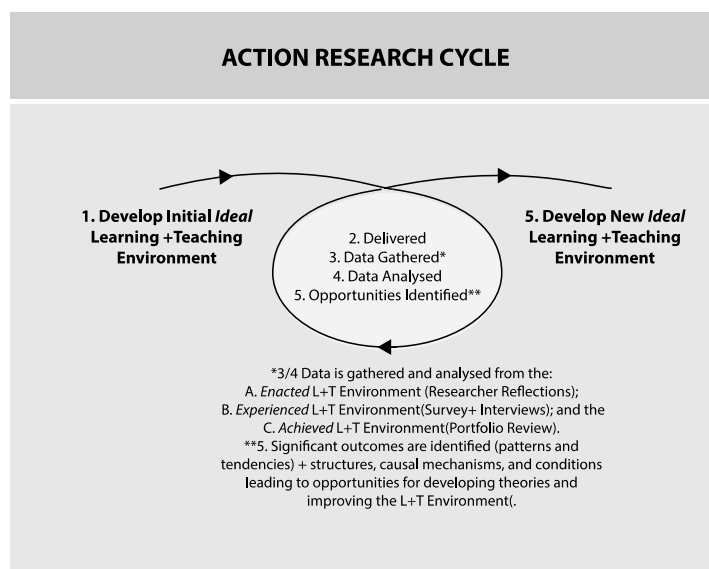


Figure 4: Action Research Cycle Model One

The data gathered included student's rating of their own expertise development (aligning with an achieved learning and teaching environment), students' self-reported learning experiences, perceptions and evaluations (aligning with an experienced learning and teaching environment) and the reflections and observations of the researcher (aligning with an enacted learning and teaching environment).

The data gathering methods included questionnaires, interviews, student portfolios and a researcher observation and reflections journaling. This is represented in a model (Figure 5).

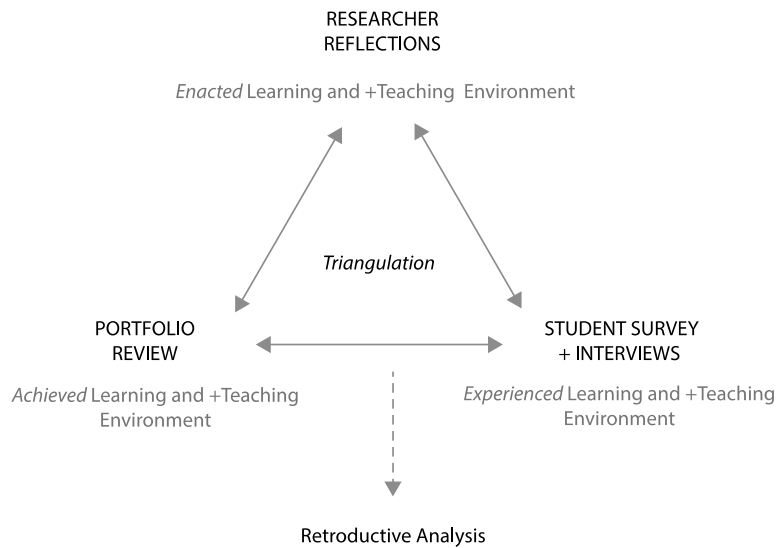


Figure 5: Data Collection Model

Data analysis involved a retroductive analysis process. Key steps in the process included the following:

- a. Identification of regularities and tendencies in student learning outcomes, perceptions and experiences;
- b. Postulation of curriculum, student and teacher mechanisms and contextual factors, including student attributes and other factors, that appear to be influencing expertise development;
- c. Review of relevant literature to help clarify and confirm mechanisms and contextual factors; and
- d. Identification of opportunities for enhancement to the learning and teaching environment (e.g. changes to learning activities, teaching methods), to increase the probability of students' developing design thinking expertise.

7. SOME FINDINGS

The findings presented below are from the iteration of the programme, which was delivered twice in semester one, 2013 over a period of 12 weeks (one session per week) to a total of 72 first-year, Bachelor of Business students. The student participants for the research were recruited as per ethics requirements. The following images document examples of the enactment process (Figure 6).



Figure 6: Delivery of the Learning and Teaching Environment

The majority of students reported a very positive experience (Figure 7), providing endorsement of the direction and approach to learning and teaching environment.

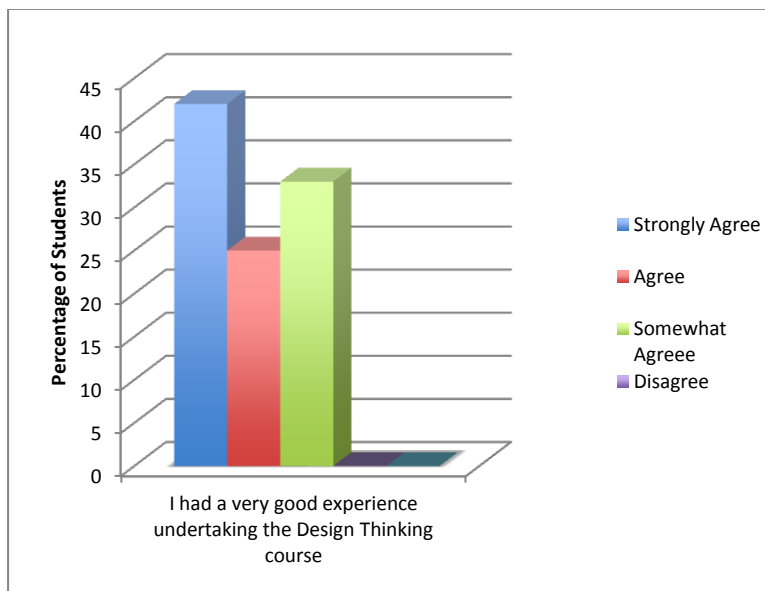


Figure 7: Students Ratings of Their Overall Experience

Positive feedback was also expressed by students in the interviews. The majority (84%) commented how much they enjoyed the course, and one other student was now inspired about the potential of Design Thinking as a future career.

100% of students also reported that the course very positively impacted their overall development of Design Thinking expertise (Figure 8). Students believed that the outcomes could be applied to their future studies and work.

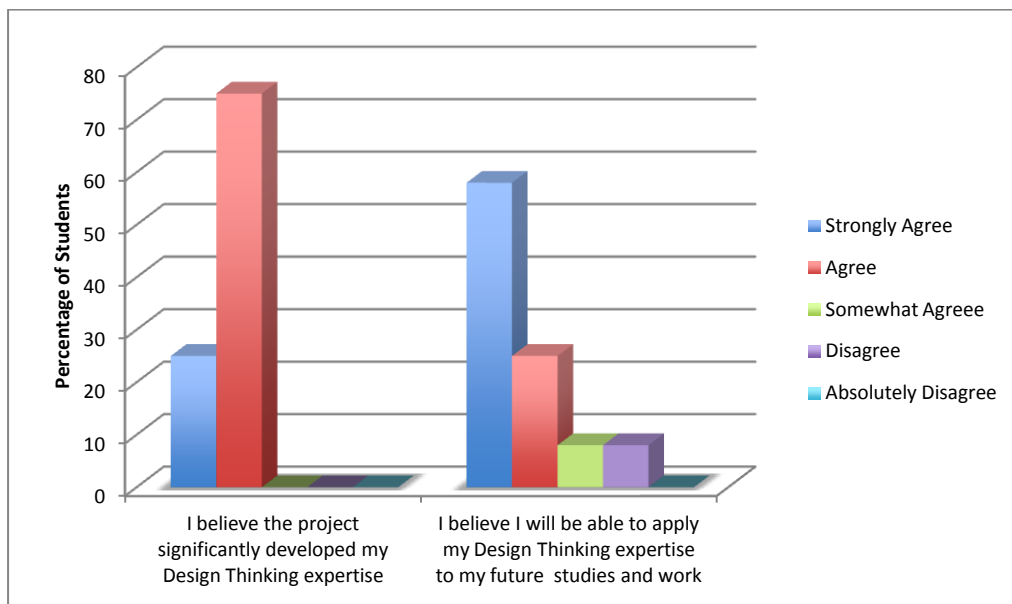


Figure 8: Student Ratings of the Overall Impacts of the Learning and Teaching Environment

8. RETRODUCTIVE ANALYSIS

This purpose of this analysis was to identify recurring themes and tendencies in the data, and postulate student learning mechanisms and contextual factors, which might account for the outcomes. In this instance the contextual factors focused on were the student attributes which might account for the activation, enhancement or inhibition of the student learning mechanisms. Research was also undertaken to examine the findings of other related and relevant research to help clarify and confirm the student learning mechanisms and related student attributes. The outcomes of this analysis for students' development of an empathetic mindset are now presented.

The development of an empathetic mindset is a foundational aspect of Design Thinking expertise. Goldman (2012) describe four mindsets that they identify as central to Design thinking including human-centered (empathetic), experimental, collaborative and metacognitive. An empathic mindset is the deep human-centred connection with, and understanding of, the people that are being designed for, underpinned by a desire to improve their experiences (Goldman 2012; Eagen 2011).

Students reported a positive rating of their personal empathy before they participated in the Learning and Teaching Environment. After participation, all students reported increased positive ratings (Figure 9).

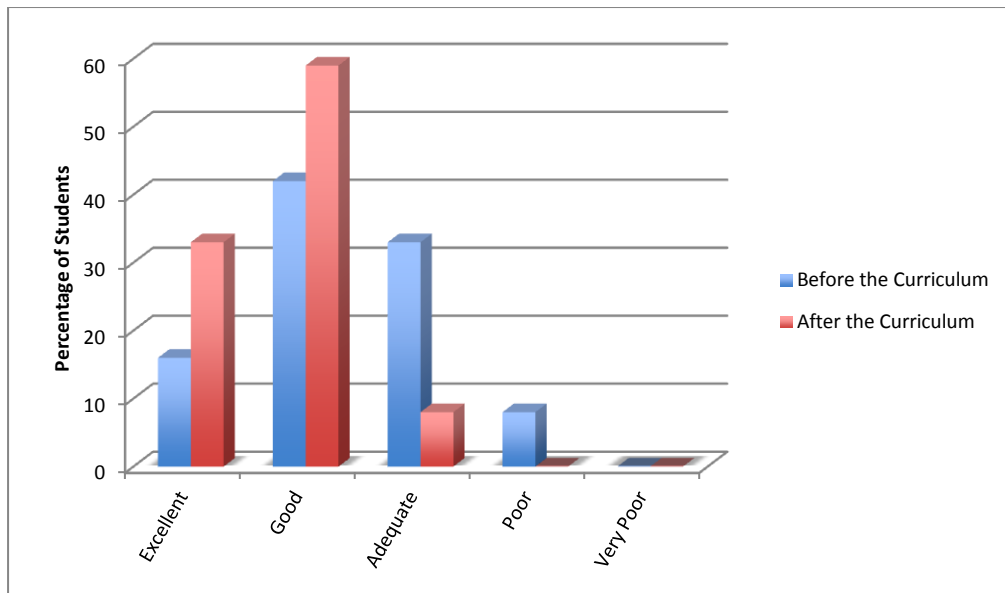


Figure 9. Student Ratings of the Overall Impacts of the Learning and Teaching Environment

Students commented that the development of personal empathy in relation to Design Thinking was a particularly significant outcome for them. Sixty percent of students identified empathy as their most significant learning outcome from the Learning and Teaching Environment.

Based on the retroductive analysis, which examined tendencies and recurring themes in the data, five key student-learning mechanisms, which underpin empathic mindset development and are relevant to Design Thinking were postulated and explored in relevant literature:

Watching and Observing: Watching and observing people (rather than asking) is important in developing a deeper understanding of their perspectives, and to get to know them (Brown 2009). In addition the degree to which we empathise with an observed person has a strong impact in determining how much we learn from them (Rak 2013). Developing empathy is a pre-cursor to effective and meaningful observation.

Active Listening. Active Listening refers to a process of building empathy through good listening, including being attentive, nonjudgmental, and non-interrupting (Active listening 2002).

Experiencing: Experiencing someone else's perspective is arguably the most powerful mechanism from affective point of view, and helps to develop a deeper emotional connection to people. It is also the most difficult and requires a lot of effort. Experiencing can be described as 'walking in the shoes of' and acting out what people are doing, seeing, and feeling (van Kraayenoord 2009) key to experiencing other peoples perspectives is the use of roleplay (Schoenly 1994).

Talking (to/with): In addition to experiencing and observing, talking directly with people, and asking them questions provides another way of getting to know them, and their perspectives.

Reflecting: Loreman (2011) describes the use of self-reflection as a form of 'listening to oneself', in order to uncover our own biases, misunderstandings and knowledge of others to help build empathy.

Comprehending: when a designer perceives, and understands what a person is experiencing at a particular moment, then uses this understanding to adopt that person's perspective (Yogev 2012; Rak 2013).

Three key student attributes that potentially influenced the activation, enhancement or inhibition of these mechanisms were also identified:

Gender: Gender appears to play some a role in empathy. Females on average have a stronger tendency to empathise (to identify another person's emotions, thoughts and actions) while males on average tend to have a stronger tendency to systemize (Baron-Cohen 2002). Systemizing, in contrast to empathizing, is an inductive process to analyse the variables in a system and to derive the underlying rules that govern the behaviour of that system (Baron-Cohen 2002).

Age and Maturity: Empathy develops in a person through stages over time (Rak 2013) therefore the stage that students are at will influence their capacity to be empathetic, and further development of an empathetic mindset.

Cognitive Development: a relationship has been identified between empathy development and cognitive development (Hogan 1969; Yardley 1999). Yardley's research confirmed a 'steplike' pattern in empathy development consistent with structural stage theories of cognitive development.

Other attributes include student's motivation and agency, knowledge, confidence, communication skills, cultural background and perspective, and past experiences. There are also neuro-biological mechanisms associated with empathy.

The analysis indicated that there are a number of opportunities to improve the learning teaching environment to increase the likelihood of students (i.e. learning when and how to) activate empathetic mindset mechanisms. The changes identified build upon existing curriculum and teaching approaches and strategies. Examples of opportunities include:

Talking further with students about the relevance and need for an empathic mindset before asking them to undertake tasks that require the capacity for empathy. This may include discussion of empathy mechanisms and contextual factors.

Providing students with the opportunity to engage in familiar, everyday activities requiring empathy before they undertake formalised research tasks (e.g. observation and interviewing) that require a strong empathy mindset and associated capabilities. Role-playing may represent an appropriate interim task that can help students anticipate the

views thoughts and feelings of people they are designing for, before they engage with them directly.

Assisting students to reflect better on their own empathic mindset development. This may include providing them with an empathy measurement framework, which could be based on recognised empathy development scales, and used in conjunction with other reflection tools.

9. FURTHER RESEARCH

The analysis of data concerning empathy and the associated attempt to postulate related mechanism and contextual factors has highlighted both the benefits and demands of a critical realism based approach. In the current project, it has been necessary to focus on selected entities/structures such as curriculum, students, teachers, elements of design thinking expertise, and possible associated mechanisms and contextual factors. There remain many other interconnected aspects that warrant similar attention. There is a great deal of unfinished business for the present researchers, and others if we are committed to optimising the learning and teaching environment for Design Thinking development programmes.

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