ABSTRACT

NOEL, LESLEY-ANN MELANIE. Teaching and learning design thinking through a critical lens at a primary school in rural Trinidad and Tobago. (Under the direction of Professor Tsai Lu Liu and Dr. Traci Rider).

The last two years of primary school in Trinidad and Tobago are marked by preparation for national standardized tests. The focus on preparing for these tests impacts teaching and learning strategies, as there is a shift to teacher centered classrooms and teaching strategies that depend on rote learning and memorization.

This study explored how design thinking, a process for creative problem solving which uses empathy and iteration to solve problems creatively (IDEO n.d), could be used as an alternative style of teaching and learning at primary level in Trinidad and Tobago to enhance critical awareness of students, and their empathy and critical thinking skills. These three abilities were found to be vital to the cognitive and social development of the children, and their long-term success. The study documented and analyzed a three-week design thinking workshop with 4th grade students at a rural primary school in Trinidad and Tobago. Qualitative data were collected via journals kept by the children and the instructors, focus group interviews, observation and the work that the children developed. The findings of the study were presented in three research articles.

The aim of the first article was to demonstrate how a design curriculum could be developed with the aim of building critical awareness, promoting agency and empowerment and encouraging critical discussions among the participants. The curriculum was developed through a lens of critical pedagogy and around design thinking strategies that encouraged the children to identify and solve problems within their community. Discussions around rights, bias and change, problems and utopian ideals were used each week to lead to the development of designs. The
findings demonstrated how the pedagogical features of the design class, and the content of the design challenges could be used to encourage critical awareness and support a student-centered approach to primary education that promotes critical consciousness.

The second article examined how children practiced empathy during the class and in the development of the design solutions. The findings revealed that the children practiced empathy in several stages in the design process such as in defining the design problem, in doing research with target stakeholders and in developing appropriate solutions. The findings also demonstrated that the collaborative nature of the design studio and pedagogical style of the design class, where children work very closely with their colleagues also meant that children could practice empathy in group collaborations and during the critique as they listened to the presentations of their colleagues and gave feedback on the projects.

In the third paper, the aim was to share with other educators how critical thinking skills could be built during the design class. The children who participated in the study used their critical thinking skills throughout the design process as they did research on their stakeholders, as they framed the design problems, as they presented and defended their designs, and as they analyzed the designs of others and provided feedback. They also demonstrated a comfort with complexity throughout the projects, preferring ill-defined design problems where they had the freedom to discuss and frame the problems, to more tightly defined problems. These results suggest that design-based education can play a role in developing critical thinking skills in an engaging way, even in an under-resourced context at elementary level.

This dissertation contributes to the discussion on the aims of twenty-first century primary education by demonstrating three different ways in which design thinking at primary level can be beneficial in children’s cognitive and social development. It provides concrete examples on how
empathy and critical thinking skills are built through the design activities. The three papers also provide detailed information that other educators can use to develop similar types of classes for students in similar and differing contexts.
Teaching and Learning Design Thinking through a Critical Lens at a Primary School in Rural Trinidad and Tobago

by
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A dissertation submitted to the Graduate Faculty of North Carolina State University in partial fulfillment of the requirements for the degree of Doctor of Philosophy

Design

Raleigh, North Carolina

2018

APPROVED BY:

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Professor Tsai Lu Liu          Dr. Traci Rider            Committee Co-chair            Committee Co-chair

_______________________________  _______________________________
Dr. Tim Wallace                Dr. Tiffany Davis
DEDICATION

I dedicate this work to “Super Azure Cool Dude” whose own interest in making things sparked my interest in using design education to improve the quality of primary education in Trinidad and Tobago. All of this work was done for you.

I also dedicate this work to the children of ‘Akurase Primary School’, who participated in this study, and hope that they will forever have fond memories of our brief design camp.
BIOGRAPHY

I grew up in Trinidad and Tobago in the 1970s and 80s and I am from a Black middle-class family from the suburbs of the capital city, Port of Spain. I studied Industrial Design in Brazil, where my university experience was very political, socially conscious and empowering. In Brazil, I learnt about Paulo Freire from colleagues and professors who did research with an anthropological and ethnographic focus. In Brazil I was also able to understand issues of power and privilege due to race, class and education, I was even aware of my own privilege as an English speaker in a non-English speaking world and learned to use this to my advantage. My time in Curitiba, Brazil also made me confident of the power of design as a tool for social justice.

My practice in Trinidad has focused on training and export development projects with crafts makers in the Caribbean and East Africa. My academic practice as an educator at the University of the West Indies has focused on design curricula for university students and makers in the Caribbean, design students in vulnerable emerging economies, elementary school children, emancipatory research methods and policies to promote design in Trinidad and Tobago.

I am a single parent of a Black boy, and this has sparked my current interest in the elementary curriculum. I am driven by the need to change the current education paradigm in Trinidad and Tobago that serves an elite minority. I hope to contribute to the development of a stimulating elementary curriculum that empowers students and challenges them to identify and solve problems in their own environment. I am also driven to see how the positive attributes of design education can now be applied to the education of Caribbean children.
ACKNOWLEDGMENTS

A PhD dissertation is not written without the support and involvement of a wide community. While it is difficult to individually thank everyone, who supported me during the process, there are a few people who need to be specifically acknowledged for their support.

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I thank all of the participants of the study, the children, the School Principal, and my co-instructor, Andrea, for participating in the study, and sharing their knowledge so freely.

Finally, I am very grateful for the support that I received from my friends and family. Thank you to my son, Azure, for being so flexible over the three years of this research. Thank you to my parents, Kenty and Sonia for always being patient, available and supportive. Thank you to many friends, especially Teshanee, Wiza and LaTonya who I met with regularly to get writing done, and Dan, Xi and Acobe who also helped get me through the process by allowing me to discuss my work with them. Thank you to my wide network of contacts that often checked on me virtually to make sure I was making progress.
TABLE OF CONTENTS

LIST OF TABLES .................................................................................................................. vii
LIST OF FIGURES .............................................................................................................. viii

CHAPTER 1 Introduction ........................................................................................................ 1

CHAPTER 2 Introducing critical pedagogy through design thinking to primary school
students in Trinidad and Tobago ......................................................................................... 3
  Abstract ............................................................................................................................. 3
  Opening Vignette ............................................................................................................... 3
  Vignette 2 .......................................................................................................................... 4
  Introduction ....................................................................................................................... 5
    Aim of the paper ............................................................................................................. 5
    About Trinidad and Tobago ............................................................................................ 5
    Colonial beginnings of local education ........................................................................... 6
    Current education in Trinidad and Tobago ..................................................................... 7
    About Design Thinking .................................................................................................. 7
    About and Importance of critical education .................................................................... 9
    Compatibility of child-centered participatory action research and critical pedagogy .... 12
    Synthesis ....................................................................................................................... 13
    Purpose of the study ..................................................................................................... 15
  Methodology .................................................................................................................... 16
    Participants .................................................................................................................. 16
    Knowledge of design in the Trinidad and Tobago context ........................................... 17
  Curriculum Development .............................................................................................. 18
    Step 1: Planning the design process ............................................................................. 19
    Step 2: Critical Discussion – Rising Action .................................................................. 20
    Step 3: Developing Personas ....................................................................................... 22
  Procedure ....................................................................................................................... 22
  Data Collection .............................................................................................................. 23
  Data Analysis .................................................................................................................. 25
  Findings ............................................................................................................................. 26
    Activism and Agency ..................................................................................................... 27
    Agency or Empowerment ............................................................................................... 28
    Democracy, Participation and Dialog .......................................................................... 29
    Co-creation of Knowledge and the collaborative Learning process ......................... 32
    Problem posing, researching, situatedness ................................................................. 33
  Discussion ....................................................................................................................... 36
  Conclusion ....................................................................................................................... 38
  References ....................................................................................................................... 40

CHAPTER 3 Fostering empathy through Design Thinking among 4th graders in Trinidad &
Tobago ............................................................................................................................... 43
  Abstract .......................................................................................................................... 43
  Introduction ..................................................................................................................... 45
Empathy in professional life .......................................................... 46
Design and empathy ........................................................................ 47
Precedents for curricula developed with a focus on empathy ............ 49
Design education ............................................................................ 50
Methods .......................................................................................... 51
  Aim of the study ........................................................................... 51
  Description of context ................................................................... 51
  Participants .................................................................................... 52
  The design curriculum ................................................................... 53
  Selection of codes for data analysis ................................................ 55
  Data collection and analysis .......................................................... 59
Findings ............................................................................................ 62
  Seeking change .............................................................................. 62
  Concern for others ........................................................................ 63
  Fantasy ........................................................................................... 63
  Perspective-taking and Empathic concern for the user ................... 66
  Managing one’s emotions and those of others ............................... 67
Discussion ......................................................................................... 75
  Limitations of the study ................................................................. 77
Conclusions ....................................................................................... 78
References ......................................................................................... 79

CHAPTER 4 Developing different types of thinking skills in a 4th grade design studio in Trinidad and Tobago ......................................................... 82
  Abstract ......................................................................................... 82
  Introduction .................................................................................... 83
  About thinking .............................................................................. 85
    What is critical thinking? ............................................................... 85
    Inquiry learning ........................................................................... 87
    How to teach critical thinking? ..................................................... 88
  Description of the curriculum and tools ......................................... 90
    Development of critical thinking at each phase .......................... 91
  Discussion ....................................................................................... 111
    How did the design curriculum build thinking skills? ............... 111
  Implications for practice and questions for future research .......... 113
  Assessing thinking ........................................................................ 117
  Study Limitations ........................................................................ 119
  Conclusions .................................................................................. 119
References ......................................................................................... 120

CHAPTER 5 Conclusion ...................................................................... 122
  Significance .................................................................................. 123
  Limitations ................................................................................... 124
  Future research ............................................................................. 125

APPENDICES ..................................................................................... 127
<table>
<thead>
<tr>
<th>Appendix A</th>
<th>IRB Application</th>
<th>Appendix B</th>
<th>Letter to Principal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>Letter to Principal, St. Gregory’s Anglican Primary</td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
LIST OF TABLES

Table 3.1: A comparison of Borba and Davis' factors of empathy ............................................. 58
Table 3.2: Broad headings of empathy related a priori codes...................................................... 58
Table 4.1: The types of thinking skills used in different phases of the design process .......... 113
LIST OF FIGURES

Figure 2.1: The framework for developing the curriculum. The outer ring shows Shor's framework for empowering education, the inner questions are borrowed from Critical Utopian Action Research. The combination of the two lead to a critical and empowering design curriculum. Source Lesley-Ann Noel ................................................. 14

Figure 2.2: On the left, well-known Carnival costume designer, Peter Minshall, works on a headpiece for a Carnival costume. On the right, a bamboo structure, holding deyas for the Hindu festival of light, Divali. Children in Trinidad and Tobago would be familiar with the concept of ‘design’ from cultural festivals such as Carnival and Divali. Sources: Parasvini and Hive Miner ............................................. 18

Figure 2.3: The Week Three 'Design Cycle' created by Miss Michelle, Angela and Thumbelina. Though the students had been making design cycles with 5-6 steps, they were not satisfied that the previous iterations represented all of the necessary steps of the design process. They adapted their previous cycles and worked with this 9 – step cycle in the final week......................................................................................... 20

Figure 2.4: Ten year old King planned to ensure greater access to school in his design. Source: Lesley-Ann Noel ........................................................................................................... 27

Figure 2.5: Sofia, Tia and Tiffany discuss the needs of the person they are designing for to co-create a 'persona'. Source: Lesley-Ann Noel.............................................................. 33

Figure 3.1: Tia created this 'persona' for the first design challenge.................................................. 65

Figure 4.1: Students lead the critical discussions around the topic.................................................. 93

Figure 4.2: This is the design process that one group agrees on in the third week......................... 94

Figure 4.3: Sofia and Tia created this 'persona' to represent a woman in the community who they interviewed for the third assignment................................................................. 98

Figure 4.4: Though the children had difficulty understanding how to use journey maps, Tia was able to use it to find a ‘pain point’ and a design concern. She wrote the question ‘how could I be safe walking at the sidewalk’, referring to her commute home after school................................................................. 99

Figure 4.5: Bumblebee, Herobring and Flash created this mindmap around things that could be improved in the school................................................................. 100

Figure 4.6: Turbo and Sofia were free to respond to the same brainstorming challenge about 'play' in different ways. Turbo preferred to draw, while Sofia preferred to write. Drawing can be a slower (more reflective) activity and therefore Sofia generated more responses in the same amount of time................................................. 102
Figure 4.7: On the left the children collaborated on an image about play during a brainwriting session. On the right, this group adopted more disruptive behaviors and destroyed the work of the people who had collaborated before them. .......... 103

Figure 4.8: Angela worked out the details of her desk in her drawing. .................................................. 106

Figure 4.9: Flash said 'The best part of the week was when I was designing the robot and creating with play clay. .......................................................... 106

Figure 4.10: Tia designed a bin that plays music for her persona, Miss Jolene. Tia effectively responded to Miss Jolene's interest in the environment and her love of music...... 107

Figure 4.1: Bumblebee presents his design to his colleagues ................................................................. 108

Figure 4.12: The children evaluated the arguments of their colleagues, by trying to decide if they would want to buy their colleague's product or not. This feedback is all for the same presentation. Two students stated that they did not think the presentation and argument were clear and therefore the argument was not convincing. .......................................................... 109

Figure 4.13: This student clearly explains why he thinks his friend would want the toy that he designed. He also gives sound reasoning for why he is not interested in his friend's design.......................................................... 110
CHAPTER 1

Introduction

What could be the benefit of introducing design thinking at primary level in rural parts of the Caribbean? The research in this thesis is situated in the fields of design and education. The intent of this dissertation was to explore the benefit of design thinking and design pedagogy to enhance primary education in Trinidad and Tobago in the Caribbean. A design thinking camp was offered to children of Akurase Primary School in South Trinidad, to examine some of the benefits of design thinking in a Caribbean context. A rural school was selected to see how design thinking could be applied in an under-resourced context.

The camp was analyzed in three different ways, driven by different research questions. The three key ideas in this thesis are a) that design education can be a tool for promoting agency and empowerment among children, b) design education can provide opportunities for practicing and developing empathy and c) design education encourages critical thinking. The three papers of this dissertation present the theses and evidence to support them.

The first paper looks at how a design thinking curriculum can be developed through a critical lens. The aim in addressing this question was to see to what extent a design thinking curriculum could be used to promote critical discussions, promote agency and awareness of social issues among children at 4th grade, or around age nine. The curriculum is described in this paper. The first paper therefore also documents how this type of curriculum can be evaluated, by presenting evidence to demonstrate the critical discussions and critical awareness among the children.

The second paper examines how the children exposed to design thinking have the opportunity to develop or practice empathy during the design thinking classes. The article
demonstrates that empathy is a desirable quality and shows evidence of empathy development and practice by the children throughout the workshop.

The focus of the final paper is on the different types of thinking that participants use in a design class. Research for this paper began explicitly with ‘critical thinking' but expanded to different types of thinking styles that the children-designers used.

The primary target audience for the articles is primary-level educators. The articles may also be of interest to design educators and psychologists. The ‘three article' format was deemed to be the most effective way of disseminating the results of the study to interested and relevant audiences. One challenge of this format is that each article must stand alone since they will be printed in different journals. There is, therefore, some overlap in the papers in the description of the context and the methodology.
CHAPTER 2

Introducing critical pedagogy through design thinking to primary school students in Trinidad and Tobago

Abstract

In this qualitative action research study, children at a primary school in rural Trinidad and Tobago were introduced to design thinking over a three-week camp during the July vacation. The study aimed to create a design curriculum that could build a critical awareness, promote agency and empowerment, and encourage critical discussions among the participants. The curriculum was developed through a lens of critical pedagogy using design thinking strategies that helped the children to identify and solve problems within their community. Discussions around rights, bias and change, issues and utopian ideals were used each week to lead to the development of a design. The data were collected through observation of the children at work, their feedback in journals and weekly focus groups, as well as journal reflections of the instructors. The findings demonstrated how the pedagogical features of the design class, and the content of the design challenges could be used to encourage critical awareness and support an approach to primary education that is student-centered and promotes social consciousness.

Opening Vignette

“...but the newspaper had so much international stories and so few Trinidad stories.”

The children were working in groups on an afternoon, playing with ‘plasticine’ or modeling clay, after a morning of discussing stories in the newspaper. In their analyses of the press, they realized that their village, Akurase in Sewaa region in south-east Trinidad (pseudonyms are used for both the town and the region), was not represented at all. Even their country, Trinidad and Tobago, did not feature significantly in the local newspaper, and the
references focused on the capital, Port of Spain and the area called the East-West corridor that stretched across the northern part of Trinidad. The only reference to Sewaa related to a murder that had taken place in a neighboring community. From the discussions, it was clear that the students themselves knew little about the parts of Trinidad and Tobago covered in the newspapers.

In the discussion, one child, who chose the pseudonym Bumblebee for himself during the study, complained that he couldn't understand how reading the newspapers and seeing if and their community was represented in the news, was relevant to design. His question about relevance led to a discussion on how they would want the media to portray their community and a review of good and bad things about the village. This incident was an example of how the local context was used within the design curriculum to promote critical and relevant discussions that could result in action.

**Vignette 2**

“I wonder where plasticine does come from...” One child, who called himself Herobrine during the study asked out loud while making models for a design concept.

“Plasticine comes from China”, the instructor answered after checking on the box.

“Oh really? .... Does everything come from China? … Do you think we can make plasticine?

“Do you think we could make it so that so we could have plasticine from Trinidad?”

Herobrine asked where plasticine came from several hours after the children’s analysis of the newspapers. The children were working quietly and concentrating on their models when he asked the question. The query seemed to indicate that the children’s curiosity about place, the
origin of products, and what could be made locally were still on their mind hours later. It was possible that the discussion sparked their interrogation of consumption of imported goods.

Introduction

Aim of the paper

The scenarios described above took place during a three-week design thinking workshop for 4th graders at Akurase primary school (all names have been changed) in Trinidad and Tobago. The curriculum for the workshop was developed around the themes of agency and empowerment with the aim of provoking critical conversations and reflections among the participating children from a rural and underserved community in the Caribbean. The focus in design education is often on the development of products and systems; the aim of this study, however, was to explore how design thinking could be used in developing an empowering curriculum for children at primary school in Trinidad and Tobago. This study focused on using design thinking at elementary level in a less than perfect setting in a rural school with little resources, and to use the problem-solving approaches of design thinking to create a sense of agency in the participants. This paper aims to share some of the experiences of the students and findings regarding developing and implementing the curriculum.

About Trinidad and Tobago

Trinidad and Tobago has a society that is dominated by the middle class maintained by a combination of factors. Class and status in Trinidad and Tobago are determined and constructed through a combination of factors that determine privilege such as where one is born, current abode, the ‘brownness' of one's complexion, one's place of employment, the level of education one has attained, and the school one has attended (IGDS, 2015). About eight percent of the
population in Trinidad and Tobago lives in urban centers; despite this the rural community and experience are often invisible in local media and may also be excluded from the dimensions of privilege that define middle class in Trinidad such as being from the right neighborhoods, going to the right schools or speaking with the right accent (Trading Economics n.d.).

**Colonial beginnings of local education**

According to Tuhiwai Smith (1999), colonial schools played a significant role in assimilating people from the colonies. Mass education, in the English-speaking Caribbean region, and specifically in Trinidad and Tobago, which was a British colony from 1797 until 1962, was initially founded with the aim of maintaining the plantation system (Bristol, 2012) and preparing obedient citizens (Bristol, 2012; Bacchus, 2006). Education in Trinidad and Tobago was developed based on colonial models and with colonial aims. This model aimed to prepare people to be workers in sugar and cocoa plantations. Colonialism resulted in a dependent mentality in the population. The stifling of independent critical thinking, creativity, and questioning in colonial schools was intentional and a way to deny the colonized of political agency (Bristol, 2012). Today education in Trinidad and Tobago continues to sustain and maintain colonial ideas and traditions through its teacher-centered pedagogies and unequal distribution of opportunities across social classes. The lack of agency in schools may be correlated to the lack of agency of rural people in Trinidad and Tobago later on as adults, as demonstrated by their lack of involvement in solving community problems (Kirton, Anatol & Braithwaite, 2010). Bristol (2012) advocated that critical and culturally relevant pedagogy is important to help citizens to understand freedom to act and think critically (Bristol, 2012), and to challenge oppressive social and economic systems that are a legacy of the colonial past. A
design-based pedagogy with a focus on identifying problems and acting on solutions was seen as a means of introducing the type of pedagogy advocated for by Bristol.

**Current education in Trinidad and Tobago**

The upper elementary curriculum in Trinidad and Tobago focuses on English Language Arts and Mathematics but includes other subjects such as Agricultural Science, Science, Social Studies, Visual and Performing Arts and Value, Character and Citizenship Education (MOETT, n.d). The Ministry of Education (MOETT, n. d.) advocates for a 'student-centered approach' that promotes 'different levels of thinking'. These subjects are tested at the end of fifth grade in the Secondary Entrance Assessment, which has the aim of preparing children for secondary school. The instructional guides suggest that there is an attempt by the Ministry of Education of Trinidad and Tobago (MOETT) to encourage a student-centered focus, however the focus on testing results in this approach not being widely adopted. The current curriculum introduces ideas of civic duty and an awareness of history through social studies. However, there are few aspects of the MOETT curriculum where students are genuinely asked to interrogate or critique the status quo. Critical education helps students to recognize that they can overcome constraints, leading to their progress and development (Freire, 2003 p. 355). In a place like Trinidad and Tobago with a large rural, poor population, and an education system that was founded on preparing people to be docile plantation workers, a curriculum with a critical focus, as proposed by Freire, could encourage the type of interrogation of ‘tradition’ that is needed to create an agenda for change.

**About Design Thinking**

Design thinking is an analytic and creative process that relies on the human ability to be intuitive, recognize patterns, to construct emotionally and functionally meaningful ideas and to express concepts through means beyond words or symbols (Razzouk and Shute, 2012, IDEO
n.d.). In 1978, the design researcher Lawson conducted a study about design behavior where he analyzed and compared the problem-solving strategies of designers and scientists. He concluded that while scientists used a more systematic way of arranging the blocks, designers (architects in this case) proposed and eliminated multiple solutions until they selected an appropriate one (Cross, 2006). Lawson’s experiments suggested that designers solve problems in different ways to engineers, preferring ‘synthesis’ over ‘analysis’, a skill that they learn throughout their design education since first-year design students do not possess this different way of thinking (Cross, 2006).

The iterative process of generating a large number of solutions, acting on feedback to improve the design, then selecting one, is a central feature of design thinking. Instead of an in-depth analysis of a problem before creating one solution, this iterative process seems to be a central feature of design thinking (Cross, 2006). He attributed this way of problem-solving to the nature of the types of problems that designers address (Cross 2006). The conditions under which designers work, which force them to develop a workable solution within a specific time frame, is also credited as an influencing factor in the way they solve problems. (Cross, 2006).

Cross (2006) identified several aspects of ‘designerly ways of knowing’. He noted that designers are solutions-focused, work with ill-defined problems, and use constructive thinking to translate vague requirements into concrete solutions. Dorner (1999), (as cited in Razzouk and Shute, 2012) observed three types of thinking that take place during the design process. Firstly, an unclear and vague idea is turned into a well-defined product through a process of ‘reflection, dialogue, and self-critique’ (Razzouk and Shute, 2012). A second form of thinking is seen in the sketches and models that are used to clarify the concept and move the vague idea to clarity. A third form of design thinking is seen in the way designers use both images and words, described
by Cross as an ‘object language’, to clarify their ideas (Cross, 2006; Razzouk and Shute, 2012). In an iterative process, designers define problems, experiment with and prototype solutions, engage with potential users to garner feedback and then repeat the process by redesigning based on the feedback they have received or observed (Razzouk and Shute, 2012). Designers also need to be able to deal with flexibility in their practice as the goals and constraints of their projects change, or when selecting and experimenting with different solutions (Razzouk and Shute, 2012).

Design thinking is now moving beyond the discipline of design. It has become popular at business schools, where it is viewed as a useful framework for understanding ill-conceived problems and for promoting innovation (Glen et al., 2015). It has also become more adopted in primary and secondary schools, where it is used to promote new problem-solving abilities and flexible thinking skills, both of which promote student success (Davis et al., 1997). Several educators have experimented with design education at primary and secondary levels with different goals and for different populations. There is little written research on design thinking at primary and secondary level in economically depressed populations, or in populations in developing countries. What could design thinking education for rural Caribbean students in an underserved community look like? The aim of this article is to demonstrate how a design thinking curriculum can be developed through a critical lens and implemented in an underserved community.

**About and Importance of critical education**

Critical Pedagogy is an approach to teaching and learning that focuses on transforming oppressive relations of power and empowering and humanizing learners (Aliakbari & Faraji, 2011). It promotes the idea of a fair society where people have political, economic and cultural
control of their lives, and that these goals can only be attained by emancipating and empowering oppressed people and enabling them to transform their lives (Aliakbari & Faraji, 2011). Education becomes critical when educators, through dialogue, encourage students to acknowledge constraints that impact their lives and recognize that some can be overcome (Freire & Macedo, 2003).

In the 1960s, Brazilian educator, Paulo Freire, developed a method of teaching literacy to adults in rural Northeastern Brazil. The population that Freire was working with had a view of the world that was ‘fatalistic, apathetic and immutable’ (Nyirenda, 1996 p.5). Freire wanted to help change the pessimistic worldview of his stakeholders and aimed to change this view to a ‘critical awareness’, which would allow them to be aware of the problems of the world that they live in and what role they could play in changing these problems (Nyirenda, 1996). Freire’s methods were grounded in this concept, called ‘conscientização’ or conscientization, and dialog (Nyirenda, 1996). Freire posited that a critical understanding of challenges and contexts would lead to critical actions that could elicit change or improvement (Nyirenda, 1996). Through Freire’s method, his illiterate stakeholders could move from a passive position of accepting their ‘lot in life’ to a place where they had a better comprehension of the reality that had limited them.

In most societies, the non-dominant classes do not have the political or economic influence to determine national interests (Freire & Macedo, 2003). Trinidad and Tobago is no different, and this means that the general education curriculum seems to serve the interests of the middle classes and upper classes, rather than all students. The types of themes proposed in essay writing components of the national exam at the end of fifth grade, that addresses experiences that many working-class children would not have had (Chapman & Snyder, 2000); and curriculum content that would have been outside of the expertise of many teachers (Chapman & Snyder,
2000), demonstrate the middle-class focus of the curriculum. Teaching with a critical focus provides an opportunity to interrogate and validate many different types of experiences. Freire and Macedo (2003) describe critical literacy as ‘a language of possibility’ that can allow ‘learners to recognize and understand their voices within a multitude of voices’ (Freire & Macedo, 2003 p. 359). For children from a rural and working-class background in Trinidad and Tobago, a more critical education would create a space to examine, analyze and interrogate the society that they live in that is not addressed in the existing curriculum.

Building on Freire’s work, Shor (1992) developed an agenda for empowering education. Education must be participatory, affective, problem-posing, situated, multi-cultural, dialogic, desocializing, democratic, researching, interdisciplinary and activist (Shor, 1992). Shor proposed a participatory model of education since the rote learning and memorization of traditional classrooms bored students. Passive curriculum, he believed, makes school an undemocratic institution. Like Freire, Shor (1992) proposed teaching situated in the context and cultures of the students to move the pedagogical focus from the teacher to the students. In empowering education, the curriculum should connect critical thought and reflection to daily life. Empowering education encourages students to become thinking citizens, change agents and social critics (Shor, 1992).

Critical pedagogy is often grounded in the student’s own culture and context, a concept described by Banks (2004) as content integration where the teacher uses examples and information from the student’s life experience to explain ideas. Critical pedagogy promotes skills of critical questioning and critical consciousness among people who have been encouraged to accept the status quo (Grant and Sleeter, 2007). Critical pedagogue Paulo Freire posited that a
A heightened critical awareness is essential for oppressed peoples to break traditional structures. Therefore, apart from conventional aims of education to promote critical thinking and impart knowledge, education for traditionally oppressed people, such as people of color, economically depressed and the rural poor, should also help them to identify and challenge traditional power structures, as this will play a role in their growth. The critical educator helps make learning relevant to what students ‘want to know’ and plays the role of helping students to question and critique information that is presented as ‘legitimate knowledge’ (Aronowitz and Giroux, 1993).

Compatibility of child-centered participatory action research and critical pedagogy

For this study, child-centered, participatory, action research methods were used to understand the children’s experience of the critical curriculum. This data collection approach was considered compatible with the transformative agenda of critical pedagogy. Outside of the field of design and design thinking, several researchers have explored qualitative research topics using participatory methods with children. Grant (2017) acknowledged the transformative nature of participatory research with children and young people. Ethnographic child centered research emphasizes children’s agency in constructing their social lives and social change (Morelli, 2017). In a child-centered action research study of street children in Kampala, the authors concluded that participatory nature of visual methods, like drawings and photographic diaries lead to high participation of children involved in research, since these methods make the children central to the research process. The methods also allow children of different ages and abilities to contribute equally to the research process (Young & Barrett, 2001). Morelli (2017) used visual methods
(photography) to support a child-centered view of social transformation in Amazonia and highlighted their experiences and perspectives to form her analysis of change in the region. In another study in Ireland, 26 children from a disadvantaged community, were interviewed to understand their perceptions of self and relationships with peers, using qualitative interviews and thematic analysis (O’Rourke et al, 2017). Van Blerk et al, (2017), encouraged other researchers to develop studies that included the views of young people and allowed them to tell their own stories in their participatory research study with street children in Africa. For street children in Peru, the act of taking photographs and recording their stories created an opportunity for emancipation and agency as the children created mementos of their adolescence (Joanou, 2017). In the same study in Peru, the visual and participatory method, photovoice, created a more balanced relationship between the researcher and the participants, and ‘humanized’ the participant boys who were street children and would normally be viewed as a threat to society (Joanou, 2017). These examples demonstrate some of the ways that participatory, child-centered action research has been used in different contexts. They also demonstrate the emancipatory and transformative nature of participatory, child-centered methods, since these methods give voice and agency to the research participants.

**Synthesis**

The critical education proposed by Giroux, Freire and Shaw, encourages dialogue between students and educators and challenges students to break social conditioning (Freire and Macedo, 2003). This type of education is needed to create change in Trinidad and Tobago and to create an environment where children are encouraged to challenge existing norms. The curriculum for the design thinking workshop for this study was developed under the principles proposed by Shor (1992). Shor (1992) proposed a framework for empowering education that
encouraged students to become thinking citizens, change agents and social critics. He proposed that empowering pedagogy must be participatory, affective, problem-posing, situated, multicultural, dialogic, desocializing, democratic, researching, interdisciplinary and activist.

The specific curriculum for this study was developed through a critical lens, with the aims of provoking critical discussions, helping the students to identify challenges and take action through design. Merely critiquing society and analyzing problems can be depressing, and this is what design (influenced by Industrial Design) brings to this equation. The active element of design thinking where children or participants propose and sometimes make solutions to problems means that the critique of systems does not remain depressing and overwhelming, and the discussion can become empowering for people who may have thought that they could not influence change.

![Framework for Empowering Design Education](image.png)

*Figure 2.1* The framework for developing the curriculum. The outer ring shows Shor's framework for empowering education, the inner questions are borrowed from Critical Utopian Action Research. The combination of the two lead to a critical and empowering design curriculum. Source Lesley-Ann Noel
The pedagogical features of a design thinking class, such as the open-endedness of the design assignments and the critique for feedback, are compatible with Shor’s principles and the aims of equity pedagogy. A design thinking curriculum can also create many opportunities for student empowerment. The design problem creates an appropriate space for the practice of equity pedagogy. The design and design thinking classrooms are student and dialog centered and promote discussions around problems and solutions. The design problems can be drawn from a local context and can be suggested by students and the community. Students can also contextualize the practice of design within their community. In a design thinking curriculum, the main content is actually about understanding and going through the design process, rather than about specific content that the students must learn to recall. This process-based approach, as opposed to a content-based approach, shifts the focus from the teacher to the students. A design curriculum can be delivered in an environment with limited resources since the focus is on thinking and problem-solving. When making is involved, the materials can be adapted to the available resources.

**Purpose of the study**

The purpose of the study was to develop and implement a design-thinking curriculum that was developed through a critical lens.

The main research question for this aspect of the study was:

*How can a design thinking curriculum be developed through a critical lens?*

The curriculum was evaluated by how the critical awareness was manifested in the discussions, behaviors and design solutions of the children who participated in it.
Methodology

The study consisted of developing a design curriculum with a critical emphasis and then using the curriculum during a three-week half-day design workshop at Akurase Primary School during the vacation in July 2017. The study was designed as an exploratory action research case study. A qualitative approach facilitated a deeper understanding of how the children experienced the curriculum and its content, including their process of acquiring the knowledge and their application of the knowledge during the workshop.

Participants

The participants came primarily from the rising 4th-grade class at the Akurase E.C. Primary School in Akurase Village in the Sewaa region. All the children in the class were invited to participate. Eighteen students committed to participating but daily attendance ranged between 12 - 18 students. The age range of the students, 8 - 12 years, was wider than anticipated since some students had been ‘skipped’ a grade level and some students had been held back. The twelve-year-old was not from Akurase E.C. but lived next door to the school and had a friendship with children at the school and the Principal. His parents requested permission for him to participate. All the children were from a low socioeconomic status, which is the norm of the village. The regular class teacher indicated that a wide range of academic ability was represented in the group, including the highest and lowest performing students of the grade. The children had some art instruction in their regular academic experience. The primary investigator was the author, a lecturer, and researcher in Design, and the assistant instructor for the workshop was a primary school teacher with a focus on Special Education. Several adults were indirectly involved in the study. The School Principal, who had a bachelor’s degree in Art, was fully committed to the success of the program. The 4th Grade teachers gave extra lessons to the
children in the morning during the program, and they attended the design class in the afternoons. The parents of the children participated in a pre-workshop session where they shared their interests and concerns.

**Knowledge of design in the Trinidad and Tobago context**

In Trinidad and Tobago, the general public would have an awareness of design linked to the celebration of festivals such as Carnival, which is celebrated throughout both islands in urban and rural communities, with the largest celebrations in Port of Spain. At Carnival, masqueraders, who dance through the streets, wear costumes that were designed for the two-day festival. Soca artistes, who sing the popular music at Carnival, invest in elaborately designed backdrops and props for many of the stage performances. Media commentators frequently use the word ‘design’ during the Carnival festival. Members of the public, regardless of social class or educational background, have strong opinions about the ‘designs’ of costumes as they annually discuss the merits and limitations of the Carnival presentations. Approximately one-third of the population of Trinidad and Tobago (35%) is of Indian heritage. Design also features prominently in the Hindu festival of Divali. Community members design bamboo displays to display the ‘deyas’, or lights, which are a major component of this celebration. The people of Trinidad and Tobago view art and design as part of the same activity. There is often little separation by the general public between the professions of ‘artist’ and ‘designer’. The two words are sometimes used interchangeably with a greater preference for the word ‘artist’.
The children in the study were all familiar with the concept of design. When asked who designers in their communities were, they accurately identified creative professionals such as seamstresses, welders, hairdressers and nail technicians. Their definitions of design were linked to ‘making’ to something to respond to people’s needs and collecting money if people were satisfied.

**Curriculum Development**

An emancipatory and critical curriculum recognizes the legitimacy of multiple discourses and narratives (Freire & Macedo, 2003). The curriculum for this design thinking workshop was created in a way that would encourage the children to participate actively in the production of knowledge. Shor’s (1992) framework for empowering education that encouraged students to become thinking citizens, change agents and social critics, underpinned the curriculum. The specific curriculum was developed through a critical lens, with the aims of provoking critical discussions, helping the students to identify challenges and take action through design.
The three-week curriculum was developed from exercises in critical pedagogy and critical literacy, in particular, ‘Critical Utopian Action Research’. The general objective of the activities was to create a platform for critical discussions, that the students would then reflect on, and use their designs as an opportunity to seek change.

**Step 1: Planning the design process**

Each week, before the start of the design activity, the children agreed on what they thought the design thinking process was. The aim in this activity was to have them think through what a design thinking model could be, instead of learning pre-developed models. This activity shifted the power and act of creation of knowledge to the students. It emphasized their agency, by demonstrating that they could develop the ‘model’ that they would use to follow the exercise. It contrasted with the typical structures in their classes where they waited for the teacher to provide the content for an activity via notes on a blackboard that they then copied in their workbooks. Having students understand that they create knowledge and that knowledge structures or systems did not always have to come from outside of the community or from abroad, was a relevant thread throughout the workshop. This emancipatory method could empower students to believe in the importance of their discourse, not necessarily replicating a dominant discourse (Freire & Macedo, 2003). Each week they looked back at the design process of the week before and decided if and how they needed to change the process to have a smoother workflow.
Figure 2.3 The Week Three 'Design Cycle' created by Miss Michelle, Angela and Thumbelina. Though the students had been making design cycles with 5-6 steps, they were not satisfied that the previous iterations represented all of the necessary steps of the design process. They adapted their previous cycles and worked with this 9–step cycle in the final week.

**Step 2: Critical Discussion – Rising Action**

In literature or script writing, the ‘rising action’ is a series of events that creates tension and suspense and builds to the climax. Each week revolved around a ‘rising action’ that provoked critical discussion that then leads to the climax of action through design.

The focus in the first week was on designing for oneself. The rising action was discussion around rights, which began with the reading of children’s books about the United Nation Convention on The Rights of the Child (UNCRC). This activity was inspired by Howe and Covell (2005) who used the UNCRC to introduce critical discussions into classes with children and to advance an agenda of democratic principles.
In the second week, the design scope grew, and the children were challenged to improve their school through design. The 'rising action' was the discussion about what they disliked about their school, and how would their perfect school be. This activity was inspired by an approach that combines critical analysis with the vision of a sustainable democratic lifestyle and action called Critical Utopian Action Research (CUAR), which was conceptualized by Nielsen and Nielsen Aagaard in 2005. The CUAR framework connects critiques to utopian ideas and action with local stakeholders around critical questions such as what's wrong?, and questions that lead to utopian action such as where would we like to go? and how can our dreams become a reality? (Husted & Tofteng, 2015, Nutti, 2016). This approach was used to guide the discussion for the week in which the children collectively identified problems in their school and brainstormed about possible solutions.

The design scope continued to expand in the third week, where children had to focus on problems in the community. Group analysis and stories in national newspapers provided the base for the rising action for this design challenge. The children noted the absence of their community in the newspapers. There was one story about a neighboring village where a murder had taken place. This discussion provided a base to introduce a discussion about what kind of community the students, and their target users, wanted to live. To better understand the needs of the community, the children developed an interview protocol to use with adults in the area. They interviewed four adults who were at the school on the day, and these included the Principal, the school security guard, and two visitors who were working on a community project in the school.
Step 3: Developing Personas

Following a general critical discussion of the issue of the week, the children developed a persona, to facilitate a more specific discussion and design development around. In drama, a ‘persona’ is a role adopted by an actor. In design, a ‘persona’ is a character who represents many users who share similar traits and preferences (O’ Connor, 2011). In the first week, students created personas of themselves, since they were the target user of their designs. The ‘self’ was selected for the first project since it would have been easy for them to start thinking about their own needs to design a product. The second week, in groups, the students created personas to represent a fictitious character who had a problem at their school. In the final week, the persona was developed around adults who they interviewed at the school. After understanding the concerns of the users, the children brainstormed collectively and individually about concepts, then developed individual solutions. Their solutions were presented to the whole group for feedback at the end of each week. By situating the design assignments around their own needs and within the community, the children, who would normally belong to a ‘subordinated’ group (Freire & Macedo, 2003 p. 357-8), were allowed to demonstrate their knowledge and expertise on a subject, assuming a more active and dominant role than in a traditional classroom. This student-centered teaching style is in keeping with Freire’s approach to pedagogy that utilizes the experience of students and shows respect for their knowledge, culture, and language (Peterson, 2003).

Procedure

The objective of the study was to create and implement a design curriculum developed through a critical lens and to evaluate this curriculum including the feedback from the children and the instructors. The curriculum was developed by adapting exercises in critical literacy and
critical pedagogy for a design class. These exercises focused on creating platforms for critical discussions that would then lead to the development of design solutions. The two instructors delivered the design thinking curriculum. They also observed the children at work and recorded these observations in a journal. The children gave their feedback daily in reflective journals, as well as in weekly focus groups.

**Data Collection**

The data were collected from multiple sources to ensure the validity of the observations and for triangulation.

**Focus groups.** The ‘richest’ data came from focus groups with the children. Weekly focus groups were held with the children to gather their feedback on the sessions. Focus groups and interviews allow the researcher to understand the perspective of the research participants (Patton, 2002). Some benefits of the focus group are that the interactions with other participants can enhance the quality of the data and shared views can be quickly assessed (Patton, 2002). Child-centered research is set apart by its emphasis on children’s concerns and salient issues (Clark, 2011) and child-focused methods emphasize ways to gain access to events and ideas as experienced by the young (Clark, 2011). The focus group gave the children space to clearly articulate their concerns and give their feedback on the class, highlighting children’s agency and power (Clark, 2011).

The children were organized into two groups for the focus groups. One group was composed of younger children, mainly girls, while the other group had older children and mostly boys. The groups had about six people each, though the actual number changed each week due to variations in attendance. The focus group sessions were recorded and transcribed and analyzed using a priori and open coding for significant themes.
**Reflective Journals.** Both the students and the instructors kept reflective journals. At the end of the day, children wrote written reflections on the daily activities of the day. Children were also allowed to draw if they did not want to write. Journal prompts were provided to guide the journaling sessions, and prizes were awarded on some days to reward longer journal entries and to encourage the students to move away from short answers. The journals were analyzed both as text and visual material.

**Observation.** The children were observed at work and while interacting with colleagues. The observation notes were recorded in the instructor journals. Through direct observation, the researcher can better understand the context within which the participants act, which is essential to create a balanced perspective (Patton, 2002). Direct observation also allows the researcher to observe details that may be missed by participants in a study because of their familiarity (Patton, 2002). Finally, through direct observation, the researcher has the opportunity to learn information that participants may be unwilling to share in an interview (Patton, 2002). Personal experience of a setting provides a base of knowledge for researchers to draw on in the analysis phase of the research. Observation is sometimes not considered a child-friendly method since it does not engage the children significantly (Clark, 2011). However, children and their parents were informed that they would be observed, and observation was used as a form of triangulation to confirm the focus group discussions and the journal reflections.

**Design solutions.** After the camp, the design solutions and the students’ final presentations were also analyzed for evidence of the a priori themes, which were derived from the literature.
Data Analysis

The first step in data analysis for this type of qualitative methodology is the development of a coding scheme, which helps to classify and organize the data (Patton, 2002). Coding is a way of reducing large amounts of data into manageable concepts and patterns. In this analysis method, how the researcher analyses the data depends on the lens that he or she uses and the research paradigm that guides his or her outlook (Saldaña, 2016). A priori coding and open or emergent coding were used in this study. In a priori coding, predetermined codes are derived from theory, the research questions of even the codebook of another researcher. Open coding involves using the content of the data to derive themes from the data to describe, name or classify phenomena that are being considered. In this study, the phenomena being addressed are empathy, critical thinking, and critical pedagogy.

The A priori codes were derived from Shor’s ‘Agenda of values for empowering pedagogy’ (Shor, 1992) as follows:

<table>
<thead>
<tr>
<th>Participatory</th>
<th>Affective</th>
<th>Problem-posing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Situated</td>
<td>Multicultural</td>
<td>Dialogic</td>
</tr>
<tr>
<td>Desocializing</td>
<td>Democratic</td>
<td>Researching</td>
</tr>
<tr>
<td>Interdisciplinary</td>
<td>Activist</td>
<td></td>
</tr>
</tbody>
</table>

In the field

Preliminary analysis began during data collection. Daily preliminary data analysis activities included collecting both the journals from the children and the observation notes and reflections from the two instructors. Each evening a rapid initial reading of the data was done to identify a priori and emergent codes. These preliminary codes were noted for inclusion in the
developing coding framework. The weekly data collection activities consisted of a comparison of a priori and emergent open codes and making general reflections on the week of activities. Notes were made comparing the code items from one week to the next to see how the repetition of class activities affected these items. Action items for the following week's session were also identified based on the feedback from the focus group meetings and the journal reflections.

Some of the codes that were added during the open coding process were:

- Student Agency
- Empowerment
- Co-Creation of Knowledge
- Challenges of implementing a critical curriculum

The a priori code of activism was the most frequent code, while the open code of agency was the second most frequent code.

**Findings**

The study examined how a design thinking curriculum could be developed through a critical lens, with the aim of promoting critical discussions and awareness, especially in underprivileged populations. The qualitative data from the focus group discussions, the children’s and instructors’ journals, and the children’s design solutions were analyzed, and the results are presented here.

There were some overlap and connection between several of the codes; it became evident that some codes are dependent on others to exist. The themes of activism, agency, democracy, participation, and dialog are interconnected and were therefore analyzed together. The next major group of interconnected themes related to the co-creation of knowledge and the collaborative learning process. The last group of connected themes related to problem posing, researching and the situatedness of the curriculum.
Activism and Agency

The theme of activism was woven into the themes of all the design challenges since they focused on the rights of the child and improving the school and community. The children referred directly and indirectly to this theme in their journal reflections, in their design solutions, in the focus groups, and in casual conversation. In their journals, the children reflected on the goal of the first design and what right it would give them greater access to. These reflections on rights provided insights into the important things in their lives. The ‘right to play’ was considered the most important right by the children. Five of the children also considered significant the right to school and education. Other rights that featured in their responses were the right to be respected, to safety, to food, to love, and one very quiet child referred to the right to speak. Several of the children’s solutions also focused on environmental activism to address problems such as litter and garbage that they had recognized in the school and the community.

*Figure 2.4* Ten-year-old King planned to ensure greater access to school in his design. Source: Lesley-Ann Noel
A significant benefit of underpinning design challenges with an activist theme is that the students could build on their ideas and discussion. In an active Freirean approach to problem-solving, they could begin to move towards the action of proposing solutions to problems (Peterson, 2003).

**Agency or Empowerment**

In empowering education, learning takes place through negotiation and discussion between the teacher and student (Shor, 1992). Student empowerment does not mean that the student is free to do what he or she wants, but it does invite the student to think and make change (Shor, 1992). Power and agency, as well as lack of power and agency, featured in many discussions of the second and third weeks of the class. The rising actions that most provoked these discussions were the design to improve the school and community. There were many discussions about whether the children had the power to make any change in their school. The children were divided on the extent of their power. Some children felt more empowered than others, and these students claimed that all they needed to do was to meet with the Principal and present a valid argument to create change. A few children said that they were only children and did not think the Principal or other adults would listen to them. However, at the end of the third week, Bumblebee, who said in the second week that adults wouldn’t listen to him since he was a child, talked about how the third project made him feel very powerful when they interviewed the adults to understand the issues in the community. This demonstrates how these design research methods can be used as tools of empowerment. Some children also indicated that the positive feedback that they received from their colleagues on their design proposals was empowering.

Every design challenge was presented as a ‘vague' problem which the students collaborated on refining before exploring solutions. To create a student-centered design class,
students were encouraged to refine the design problem and target market. For some activities, students were allowed to choose if they wanted to express themselves in words or by drawing. As the class progressed and built on their active role in defining design problems and means of expression, the students also became more vocal about what changes they would like to see in the class. This illustrates the theme of agency and empowerment. Students proposed ideas for new content such as a session of painting and drawing for fun instead of having the objective of producing a design. As a result, the schedule of the final week of the camp was modified to accommodate their requests. At the end of the second week, they also suggested additional reflection questions in addition to what the instructor had prepared. Through these added questions, the students shared more information about what they did not like in the traditional school day and the traditional curriculum. Participants also proposed ways in which the camp instructors could manage discipline and noise while recognizing their role in the problem.

Democracy, Participation and Dialog

Participation

“When was this class not participatory?”

One instructor asked the other ‘but when was this class not participatory?', as she reflected at the end of the camp, on whether the children were allowed adequate space to participate throughout the classes. For educational theorist John Dewey, participation is a fundamental tool needed for active learning, and through participation, students go from passive learners who wait for instructions to active learners with democratic habits (Shor, 1992). Participation was woven into the design of the class, and students were encouraged to participate on many levels. The children were encouraged to ask questions throughout the camp, both to the instructors and to their classmates. The opportunity to ask questions gave them an empowered
role, linking back to the theme of Agency. At first the students were not accustomed to asking questions and had to be coached by the instructors to ask their colleagues questions that would help improve their designs. By the third week, the students did not need this coaching anymore.

In reflections at the end of the camp, the lead instructor noted that to save time, she had narrowed the options in the first design challenge and told the children they had to design toys related to the acquisition of rights. The second instructor, Angelica, noted that the options in the first week were too narrow and suggested this might have been the reason that the first challenge had less creative design solutions than the other two. The solutions for the first challenge were all very similar. Angelica noted that the students seemed to be copying their designs from their classmates. In the second and third challenges where the children had to define the problem and solutions on their own or with colleagues, the design proposals were more varied, and better met the needs of the target users. In the second and third challenges, the children discussed their possible solutions in greater detail with their colleagues, illustrating an increase in participation.

The children also participated in the development of the class and activities in the second and third weeks by requesting the right to choose their partners and by indicating their preference for materials such as using modeling clay and painting. In the last two weeks, they were given the opportunity to change the reflection questions at the end of the day. At the weekly focus groups and in their daily reflections, the children presented their feedback on how they felt about the class and what would make the experience better for them. This information was also recorded and coded.

**Democracy**

There were many opportunities for the children to practice democracy throughout the camp. Learning about rights in the first week provided the seed for thinking about justice
throughout the rest of the camp. The theme of democracy returned several times during the three weeks of the camp, both in the content of the discussions of the camp and even in casual conversation. The talk of rights led indirectly to debates about democracy. For example, the children proposed voting to resolve several issues during the camp, such as what changes to make for the following week, e.g., whether to use modeling clay or not, the next week, and whether to try to finish the material earlier by working harder so they could get a free day. One girl, Sofia, asked the group if she could redo a presentation that she thought had been unsuccessful, and her team members voted to determine if she should be allowed to revise it. They voted in favor. The children also suggested possible disciplinary methods and methods to control the noise in the studio. They indicated that the instructors use a whistle to let them know when the studio was too loud.

In comparing the design class to regular school, Bumblebee noted the lack of democracy or the non-participatory nature of the traditional classroom. He remarked, ‘they don’t give us options…. We just have to do it!’. Bumblebee also noted that having to make decisions and not just follow orders was much more difficult. The children agreed that in regular school they could not share their opinions while they felt they could in the design class.

**Dialog**

The teaching and learning process in art and design education is ‘dialogic', which is a feature of the student-focused approaches in design education (Shreeve 2015). The dialogue does not only take place between the tutor and the student but also peer to peer and in small groups (Shreeve 2015). Bumblebee, who was one of the more outspoken students at the camp, noted that in ‘regular school' the children were not given options or choices. They had to do what their
teachers told them. He appreciated being able to have a more open dialog with the instructors 
and peers in the design class.

The layout of the furniture and the organization of the design classes, where students sat 
in small groups, also facilitated peer to peer dialog, while reducing the focus on the instructors. 
The dialogic structure of the class also created an environment where the children felt 
comfortable enough to propose changes to the class. They offered their solutions to problems of 
discipline in the classroom, such as what the instructors should do if the children were talking 
too much. They also suggested how to improve the reflections at the end of the day in the 
reflection journals by suggesting alternative questions that could be used to solicit greater 
insights.

**Co-creation of knowledge and the collaborative learning process**

The design class had a flat hierarchy where the students were allowed to participate as 
experts on their own needs, on problems in the school, and on the issues in their community. 
This flat hierarchy allowed the participants to contribute their knowledge to the problems, and to 
work collaboratively with other children and instructors. In a traditional teacher-centered 
classroom, in what Freire described as the ‘banking model (Aliakbari & Faraji, 2011), the 
children one-way receive information from the teacher. Ten-year-old Tiffany shared her views 
on the traditional classroom, saying, ‘we just have to sit there and wait for the teacher to finish 
writing her notes on the board, and then we copy them down'. In the design class, the hierarchy 
was changed due to the work in small groups, and the student-centered discussions. The children 
had greater freedom to work together and to create knowledge together.

The design classes were comprised of a mix of individual and group activities. These 
activities also laid a foundation for collaborative learning and co-creation of knowledge. The
instructors guided the discussions, but much of the learning took place independently or collaboratively on a student level. There was less instructor intervention than a traditional teacher-centered classroom as the children discussed in groups, worked independently on their designs and gave each other feedback. Though they had some difficulty at the start of the camp, by the end of the first week, the children were working collaboratively and could be seen soliciting and giving each other feedback on their work.

Figure 2.5 Sofia, Tia and Tiffany discuss the needs of the person they are designing for to co-create a 'persona'. Source: Lesley-Ann Noel

**Problem posing, researching, situatedness**

**Problem Posing**

Freire developed the theory of ‘problem-posing' education from the teachings of Dewey and Piaget that advocated for education where students ‘made knowledge' instead of 'memorized facts' (Shor, 1992 p. 31). In problem-posing education, the teacher's role is to lead critical discussions on issues such as democracy and inequality (Shor, 1992). Problem-posing education promotes critical questioning, which is seen in the opening vignette where students question the
origin of the modeling clay and question established trade structures. There were fewer examples of this kind of critical questioning in the first and second weeks of the workshop, and more examples of critical questioning in the third week. This suggests that continued exposure to critical discussions over time may lead to greater critical questioning and analysis. The most critical discussions that demonstrated the children’s reflection on power relations took place in the final week. The assignment in the third week began with the reading of the newspaper, which led to critical discussions about how the community was represented. They had critical talks with adults in their community about problems in the village, and how the community could be improved as they researched the design problem.

**Researching**

Shor advocated that dialogic education involves research (Shor, 1992) to promote student self-development in a meaningful activity. The general themes for the three design assignments were determined before the start of the workshop, but the discussions, the brainstorming and the interviews with the community led to the narrowing of the problems and the development of final solutions. In the design class, the children immersed themselves in the research process. In all of the challenges, they analyzed the problem space and narrowed their focus onto a sole product for a single user. The third challenge, where they developed their questionnaires for the adults that they were going to interview to understand problems within the community, created a meaningful environment for deep learning. This opportunity for research resulted in the development of complex solutions that met the needs of the users. The children learned from each other, from the instructors, and from members of the community through self-directed learning tasks.
**Situatedness**

Freire (1968) and Shor (1992) proposed that critical pedagogy must be situated in issues from the lives of the people in the educational context. A generative theme is a theme of interest to a community of learners that can generate deep discussion. Freire and Shor advocated for the use of generative themes in empowering education. Before the workshop, parents were asked to suggest topics of interest to the community. The children were also encouraged to lead the discussions into directions that interested them.

The design challenges were set around reasonably familiar contexts for the children. The second instructor remarked during a reflective discussion at the end of the camp: ‘Most of the information that they used in the design, would come from their background, … Their designs would have been from their cultural background. Their skillset and their knowledge base, and they would have brought that into their work – do you know what I mean?’ In some situations, in the teacher-centered class, children with ‘greater’ levels (middle class) of exposure can contribute more than students with ‘less’ exposure. A composition question such as ‘a day at the seaside’, is an example of an examination question with a social bias (Chapman & Snyder, 2000). However, the three assignments in this design class were situated in contexts that all children knew, such as themselves, their school and their community, all students were able to participate fully from the start. One child offered insight on why he preferred the second and third assignments, saying that he knew his school better than his rights, and this made the second activity easier than the first.
Discussion

This research investigated how a design thinking curriculum could be delivered and evaluated through a lens of critical pedagogy. Shor’s framework from empowering education was used to develop the class curriculum. Critical discussions were then introduced before each assignment. The findings showed that the content of the design assignments resulted in a critical discussion around the themes of rights, change, and power. The context also fostered critical questions outside of the targeted talks, such as the questions on whether materials could be made in Trinidad instead of imported. The student-centered pedagogical style of the design class also created a space for empowerment and agency as the children influenced the themes of the design challenges, conducted their design research, and gave each other feedback.

By analyzing the verbatim remarks from the students and instructors, and the designs that the students developed, the findings from the study suggest that design thinking education can be delivered through a critical lens that encourages children to be reflective and empowered. This education approach built on the experience and expertise of the children as proposed by Freire (Peterson, 2003), around the subject areas of themselves, their school and their village. The Freirean model of open-ended questions that ‘prod students to critically analyze their social situation and to work towards changing it’ is compatible with the dialogic, open ended nature and student-centered approach of design challenges and design studio pedagogy (Noel & Liu, 2016). Since a Freirean approach also advocates action in addition to thought and words (Peterson, 2003), a design approach for critical pedagogy allows a space for students to move beyond potentially pessimistic reflection on problems to a more positive space where they can develop solutions. Reflection and brainstorming about problems give the children a space to speculate about different futures or alternative scenarios, which ties back to Dunne and Raby’s
(2013) proposal for using design to help envision how things ‘could be’ and developing new responses to ‘wicked problems’. Thinking about and acting on ideas for the future through design also creates responses to situations that might sometimes leave stakeholders with a sense of hopelessness and lack of agency.

**Challenges in implementing critical curriculum**

Increased critical awareness should lead to change. This type of transformative agenda, however, can spark fear among parents and educators, as they wonder how ‘angry’ or ‘radicalized’ the children will become after participation in this type of education. This concern was expressed when the research was proposed to the Board of Education responsible for the school. One person asked, ‘But do you want to make the children angry?’ after learning that the curriculum aimed to promote critical consciousness. Peterson, (2003), also noted that many factors impact the implementation of a critical curriculum, such as the involvement of parents and peers, and the political nature of the school and community. He dealt with these challenges by confronting power relations within the classroom. Throughout the three weeks of the design class, the discussions did not reach the critical depth that the researcher had hoped they would. It seemed that many more discussions would be needed to promote more questioning of social structures and for deeper analysis of inequality. At times it seemed that the children did not see anything wrong with the way ‘things were' and that they had concluded that ‘things were the way they were in a place like theirs’. One instructor, Angelica, reflected in the final debriefing: ‘The problem is that they have developed their consciousness of what a place like this is ... and that this is okay for this place .... This is not a ‘town' area'. She was referring to the fact that the children correlated rural life with a lower standard of living and therefore had lower expectations. This reflection ties back to Peterson's (2003) remarks on the difficulty of
implementing a critical curriculum. The level of critical and political awareness in the general community will affect the implementation of the curriculum.

Conclusion

Limitations and Future Directions for research

One weakness of the project is that it was only implemented for three weeks with an average of about twelve children per day, with the attendance ranging between 10 and 18 students per day throughout the study. Three weeks was a minimal amount of time. The children needed time to understand the student-centered nature of the design class. The final sessions ran much more smoothly than the initial ones, and the students noted this in their reflections. A more extended study over more weeks such as an entire school term or school year would be a more appropriate period to observe the impact of the design pedagogy on student's critical awareness, confidence, empowerment, and sense of agency. The current focus in Trinidad and Tobago of the primary curriculum on test preparation in Grades 4 and 5, however, make it difficult to gain access to students for more extended periods. The results of smaller studies such as this one can be used in making a case for access to students for a longer period.

The aim of the study was not to achieve generalizability, but to be an introductory study with a specific population that could encourage repeat interventions with other groups. While these results may be relevant to the particular group in Akurase Village in Trinidad, additional studies with similar and different groups will be needed. The group of 4th graders who participated in the study at Akurase E.C. primary school was more heterogeneous than anticipated. The range of students was from age 8 - 12, while the anticipated age of the students in the intervention was 9-10 years old. This variation, however, made it possible to compare the responses of the older and younger children in the group.
Another limitation is that the primary instructor for the design camp was also the primary investigator. The researcher’s epistemological outlook and personal teaching philosophy therefore have affected the research. Other studies where the material is delivered and observed by other educators would be useful.

**Recommendations for other educators**

The primary research question was: *How can a design thinking curriculum be developed through a critical lens?* The curriculum was evaluated by how the critical awareness was manifested in the discussions, behaviors and design solutions of the children who participated in it. One suggestion to other educators, to achieve the aims of the curriculum in promoting critical discussions that lead to critical awareness and foster agency and empowerment, would be to emphasize the dialogic and student-centered style of the design class. Students should be allowed to take the lead in determining the problems on which they want to work. For more significant and more empowered learning, educators should resist the urge to narrowly define the scope of the design problem that the students will tackle. Students can determine the projects that they want to work on through discussion, brainstorming, and feedback. This approach will lead to a more meaningful and empowering educational experience for them. The students' lives and experiences should also significantly influence the themes of the projects, as centering the projects around their lives allows them to participate actively and demonstrate their expertise on the subject that they know about and use this knowledge of the context to develop substantial proposals to problems that they have identified.
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CHAPTER 3

Fostering empathy through Design Thinking among 4th graders in Trinidad & Tobago

Abstract

Empathy is a skill that is developed during childhood. It can be enhanced through practice. Lack of empathy has been linked to the societal problems such as an explosion in bullying at school. Empathy is also a skill that is needed later on in life and can lead to greater success of many professionals such as those in healthcare, customer service, sales and marketing and education (Noel & Liu, 2016). There are few curricula developed with the aim of enhancing empathy skills among children. Empathy is also a fundamental skill required by designers, so they can better understand the lives of the people for whom they design. Therefore, introducing design education at primary school could provide a learning experience that facilitates the development of empathy.

In this study, children from a fourth grade class at a primary school in Trinidad and Tobago participated in a three-week summer camp with a curriculum based on design thinking. One of the aims of the study was to examine how children had the opportunity to develop and practice empathy during the class and in the development of the design solutions. Findings revealed that children had the opportunity to practice empathy in several stages in the design process such as in defining the design problem, in researching with target stakeholders and in developing appropriate solutions. The findings also demonstrated that the collaborative nature of the design studio, where children work very closely with their colleagues also provided opportunities for children to practice empathy. The children practiced empathy in group collaborations and during the critique as they listened to the presentations of their colleagues and gave feedback on the projects. Data were collected via focus group discussions, observations and
journal reflections by the children and the instructors, and the children’s own words provided thick descriptions of their experience during the camp, and their comparison with traditional school. These findings improve our knowledge of the potential benefits of design education in a rural primary school in the Caribbean, demonstrating how design education can be used to enhance the social development of children by providing opportunities for them to practice empathy.
Introduction

Empathy is the detailed awareness and perception of the experience of another person (Levine, 2010). Empathy is a condition that historically was necessary for the biological fitness and reproductive success of the human race (Preston and Wahl, 2002). The condition was required for humans to survive through empathic responses that would ‘fast track’ the acquisition of knowledge to facilitate survival. Distress contagion, or the spread of distress, is an early empathic response among children and infants, where they begin to cry because of the distress of another (Preston and Wahl, 2002). In the modern world, we still require empathy for our success and survival, as our skill in understanding the thoughts, acts, and experiences of others (Howe, 2012).

The explosion of bullying in elementary school is a possible indicator that society has not been successful in promoting empathy among children (Borba, 2017, Levine, 2012). Psychologists have provided much evidence on the importance of developing the skill of empathy among children (Levine, 2012). When asked what children need for their happiness and success, author and psychologist, Michelle Borba declared that they need empathy (Borba, 2017). In a study conducted by Duke and Pennsylvania State Universities it was found that students who were more generous and caring were more likely to finish high school, while it was more probable that students who had characteristics associated with less empathy, such as being bullies, would require government support or would be detained in a juvenile detention facility (Jones et al, 2015). Empathetic children grow into empathetic adults who are likely to perform better in general and be more successful in life.

Beyond its evolutionary origins, empathy is a skill that is improved in children through practice. This form of behavioral development relies on a bond between mothers and their babies
(Preston and Wahl, 2002). The active involvement of fathers is also considered a strong predictor of empathic concern for others among children (Levine, 2010). Parents can nurture empathy in their children by encouraging them to reflect on the consequences of their deeds on both themselves and other people (Levine, 2010). Greater empathy can contribute to children’s success as it can make them more appreciated by colleagues and teachers (Levine, 2010). In later life, it also leads to success as the skill of understanding people becomes more important as we move towards an ‘empathy economy’ (Nussbaum, 2005), where companies that empathize with users will be the most successful, and therefore early grounding in the skill of empathy can lay a solid foundation for a successful life.

**Empathy in professional life**

Empathy is a learned skill that is needed in many professions, and therefore empathetic children are likely to perform better in general and be more successful in life as this skill accompanies them in their professional lives. In the medical profession, health care providers must be able to use cognitive empathy to understand the patient's point of view, as well as affective empathy to relate to their feelings (Chen et al., 2015). Empathy is required of physicians since it affects patient diagnoses and care. Patients will offer more information about their symptoms to empathetic physicians, and emotionally engaged physicians will attend more carefully to patients' needs. Empathy on the part of the physician will also lead to greater patient satisfaction. (Stepien and Baernstein, 2006). While most nursing schools use grade point averages GPA to ascertain who will be accepted into their programs, this data does not accurately predict who will become more empathetic nurses, and quantification of empathizing characteristics might more accurately predict aptness for the career of nursing than GPA (Penprase et al, 2013). Salespeople that are empathetic build and maintain long-term profitable
customer relations since they are better able to understand their customers’ needs (Delpechitre, 2013). In the field of teaching, the application of empathy helps teachers to better understand the worlds of the children whom they teach. (Warren, 2014). In the area of management, empathy can help managers to establish a rapport with their employees and to gauge how new ideas will be accepted. Employees will also perform better for the manager who has shown them care (Somogyi et al 2013). These examples of the need for empathy in career success demonstrate how education with a focus on empathy is beneficial to all students, as the skill of empathy is a key skill for success in the twenty-first century.

**Design and empathy**

Designers rely on empathy to identify problems and develop solutions for target users. Design thinking is a process-based method rooted in the work of Dewey and Montessori (Roth, 2017). Empathy is as an empathy-driven, user-centered approach to solving problems (Elmansy, 2016, Goldman & Kabayadondo, 2017) that can be applied in daily life situations in order to solve everyday problems (Elmansy, 2016) and can lead to new objects, ideas, narratives or systems (Goldman & Kabayadondo, 2017). The phases of the design thinking process are based on curiosity, empathy, exploration of human and environmental needs through research, ideation, prototyping, and testing. During the design research process, designers must understand the needs of target users including key issues and problems that can impact the solutions that the designers will develop. Designers do this in different ways such as by observing and interviewing users to gain a deep understanding of their lives and problems, and then returning to the users for feedback on the solutions that they have developed.

Stanford University is considered the ‘ground zero’ of design thinking. David Kelley founded the Hasso Plattner Institute of Design, also known as the d.school at Stanford University
in 2005 (Kelley & Kelley 2013). Its mission was to teach design thinking as a method for routine innovation to graduate students at Stanford. The focus of the approach is to develop innovations through human-centeredness, and an improved understanding of what is meaningful to people rather than developing innovations based on technology or business ideas (Harris, 2014). Kelley believes that anyone can be a design thinker with some coaching. (Goldman and Kabayadondo, 2017). He stresses the importance of being iterative, building many prototypes and collecting feedback during the design thinking process, noting that people are more willing to provide feedback on a crude prototype than a more sophisticated one (Harris, 2014).

Designers normally solve problems for other people, and not themselves, so they must be able to empathize with these people (Both, 2011) by observing first, then engaging via conversation-like interviewing and eliciting stories from stakeholders, and finally by watching and listening (Both, 2011). The phases of the d.school’s model of design thinking are **Empathize - Define - Ideate - Prototype – Test.** In the ‘Empathize’ phase designers strive to understand the people whom they design for, how they do things and what is meaningful to them (Both, 2011). In the ‘Define’ step of the model, designers aim to bring make the design task clear and to establish the focus of the task (Both, 2011). The designer must define the challenge based on the information that has been collected and develop an actionable problem statement, also called a ‘point of view’, (Both, 2011) that guides the focus on the insights of the user. Designers must identify emerging patterns or ideas that stood out in the conversations with and observations of people (Both, 2011). ‘Ideate’ is the phase in which designers concentrate on generating ideas (Both, 2011), combining their understanding of the problem space with their imagination to create the widest range of solutions (Both2011). The **prototype** phase is where preliminary solutions are iteratively generated to support the development of a final solution. The d.school
model encourages low-resolution prototypes that are cheap and quick and easy to make. The prototype is built to help the ideation process, to start a conversation, to fail quickly and cheaply, to test possibilities and to manage the solution-building process (Both, 2011). In the test mode, designers solicit feedback from users and this provides another opportunity to build empathy (Both, 2011). In the testing phase, designers are encouraged to focus on what they can learn about the user and the problem and not on whether the users like the solution or not (Both, 2011). Testing allows designers to refine prototypes and solutions, learn more about the user, and to refine their points of view. Designers are encouraged to show solutions without explanations, to create experiences and to compare multiple prototypes to reveal unidentified needs.

**Precedents for curricula developed with a focus on empathy**

Though it is not a common curricular focus, there are several examples of curriculum that have been developed with a focus on empathy. In one example, design-thinking coach, Dr. Jennifer Pieratt, offered guidelines on her blog about explicitly teaching empathy. She advocated doing this by focusing on skills of listening, asking questions, analyzing assumptions and using equity lenses in teaching and discussions. In the field she recommended a) teaching children ethnographic research methods for collecting data in the field; b) getting children out into the field; and c) making virtual connections for children for them to conduct interviews. (Pieratt, 2016).

In another example, in Danish schools, students have one hour a week to talk through individual and group problems in a session called *Klassens Tid (Classes’ Hour)*. During this session, they also bake a cake together. This session has been around since the 1870s, but came into law in 1993, and is meant to help students and teachers (Anderson, 2016). Most of the discussion during this hour is concentrated on problems or issues that students introduce for
discussion, but parents can also propose topics for discussion (Sandahl, 2017). The discussions are around feelings and emotions, as well as promoting ways of acting in response to some of the problems that are presented. Team building activities also happen during the Klassen’s Tid such as cooperative or collaborative artwork, baking a cake or games that are developed around sharing feelings e.g. a word game around saying nice things to classmates (Sandahl, 2017).

‘Roots of Empathy’ was created by Mary Gordon to increase levels of empathy and reduce bullying and aggression in the classroom. In this approach, a parent and infant visit the classroom once a month for a year. The students learn to understand the infant’s needs and disposition and accompany his or her development throughout this year. The children also accompany the strengthening of the bond between the parent and the child. The rationale behind this program is that children are exposed daily to violence and aggression in the media, and this must be counteracted in the classroom. As the children experience a growth in empathy, they also experience a decrease in aggression (Gordon & Green, 2004).

Designers use empathy in their professional activities to gain a deep understanding of the people for whom they are designing, to develop meaningful solutions to design problems.

**Design education**

Some of the key abilities of designers are the ability to empathize, visualize, synthesize and to resolve problems (Yee and Jefferies, 2013). Students in design classes practice these skills in design challenges and projects that are guided by the teacher. These students benefit from collaborative problem solving, learning new skills from the teamwork that they must use in the process. In the group work they must focus on a goal, and this focus, created by the design thinking process, helps them to understand and practice the principles of collaboration, teamwork, and empathy (Carroll, Goldman, Britos et al 2010). Design education is problem-
posing student-centered and dialogic (Shreeve, 2015), and it offers many opportunities to make authentic connections with real life and to enhance the skills of empathy and critical thinking. Design pedagogy is constructivist, dialogic and student-centered, and design thinking provides ample opportunities to build social skills such as empathy and cognitive skills such as critical thinking. A design-based pedagogical approach could be explored as an empathy infused alternative to current teaching and learning methods.

Methods

Aim of the study

One of the aims of this study was to understand how empathy was manifested as children participated in a design camp. One goal was to identify and interpret the ways empathy emerged as a theme during the camp. A second goal was to determine the potential indirect benefits of design education at the primary level after guiding children through the design process. A qualitative research design was used to collect and analyze data. Qualitative methods focus on interpretation and meaning and emphasize the study of participants in their natural setting. A qualitative approach facilitated a deeper understanding of how the children practiced empathy during the workshop, incorporating perspectives from the children and the instructors. Thick description of their empathic practice was derived from observation of the students at work, journal reflections of the children and the camp instructors and through weekly focus group discussions with the participants to gather their feedback on the week.

Description of context

The research setting was a small public primary school located in a remote and economically depressed village in southern Trinidad. The school houses kindergarten to fifth
grade students who are aged 5 - 12 years old. The rising fourth grade class was selected for the target intervention since most upper elementary children master language and are proficient communicators, which would facilitate the feedback process. Children at this level can discuss more complex ideas and consider the perspectives of listeners (Finnan, 2009). Fourth Grade is also the period just before the beginning of intense preparation for secondary entrance exams. At this point the focus of the curriculum changes from a more open approach to education with a broader range of subjects to a more focused emphasis on Math and English, drills and rote learning. The studied activity took place during a 3-week day camp over the 2017 July-August vacation.

Participants

The children were recruited from students of the incoming fourth grade class at Akurase Primary School in July 2017. All of the 20 – 25 students of the S class were invited to participate. Parents and children opted-in to the study, as it was an extra-curricular activity during the summer vacation. Most of the children were going into fourth grade, but one student was going to be kept back and would have to repeat third grade. The class size of the group ranged daily from 10 – 18 during the three-week camp. The class size changed since some children left the study after a few days. All of the children did extra lessons in the morning with the class teacher. They then stayed for the camp after lunch. The camp was free, but the extra lessons were not. Two children temporarily dropped out of the study at the start of the second week because their mother did not have money for the extra lessons in the morning. The Principal intervened, and they re-joined the study after a few days, by the end of the second week.
There were two camp instructors. The first was the primary author of this article. I am an Industrial Designer and a lecturer in Design at a local university and did not have experience teaching elementary school level. I also was not from the community. The second instructor was a primary school teacher with a bachelor’s degree in Special Needs education and a master’s degree in Curriculum Development. She did not have any experience in Art or Design as a teacher or a student. She was also a resident of a neighboring community that was about 20 minutes away from the school.

**The design curriculum**

During the camp, the children addressed a different design scope each week. In small groups, the children discussed the design thinking model, and if and how they would modify it. They developed the design process they planned to use each week, by tweaking the process from the week before. In their groups, they gained a better understanding of the problems through discussions and interviews with stakeholders, techniques that often used by designers. Individually they identified what design solution they wanted to develop in response to these problems. They brainstormed about the target person, called a persona, for whom they were designing. They used design tools for ideation such as brainstorming, brainwriting, and user journey maps. They also were given pointers on how to prepare a presentation for their projects. Finally, they were given guidelines on how to evaluate their colleagues’ work and how to help their friends improve their work by asking questions that would deepen the design idea.

The children participated daily in the Design Camp on afternoons from 12 - 3 p.m. During the morning period they attended an extra lessons class in Math and English, that was conducted by the class teachers. The weekly schedule was designed to be as follows:
Monday: Discussion of the problem

Tuesday: Identification of the needs of the persona and development of the general concept

Wednesday: Development of preliminary 2D solutions

Thursday: Development of 3D prototype / Preparation for the presentation and critique.

Friday: Critique and feedback.

In the second and third week, the 3D prototyping was eliminated, and the cycle was shortened by one day, since in the second week the school was unavailable on Friday, while in the third week, the children preferred to do different activities on the final day.

The three design challenges in the developed curriculum were based on examples of lessons that promote critical discussions at elementary level found in the literature. Age-appropriate themes that would engage the students’ interests and lead to critical discussions were selected for each of the three activities of the design thinking workshop: the rights of the child, improving the school and improving the community.

Week 2: The second design activity challenged the children to improve their school using a Critical Utopian Action Research approach, where they had to identify problems within the school and imagine a utopian or ideal solution. Critical Utopian Action Research is an action research framework that is linked to democratic practice and the vision of a sustainable democratic lifestyle (Nutti, 2016). It connects critique to utopian ideas and action through collaborative work between researchers and participants (Husted & Tofteng, 2015). Three main questions are part of this framework: ‘what's wrong?’, ‘where would we like to go' and ‘how can our dreams become a reality’? (Nutti, 2016). During the second week, the children again worked in groups while they were framing the problems. Since the focus was the school, the groups did
‘walkabouts’ as part of the research process, to identify areas that could be improved within the school. Each group co-developed ‘persona' to represent their target user, and would refer to their persona throughout the process, to check if their solutions were relevant. They then developed individual solutions for the problems the persona that the group had created based on their utopian ideals.

Week 3: The final project encouraged them to bring issues of the outside world into the classroom. The project began with an analysis of the local newspapers, where they had to identify positive and negative local stories and the part of the country that was featured in the story. This analysis sparked some critical discussion about the under-representation of their region in the news, which then led to a discussion about the positive aspects of their community that could be highlighted. In the second part of this activity, the participants interviewed people from the community again trying to find out about positive aspects of the community, as well as negative aspects that the interviewees would like to change. Based on these discussions the participants proposed design solutions for challenges that they had identified. As in the second week, the children started the process in groups. They collaborated on the research questions that they would use to interview community stakeholders. In this week, in addition to the feedback that they would typically provide during the critique, with some prompting from the instructors, they also gave each other regular feedback on how to improve their designs, during the design process.

**Selection of codes for data analysis**

For this study, a priori coding was used. A priori codes are predetermined codes and were developed around the theme of empathy from selected literature. Open coding was maintained as an option for the data analysis, but during the coding process, preference was given to a priori
coding. Open coding involves using the content of the data and deriving themes from the data, describing, naming or classifying phenomena that are being observed. On a weekly basis during the study, a priori and emergent codes were reviewed, and general reflections of the week were written. Code themes were compared from one week to the next to see how the repetition of the class affected the items. Empathy, critical thinking, and critical pedagogy were the phenomena that were considered in the full study, however, the phenomenon of empathy is what is relevant to this article.

Evidence of empathy in this study was found in several behaviors such as observing the way the students thought about their target users; as well as in the way they viewed and treated their colleagues in the design studio. Some internal manifestations of a move to greater empathy could be the ways students rethink scenarios and take perspective of other individuals (Wiggins and Mc Tighe, 2005), their receptiveness to new ideas and occurrences throughout the design process (Wiggins and Mc Tighe, 2005), or their move from an ethnocentric worldview to an understanding of broader issues from a different perceptual lens. This type of perceptual change, however, might not be evident over a three-week camp.

The empathy-related a priori codes were derived from the work of Borba (2016) and Davis (1983). Borba (2016) divided the sections of her book on promoting empathy among children into three broad headings. These headings; a) developing empathy, b) practicing empathy and c) living empathy; provide a useful framework to analyze the evidence of empathy in the design class, and therefore became three broad categories for a priori codes. Phase one, developing empathy, requires that children gain emotional literacy, develop a moral identity, learn to perspective take and develop a moral imagination (Borba, 2016). The second phase, practicing empathy, requires that children learn to control their emotions, practice kindness with
others and learn to work with others. In the third phase, living empathy, children learn to act on their empathy by learning to become changemakers and practicing empathetic acts regardless of the consequences, in the form of ‘moral courage’.

Davis (1983) identified four main aspects of empathy, drawing upon previous research, which he used to develop the Interpersonal Reactivity Index (IRI) scale to measure empathy. The four aspects are perspective taking, fantasy, empathic concern, and personal distress. Perspective taking is described as ‘the gateway to empathy’ (Borba, 2016). This skill helps people to predict the behaviors and reactions of others by understanding their perspective and feelings (Davis, 1983). This understanding facilitates human interactions, and therefore better perspective taking ability leads to improved social skills. Fantasy is the ability of people to place themselves into the context of a fictitious character, e.g., from a movie or a book (Borba 2016). Though fantasy scale scores seem unconnected to social functions (Davis, 1983), people with high IRI fantasy scale scores are more verbally intelligent and emotionally reactive (Davis, 1983) and are more attuned to the feelings of others. The third criterion of the IRI scale is empathic concern, which assesses the individual's feelings for the good fortune or misfortune of others (Davis, 1983; Bohorquez, 2017). Individuals with high scores of empathic concern are less lonely, are more shy and anxious, but are not selfish and boastful (Davis, 1983). The final criteria in measuring empathy, on the IRI scale (1983) is personal distress. Individuals with high levels of personal distress are often fearful and vulnerable, more introverted, shy and socially anxious and have low self-esteem (Davis, 1983). Davis's four-factor IRI model was later condensed into a two-factor model with perspective-taking and fantasy being combined into a ‘cognitive empathy factor' and empathic concern and personal distress being combined into a single ‘affective empathy factor'. (Chrysikou & Thompson, 2015).
Table 3.1 A comparison of Borba and Davis’ factors of empathy.

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Borba’s model provides cues on how to build empathy among children, while Davis's model provides information on measuring cognitive and affective empathy. Perspective-taking and empathic concern are vital elements in both models. Fantasy is also evident in both models, as Borba recommends several fantasy-based ways of promoting empathy among children, such as using books and images to teach children to recognize feelings and reading and watching movies to help children learn to take perspective. Based on the work of Borba and Davis, the categories for the a priori codes for this study were:

Table 3.2 Broad headings of empathy related a priori codes

<table>
<thead>
<tr>
<th>Seeking change</th>
<th>Concern for others</th>
<th>Managing emotions</th>
<th>Working with others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developing a moral identity,</td>
<td>Perspective taking,</td>
<td>Developing emotional literacy,</td>
<td>Practicing kindness,</td>
</tr>
<tr>
<td>Developing moral courage,</td>
<td>Fantasy</td>
<td>managing emotions,</td>
<td>collaborating with others</td>
</tr>
<tr>
<td>giving children a voice</td>
<td>Empathic concern for the user</td>
<td>personal distress</td>
<td>empathic concern for colleagues</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Perspective taking</td>
</tr>
</tbody>
</table>
Data collection and analysis

Children's perspectives are becoming more and more prevalent in modern social research and the roles that children play in research have changed in recent decades. Children are increasingly co-researchers rather than research subjects. (Bucknall, 2014). Child-centered research is set apart by its ‘emphasis on children's concerns and salient issues' (Clark, 2011) and child-focused methods emphasize ‘ways to gain access to events and ideas as experienced by the young' (Clark, 2011). Clark (2011) made a strong case for research done with children instead of on children and she purported that qualitative research with children is an opportunity to ‘amplify their voices'. There is a scarcity of research on the child's perspective of school, and the views of children are marginalized in an adult world, even on matters of interest to them (Clark, 2011). This approach offers clearer perspectives on children's opinions on the things that directly affect them, and this is one of its key strengths.

In designing data collection, emphasis was placed on understanding the perspective of the children who participated in the study and on their experience while learning how to problem solve using design-thinking techniques. Using child-centered methods, the researcher attempts to highlight matters of concern for children in the study (Clark, 2011), which requires some modification of traditional methods of data collection. In the research design, the research and data collection methods were selected to ensure that the children would feel comfortable about sharing their perspectives throughout the process.

The children in this study were informed that they were being provided an opportunity to participate in the study and that researcher would collect data through several methods. Parents were given consent – assent forms, which the children had to sign to demonstrate their willingness to be part of the research. At the start of the study, even after forms had been
collected, children were again reminded of their right to opt out of the study at any time, a right which three children exercised during the study. The researcher explained all of the data collection methods and the research aims to the children in great detail. The children were reminded throughout the study that they would not be chastised for what they would say and that the class and the focus group sessions were ‘safe spaces’. The researcher also collected data from adults in the study such as the class teacher, the Principal, and parents, to add more thick description and contextual information to the case. However, in the presentation of the data, care was taken not to present the findings with an ‘adultist’ slant.

The data was collected through four main strategies.

a) **Children’s daily journals.** The children also wrote their reflections on the activities of the day in journals that were given to them at the start of the camp. Daily journal prompts were given in the form of stickers and speech bubbles to help guide the reflections of the students. The children were encouraged to draw when they did not want to write anymore. Since the children were very competitive, competitions were introduced to reward the children who wrote the most in their journals. Other little competitions for treats and group rewards, such as snacks were also introduced to encourage the children to participate more enthusiastically. Sometimes in group discussions at the end of the day, the children proposed additional questions that they wanted the group to address in their journals.

b) **Focus group.** At the end of each week, the children participated in a focus group where they gave feedback on the activities of the week, and they also offered suggestions for the following week. The whole group of students was divided into
two smaller work groups. One group would go into the focus group session, while the other remained in the classroom preparing for the presentation. The focus group session would take 30 - 45 minutes.

c) **Observation and written reflections of the instructors.** Firstly, through observation of the participants at work by the two instructors. These observations were recorded in a journal after a daily debriefing discussion between the two instructors. Observation is at times not considered a child-centered method since it is a less participatory method (Clark, 2011); therefore it was supported with other more child-centered methods.

d) **Analysis of the work** that the children did in the class such as the personas that they developed, and their proposed solutions to the design challenges.

In situ, both the reflections of the children and the observations of the instructors were collected daily. The two instructors discussed what they had noticed during the day in a meeting at the end of the day, before writing their reflections and observations in a journal. These reflections were rapidly examined at the end of the day using the a priori codes and to make note of anything that would impact the following day. The reflections were also analyzed during the weekend, to see if the feedback in the reflections would impact the following week. The focus group sessions and some of the class activities were audio recorded. These recordings were transcribed several weeks after the camp in preparation for coding, which also primarily happened after the camp.
Findings

Seeking change

Moral courage and moral identity play a role in building empathy (Borba, 2016), and children need opportunities to give feedback, listen to others, and to share converging and diverging views (Borba, 2016). The fact that the design classes provided opportunities for them to share feedback was evident to the children. In the focus group, one child stated that the design class was different to a regular day at school because they could share their opinions (Herobrine), while another (Flash) stated that he felt that in a regular class they did not have that freedom. The other children in the focus group all nodded in agreement. The pedagogical nature of the design studio and the flexibility of the design challenges provided many opportunities for students to find their voice. Another forum where the children were given a platform and a voice to promote change was in the development of their solutions and the presentation of their ideas.

The activist nature of the design challenges facilitated the development of empathy (details). The design presentations during the critique gave the children a platform and a voice to promote change, as recommended by Borba (2016). The focus of the design challenges provided opportunities for the children to develop their 'moral identity'. Week one encouraged the children to reflect on their rights and the rights of other children around the world. The discussions around this problem drew them out of their own ‘small’ worlds and made them more aware of life in other places. In week two and week three, they focused on designing for the school and the communities, for either the personas that they had created or individuals whom they had interviewed. This activity would have made them examine the world around them from a point of view other than their own. Borba (2016) warned that narcissistic children focus on their
feelings and needs, but this type of activity encourages empathy, by making the children focus on the needs of others.

Children who help others are also known to become more helpful (Borba, 2016), so the specific design challenges can be empathy building exercises as they focus on helping others through their designs. In this design class, the children were also observed helping each other, which will be developed later in this paper.

**Concern for others**

The theme of empathic concern for the user is a prevalent one in design. To develop this skill, the children needed to take perspective. Fantasy was also an element that was employed to help the children to take perspective. Another element of ‘concern for others’ is the act of making others feel good about themselves and generally practicing kindness. The children practiced kindness in working with each other. Some further examples are given in the section on working together later on in the article. They seemed to try to make each other feel good about themselves after the first few days of the study, where they tried to make each other feel better about their critiques, by complimenting each other on their posters and trying to give supportive feedback on how to get through the critique.

**Fantasy**

In this design camp, perspective-taking and fantasy were interwoven with the theme of empathy for the user. The element of fantasy to build empathy for others featured in several aspects of the design camp. During the first project on their rights as children, picture books on the ‘UN Rights of the Child’ were used to guide small group discussions. Three of the books depicted the rights using vivid artwork in different styles. The children commented on the artwork and made it clear which illustrations they preferred over others. On some pages, the
instructors would read, and on others, the children would read in unison or take turns reading.

The instructors were surprised, however, at the response of the children to one book where photographs of real people were used instead of illustrations. This book provoked a more full range of emotions from the children, than the others, and included emotions such as shock at the conditions of life of some of the characters, surprise at the absence of some of the rights that they had taken for granted, and sympathy for the people whom they felt were mistreated in the book.

Fantasy was again a theme when the children created personas for their design problem. In design and marketing, personas can be used to represent the target user of a product. In the first week, the children created a ‘persona’ based on themselves or a fantasy version of themselves. In developing these personas, the children shared details about their likes and dislikes. Some children also included the right to which they wanted greater access.
In the second week, as a group, they created a persona for a design problem related to their school. The groups worked together to develop four personas: Desmond, Serena, Jace, and Naruto. The children filled in details of the personas. Desmond was a magician, Jace liked football (soccer), Naruto liked to catch crabs at the beach, and Serena did not share secrets that people tell her. The children discussed their personas in great detail when they were developing them. They referred to the personas by name throughout the week, to check what the needs of the personas were, and this interest in the needs of the personas was reflected in the final design.

In the third week, the children interviewed real people from the community. The challenge focused on developing designs to improve the community based on the problems that
people spoke about. In their groups, they created interview protocols to interview the adults. After the interviews. They created the personas from the information that they had collected. The personas in Week 3 were Sir, Miss Rhonda, Steve, and Miss Jolene.

**Perspective-taking and empathic concern for the user**

The children's designs reflected a better understanding of the needs of the users as the weeks progressed. In the first week, most of the children seemed unable to focus on designing a toy for someone else, and even though they had developed personas, their solutions were focused on themselves and their own needs, rather than that of the persona. In the second week, since the problem area was their school, they were able to build on their knowledge of their needs as users of the school, to develop solutions that were relevant to the needs of the personas that they had created. Flash described how he designed a fantasy sword to help Desmond pick fruits and vegetables. This understanding of Desmond's needs demonstrates his empathic concern for the user and understanding of the needs of the user. He wrote:

> My name is Flash. The name of my design is the tree picker upper. My super object is used to help Desmond to get fruits and vegetables. Desmond has a whole set of fruit and vegetables in the back of his yard. The side of my product has a sword to pick and slice the mangos and vegeta trees.

His groupmate Bumblebee, also demonstrated similar empathic concern for Desmond, as can be seen in his speech about the design he did for Desmond:

> My design helps my persona Desmond by helping him picking and cutting mangoes. Although Desmond is a magician, he wants a mango picker because he does not perform magic tricks outside of magic shows. My design is not only for Desmond it can be used by anyone. Desmond loves his ‘Cut, Cut Mango’ (name of product) very much because it helps him very
much. Using this design, it saves time. Desmond mango tree is in his backyard. He does not like to go in his backyard so the ‘Cut, Cut Mango allows him to stay at his back door and cut the mangoes and it collects the mango and brings it back for him. The ‘Cut Cut Mango’ also allows Desmond to cut up the mango so he can make anchar, cuchila, and other mango foods. The ‘Cut, Cut Mango’ also squeezes the mango so he can make juice.

Flash understood Desmond's love for mangoes and designed a sword for him. Bumblebee goes a step further and designs a mango picker to help Desmond save time, and even stay inside while the picker is in operation. Both children show empathic concern for Desmond, the target user.

**Managing one’s emotions and those of others**

**Developing emotional literacy**

One phase of developing empathy is developing emotional literacy (Borba, 2016), and being in tune with his or her feelings is what motivates a child to care. Several opportunities were created during the design camp where children were encouraged to express their feelings. The children expressed their feelings during the discussions facilitated by the instructors, during group work with their colleagues during the day, at the end of the day in their journal reflections and at the end of the week during the focus group discussions. Sometimes the children responded to prompt questions such as ‘how did you feel when ….’ in their journals, and sometimes they expressed their feelings without prompting.

During the first project on their rights as children, the children expressed many emotions during this activity as they reflected on the right to play, such as surprise, happiness, and sadness. Throughout the day, and in their journals at the end of the day, they were asked to reflect on the rights about which they had learned. Nine-year-old Andrea wrote in her journal, ‘in my design I
will have greater access to being free and safe.' While Herobrine, wrote that in his design he intended to create greater access to love and care, with a drawing including the words, ‘you are the best. I care for you.’

Quiet Angela, who did not participate verbally in many of the activities, revealed in her journal that she was worried that the teachers did not like her, writing that her design would help her persona be her friend. Angela revealed in that same journal entry that she was worried that the teacher did not like her.

Twelve-year-old BumbleBee said that in his design he would like to work on the right to be respected, and he drew an image that contained the words ‘Welcome! I’m fat, it's ok if you are fat!’. Demonstrating that he would like to create a welcoming space for others. Bumblebee was not an overweight child, so he was thinking of how to improve the quality of life of others whom he had seen being affected in other contexts.

During the design classes, children were required to cope with negative emotions at various phases of the process, such as when they received feedback during critiques, or when faced with the challenges of group work. Self-regulation of strong emotions is a factor in personal development and the development of empathy (Levine, 2012, Borba, 2016), and the discussion led by the children during the focus groups showed that they learned over time to regulate their emotions better. The children were very vocal about how the feedback made them feel during the weekly focus groups sessions. When asked how the feedback made her feel in Week 2, nine-year-old Thumbelina was very specific, and said it made her feel ‘bad, sad, angry, embarrassed and ashamed’. However, her colleague, twelve-year-old Bumblebee, remarked in the focus group that ‘people who are not accustomed to design might feel disappointed when
getting the negative feedback’, demonstrating that he felt exposure to the design class had made them better understand the process of giving and receiving feedback from colleagues.

By the focus group in Week 3, the children seemed to agree that they should use the feedback to improve their work and were grateful when others told them that their work ‘did not look good’ and gave suggestions on how to improve their work. They learned over the three weeks to control their emotions and move beyond the initial anger of receiving negative comments to being able to find the critical points in the negative comment to improve their work. Ten-year-old Logan Kill noted that in the regular (traditional) classroom, other students would laugh at them instead of helping them to improve, showing how pedagogical features of the design class can promote a forum where students can share opinions, make suggestions and collaborate on solutions.

**Personal Distress**

The weekly critique also placed the children in situations where they were confronted with their distress, and the personal distress of others, which led them to demonstrate empathic concern for others. The children shared their fears of presenting their work with their colleagues. One girl, Tiffany, shared with her small group how afraid she was of having to talk in front of everyone. Miss Michelle, another girl, suggested a strategy of pretending that she was in a more comfortable setting like a room in her own home instead of in the classroom. In other fora over the three weeks, other children suggested to their colleagues many strategies on how to feel better during the critique, such as looking at the wall behind the audience instead of directly at the audience. The children empathized with the distress of their colleagues and proposed ways to ameliorate the situation. This was not lost on Logan Kill, who reminded the others that in a
typical classroom they all would have laughed at the person in distress, but he found the design class was a more sympathetic environment to share work with colleagues.

**Working with others**

The children who participated in the study were not accustomed to having to work together so frequently. In the first week, the group with younger girls (Miss Michelle, Superwoman, Lucy Lucy and Tia) fought over everything. The girls turned Miss Michelle into the target and attacked her verbally during the first day of the study. As they worked on a mind map together on the first day, they fought over the color of the markers that each group member used. They fought about where each group member wrote the idea that they wanted to add to the mindmap. They fought about the neatness of the mindmap was and kept reporting on group members to instructors on how and what they were writing on the mindmaps. The instructors tried to reassure the children that the neatness of the mindmap did not matter. In their reflection at the end of the day, the instructors surmised that the conflicts on the first day were related to the influence of the traditional work attitude at school where there is less group work, and where teachers also place a high value on order and rules, and less value on spontaneity. To minimize conflict, Lucy Lucy, aged eleven, one of the older girls in the group, was moved to a different group on the second day.

Over time, the work environment improved as the children learned to collaborate more, and they realized that the instructors placed value on their group collaboration. Lucy Lucy who had been moved to another group, and who had been called a ‘bully’ by other students, worked better over the next few days in her new group. However, she stopped coming to the camp by the end of Week 2. The children had the opportunity to collaborate during many activities at the start of each week such as discussions on the design and research process they would use each week,
during problem framing and brainstorming. They also worked together but less collaboratively while making their prototypes and posters for their presentations. For these latter activities, they shared materials such as modeling clay and markers and colored pencils, even though they worked on individual projects.

After the first two challenging days where students became more accustomed to group work, the students took the initiative to collaborate among themselves, without prompting from the instructors. By Day 4 of Week 1, the children were observed helping each other prepare for the presentation and critique on Day 5. Michelle placed her design on the wall, and Tia asked the other students to pay attention to Michelle's work and to help her check how clear the poster was. Thumbelina gave Michelle and Tia feedback, letting Michelle know that the lettering was not evenly sized. Michelle, who had complained about negative feedback earlier on in the week, accepted the critique that had been given and proceeded to revise her design.

Three boys, Flash, Deadpool, and Herobrine, were also observed helping each other in the model making process. As they made their models of robots, they would check with each other to ask what the others thought of their models.

During the three-week design camp, the participants were forced to learn to regulate their own emotions and cope with negative emotions and the challenge of working with others, key skills needed in practicing empathy (Borba, 2016). Later on, they also had to manage their emotions as they received feedback from their peers on their ideas. Some of the feedback was positive and made them feel good, some feedback was also negative, and the students now had to understand how to ‘sift through’ the negative comments to figure out how to improve their designs. Ten-year-old Naruto was upset with the feedback that he got from his group mate, ten-year-old Tia. Tia defended her feedback saying, ‘I told him it looks nice, but he could have done
it better’. They eventually worked things out. She explained to him that she was only telling the truth.

**Collaborating**

During the design challenges, there was also a mix of group and individual work. The group work was challenging for the young children, and they complained about how difficult it was many times during their focus group sessions, and in their journals. Early in the design process, the children brainstormed collaboratively in an exercise called brainwriting where they worked as a group and passed their drawings to the person on the right who would then have to continue working on the same drawing. This collaborative drawing exercise was an extremely challenging activity for many of the children, and they expressed their frustration at how they felt their classmates had treated their work both in their journals and in the focus group meetings at the end of the week. In one group the children scratched out the drawings of their classmates. In this activity, the children also had to give up ownership of their initial drawings, as the drawings passed from one student to the next and became less and less reflective of their original individual intention, and more reflective of the group collaboration.

Despite the difficulty of the group work, it also took the focus away from the individual and created a ‘co-dependence’ as everybody had a stake in everybody's success. Logan Kill, who made a very insightful comment at the end of the workshop about the benefit of collaboration. "Miss, in the design class nobody can make fun of your work!". He pointed out at the last focus group that doing work in the design class was better than doing work in the traditional class since nobody could make fun of other students. After some probing, he said that it was impossible to make fun of the work that was produced in the design class, since everybody had a stake in it, as everybody had contributed to it. It was, therefore, everybody's work, and not the work of one
individual. He said that he appreciated that and indicated that he preferred the collaborative process.

**Perspective taking and empathic concern for colleagues**

It seemed clear that the children were accustomed to laughing at each other and making fun of each other in the classroom. When the children were choosing their pseudonyms, one child, chose a name that she did not know how to spell. She asked the two children who sat nearest to her, how to spell the name ‘Sofia’. One of the children, Lucy Lucy, started to giggle and shouted out ‘Miss! Look she doesn’t know how to spell Sofia!’. Sofia looked hurt and embarrassed as the other children gasped and giggled. ‘That’s okay’ the instructor responded. ‘So, what should we do if someone doesn't know how to do something?’, the instructor asked the children. Michelle, another student, piped in to respond ‘we should help them! At which point Tia helped Sofia spell her name. When they were encouraged to reflect on how others would feel at being laughed at, and when more positive behaviors were modeled and reinforced the classroom environment changed, and the group dynamics improved. There was an increased collaboration among the children as the week went on.

Flash, one of the boys, was also seen helping Herobrine, prepare his poster. As he was walking back to his seat, he stopped next to Herobrine and asked if he needed help in making the poster more readable so that he could have a better presentation on the following day.

The student who was the instigator, Lucy Lucy, was accustomed to being mean for attention in the traditional school environment. She would often be mean and seek approval from both instructors, with the aim of making the victim look inadequate. However, in the more empathy focused classroom, the ‘victims’ gained power, Lucy Lucy who normally would have been rewarded for the ‘bullying’ attitude by the attention she would have received and the related
scorn that the victim would have gotten from other children. In the empathy focused and collaborative workspace, Lucy Lucy was ignored, and the other children were encouraged to help Sofia. During the week Lucy Lucy’s behavior improved and she worked better with the partners than compared to previous days. She also collaborated with Herobrine to develop a design together with him. The other children became more confident in what they were doing as the week progressed. Lucy Lucy withdrew from the other children as the week progressed and eventually did not return for the second week of the workshop.

**Lack of empathy**

The instructors were concerned about the many examples of lack of empathy that were seen throughout the study, through relentless teasing, laughing at the misfortunes of others and tattling, or reporting on others to instructors to make them get into trouble. Lucy Lucy reported on Emma for having a pen in her mouth while she was thinking. She also reported on Sofia for not knowing how to spell her name. During presentations, King and Deadpool gave hurtful verbal and written feedback on why they would never buy the designs that some of their colleagues had presented. The cruelty in the general classroom environment affected the group dynamics in the early days.

Some of the children also complained about these incidents. In discussing things that he did not like about the week, King complained in the first focus group about how others had called him names and were laughing at him. He had chosen the name ‘King’ for himself, but the other children did not like it. The instructor reminded the children that they have to respect the names that people had and chose for themselves, at which point, Flash, Herobrine, and Deadpool reassured him that it was a good name, though they had not told him that during the week.
Another example of a lack of empathic concern for others was seen in an early collaborative brainstorming activity, where the children would start a drawing and after ten seconds pass the drawing to the person on their right who would continue the drawing. This exchange of drawings would happen about five times, at the end of which the group would have about five drawings or ideas that had been developed collaboratively, and it would have been hard to identify who was the owner of the original idea. Some of the children, e.g., Deadpool and King, felt it was okay to deface the drawings of others when the drawings reached them. The treatment of their work caused considerable angst among their colleagues, who discussed this event at every focus group for the three weeks and in their journals throughout the camp. The children apologized, but the hurt remained. The instructors noticed over the three weeks that the children responded to the modeling of more empathetic behaviors which could also explain why there was more significant evidence of empathy in later weeks.

Discussion

The design class with fourth graders created an environment where empathy could be fostered by the types of activities that participants went through to create user-centered solutions. These guided activities included collaborating with other children, doing research and focusing on the problems of the users, and finally presenting their work and giving and getting feedback on their proposed designs. The four broad themes related to developing empathy that were used as codes in this study were: a) seeking change; b) empathic concern for others, including the user and colleagues; c) managing one’s emotions and developing emotional literacy; and d) working with others (See Table 2). Elements of all four themes were seen in this specific intervention, likely related to the specific content of the design challenges, which had an activist undertone. The activist themes would account to some extent for some of the examples of empathy-building
related to seeking change and activism, which affect some empathy building activities proposed by Borba (2016) such as developing a moral identity, developing moral courage and giving children a voice.

The participants ranged in age from eight to twelve years old. The focus of this activity was to understand how empathy featured in the design class at this age. In this study, the design brief was developed in a way that was conducive to greater empathy since the products focused on social issues such as human rights and promoting change in school and the community. The work attitudes that were fostered in the class also would have played a role in facilitating the practice of empathy since the children had many opportunities for group work, and to give feedback on the work of others. The participants demonstrated their concern for others in both the products they developed and the way they interacted with their colleagues. Throughout the whole process, they had to learn to manage their emotions and to take care of the emotions of others.

One benefit of these types of design classes at primary school is that there are many opportunities to build empathy in children through diverse paths, such as promoting civic engagement in the participants (seeking change), promoting empathic concern for others, providing deep and emotional experiences as well as opportunities for collaboration. The design studio also provides opportunities to model empathic behavior for the students to emulate by encouraging them to take perspective and imagine how their users feel or to imagine how their colleagues feel during a critique. Participants in this study responded positively to the modeling of empathic behavior and became more empathetic with their colleagues over the period. Empathic concern for the user might be an expected outcome in a design challenge given the
focus that the designer must have on the user. Empathic concern for colleagues, however, may be a less anticipated outcome.

These findings suggest that the combination of the design brief and the studio pedagogy create an environment that can facilitate the practice of empathy among children, rather than the isolated act of designing. Therefore, educators wishing to use design projects as a way of promoting empathy must also ensure that they are familiar with and employ design pedagogies such as the collaborative work, group discussion, presentations, and critiques.

It is interesting to note that the examples of lack of empathy and lack of concern for their colleagues, and the teasing, and even the discussions within the focus groups, suggest that at this age, the children already have developed non-empathetic behaviors. Non-empathetic behaviors, such as telling on others, and teasing and putting down others, are often rewarded in the traditional classroom by both teachers and students by the attention that the non-empathetic person receives from the teacher and students. The instructors speculated that one of the students who dropped out of the workshop, who would be considered a bully in a traditional school environment, left because she was not getting the attention that she was used to receiving for the acts mentioned (telling on others and pointing out the weaknesses of others). Fourth grade was selected as the period for the intervention because of the developmental and cognitive phase of development in which the children should have been. However, the evidence of lack of empathy seems to suggest that empathy building activities at school (design-based or not) need to take place at an even younger age. Fourth grade might be late for this type of intervention.

**Limitations of the study**

This study took place within the setting of a school but took place as an extracurricular activity in a more informal environment over a period of three weeks. The shortness of the
workshop was due to the difficulty in gaining access to a class for a more extended period during the academic year. The researchers recognize that three weeks is a short period for this type of study, and therefore these findings should be considered preliminary findings that can be used to suggest a framework for a more extended study. The design studio pedagogical style is a more relaxed style than a traditional teacher-centered classroom. Students who did not want to participate in this study could opt out, and as a result of this, it was not possible to fully engage some of the children in the study since they left before the end. Their feedback and attitudes could have provided significant insights, on why they were less engaged and whether a less engaged student would also have become empathetic over time.

Conclusions

The findings indicate that participating children had the opportunity to practice empathy in several stages in the design process such as in defining the design problem, in researching with target stakeholders and in developing appropriate solutions. However, the children revealed in their own words that they were also able to practice empathy through the act of collaborating with other students, which they would not have typically done in their regular classroom. They empathized with their colleagues who were afraid of making a presentation to the group during the critiques. They learned to find ways of providing gentle feedback on the designs.

This paper presented detailed accounts on the practice of empathy among children who participated in the design camp. In a world where lack of empathy has increased social problems such bullying (Borba, 2017), the authors propose that design education at an early age can create many opportunities for children to develop this much-needed skill.
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CHAPTER 4

Developing different types of thinking skills in a 4th grade design studio in

Trinidad and Tobago

Abstract

Critical thinking relates to the use of cognitive skills or strategies that increase the probability of a desirable outcome such as achieving a specific goal (Butler, 2012). It is the kind of thinking involved in solving problems, drawing conclusions, predicting probability and forming judgments (Halpern, 2007). Critical thinking ability is considered a better predictor of future success than IQ scores (Butler, Pentoney & Bong, 2017). Therefore, developing critical thinking is an essential goal of modern education, and required skill for future success.

Fundamental critical thinking skills of making connections between ideas and themes, presenting and evaluating arguments and systematic problem solving are also vital components of design thinking. In this study, children from a fourth grade class at a rural primary school in Trinidad and Tobago participated in a three-week vacation camp with a curriculum based on design thinking. One of the aims of the study was to examine how children had the opportunity to develop their critical thinking skills during the class and in the development of the design solutions. Findings revealed that the participating children used their critical thinking skills throughout the design process as they researched their stakeholders, as they framed the design problems, presented and defended their designs, and analyzed the designs of others and provided feedback. They also demonstrated comfort with complexity throughout the projects, preferring ill-defined design problems where they had the freedom to discuss and frame the problems, to more tightly defined problems. Higher levels of student engagement are also linked to higher levels of critical thinking (Williams & Lahman, 2011) and therefore the high levels of student
engagement throughout the activities are significant. These results suggest that design-based education can play a role in developing critical thinking skills in an engaging way, even in an under-resourced context at the elementary level. The findings could also have implications for other levels of design education, as it demonstrates how educators can factor in activities that promote higher levels of critical thinking and student engagement into their courses. This paper aims to share the details of the study for other educators to be able to incorporate into their work.

**Introduction**

‘‘Why do we send our children to school?’’ Deanna Kuhn tried to answer this question in ‘Education for Thinking’ by responding that ‘We expect schools to prepare children for life … to produce students who will become confident, eager and self-motivated learners’ (Kuhn, p. 3). Most of us hope that school will lay a solid foundation for children later on in life. This foundation comes from the ways in which we learn to think at school. Many course outlines at elementary, secondary and tertiary level include the ‘development of critical thinking skills’ as one of the key objectives. This suggests that building thinking skills, and in particular critical thinking skills, is valued as a significant aim of modern education.

This paper aims to examine and demonstrate how a design-based curriculum can be used to foster thinking skills and to provide useful recommendations for other educators. The paper clearly outlines the modes of thinking that students used at each stage of a three-week design class, drawing examples from the curriculum, the participants at work, and references to relevant literature. The context of this study was a primary school in a rural village in Trinidad and Tobago. The general academic performance at the school was historically significantly lower than at schools from more urban areas. The participants were mainly from the 4th grade class of the school.
Education is preparation for life (Kuhn, 2005, Strauss, 2015), work and citizenship (Strauss, 2015). Educators need to understand better how education can be made relevant to life, especially to a future life that has not yet been envisioned. One way of developing education that is relevant to an unimagined future is to focus on thinking skills rather than content. Skills such as inquiry, analysis, inference, and argument can be built through regular exposure to problem-solving challenges. These challenges require a context, however, to give students a focus that ensures better problem solving (Kuhn, 2005), and keeps students more engaged in the process, which will also ensure better learning (Kuhn, 2005). A design thinking approach was considered as an engaging and appropriate educational approach to build thinking skills among children in Trinidad and Tobago, given the public interest in and exposure to design through festivals like Carnival and Divali, and the possibility of problem-solving around everyday problems within the community.

Escobar (2018), highlighted differences in the focus of design research from the Global North and Global South. Research issues in the Global North focus on social innovation, transition, and ontology among other areas; while research issues from the Global South seem to focus on issues related to decoloniality, design methods from the South, alternative design practices and autonomous design that is co-developed by people who are not designers. In this light, this paper is situated in research issues of the Global South. The focus of this study is on alternatives uses for design methods that relate to the development of people. In this study, this was achieved by developing a design curriculum to promote cognitive and social development skills of children by building their empathy and critical thinking skills. The design curriculum was developed through a critical lens, with design challenges that were chosen to enhance the critical awareness of the participants.
One of the research questions that drove the study was ‘how can a design-based curriculum be used to foster critical thinking in a rural school in Trinidad and Tobago?’ To answer the research question a three-week design ‘camp’ took place at the selected school. Qualitative data were collected from the children through weekly focus group discussions, their reflections in their journals and observation of the children at work. This paper gives details on the content of the assignments, as well as how several thinking types, including critical thinking, were manifested in the behaviors and responses of the children throughout the camp. The paper ends with recommendations for other educators who might want to use a design-based approach to build thinking skills among children.

About thinking

What is critical thinking?

Information in the early 21st century is spread at an astonishing pace from many different credible and incredible sources (Halpern, 2003). In this century, the development of critical thinking skills is even more important as they will help people to evaluate the validity of the information that they receive (Halpern, 2003 p. 37). Developing critical thinking is an essential goal of modern education, and it is a skill that is being demanded more and more by employers around the world. It is a skill that can be built through practice, and students reap the benefits long after they have left the classroom since critical thinkers make better decisions about life in general, including making important financial, legal, medical and interpersonal decisions.

Critical thinking is the use of cognitive skills or strategies that increase the probability of a desirable outcome such as achieving a specific goal (Butler, 2012, Halpern, 2003). It does not relate to the development of claims, but about analyzing and verifying the claims ((Moore & Parker, 2008). Critical thinking focuses on ‘claims, issues and arguments’ (Moore & Parker,
We present information in claims, ask questions through issues, and when we believe a claim is true, we present an argument (Moore & Parker, 2008). Critical thinkers look for evidence to support claims (Halpern, 2003). It is the kind of thinking involved in solving problems, formulating inferences, calculating likelihoods and making decisions. People develop critical thinking skills through practice, but they must also develop the disposition that makes them open to critical thinking (Halpern, 2003), along with the ability to decide which critical thinking skills to use when (Halpern, 2003).

A wide range of skills makes up the suite of critical thinking skills. Some of the skills that are needed for critical thinking are the ability to a) differentiate claims from evidence, b) identify evidence as a source of knowledge and c) develop the skill of managing theory and evidence. Halpern (2003) separated critical thinking into several types of activities such as reasoning, analyzing arguments, testing hypotheses, making decisions, estimating likelihoods and acknowledging that in real life these tasks cannot be separated. These tasks are separated in critical thinking teaching and learning, but they are not cut into these neat segments in real life.

Faulty thinking strategies get in the way of critical thinking. Some popular faulty thinking strategies include ignoring evidence that we have access to; creating evidence to fit a theory and validating our theories with selective evidence (Kuhn, 87). Some people have a ‘confirmation bias’, which means that they tend only to use information that supports their theories (Halpern, 2003, 178). With a proliferation of incorrect information available, educators have to not only foster critical thinking, but they also have to encourage students to adopt dispositions that are compatible with critical thinking, and to abandon flawed thinking strategies.

There is considerable overlap between critical thinking skills in the areas of problem-solving, decision making and creativity (Halpern, 2003). So, in addition to the skills of critical
thinking, educators interested in building thinking skills, have to understand some key terms, such as vertical and lateral thinking; inquiry, analysis, inference and argument; and metacognition. In solving problems, we use lateral and vertical thinking at different stages of the problem-solving. Lateral thinking uses a creative and innovative approach, while vertical thinking uses more conventional and sequential processes (Bala, 2014). Scientific thinking can be summarized into four phases: inquiry, analysis, inference and argument, and these skills are essential in inquiry learning which is described in more detail in the following section. Metacognition is also a significant critical thinking ability in which people think about thinking. It is related to combinations of information around self, tasks, and strategies for resolution.

**Inquiry learning**

Inquiry learning is learning with the aim of fostering skills of investigation instead of a focus on content. In this way, students can bring their wisdom to their understanding of the material that is presented to them (Kuhn, 2005 p. 79). In inquiry learning students play a dominant role in their education, as they select questions, they want to pursue (Kuhn, 2005). This type of approach is considered sound preparation for the future since the educational objectives are broad and transferable to other aspects of life. Inquiry skills grow through practice (Kuhn, 2005). In inquiry learning, students use a mix of strategies of inquiry, analysis, and inference. Successful inquiry learning depends on students identifying a question and finding answers to the question that give the activity more relevance and significance (Kuhn, 2005). This style of learning is often seen in science education but is also applicable to other subject areas (Kuhn, 2005). An example of an inquiry-based project in science where the student finds his or her question for analysis would be a science fair project where the student selects the project, identifies the question, designs the experiment, collects the data, describes the findings and then
makes logical conclusions. From the teacher’s perspective, this type of instruction is hard, since the guidelines for teaching it are not explicit (Kuhn, 2005).

Kuhn cited a precedent for ‘learning by design inquiry’ by Kolodner and colleagues. This program focused on providing ‘goal-based activities’ for the students where they produced tangible objects. The objects served as a point of engagement for the students; however, students were encouraged to analyze the factors that affected the outcomes of their work. ‘Learning by design’ was found to be a good platform for science instruction. The hands-on experiences kept students motivated and reflective, which helped the students improve their results (Kolodner, 2002).

**How to teach critical thinking?**

As stated before, Halpern (2003) noted the importance of fostering a critical thinking attitude in addition to the critical thinking skills, since it is not enough to have the skills alone. These attitudes include a flexible nature, a willingness to plan, persistence, seeking consensus in groups, an ability to correct oneself, and a mindful attitude (Halpern, 2003). The educator wanting to build critical thinking abilities also has to ensure that the educational environment is conducive to a critical thinking disposition. Some of these attitudes can be nurtured during a design studio class such as planning ability, flexibility, persistence, and self-correction through the iterative nature of design exercises, while the ability to work with others and seek consensus can also be fostered through group work in the studio.

Kuhn (2005) also emphasized the importance of sustained engagement to ensure that young people have maximum cognitive benefit from school. Disengaged students get less benefit from school than engaged students. In contrast to traditional teacher-centered classrooms where students sit in rows and face the teacher, art and design classes allow students to move around
more and encourage different seating arrangements to support group work and discussion. While a few focused students might dominate the classroom discussion in a traditional classroom (Dyer, 2015), the active nature of the exercises in the art and design classes maintains the interest of more students. High engagement of students in Art and Design classes suggests that this could be a valuable means of fostering critical thinking among a more significant number of students.

Critical thinking skills, such as inquiry and argument develop through sustained practice over time (Kuhn, 2005). Art and design problems can provide a framework for improving problem-solving ability (Vande Zande, 2014) and for practicing the skills of inquiry through the research about a design problem, and argument as students defend their decisions. Another benefit of exposure to design problems is that designers develop skills in framing and reframing questions and developing and asking the right questions in developing their solutions (Cross 2011; Dorst 2015); this may be an ability that can be developed in children as well. In inquiry learning, students very often direct their learning by choosing questions that they wish to focus on, such as in the science project in the example above. This approach is compatible with the design studio.

In this study, therefore, the researcher sought to use a design class as a form of ‘inquiry learning’ to foster skills such as critical thinking, inquiry, analysis, argument, and metacognition. The researcher sought to identify the kinds of critical thinking skills that were evident among the behaviors and responses of the children during design activities.
Description of the curriculum and tools

After developing a better understanding of how critical thinking is developed and nurtured, it was felt that the design studio could provide a good environment to develop these skills. A three-week ‘pilot’ design program was created, and it took place over the summer vacation in 2017. All, but two of the participating children were fourth grade students at Akurasi Primary School in Sewaa Village in southern Trinidad. The children were given a different design problem activity for each of the three weeks. The two instructors observed the children at work, and qualitative data were also collected through focus groups, and a thorough analysis of the design solutions that the children proposed, and the presentations that the children made.

The classes followed a similar cycle to a design class at tertiary level or professional practice. The level of complexity was compatible with the age of the children. The scope of the problem grew each week. In the first week, the students designed an object for themselves, the second week for their school, and in the third week, they designed an object to improve their community. In order to develop the practice of improving their inquiry skills, the classes followed a similar cycle each week where they:

1) had a critical discussion about the problem space;
2) agreed on the design process they were going to use
3) identified the design challenge and framed the problem
4) developed a persona for whom they would develop the design and used several design tools for developing concepts.
5) selected a concept
6) created prototypes (first week only)
7) prepared for a presentation, presented their work and got feedback from colleagues.
8) reflected on the activities of each day in their journals.

The activities are described in detail in the following section, along with explanations of how the critical thinking processes are developed in each one.

**Development of critical thinking at each phase**

1. **Critical discussion about the problem space**

The design projects began with an inquiry phase. The inquiry phase includes several steps such as identifying the goals of the activity, locating data, recognizing the relevance of the data, brainstorming and generating multiple solutions. At the end of the inquiry phase the students draw conclusions based on their research, e.g., they select an appropriate solution to a design problem based on research that they have done on the user needs, materials and production processes.

The design challenges in this study began each week with a critical discussion around the weekly theme. This discussion aimed to create a context for the children to ground their work. In the first week, they discussed the rights of children and their rights at home and school. In the second week, they discussed what they disliked about their school to find a design opportunity. While in the third week, they read and analyzed the newspapers, which led to a discussion on how their community could be improved.

Group projects can create a fertile ground for productive discussions, and discussions create a robust environment for social interaction and critical thinking (Hajhosseini, Zandi, Shabanan & Madani, 2015). Brookfield and Preskill argued that discussion in an educational context plays four major roles: (a) to help the students comprehend a subject better, (b) to increase one’s awareness of self, and promote self-critique, (c) to encourage a recognition of
multiple perspectives and (d) to create a stimulus for people to make change (Brookfield & Preskill, 2005; Hajhosseini, Zandi, Shabanan & Madani, 2015).

Wicked problems are ‘unstructured, crosscutting, and relentless’ (Weber, Lach & Steel, 2017 p. 2). These problems are complex social problems, such as poverty, hunger, and health care, and they are often unsolvable. Most problems that are presented to children in a school context are well-defined; however, the problems they encounter in real life are more likely to be ill-defined with vague goals (Halpern, 2003). The assignments focused on rights the children wanted for themselves, and on improving their schools and their community. The topics were selected because they were close enough to the children’s experiences for them to be passionate about them, which would lead to higher levels of interest. The problem spaces of the design challenges introduced the children to the complexity of wicked problems, especially in the third week as they read the newspapers, interviewed community members, and analyzed the problems of the community.

The social interaction of the group discussions allowed the children to share their knowledge of the problems with others, and to gain a better understanding of the perspectives of their colleagues. ‘Thinking is a social activity’ affirmed Kuhn (2005). Outside of academia and in real life, people have to think with each other. Thinking happens most often with other people, despite the image in academia of the lone researcher. Collaborative thinking and reasoning are intellectually superior to individual thinking (Kuhn, 2005) as people develop their ideas more quickly and more deeply in collaborative work than on their own (Kuhn, 2005).

Kuhn highlighted the importance of discussion and authentic conversations in the classroom from an early age to build skills of argument. Regular exposure to these types of deep discussion help students to take part in arguments and assess their support for or against an
assertion (Kuhn, 2005). By the third week, the children were very active participants in co-creating knowledge in the classroom. They were very engaged in the activities and did not merely follow instructions; they asked why they were doing specific activities. For example, the children asked why they were reading the newspapers, and why were they trying to understand how their community was portrayed, not as an act of defiance, but as a manifestation of metacognition where they were thinking about the importance and relevance of the activity. They also questioned the importance of and relevance of the exercise to design, demonstrating ‘metacognition’ and their consciousness of specific elements of the activities.

2. Agreeing on the design process

In the first week, the children discussed what designers do and who they thought were designers in their community. Students were asked to reflect on how designers solve problems. As a group, they then had to create a model for a design process that they could use to solve problems. They then used their design ‘process’ to approach the problem of the week. The

*Figure 4.1 Students lead the critical discussions around the topic.*
following week they would tweak their processes from the week before. This activity encouraged metacognition or thinking about thinking. The children had to think about how designers think about and resolve problems, and they discussed in their small groups which step would come before what. They also had to reflect on how they would solve problems as designers in order to complete their design process in their small groups. Weekly revision of their design processes also made them look back at what they had done to critique their process and see how it could improve. This type of reflection is not a typical component of design activities in design education and practice, but it was explicitly added to stimulate metacognition.

![Diagram of design process]

*Figure 4.2* This is the design process that one group agrees on in the third week.
3. Problem framing

'We have to get ideas ... in school they just give you ideas and then that just make everything easier'. Thumbelina 9 years

The activity of finding and framing problems is also a creative act, so the designer’s first creative step in developing the solution is in finding the problem. Design projects with open-ended outcomes where students are required to frame the design question, identify the design outcome, as well as the steps needed to achieve that goal present a good critical thinking challenge. However, in the first week due to time limits, the children were given a problem that was severely constrained. The children discussed the United Nations Convention on the Rights of the Child, by reading and discussing children’s storybooks on the topic. Then they were told to design a toy that would give them more access to the right that they all agreed on, ‘the right to play’. In the second and third week, more time was allocated to the problem framing activity and the children were allowed more freedom to define the specific problem.

The role of ‘framing the problem’ was new to the children, and the complexity of this activity was not lost on them. One child remarked ‘in school, they just give you ideas and then that just makes everything easier’. He was referring to the well-defined problems that they would normally have to approach in school and the difficulty of deciding on what part of the problem to focus on if it were ill-defined. In the design class, they were given broad problem topics, that they had to narrow to select what their area of focus would be and therefore from where their solution would come.

Paton and Dorst (2011) state that the ability to frame a problem in innovative ways is one of the main features of design thinking. In the design challenge where the problem was framed for the children, the children were less engaged. Engagement levels were much higher in the
weeks where they had the opportunity to frame the problems for themselves and create their own ‘mini-briefs’ for the general design problem through discussions in their small groups. This high engagement when given the opportunity to frame the design question, is consistent with Paton and Dorst’s research on problem framing and briefing where designers indicated that they did not like to work with a narrowly defined brief, where they were ‘technicians’ (Paton & Dorst, 2011 p. 578) and were expected to merely fulfill the requests of the clients. The children in the workshop also demonstrated their lack of interest in a narrowly defined brief, by their lower levels of engagement and solutions that were very similar to those of their colleagues, and were, therefore, less innovative. The preferred role of designers in Paton and Dorst’s research was that of ‘collaborator’ (Paton & Dorst, 2011, p. 579), and they described interactions between client and designers as ‘highly iterative, transparent and playful’. In the second and third weeks, the expectations for the resultant designs were more open-ended. The children in their roles as ‘collaborators’ were more playful in developing their design solutions, and this resulted in a wider range of solutions.

Lateral thinking is used to generate ideas by changing the way a problem or idea is analyzed (Halpern, 2003, Bala, 2014). In the problem-framing process, the children used lateral thinking as they decided which aspects of the problem space they were going to focus on, and how they were going to define the problem that they want to address. According to Halpern (2003), this creative thinking relies on evaluating what is significant in a problem and developing an innovative way of reaching a solution. The choice of what problem to solve is also a creative design, and as important as arriving at a solution (Halpern, 2003).
4. Using popular design tools to understand the user and develop concepts

After the children framed their problems, they used several well-known ‘tools’ to better understand the users and to rapidly develop many design concepts. Most of these design tools require lateral or creative thinking processes that result in innovative solutions. They also require the skills of inquiry and analysis. They worked in groups for most of these activities, thereby using a form of social learning.

*Developing personas.*

Personas are a depiction that summarizes ‘behavior, values and needs’ of the target user for whom a product or service is being designed (van Boeijen, Daalhuizen, Zijlstra, & Van der Schoor, 2016). Personas are used by designers to help define and understand the target users for their design. In the workshop, the children combined their knowledge of the target user through discussion, using a collective and social form of thinking. In the first problem they developed personas of themselves, in the second they created a fictitious character for whom they would design something, and in the third problem, they interviewed people from the community and then developed the persona around the details from the interview. In this way, they used personas differently to the way a design professional would since in the design process the persona would represent an archetypical user. The personas were used to help give the children an external focus for the designs. They would make the target user more concrete.
Sofia and Tia created this 'persona' to represent a woman in the community who they interviewed for the third assignment.

The children used a very deep type of thinking as they analyzed the personas and developed the designs. One child talked about how important it was to ‘dig in deep’ when creating personas so that they could understand the key issues of the target users. The children were heard asking each other ‘What would X persona think about our design?’, showing how they had internalized the process.

Some students demonstrated evidence of metacognition in developing the personas. ‘Bumblebee’ shared the strategies that he would use to discover more about his persona Desmond. He said that if he wanted more information about Desmond, he would try to find out...
more about his daily life by talking to him and ‘digging in’. Bumblebee also shared that he could observe Desmond at work and try to look at the problems he was having. His analysis of strategies that he could use to gain insights on his character demonstrated metacognition.

Creating Journey maps.

The customer journey map is used by designers to gain insights into the customer experience while using a product or service (van Boeijen, Daalhuizen, Zijlstra, & Van der Schoor, 2016). The children used the journey map during the assignment for the first week. They used it to analyze their days. The tool was not used again during the second and third week, because the instructors felt that the activity was too difficult for the children to understand. As difficult as the activity may have been, the children often referred to the journey map exercise in their feedback on the camp, even several weeks after they had completed the exercise.

Figure 4.4 Though the children had difficulty understanding how to use journey maps, Tia was able to use it to find a ‘pain point’ and a design concern. She wrote the question ‘how could I be safe walking at the sidewalk’, referring to her commute home after school.
**Mind mapping.**

The children created mind-maps in small groups near the start of each design challenge to help them consider where they wanted to develop their design solutions. A mind map is used to help organize and connect ideas around a problem (van Boeijen, Daalhuizen, Zijlstra, & Van der Schoor, 2016). In a mind map, the core area of the problem is usually located in the center of the map, while sub-areas are located on branches and sub-branches that extend out from the core area. The children did not understand how to create sub-branches, and though they generated an appropriate quantity of ideas, they did not collaborate in this instance to build on the ideas of others.

*Figure 4.5* Bumblebee, Herobrine and Flash created this mindmap around things that could be improved in the school.
Brainstorming.

“My brain was hurting. It was hard.” Flash, 9yrs.

After the mindmaps, the final activities in the concept development phase involved brainstorming and brainwriting. Brainstorming is a technique that is used to generate a large number of ideas. This activity was set as a competition where in their small groups they competed to see who could come up with the most innovative solution concepts. Though research has suggested that competition and reward can hinder creativity, a few studies have indicated that under the right conditions, creativity can be stimulated by competition, reward and limited choices (Halpern, 2013). This certainly seemed to be the case in this study, where competition and reward, in the form of snacks, seemed to be a positive encouragement for students to work hard on the activity and develop more creative ideas in a short space of time. Students also were highly motivated and engaged during the brainstorming. Whereas in several of the activities, there were elevated noise levels in the classroom as the children worked, during the intense brainstorming they were very quiet and focused. One child complained that he was so tired after the intense brainstorming saying ‘My brain was hurting. It was hard.’

They were given the option to either write or draw to participate in the same activity. This option was appreciated by students, especially those who preferred to draw. Students who drew, however, were at a disadvantage in the competition since they generated ideas at a slower pace than the students who wrote.

The brainstorming also fostered metacognition, as the children gradually understood the significance of generating a large number of ideas in order to arrive at solutions that others had not thought of before. Bumblebee, reflected “Because like we was brainstorming … the first thing come to my mind, I write it down, but everybody else had that same idea….” The children
also found that the competitive element forced them to think more quickly. They complained extensively about the timed activities, but in their journal reflections and the focus groups, they acknowledged how the time element made them work much faster.

*Brainstorming was hard ... we had to think of plenty things, ... when you put out all your brains, you don’t have nothing else.* Michelle aged 8

*Figure 4.6* Turbo and Sofia were free to respond to the same brainstorming challenge about ‘play’ in different ways. Turbo preferred to draw, while Sofia preferred to write. Drawing can be a slower (more reflective) activity and therefore Sofia generated more responses in the same amount of time.

*Brainwriting.*

Brainwriting is a variation of brainstorming where participants build on the ideas of others. They write or draw their ideas on a sheet of paper, and then this paper is passed on to other group members who individually continue to develop the ideas, and then pass the drawing on to the next person after a specific amount of time. The paper is passed on until it reaches back to the original person (van Boeijen, Daalhuizen, Zijlstra, & Van der Schoor, 2016). The children developed very innovative design solutions in this activity. There was, however, so
much conflict in the groups that this activity was not repeated in subsequent weeks. The children were unable to give up ownership of their ideas during this process. They also were not able to suspend their criticism, when doing brainwriting in groups, and this is of crucial importance in this activity. The children were very attached to their original ideas and were very displeased that other people had drawn on them. The children also adopted more disruptive behaviors such as scrawling over the drawings of others, which caused much confusion when the drawings reached back to the original person. In a future iteration of this study, this activity would be introduced after much coaching and team building.

Figure 4.7. On the left the children collaborated on an image about play during a brainwriting session. On the right, this group adopted more disruptive behaviors and destroyed the work of the people who had collaborated before them.

5. Selecting concepts

At the end of the ideation phase, a solution must be selected. Selection is a significant step in the creative process (Halpern, 2003). In a good design process, there should be many alternatives to select from, and the generation of few alternatives is recognized as a typical decision-making failure (Halpern, 2003). Designers and design students use creativity to evaluate
their solutions. Creativity is defined by two aspects of the result - novelty, and quality of the process that led to the result. The selection phase is a point where the remainder of a project is outlined, and additional relevant questions begin to be formed. Students used the skills of analysis and inference when they were selecting concepts. They performed tasks such as recognizing the importance of data and recognizing the relevance and impact of the varied solutions. They also evaluated the technical feasibility of some of their designs, eliminating some designs due to the difficulty of making a prototype or the difficulty in drawing or conceptualizing some of the details.

In this phase, students made comparisons, sought and detected patterns in solutions that they generated. Students practiced their analytical skills in the design challenges by analyzing and comparing various options, e.g., why is concept X better than concept Y? In the inference phase students considered what they knew about a problem and how they knew it, then after discussion and brainstorming, they drew conclusions either based on the research that they had conducted (as in Week 3) or information from their discussions (as in Weeks 1 and 2). They used their knowledge of the problems to eliminate unreasonable solutions. It should be noted that the quality of the solutions would also be limited by the breadth of knowledge and exposure that the children have and the quality of research that they did in the absence of that knowledge. A decision is only as sound as the information on which it is based, and therefore adequate time must be included in the design process for students to understand the problem thoroughly and to do additional research.

In this study, in the first week, the instructors helped the students to select their solutions. By selecting the solutions, the possibility for the practice of critical thinking skills was limited in that week. However, in the second and third week, the students selected their solutions. In the
ideal scenario, the instructor would resist the urge to select the best solution and allow the students to select and justify their selections based on the evidence that they collected. In the justification process, students would also be able to determine if they had enough evidence or information to create a convincing argument. Presentation of their justification to their peers would help them to practice their ability to construct an argument. In the third week, the students discussed their concepts with their colleagues so that they could help them with the selection of a final idea. Guided by the instructors, the children gave each other many ideas on how to improve their concepts, which meant that the concepts in the third week were more well-developed than the previous weeks.

6. Prototyping

“For my creation I spent one third of my time thinking” Cool Dude 9yrs.

After the children decided on one of the designs from their conceptual drawings, they moved to a model-making or prototyping phase. The design process of the children varied. One child, Flash, intently studied his drawing to make his models, while some children made models that were unrelated to their original drawings. During this ‘making’ phase, the children were quiet and concentrated on their work, without their usual chatter with their class friends. In their reflections at the end of the day, Bumblebee described how difficult it was to move from 2D to 3D but how he overcame that difficulty by thinking things through. He wrote:

‘the hardest part of the week was turning 2D design into a 3D design ... I didn’t get frustrated. I just worked through it and tried to just stay calm and work through the design.

Bumblebee aged 12 years

Nine-year-old, Cool Dude, was surprised that he had to think so much to make his prototype out of modeling clay, which was not an unfamiliar material for him. In the prototyping,
the children moved between both creative lateral thinking and more ‘logical’ vertical thinking. They examined their designs more analytically as they tried to understand how to make them work. Then they had to make creative choices when finalizing some of the details.

Figure 4.8 Angela worked out the details of her desk in her drawing.

Modeling clay was a challenging material to use in prototyping. It was hard to manipulate, and as a new material that was perceived to be expensive, it inhibited the way the children used it. Therefore, educators should be mindful of the need to use low risk, low-cost materials that the children will experiment with freely.

Figure 4.9 Flash said ‘The best part of the week was when I was designing the robot and creating with play clay.’
7. Presentation and feedback

The day before the presentations, students prepared a ‘presentation board’ with a drawing of the product and a description of the key elements of the design. They also prepared a ‘sample speech’ for their presentation which they either read or recited, or they used as a guide and improvised. On both the day before and the morning of the presentation, students were seen evaluating their poster designs themselves by putting the posters on the wall and stepping back to test the legibility. They also offered to help each other in this process and gave feedback to their colleagues on the layout of the posters. This activity was done with little instructor input after the task was assigned.

Figure 4.10. Tia designed a bin that plays music for her persona, Miss Jolene. Tia effectively responded to Miss Jolene's interest in the environment and her love of music.
Constructing Arguments

Developing and defending evidence-based arguments is an integral part of education. In their education, students should be provided the opportunity to practice these skills which they will need later on in ‘life, work, and citizenship’ (Strauss, 2015). A presentation is a good place for argumentative discourse in the design studio. This type of discourse opens participants’ minds to other points of view and helps them to develop their ideas (Kuhn, 2005). Designers are often required to develop and present an argument as they defend their designs. The students defended their designs to their colleagues by explaining how the design met the needs of their personas. They practiced their presentations with group members on the day before the final presentations and improved their concepts and arguments based on the feedback they received.

Figure 4.11 Bumblebee presents his design to his colleagues.
Analyzing an argument

While students presented to their colleagues, their colleagues, in turn, had to write down if the presentation convinced them to buy the product. In the second and third week, they also had to say why. In the first week, most of the feedback on whether or not their friend had convinced them to buy their products, was a monosyllabic ‘yes’. The children were encouraged to come up with questions to ask the presenter, so they could understand the design better. In the first week, many of the questions were simple and repeated. By the second and third week, however, the questions became more interesting.

Figure 4.12 The children evaluated the arguments of their colleagues, by trying to decide if they would want to buy their colleague's product or not. This feedback is all for the same presentation. Two students stated that they did not think the presentation and argument were clear and therefore the argument was not convincing.

In evaluating the credibility and effectiveness of the arguments and claims of their colleagues, the students were using the skills that are most directly related to critical thinking. The students’ questions for their colleagues also challenged their colleagues to deepen their
thoughts about their projects. The students’ analysis of the presenters’ arguments was evident in the types of questions that they asked. The competitive nature of the children also made them verify if their colleagues were asked as many questions as they had been asked. Their competitive nature made them ask more questions, and that caused the type of question to deepen. They asked about the price of the product or service, technical details, about its durability, about its availability. The playful and competitive nature of the children made them ask more and more difficult questions to their colleagues, to keep them in the spotlight for a more extended period while lessening the time available for their presentations afterward. This playful act made both the presenters and the evaluators think more critically.

Figure 4.13 This student clearly explains why he thinks his friend would want the toy that he designed. He also gives sound reasoning for why he is not interested in his friend's design.
Discussion

How did the design curriculum build thinking skills?

During the problem framing and initial concept development phase, the students used several different types of thinking. Lateral thinking is used to create ideas, and vertical thinking is used to expand them (Halpern, 2003). The children used lateral thinking as they framed the design problems and tried to find interesting or unusual aspects of the problem to tackle. They used inquiry skills to understand the problem and the user. They used metacognitive skills as they developed their design cycles. They also used metacognitive skills as they reflected on what strategies they should use to have more effective thinking skills and more success in the mini-challenges such as in the brainstorming ‘competitions’. When they moved on to the detailed drawing and prototyping phases, the children used more vertical thinking as they thought logically and analytically about the details of their design concepts. They however still had to make creative decisions such as when choosing one detail over another. In this phase (prototyping and detailed drawing) they also used mainly vertical thinking, with the skills of analysis and inference. In the presentation and feedback phase, they once again used lateral thinking in developing the concept for the presentation, but vertical thinking when preparing the defense of the design. They use critical thinking skills in evaluating the claims of others.

Kuhn (2005), compared the thinking processes of students at a high-performing and underperforming school. She emphasized the importance of giving academic work a focus and offering students a reason to think and argue that would help to keep them engaged, and found that this focus was lacking in the underperforming school. This lack of focus also seemed to be a factor in the regular classroom of the participating children. One child noted in her reflection that on a regular day at school they merely had to wait for the teacher to finish writing on the board,
and then to copy what she had written in their notebooks. The goal-oriented nature of the design activities and concern with improving school and community created a favorable environment for the deep thinking and high levels of engagement that were required to arrive at solutions. The levels of engagement increased each week as the problems became more complex. In the last week, the children were more self-motivated, and they required less coaxing to do their work independently.

During the three-week design camp, the participants were presented with opportunities to improve several thinking skills such as inquiry, analysis, inference, argument, and metacognition. The specific skills were not limited to specific aspects of the design phase, but several skills were used at the same stage of the process, harking back to Halpern’s assertion that part of critical thinking is concerned with knowing which skills to use when. The participants also moved back and forth between vertical and lateral thinking. They used lateral thinking for aspects of the design challenges that were more open-ended and required novel solutions such as problem framing and ideation. They used both lateral and vertical thinking but leaned more heavily to vertical thinking as they developed their research questions for community members, selected alternatives and worked out the details of their designs. They practiced their argument skills as they presented and defended their choices to their groups. They used critical thinking to evaluate the work of their colleagues.
Table 4.1 The types of thinking skills used in different phases of the design process.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Vertical Thinking</th>
<th>Lateral Thinking</th>
<th>Inquiry</th>
<th>Analysis</th>
<th>Inference</th>
<th>Argument</th>
<th>Metacognition</th>
<th>Critical Thinking</th>
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<tr>
<td>1. Critical Discussion</td>
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<td>3. Identification of the Design Challenge / Problem Framing</td>
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<td>4. Using design tools</td>
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<td>Other research around the problem</td>
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<td>5. Selection of concepts</td>
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<td>6. Prototyping</td>
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<td>7a. Presentation</td>
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Implications for practice and questions for future research

During the study, it was possible to isolate which specific skills were developed at each phase of the design activities. This information allows educators to consider the benefit that could be gained by using a design-based problem-solving approach to education. This approach provides a meaningful and focused context for inquiry learning and allows children to take control of their learning by selecting the strategies that they want to use in solving the problem. The iterative approach also allows the students to change strategies to see which one works best for them.

The design exercises can provide a framework for deep thought, and it is possible that frequent exposure to this model can improve thinking processes while maintaining the engagement of the children. A review of the literature was continued after the study to
understand better what was observed. In the following paragraphs, some key issues are presented for the consideration of other educators who are interested in trying this approach. Possible future research questions are also presented after each section.

**Keep optimism in check**

The students used the skills of inquiry, analysis, inference and argument throughout the three weeks. However, it was necessary to see how these skills could be further improved in a future study. Halpern (2005) stated that excessive optimism could prevent the realistic assessment of the pros and cons of a decision. Optimism has been identified as an essential trait of a design thinker, and design thinking is described as ‘inherently optimistic, constructive and experiential’ (Brown & Wyatt, 2010 p.32). The thinking and analysis skills of students in a future study (as well as the designer in practice) could be improved if they solicit the critical feedback of a less optimistic team member, or if they are encouraged to analyze their designs from an opposing stance. Optimism can bias decisions throughout the design process. Therefore, design students should seek ‘disconfirming evidence’ (Halpern, 2003 p. 347) to verify the validity of their arguments at several points along the design process. Halpern also stated the need to develop a defense from the opposing perspective as a way to improve critical thinking, and this is something that design students and professionals can do when presenting their designs for evaluation and justifying some of their selections.

**Manage over-investment in a design**

There is also the risk of design students succumbing to ‘entrapment’ (Halpern, 2003 p. 345), where they become too invested in a design where they have spent too much time or energy. Entrapment can also bias decision making during the design process. If a rapid ideation process is used, as well as a rapid prototyping process, where many solutions are generated,
designers may be less susceptible to this form of entrapment. The children in this study were able to generate many concepts during the brainstorming process fluidly, but after they had selected a design, and moved on to creating more detailed drawings and models, they began to become over-invested. Time constraints during the week also resulted in them developing one model or detailed concept. This study also omitted a testing and feedback phase where users test the products and give feedback.

In a future study faster prototyping, with materials that were perceived to be less expensive, would take them to the feedback stage at a faster rate, so they could get more user feedback on prototypes and build on their failures more quickly. This addition would strengthen many of the thinking skills such as inference, analysis, and evaluation.

**Improve argumentation skills**

Students have to be encouraged to present sound arguments which Halpern defined as meeting three criteria: ‘premises that are acceptable and consistent, relevant to the conclusion and strong’ (Halpern, 2003p. 228). The students need to ensure they are aware of missing components of the problem, even if they chose not to address them in their solutions, and that these missing elements should be made explicit. Argumentative discourse promotes metacognitive skills by encouraging the participants to think about and discuss ‘meta-level’ questions, such ‘how do you know, what makes you say that…’ (Kuhn, 2005 p. 115).

At first, students were uncomfortable opposing ideas of others or giving negative feedback, because they did not want to be unkind to their colleagues. However greater and deeper thinking takes place in an environment that encourages both positive and negative feedback, and argumentation to defend positions. It could be useful, in a future iteration of this study, to have students develop their positions by partnering with colleagues who might have an
opposing position on their designs, or the needs of the users to help them develop their skills of argument.

**Complexity vs simplicity**

It was evident during the study that the more constrained, and therefore more straightforward, the problem area, the less engaged the students were, and the less creative were the generated solutions. The children themselves shared insights that they did not need to use deep thought processes in many of the assignments at school since all of the information was provided for them. Some activities were challenging for the children (e.g., creating journey maps), but in their reflections they discussed strategies to deal with the difficult challenges so that they would not get frustrated, demonstrating metacognition and comfort with difficulty. The vague problem areas were selected to expose the children to the complexity of wicked problems, however, some research suggests that leaving out unnecessary data, and therefore presenting simpler problems to students, could allow the student to focus more on developing solutions (Kuhn, 2005 p. 79). Ill-defined problems were selected so the participants could develop the skills that are needed to refine problems and ‘select and sort’ information.

One future study could compare how children respond to well-defined vs. ill-defined problems. Another future study could compare the effectiveness of critical thinking instruction in design ‘in toto’, meaning activities that use a combination of different thinking strategies vs. design based critical thinking instruction that focuses on discrete thinking skills.

**Create a framework for Decision making**

One instance where designers are faced with decision-making challenges is when they are eliminating design ideas. Decisions are sometimes made by eliminating alternatives until only one or two remain. Crucial design decisions could be optimized by preparing a worksheet in
which alternatives are listed and weighed in a table format. This approach is often used in product development in an engineering or business context but may be less common in a design context. Another way to improve the decision-making process could be to find disproving evidence that will eliminate a design alternative. In this 3-week study, students developed several ideas for each project, but they would have benefited from more time to develop and rapidly test many more ideas. Students should be encouraged to develop many ideas but also to use specific skills in eliminating ideas. A future study could analyze what strategies the participants use in decision making to eliminate the alternatives.

Assessing thinking

In education, only what is assessed is valued, and therefore a framework for assessing thinking in design projects will become necessary. Robert Ennis (1993), the author of several critical thinking tests, provided a framework to assess critical thinking. Ennis’s guide could also provide a framework for critical thinking instruction during the design projects. Students could use it to help prepare their arguments and presentations. Their peers could use it during the critique where they evaluate the success of their colleagues’ arguments using the guide as a rubric for assessment. Instructors could also use it as a guide when developing the design problems for collaboration, as well as a tool for assessing the success of projects. The list of questions below was developed around Ennis’ framework.

1. Can students provide reliable sources for the research that they are doing that will impact the design?
2. Can students use the research they have collected to make design decisions?
3. Have students evaluated all sides of an argument? e.g. when is wood a better choice than metal or plastic a better choice than paper? Is paper as eco-friendly as it is touted to be?
4. After selecting a material or making a design decision can the student defend this decision based on evidence or research?

5. Can the student use clarifying questions to solicit more information for a vague design problem? Can the student use clarifying questions to evaluate another student’s design choices?

6. Can the student effectively plan the production of the prototype as well as evaluate finished prototypes, assessing what could be done better in a future version?

7. Can the student explain context-specific language to a broader audience? Can the student use the language that is relevant to the context?

8. Is the student sufficiently open-minded enough to allow the brainstorming process to take place?

9. Has the student done enough research to support the design decision that he or she has made?

10. Has the student been critical of his or her own design decisions, recognizing limitations? Has the student made the most appropriate design decision taking into consideration factors that impact that selection?

Even though this intervention took place at the elementary level, students could use these questions to guide their design work at any stage and to improve their critical thinking ability.
Study Limitations

This study was conducted over three weeks outside of the regular school year. The children only met for half-day after lunch. In light of this, the context may have been removed from a regular day at school. The primary instructor was a design educator. Differences between the teaching and learning style in the design studio and the regular classroom may make implementation of the curriculum difficult for the non-designer. The non-designer would, therefore, require professional development to understand vital elements of the design studio that facilitate inquiry learning.

Conclusions

The high student engagement in design learning can facilitate the delivery of inquiry learning. Despite the lack of resources in the context of the study, design problems drawn from the lives of the children were used to stimulate deep thinking and engagement that could lead to higher academic benefits for the children. Students at different academic levels were able to participate in the activities, by deciding which strategies could make them more successful, such as the children who preferred to draw than to write. Self-motivation is also a key component of learning, and during the three-week program, the children took more control of their learning, and the instructors needed to give less direct instruction. It can be concluded therefore that a design based curriculum is good at introducing and building thinking skills that children can use throughout their entire lives.
References


designe


CHAPTER 5

Conclusion

The objective of this study was to explore how design education could improve the education paradigm in Trinidad and Tobago, by looking specifically at how it could be used to develop critical consciousness, empathy and critical thinking in the participants. The evidence from the study suggests that these objectives were met. The evidence also pointed to unexpected ways in which these factors were fostered. As they were fostered not only by the content of the class but also in the ways that the students collaborated in the design class.

There were many significant moments in the research. In the third week when the children questioned the origins of modeling clay, it seemed that their critical consciousness was beginning to form. The point where Logan Kill noted that in the design class other children could not laugh at him since they had also contributed to his work offered great insight on how collaborative work could also play a role in empathy. Bumblebee’s realization that he had to move beyond his initial concepts to create ideas that were different from those of other children's was a good example of how the design studio encouraged reflection, metacognition and deep thinking.

An unexpected finding of the study was how interrelated the three core concepts were. Empathy is needed for critical consciousness, as the children needed to be able to think about the social context of others. Critical thinking about a situation could promote more empathy as the children assessed an argument from different perspectives. Metacognition and reflection were required for empathy, critical thinking and building a critical consciousness. In the initial design of the study, three core concepts were considered distinct and discrete skills that needed to be
fostered in children. However, as the study went on, it became clear that the three are interrelated and actually can be developed simultaneously.

**Significance**

This study is significant since it isolated three specific areas that could be developed through a design curriculum at the primary level. Specific evidence was found to support the claims. While the link between design thinking and empathy is not new by carefully examining the instances where the students had the opportunity to be empathetic, the study demonstrated new ways in which empathy is formed in a design studio. The use of a design studio experience to build critical consciousness and critical thinking ability is novel. This study, therefore, adds significantly to the body of research on design education at primary level, going beyond previous research related to using the design studio to support the delivery of other content (Davis, Vande Zande). The research emphasized the importance of features of design studio pedagogy, such as group work iteration and feedback and demonstrated how these could be used to build cognitive and social development ability.

The study is also significant because it gave insights on using design thinking approaches in under-resourced contexts. Limited resources did not impact the delivery of the curriculum since the materials were simple; however, it was noted that the use of the modeling clay for prototyping, seemed to inhibit the creativity of the students because they wanted to use it sparingly. They also were heard talking about conserving other materials such as paint and paper and using them sparingly. Design thinking is often linked to the use of ‘sticky notes’, it must be noted that in some contexts these materials can seem to be expensive in some contexts, and therefore perhaps these need not be viewed as so integral to the design thinking process. The
sticky notes were used in this study, however, in another study in a similar context, they might not be used because of the perception of cost.

**Limitations**

This study was developed specifically for Trinidad and Tobago and had the potential to suffer from impact limitation. Despite this, part of the curriculum was used in a class in Puerto Rico, suggesting that it has broader application possibilities, despite the specific context for which it was designed. The sample size for this exploratory qualitative study was small. The aim was not to produce generalizable results, but rather to get deep insights into the children’s perspective when doing the work. This study would have been more difficult with a larger sample size. Since the school provided the children who participated in the study, the researcher did not have full control over the selection of the participants. The age range of the participants was, therefore, wider than anticipated. In the data collection, written reflections, audio recordings of focus groups and photographs of the children’s work, were used as data points. Video recordings would have also been a useful data point to capture some of the dynamics of the group work, presentations and focus group discussions that were otherwise lost. The study took place over three weeks, and therefore to understand how exposure to design thinking could affect cognitive and social development exposure over a more extended period is needed. Due to the time challenges some vital elements of the design cycle were omitted, such as prototyping in two of the weeks, and user testing and feedback in all of the weeks. Another limitation was that the study did not take place during the academic year since access was much easier to gain during the summer vacation. While the camp had some elements of the school context, attitudes during the summer vacation are different than during the academic year, and therefore this would have also affected the behaviors of the children. Finally, due to scheduling conflicts, and the fact that
the researcher and the participants were in different countries, it was not possible to do a post-study evaluation, to see what the children had retained and how the behaviors continued to manifest themselves.

**Future research**

This exploratory study has provided insights that could later provide the base for future studies. The first topics for future research should address the limitations that affected this study, such as:

- studies for more extended periods of time within the academic year;
- longitudinal studies;
- studies that include all of the elements of the design cycle, including rapid prototyping and user testing and feedback;
- Studies with a more tightly controlled population with less variation in age;
- and studies with larger sample sizes.

The variation in the age of the participants in the study provided an opportunity to observe how younger (age 8), and older (age 12) children responded to the same material, as well as some insight on how the responses differed according to gender. An area for future research would be to focus on how age and gender affect metacognition, and the development of critical thinking, critical consciousness and empathy. Future studies in the area of critical thinking could focus on the development of specific skills such as using mixed methods or quasi-experimental methods to test how children respond to well-defined vs. ill-defined problems; or what strategies children use in decision making during the design process. Future comparative studies between different schools, among different populations from different socioeconomic or ethnic backgrounds, or different classes within the same school would also be useful.
In conclusion, the findings of this exploratory qualitative study indicate that exposure to design education can build cognitive and social development skills, specifically by promoting empathy and critical thinking skills. The curriculum that was developed for the intervention also demonstrates that a critical consciousness can be fostered in the design studio. The insights from the findings add to the existing research on empathy and design and add new knowledge to the areas of critical pedagogy in design, and critical thinking in design.
Appendix A

IRB Application

NORTH CAROLINA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD FOR THE USE OF HUMAN SUBJECTS IN RESEARCH
SUBMISSION FOR NEW STUDIES

Protocol Number 11951

Project Title
Teaching and learning design thinking at a primary school in rural Trinidad and Tobago

IRB File Number:

Original Approval Date:
07/12/2017

Appraisal Period:
07/12/2017 - 07/12/2018

Source of funding (If externally funded, enter PINS or RADAR number of funding proposal via 'Add New Sponsored Project Record' button below):

NCSU Faculty point of contact for this protocol/ NCR only this person has authority to submit the protocol
Liu, Tsai: Graphic and Industrial Design

Does any investigator associated with this project have a significant financial interest in, or other conflict of interest involving, the sponsor of this project? (Answer No if this project is not sponsored)

No

Is this conflict managed with a written management plan, and is the management plan being properly followed?

No

Preliminary Review Determination

Category:
Expedited 7

In lay language, provide a brief synopsis of the study (limit last to 1500 characters)
The purpose of this qualitative case study is to explore how 4th grade students respond to a design-thinking curriculum that has been developed through a culturally relevant lens. The study will take place during a 3-week design camp with 4th grade students at a school in Trinidad and Tobago from July 10 & 28 2016. During this camp, campers will learn about the design process, will identify problems within their community and develop solutions to these problems and present these solutions to their peers, family and members of the community. The main research questions of the study are a) what is the experience of students engaged in design thinking through a culturally relevant lens? And b) what are the student learning outcomes from design thinking through a culturally relevant lens? The primary focus of the study is on the experience of the study but data will also be collected from parents, camp counselors and the class teacher to better understand the experience of the children.

Briefly describe in lay language the purpose of the proposed research and why it is important
The purpose of this study is to explore design thinking methods with children at a primary school as an alternative approach to elementary education in Trinidad and Tobago, and to understand what is their experience of this new methodology, as well as to understand some of the non-academic social and cognitive development outcomes, such as skills like empathy, collaboration and critical thinking, that are derived from this method. The study is important since there have been several calls from teachers and parents to use alternative approaches that are not test-focused and do not use rote learning. This study provides an opportunity to understand how children respond to an alternative mode of instruction.

My research qualifies for Exemption. Exempt research is minimal risk and must fit into the categories b.1 - b.6 found here: http://www.fhs.gov/ohrp/humansubjects/guidance/45cfr46.html

Is this research being conducted by a student?
Yes

Is this research for a thesis?
Yes

Is this research for a dissertation?
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<td>Is this research for a course?</td>
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<td>Do you currently intend to use the data for any purpose beyond the fulfillment of the class assignment?</td>
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If you anticipate additional NCSU-affiliated investigators (other than those listed on the Title tab) may be involved in this research, list them here indicating their name and department.

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<td>Describe funding flow, if any (e.g. subcontractors)</td>
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<td>Dr. Carol Logie</td>
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<td>Administrative Director of The University of the West Indies-Family Development and Children’s Research Centre, Senior Lecturer in the Faculty of Humanities and Education The University of the West Indies, Trinidad and Tobago <a href="mailto:carol.logie@sta.uwi.edu">carol.logie@sta.uwi.edu</a></td>
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<td>Dr. Jennifer Yamin-Ali</td>
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<td>Director, School of Education The University of the West Indies Trinidad &amp; Tobago <a href="mailto:jennifer.yamin-ali@sta.uwi.edu">jennifer.yamin-ali@sta.uwi.edu</a></td>
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<td>Adults age 65 and older?</td>
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<td>Minors (under age 18—be sure to include provision for parental consent and/or child assent)?</td>
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Prisoners (any individual involuntarily confined or detained in a penal institution – can be detained pending arraignment, trial or sentencing)?
No

Pregnant women?
No

Are pregnant women the primary population or focus for this research?
No

Provide rationale for why they are the focus population and describe the risks associated with their involvement as participants.

Fetuses?
No

Students?
Yes

Does the research involve normal educational practices?
Yes

Is the research being conducted in an accepted educational setting?
Yes

Are participants in a class taught by the principal investigator?
Yes

Are the research activities part of the required course requirements?
No

Will course credit be offered to participants?
No

Amount of credit?
No

If class credit will be given, list the amount and alternative ways to earn the same amount of credit. Note: the time it takes to gain the same amount of credit by the alternate means should be commensurate with the study task(s).

How will permission to conduct research be obtained from the school or district?
The school is owned and operated by the Anglican Board of Education of the Anglican Diocese of Trinidad and Tobago. The Anglican Bishop, the Secretary of Education from the Anglican Board of Education and the School Principal have already given consent to the project. Meetings were held with all three. They will receive a formal letter outlining the project and receive copies of the research protocols and letters to the parents and children subsequent to the IRB approval.

Will you utilize private academic records?
No

Explain the procedures and document permission for accessing these records.

Employees?
No

Describe where (in the workplace, out of the workplace) activities will be conducted.

From whom and how will permission to conduct research on the employees be obtained?

How will potential participants be approached and informed about the research so as to reduce any perceived coercion to participate?

Is the employer involved in the research activities in any way?
No

Please explain:

Will the employer receive any results from the research activities (i.e. reports, recommendations, etc.)?
No

Please explain. How will employee identities be protected in reports provided to employers?
**Impaired decision making capacity/Legally incompetent?**

No

**How will competency be assessed and from whom will you obtain consent?**

**Mental/emotional/developmental/psychiatric challenges?**

No

**Identify the challenge and explain the unique risks for this population.**

Describe any special provisions necessary for consent and other study activities (e.g., legal guardian for those unable to consent).

**People with physical challenges?**

No

**Identify the challenge and explain the unique risks for this population.**

Describe any special provisions necessary for working with this population (e.g., witnesses for the visually impaired).

**Economically or educationally disadvantaged?**

No

**Racial, ethnic, religious and/or other minorities?**

No

**Non-English speakers?**

No

Describe the procedures used to overcome any language barrier.

**Will a translator be used?**

No

Provide information about the translator (who they are, relation to the community, why you have selected them for use, confidentiality measures being utilized).

**Explain the necessity for the use of the vulnerable populations listed.**

The aim of the study is to assess how 4th grade students experience the new curriculum and what the non-academic learning outcomes are. Therefore it is necessary to use the listed vulnerable population of 9 - 11 year olds to get the required feedback.

State how, where, when, and by whom consent will be obtained from each participant group. Identify the type of consent (e.g., written, verbal, electronic, etc.). Label and submit all consent forms.

Children, camp counselors, parents and teachers will receive information on the research via a letter and a stakeholder meeting at the school before the start of the camp. At the stakeholder meeting they will receive all the information on the aims of the study.

Consent and assent forms will be provided for the parents and children at the meeting. The camp is an extra-curricular activity and stakeholders will be informed that participation is not compulsory and non-participation will have no impact on their status at the school.

*If any participants are minors, describe the process for obtaining parental consent and minor’s assent (minor’s agreement to participate). Minor assent will be collected on the same form as parent consent.*

*Are you applying for a waiver of the requirement for consent (no consent information of any kind provided to participants) for any participant group(s) in your study?*

No

Describe the procedures and/or participant group for which you are applying for a waiver, and justify why this waiver is needed and consent is not feasible.

*Are you applying for an alteration (exclusion of one or more of the specific required elements) of consent for any participant group(s) in your study?*

No
Identify which required elements of consent you are altering, describe the participant group(s) for which this waiver will apply, and justify why this waiver is needed.

<table>
<thead>
<tr>
<th>Are you applying for a waiver of signed consent (consent information is provided, but participant signatures are not collected)? A waiver of signed consent may be granted only if: The research involves no more than minimal risk The research involves no procedures for which consent is normally required outside of the research context.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
</tr>
<tr>
<td>Would a signed consent document be the only document or record linking the participant to the research?</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td>Is there any deception of the human subjects involved in this study?</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td>Describe why deception is necessary and describe the debriefing procedures. Does the deception require a waiver or alteration of informed consent information? Describe debriefing and/or disclosure procedures and submit materials for review. Are participants given the option to destroy their data if they do not want to be a part of the study after disclosure?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>For each participant group please indicate how many individuals from that group will be involved in the research. Estimates or ranges of the numbers of participants are acceptable. Please be aware that participant numbers may affect study risk. If your participation totals differ by 10% from what was originally approved, notify the IRB.</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 - 25 Student participants</td>
</tr>
<tr>
<td>3 - 5 Camp counselors / research assistants</td>
</tr>
<tr>
<td>1 - 2 Class Teachers</td>
</tr>
</tbody>
</table>

How will potential participants be found and selected for inclusion in the study?

Participants for the study will be consenting / assenting students of the 4th Grade (Standard 4) class at St. Gregory's Anglican School in Trinidad and Tobago.

All of the students of the class (25) will be invited to participate in the study which will take place during the summer vacation 2017 from July 10th - 28th.

For each participant group, how will potential participants be approached about the research and invited to participate? Please upload necessary scripts, templates, talking points, flyers, blurbs, and announcements.

Students, parents and teachers will be informed about the research via letter and at a stakeholder meeting at the school before the end of the school term. They will be invited to participate. They will be informed that participation is not mandatory and the camp is an extra-curricular activity and that therefore non-participation will not affect their standing at the school. The teaching assistants and class teachers will be invited to participate in the study via letter. The School Principal will invite young people from the community or alumni of the school to apply to be camp counselors or research assistants and they will be briefed via letter and a pre-camp workshop. The class teacher(s) will be asked to give feedback on the children during the following school term and will be briefed at a meeting before the stakeholder meeting and the camp.

Describe any inclusion and exclusion criteria for your participants and describe why those criteria are necessary (If your study concentrates on a particular population, you do not need to repeat your description of that population here.)

All the grade 4 students (approx. 25) of St. Gregory's Anglican Primary School will be invited to participate in the study. There no inclusion nor exclusion criteria.

Is there any relationship between researcher and participants - such as teacher/student; employer/employee?

No

What is the justification for using this participant group instead of an unrelated participant group? Please outline the steps taken to mitigate this relationship.

Describe any risks associated with conducting your research with a related participant group.

Describe how this relationship will be managed to reduce risk during the research.

How will risks to confidentiality be managed?

Address any concerns regarding data quality (e.g. non-candid responses) that could result from this relationship.
In the following questions describe in lay terms all study procedures that will be experienced by each group of participants in this study. For each group of participants in your study, provide a step-by-step description of what they will experience from beginning to end of the study activities.

Student participants
At the start of the study, students will complete a written questionnaire to assess their previous design knowledge. The camp will consist of three main problem solving exercises. The children will identify problems and themes in their community that they would like to work on solving or addressing. During the design camp there will be times for small focus group discussions, individual interviews and written journal reflections on different steps of the design process. The students will build their solutions and present them to their colleagues and their parents at the end of the camp.

Camp counselors
The camp counselors will guide the discussion of the children during the camp. Data will be collected from the counselors via the observation protocols. Data on their prior knowledge of design will also be collected.

The class teacher will give feedback on the students in the following school term. The class teacher will provide pre-camp data on his or her prior knowledge of design, and will provide post-camp feedback via a one on one interview.

Teaching Assistants
Describe how, where, when, and by whom data will be collected.

Pre camp data will be collected from:
Parents - Anonymous demographic data will be collected to provide a background context for the study. They will also do the prior design knowledge survey which will be returned to the PhD student.
Children - Data will be collected on their prior design knowledge via a written journal reflection on the first day of camp or the last day of school which would be the week before camp.
Teachers - Data will be collected on his or her prior knowledge of design via a written questionnaire which will be returned to the PhD student.
Counselors - Data will be collected on his or her prior knowledge of design via a written questionnaire which will be returned to the PhD student.

During camp:
Children - Data will be collected from the student participants via observation, focus group discussions, written journal entries, analysis of design solutions. The focus group discussions will be led by the PhD student.
Camp counselors - data will also be collected via reflections on the observation protocol.

Post camp
Children - Data will be collected from the children via an interview with the PhD at the end of the camp.
Teacher - Data will be collected from the teacher in the Fall 2017 term via a Skype interview with the PhD student.

Social?
No

Psychological?
No

Financial/Employability?
No

Legal?
No

Physical?
No

Academic?
No

Employment?
No

Financial?
No

Medical?
Private Behavior?  No
Economic Status?  No
Sexual Issues?  No
Religious Issues/Beliefs?  No

Describe the nature and degree of risk that this study poses. Describe the steps taken to minimize these risks. You CANNOT leave this blank, say 'N/A', none' or 'no risks'. You can say "There is minimal risk associated with this research."

There is minimal risk associated with this research

If you are accessing private records, describe how you are gaining access to these records, what information you need from the records, and how you will receive/record data.

Private records will not be accessed.

Are you asking participants to disclose information about other individuals (e.g., friends, family, co-workers, etc.)?

No

You have indicated that you will ask participants to disclose information about other individuals (see Populations tab). Describe the data you will collect and discuss how you will protect confidentiality and the privacy of these third-party individuals.

If you are collecting information that participants might consider personal or sensitive or that if revealed might cause embarrassment, harm to reputation or could reasonably place the subjects at risk of criminal or civil liability, what measures will you take to protect participants from those risks?

Participants are not likely to reveal information that could cause embarrassment

If any of the study procedures could be considered risky in and of themselves (e.g. study procedures involving upsetting questions, stressful situations, physical risks, etc.) what measures will you take to protect participants from those risks?

The study procedures are not risky.

Describe the anticipated direct benefits to be gained by each group of participants in this study (compensation is not a direct benefit).

There is no direct benefit to the participants. They may learn design and critical thinking strategies that they can apply outside of the research activity.

If no direct benefit is expected for participants describe any indirect benefits that may be expected, such as to the scientific community or to society.

The indirect benefit is that information will be collected on experience and outcomes of 4th graders during design problem-solving activities, and this could be useful for future curriculum development. There is a public interest in alternative formats for the 4th grade curriculum in Trinidad and Tobago and this study can contribute to that discussion.

Will you be receiving already existing data without identifiers for this study?

No

Will you be receiving already existing data which includes identifiers for this study?

No

Describe how the benefits balance out the risks of this study.

Will data be collected anonymously (meaning that you do not ever collect data in a way that would allow you to link any identifying information to a participant)?

Yes

Will any identifying information be recorded with the data (ex: name, phone number, IDs, e-mails, etc.)?

No

Will you use a master list, crosswalk, or other means of linking a participant's identity to the data?

No

Will it be possible to identify a participant indirectly from the data collected (i.e. indirect identification from demographic information)?

No

Audio recordings?

Yes

Video recordings?

Yes
Describe all participant identifiers that will be collected (whether they will be retained or not) and explain why they are necessary.

Participants will select a pseudonym at the start of the research for the pre-interview questionnaire. They will use the same pseudonym throughout the study, however no master list matching pseudonyms with real names will be retained. Participant identifiers will not be collected nor retained. Participants' age and gender will be recorded.

If any links between data and participants are to be retained, how will you protect the confidentiality of the data?

No links between data and participants will be retained.

If you are collecting data electronically, what (if any) identifiable information will be collected by the host site (such as email and/or IP address) and will this information be reported to you?

No data will be collected electronically.

Describe any ways that participants themselves or third parties discussed by participants could be identified indirectly from the data collected, and describe measures taken to protect identities.

The participants may be identifiable only to those involved in the research activity from their description of the specific responses to the design problem or activities.

For all recordings of any type: Describe the type of recording(s) to be made Describe the safe storage of recordings Who will have access to the recordings? Will recordings be used in publications or data reporting? Will images be altered to de-identify? Will recordings be transcribed and by whom?

Interviews and focus group sessions will be recorded. These recordings will be stored on password protected devices. Only the main researcher will have access to the recordings. The recordings will not be used in publications or data reporting. The recordings will be transcribed but the full transcripts will not be used in publications. The transcripts will also be kept on password protected devices.

Describe how data will be reported (aggregate, individual responses, use of direct quotes) and describe how identities will be protected in study reports.

Partial individual responses and direct quotes will be used in the data reporting. Participants will select pseudonyms at the start of the research and these will be used throughout the data collection process to ensure the protection of their identities. Direct quotes will be linked to the pseudonym in reports and publications.

Will anyone besides the PI or the research team have access to the data (including completed surveys) from the moment they are collected until they are destroyed?

No

Describe any compensation that participants will be eligible to receive, including what the compensation is, any eligibility requirements, and how it will be delivered.
Student participants will not be compensated. Class teachers will not be compensated. Camp counselors / research assistants will be compensated since they will be working in the camp.

*Explain compensation provisions if the participant withdraws prior to completion of the study.*

The direct study participants will not be compensated so this will not apply.
Appendix B

Letter to Principal

Letter to Principal, St. Gregory’s Anglican Primary

Teaching and learning design thinking
at a primary school in rural Trinidad and Tobago

April 5th 2017.

Dear Mr. Matthew,

Thank you for discussing my doctoral project on design thinking at primary school in Trinidad and Tobago with me in July 2016.

I am researching how Standard 4 children at a rural primary school in Trinidad and Tobago respond to design thinking that is taught through a culturally relevant lens. I will be focusing on the experience and the non-academic cognitive and social development outcomes of the course, such as empathy, collaboration and critical thinking. Parents and children of the Standard 4 class of St. Gregory’s Anglican Primary will be invited to participate in the study, which will be a 3-week vacation camp from July 10 to 28, 2017. It will be clear to parents and children that participation is not mandatory and that non-participation does not affect their status at school. They are also free to withdraw from the study at any time without affecting their relationship with St. Gregory’s Anglican Primary School or the Anglican Board of Education.

The children who participate in this study will be introduced to design thinking principles during a 3-week design camp at St. Gregory’s Anglican Primary from July 10 – 28th 2017. Data will be collected during the camp and during Term 1 of the academic year 2017 – 2018. Parents will also complete an anonymous demographic questionnaire before the study. During the camp data will be collected via observation of the children at work and play, through written journal entries, interviews and focus group discussions with children, and via analysis of their design solutions. The camp counselors will also give their feedback on the activities. The class teacher will be asked for feedback in September on what lasting impacts were seen from the camp. This information will help us understand from a child’s perspective, what is the experience of learning design thinking and help to improve design activities for children.

Parental and youth permission will be sought to record audio and video of camp activities, face-to-face interviews and focus group discussions that will be done during the study. This will support the data collection process. These recordings will only be used for data analysis and will not be made public in anyway. They will not be used during publications or presentations. They will be erased as soon as the study is completed and all information has been transcribed. Participants will select pseudonyms at the start of the research, and their real names will not appear in any professional report of this research. There will be no master list to match
pseudonyms with real names. Data from the study will be kept on password-protected devices. Consent forms will be kept in a location separate from the data that is collected. Video and/or audio recordings will be deleted as soon as the study is completed and all information has been transcribed. A confidentiality clause will be part of the counselors’ code of conduct (see attached).

The results of the study will be used in my doctoral research and will be shared with the Anglican Board of Education, the Ministry of Education and via academic journals and or conferences with a focus on design and education and related fields. I foresee no risks to participants beyond those that are normally encountered in typical camp or school activities.

I would like to assure you that this study has been reviewed and approved by the Institutional Review Board of North Carolina State University, which is a committee established to review and approve applications for research projects involving human subjects. The primary purpose of the IRB is to protect the rights and welfare of the human subjects. In addition, it has the support of the Department of Graphic and Industrial Design at the College of Design of North Carolina State University. If participants feel they have not been treated fairly or that their rights as participants in research have been violated during the course of this project, they may contact Deb Paxton, Regulatory Compliance Administrator at dapaxton@ncsu.edu or by phone at 1-919-515-4514.

I thank you again, for allowing me to work with St. Gregory’s Anglican Primary. If you have any additional questions about the study, please feel free to contact me, at lmnoel@ncsu.edu or via phone at 919-628-6844 (North Carolina) or 868-756-3597 (Trinidad and Tobago) or my faculty supervisor, Prof. Tsai Lu Liu at tsailu_liu@ncsu.edu. Thank you in advance for your interest and support of this project.

I look forward to working with you to plan the pre-workshop activities, such as recruiting counselors and participants and hosting the parent workshop, as well as to plan the three-week camp.

Sincerely,

Lesley-Ann Noel
PhD Student
College of Design
North Carolina State University
Appendix C

Consent and Assent Form

Information Letter and Consent Form for Parents or Guardians
Permission for Research with Minors
Teaching and learning design thinking at a primary school in rural Trinidad and Tobago

June 20\textsuperscript{th} 2017.

Dear Parent(s) or Guardian(s):

I am a student in the PhD in Design program at North Carolina State University. I will be doing research with Standard 4 students at a camp St. Gregory’s Anglican Primary. The camp will take place from July 10 – 28\textsuperscript{th} 2017.

The information in this letter will help you decide if you and your child want to take part in this research. The camp will be free of charge but only children who take part in the study will be able to attend. Participation is optional and if your child does not take part in the study this will not affect your relationship with St. Gregory’s Anglican Primary School. If your child takes part, he or she can leave the study and the camp at any time if you change your mind about being part of the research.

In my research I want to understand how children learn to solve problems using design. In the camp children will find problems in their community that they can solve through design. The design problems will focus on making their own lives better. They will work on their own and in small groups.

Before the camp parents will be asked to give some information that will be used to understand the backgrounds of the children in the study. This information will be collected anonymously and will not be linked to individual children or their parents.

During the camp we will collect information on how the children learn through design by looking at them at work and play, by looking at their daily journal entries, and at weekly group chats with the children on what they did in the camp. Their designs will also be studied to see how they were influenced by local experiences. Class teachers and children will also give feedback later in the year on how the camp affected their schoolwork after the experience. This will help us understand from a child’s point of view, how they learn design and will help to us to plan better design activities for children in the future.

I am asking your permission to record audio and video of camp activities and group chats that will be done during the camp. These recordings will not be shared with the public. They will be erased as soon as the needed information is written down.
All the children’s feedback will be anonymous. Children will choose a nickname for themselves at the start of the study and these nicknames, not their real names, will be used in reporting. The names of the children and their parents will not be used in any reports of this research. Data from the study will be encrypted and kept on password-protected computers until it is deleted. Camp counselors will also have to agree to keep call information on the camp secret.

An exhibition of the finished designs will happen at the end of the camp so the children can show their creativity to parents and other members of the community. I will return to the school in December 2017 / January 2018 to share the results of the research with parents, children and school officials and to get feedback from the community on the results. Results will also be shared later on with the Anglican Education Board of Management, the Ministry of Education and may be shared via academic journals, which are magazines where researchers share their work with other researchers, or conferences.

The children will not face any risks that they would not normally face in camp or school activities.

This study has been checked and approved by the Institutional Review Board (IRB) of North Carolina State University. The IRB is a committee that checks and approves research with people. The main purpose of the IRB is to protect the rights and welfare of people. The project also has the support of the Anglican Education Board of Management in Trinidad and Tobago and the Department of Graphic and Industrial Design at the College of Design of North Carolina State University. If you feel you have not been treated according to what is described in this letter, or your rights as a participant in research have been violated during this project, please contact Deb Paxton, Regulatory Compliance Administrator at dapaxton@ncsu.edu or by phone at 1-919-515-4514.

If you have any questions about the study, or if you need more information to decide to take part, please contact me, Lesley-Ann Noel at lmnoel@ncsu.edu or via phone at 919-628-6844 (North Carolina) or 868-756-3597 (Trinidad and Tobago) or my supervisor at the university, Prof. Tsai Lu Liu at tsailu_liu@ncsu.edu. Thank you for your interest and support of this project.

Sincerely,

Lesley-Ann Noel
PhD Student
College of Design
North Carolina State University
Consent Form

I read the letter about the research, on how children learn to design, that is being done by Lesley-Ann Noel of the College of Design at North Carolina State University. I was allowed to ask questions and get additional details about the study. I understand that all information gathered on this project will be used for research only and the identities of children who take part in the study and their parents will be kept secret and not be made public. I know that children who take part in the study can leave at any time without affecting their relationship with St. Gregory’s Anglican Primary School. I allow the researcher to record audio and video and take photographs and understanding that these will be deleted after the information that is needed is written down. I know that this project has been checked by and approved by the Institutional Review Board of North Carolina State University, and that I may contact this office if I have any comments or am worried about my son or daughter’s participation in the study. If I have any questions about the study I can call the researcher Lesley-Ann Noel at 919-628-6844 (US) or 868-756-3597 (TT) or contact her via email at lmnoel@ncsu.edu.

Parent Consent

☐ Yes – I want my child to take part in this study

☐ No – I do not want my child to take part in this study.

Child’s Name (please print) ____________________________________________

Child’s Date of Birth __________________________ Child’s Gender ____

Parent or Guardian Signature ______________________________ Date __________

Child Assent

☐ Yes – I want to take part in this study

☐ No – I do not want to take part in this study.

Child’s signature ______________________________ Date ______________
Appendix D

Camper Code of Conduct

LIU11951

Camper Code of Conduct

My attitude and behavior are important to the success of the research and the camp.

- I will be respectful and polite to other campers and counselors.
- I understand that the Design Camp staff has to make sure campers follow camp rules for the safety and comfort of everyone.
- I will take good care of the materials and equipment that I use during the camp.
- I will keep the studio spaces neat and tidy.
- I will arrive on time to all activities.
- I will take part in all activities during the 3-week camp.
- I will tell my counselors where I am during the camp at all times.
- I will wear clothes that allow me to participate comfortably in camp activities.
- I understand that the Design Camp counselors cannot connect with me on Facebook, Instagram, Snapchat or other social media.
- I will not use abusive or offensive language or actions.
- I will report any unsafe or improper behavior at once to my counselors.
- I understand that I can be expelled from the camp for inappropriate behavior including fighting and bullying.

Camper’s signature ____________________________ Date ______________