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Connecting dots : interaction design for holistic learning

Michelle Tan
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Connecting Dots - Interaction Design for Holistic Learning

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ABSTRACT

Connecting Dots proposes that new media such as interactive websites can be developed using a design framework based on elements of holistic education identified by Miller (1996) as *Balance, Inclusion and Connection*, so that holistic learning can be achieved. Recognising the negative consequences of the focus on meritocracy, the Singapore government have in recent years advocated for a transformation of the education system to include opportunities for holistic learning. This research contends that holistic learning is a responsibility that has to be shared by both the education system and families. This should be cultivated in a child from an early age so that a strong foundation for life-long learning can be established. As children are increasingly exposed to media technology at an early age, there is a pressing need for online content to provide families with a platform to engage their young holistically. Using the design framework, an interactive website, also titled *Connecting Dots* was developed and tested through a qualitative study as part of a practice-based research that uses an iterative and incremental development process. With the appropriate methods used to collect and analyse data, the research endeavors to develop design recommendations that can be transferred to other interactive websites that promote holistic learning, not limited to the Singapore context.

DECLARATION

I certify that this thesis does not, to the best of my knowledge and belief:

- i. incorporate without acknowledgment any material previously submitted for a degree or diploma in any institution of higher education;
- ii. contain any material previously published or written by another person except where due reference is made in the text of this thesis; or
- iii. contain any defamatory material



Michelle Tan Ching Ying

February, 2014

CONFERENCES AND PUBLICATIONS

Preliminary aspects of this research have been presented at a nation conference and published refereed proceedings.

Conference presentation

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Publication

Tan, M., (2013, April 11). *Shifting Sense: The past as our future*. Paper presented at Australian Council of University Art & Design Schools Conference: Region and Isolation: The changing function of art and design education within diasporic cultures and borderless communities, Central Institute of Technology. Perth, Australia: ACUADS.

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1. Introduction

This research aims to develop design recommendations so that future educational interactive websites can be designed to promote holistic learning where an individual's intellectual; emotional; social; moral and cultural aspects are developed. While the research focused on the learning experiences of Singaporean preschoolers, the outcome of the study can be applied beyond the context of Singapore and has the potential to transform how future interactive multimedia content for preschoolers are designed.

In recent times, the Singapore government has promoted for a change in school curriculums and activities in response to public feedback that the education system is getting “overly competitive and stressful” (Heng, 2012, p. 1). The changes advocate a shift in focus from academics and merit to education that is holistic in nature so that students can be prepared to manage life and its offerings. With the prevalence of technology and the plan to implement nationwide fibre optics broadband, known as “Singapore’s Next Generation National Broadband Network”, the opportunities for media and content developers to harness its potential and contribute to how individuals learn in a holistic manner is extensive (Info-communications Development Authority, 2008).

It has been observed that while television programs used to be a popular medium, the development and affordability of technology has seen an increase in new media formats that are being used for entertainment and educational purposes. Therefore, the goal of transforming the way children in Singapore learn can be assisted with new media such as interactive websites. In developing new media content for children’s learning and development, it is necessary to consider how knowledge is acquired. This can be traced throughout the history of psychology but the holistic development of a child has been in particular greatly influenced by Gestalt psychology, cognitive psychology and narrative psychology. These three viewpoints in the field of psychology, its association with collaborative learning, self-efficacy and imaginary play as well as its overall impact on holistic learning are elaborated in the literature review (See Chapter 2). The literature review also describes Singapore Government’s definition of holistic education, the general view of holistic education and the elements of *Balance, Inclusion and Connection* that were identified by Miller (1996) as components that contribute to holistic learning. It then explains the trends of media technology and how it influences

holistic education, before focusing on how new media can also adopt a holistic approach.

Through the concepts and theories presented in the literature review, an initial holistic interactive framework for the development of an interactive website was identified. The framework consists of balance, inclusion and connection where:

- Balance should be achieved in the interactive media design by giving users the opportunity to combine knowledge and imagination.
- Inclusion should allow users to collaborate with others in solving problems so that learning can be personal and socially meaningful.
- Connection should be achieved by including integrated topics so that users can see how information and knowledge is related to wider concepts and assist users in understanding their position in relation to the world.

Using this initial framework as its foundation, a website prototype, also titled *Connecting Dots*, was developed and evaluated to determine its effectiveness in promoting holistic learning. The data from the evaluations were then analysed to develop a new holistic interactive framework with the following elements, establishing that for interactive media to promote holistic learning, the interactive experience should be designed so that it is:

- personally meaningful
- engaging through imaginary play
- engaging through active hands-on exploration
- engaging through designs that consider usability
- engaging through the inclusion of questions that directly addresses users
- engaging through timed challenges

- engaging through visual content design
- engaging through the inclusion of puzzles
- engaging through unique character designs within the experience
- balanced in its music design as well as the presentation of concepts; interactive tasks and media elements
- a collaborative experience
- an imaginative and creative experience
- able to help individuals connect information through various means

These elements feature an expansion of the elements found in the initial holistic interactive framework and is further discussed in chapters 4 and 5. As the elements of the new framework have been formulated as general guides, they can be interpreted according to different contexts and serve as recommendations for the future development of interactive websites for holistic learning.

1.1 Rationale and Significance

The push for holistic learning in Singapore has been focused on the design of curriculum and activities in school. However, as children spend a majority of their time outside of school, the responsibility for developing the child as a whole being should also be sustained by families.

The proliferation of technology and the Internet means that children are being exposed to media at an earlier age. This presents an opportunity for holistic learning to be promoted through media formats that appeal to children so that its practice can be cultivated from an early age. The 2013 Annual Survey on Info-communications Usage in Households Statistics show that families in Singapore have jumped on the technology bandwagon and are more ‘connected’ than ever. In 2012, 60% of Singaporean households had access to one computer at home while 25% had access to more than two

computers at home (see figure 1). Of this 85%, only 1% did not have Internet access, with the rest connected through broadband (IDA, 2014).

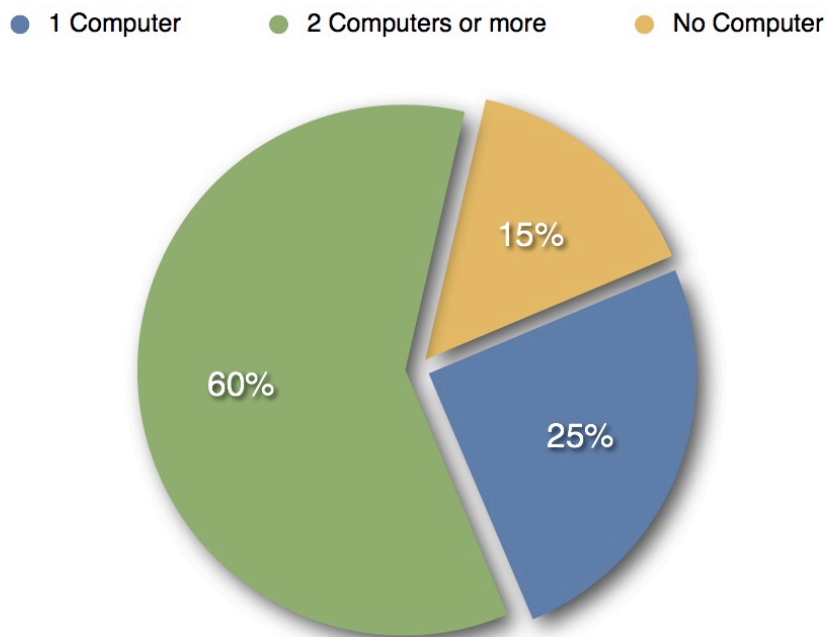


Figure 1. 2012 Statistics of Singaporean Household's Computer Access.

The government of Singapore has also recognised the importance of ensuring that it keeps up with providing its citizens with connectivity. To do so, it has implemented the National Broadband Network through fibre optics, giving Singaporeans better access to information and resources. Beyond that, they spent SGD\$2.6 billion between 1997 and 2008 to transform Singapore's education environment with Information and Communication Technology (ICT) so that its students were equipped with the skills to thrive in a knowledge economy (Ministry of Education Singapore, 2008). However, these have only influenced Primary and Secondary education. As such, it has been identified that preschoolers are not afforded early training in preparing them to be media literate.

However, with the availability of technology, the unregulated nature of the Internet as well as the lack of parental supervision due to an increase in both parents working, the censorship of content becomes a concern. These different conditions increase the risk for vulnerable users such as children to be exposed to inappropriate materials or information. That being the case, the trend makes it important for parents to be cautious about how their children interact with technology and its information. Through this

research parents will be encouraged to be more proactive in teaching their child about media literacy and cyber safety.

This research will therefore provide a platform and opportunity for families of preschoolers to be engaged in new media that promotes holistic learning so that they will have a strong foundation for life-long learning.

1.2 Research Objectives

This thesis recognises that there is a need for Singaporean preschoolers to engage with interactive media experiences that facilitates holistic learning. Through their experiences, the individuals are encouraged to learn and develop different aspects of their lives. Although this can occur in formal environments like schools, the thesis also acknowledges that families play a big role in how a child develops holistically. Hence, families should be afforded opportunities to engage in new media experiences where children can be exposed to content that enhances their growth and promotes a strong foundation for life-long learning.

The research endeavours to develop a framework that interactive media designers can use as a guide in designing and developing future interactive media content and experiences that promotes holistic learning in young preschoolers. While the study targets preschoolers and their families from Singapore, the intent is for the resulting framework to be applicable in a universal context. To achieve this, the following question is set to guide the research.

How will the content, interface and interaction designs of an interactive website developed using the framework of balance, inclusion and connection promote holistic learning?

The objectives of the research are therefore:

1. To investigate Singapore's interpretation of holistic education and learning
2. To investigate theories of learning, psychology and its influence on holistic learning.
3. To investigate the definition of holistic education and its characteristics

4. To design an initial holistic interactive framework based on the theories and definitions discussed in the literature review.
5. To develop a website prototype based on the initial holistic interactive framework.
6. To evaluate the effectiveness of the initial holistic interactive framework in promoting holistic learning
7. To analyse the evaluations so that components influencing the holistic learning experience can be identified
8. To derive a new holistic interactive framework that will be used as a guide for the development of future interactive media design for young preschoolers that will promote holistic learning.

1.3 Data Collection Methods

Data for this research was collected through user tests where six groups of Singaporean families with children aged between four to six years, interacted with a website prototype developed using the initial holistic interactive framework. The framework was designed based on Miller's (1996) identification of Balance, Inclusion and Connection as elements that contribute to holistic learning. The procedure of each user test required participants to view content and engage in activities within the website prototype. As part of the activities, the participants were also required to produce two craftworks in a physical and electronic form. As the user tests were conducted, their responses and how they interacted with the website prototype were recorded. At the end of the user tests, participants were also interviewed as a means to validate the observations of their responses and interactions. The data collected was then used to determine the initial holistic interactive framework's effectiveness in guiding the designs for a balanced and inclusive interactive experience.

Besides the user tests, parent participants were also required to observe their children over two weeks and report their observations in a provided diary. The data collected from the diary was then analysed to determine if the initial holistic interactive framework was successful in assisting users to make connections between learning content and application to their lives.

The approaches used in this research allowed an examination of the effectiveness of the initial holistic interactive framework and the exploration of how it can be improved so

that future interactive media can be developed to promote holistic learning. These approaches are further expounded in Chapter 4.4.5.

1.4 Structure Of This Thesis

This thesis is organized into six chapters:

- Review of psychological theories fundamental to holistic education and learning; defining elements of holistic education, how it is impacted by trends in media technology and its influence on interaction design (Chapter 2);
- Identification of the initial holistic interactive framework; description of the approach, design and methods employed by this research in the development of the website prototype, also titled *Connecting Dots*, that was used for evaluation and analysis (Chapter 3);
- Discussion of analysed data collected from the user tests, interviews and observations (Chapter 4);
- Findings of this research in the development of recommendations for a new holistic interactive framework (Chapter 5);
- Discussion of the conclusion of this research, its contribution and future research opportunities (Chapter 6).

Chapter 2 sets the backdrop for this research by describing the education scene in Singapore and highlighting its impetus to establish holistic education as part of its educational program. To better comprehend holistic education and its learning principles, the chapter reviews theories from psychology that are significant to its establishment. Additionally, it also accentuates elements particular to a child's holistic development such as collaborative learning; self-efficacy and imaginary play. The chapter also describes the features of holistic education and how it is affected by trends in media technology. It then concludes by drawing attention to Human Computer Interaction design and expounds on how approaches within the discipline has been transformed with the inclusion of holistic perspectives.

Chapter 3 describes the methodology and data collection procedures used in this research. In this chapter, the initial holistic interactive framework and the development process of the *Connecting Dots* website prototype are also introduced before it is evaluated for its effectiveness in promoting holistic learning for preschoolers. The chapter considers the design; ethical considerations and limitations of the research, while also justifying the approaches and procedures implemented by this research.

Chapters 4 presents the analyses of the collected data, and discusses how the initial holistic interactive framework influenced users' interaction with their collaborators, the website prototype's content, and its impact on the preschooler's ability to learn holistically.

Chapter 5 identifies the main elements from the collected data that forms the new holistic interactive framework and describes how it can be applied to future interactive websites for preschoolers.

Chapter 6 concludes the thesis by summarising the contributions of this research to knowledge in design and human computer interaction research. It also suggests directions for future research.

2. Literature Review

With a determination to nurture its people so that there can be economic development, the Singapore government constantly reviews its education system to ensure that it can support and encourage its people to develop to their full potential. Through reflection, they have come to realise that the nation's previous focus on meritocracy, grades and achievements has both positive and negative consequences. On one hand, it has helped Singapore to maintain a high education standard as evident in the consistent TIMSS results over the years (Mullis, Martin, Robitaille, & Foy, 2009). Yet, this has come at the price of the young having to endure more stress in their childhood years. It also affects the quality time spent within family units because a child's free time is spent on revisions and taking supplementary lessons in an attempt to either maintain or achieve success over their peers, even at the pre-school level. Therefore the over emphasis on grades can be detrimental to the very fabric of society - family.

Parents in Singapore are also not immune to the stress and are on the constant search for ways to help their children excel. However, in reality, the race is not so much to help children excel but to help children catch up with those whose parents are more aggressive in engaging extra tuition for their children. This has resulted in what could only be described as a blatant disregard to consider a child's scholastic abilities. In Singapore, there is no space for stress, just pressure for growth. More recently, research has yielded results showing 72% of parents surveyed want pre-school education in Singapore to be formalised so that the children are better prepared for primary school education (Ang & Lien Foundation, 2012). This is reflective of the current educational environment where competition is a norm and educators are caught in the conundrum of preparing children for lifelong learning against the pressures of having to fulfill parental expectations fueled by the focus on academic achievements (Ang, 2008). As such, schools feel compelled to deliver academic-driven lessons that focus on formal aspects of learning. But by doing so, the importance of developing the children as whole beings through versatile and age-appropriate experience is compromised.

The world's policymakers have long recognised the importance of providing quality pre-school education so that a child can be adequately prepared for their future (OECD, 2006). As highlighted by the 2000 Dakar Framework for Action, it is important for communication between the different phases of education to take place so that children can benefit from being engaged in a holistic, continuous educational experience (UNESCO, 2000). As such, the Singapore government now sees the need for schools to be engaged in holistic education, where children are encouraged to excel academically and are also prepared to confront life and its challenges through character and morality building. This change in focus targets not only pre-schools but across the various levels of education. To successfully transform the education scene and society's expectations on how children are equipped for the future, an understanding of how children learn and its effect on their self-confidence is paramount.

In order to assist in the understanding, this chapter examines how learning is guided by psychological theories and highlights concepts postulated by Gestalt psychology; cognitive psychology and narrative psychology. These three psychological perspectives have been identified as theories that are fundamental to holistic education and its practice. An analysis of the three perspectives also reveals that collaboration is an important element that is vital to holistic learning experiences as it determines an

individual's self-efficacy; confidence and motivation to function and discover new skills and knowledge. Another important element to holistic learning and the strengthening of an individual's self-efficacy has also been identified as imaginary play. When individuals are engaged in imaginary play, their imagination and creativity are exercised and through symbolism, they are aided in their awareness of themselves and the world around them. This awareness serves as the basis for their holistic learning and development. The chapter also examines the different perspectives on what defines holistic education and how it is affected by trends in media technology. Finally, it analyses how the approach to designs in new media can also adopt a holistic nature so that learning experience using media technology can provide learning individuals with fun and engaging experiences that also promotes the development of their whole being. Based on the literature review and the comprehension of the different theories and perspectives, the basic elements of the initial holistic interactive framework are established. This framework purports that it can be used in the development of interactive media that can promote holistic learning.

2.1 Psychology And Learning

Learning is the acquisition of knowledge and skills that results in long-term behavioural changes due to experience. Although not a direct practice of psychological theory, a basic knowledge of its theories is necessary for the sake of developing effective learning experiences (Coon & Mitterer, 2008; Notterman & Drewry, 1993). This is also supported by William James' (1958) talk to teachers as cited in Notterman and Drewry (1993) that "psychology is a science and teaching is an art". Therefore, psychological theories cannot be directly extrapolated for educational instruction. However, through the interpretation of another person's intermediary inventive mind, the theories can find its meaning.

It is argued that it is impossible to map the historical roots of holistic education as its principles are "timeless and found in the sense of wholeness in humanity's religious impetus" (Forbes, 1996). However, some of its applications can be perceived as interpretations of theories from the history of psychology. Just as present day psychologists draw from a range of perspectives to explain complex forms of human behaviour, holistic education engages with a range of psychological theories over the years and continues to evolve as the understanding of knowledge acquisition progresses (Coon & Mitterer, 2008).

2.1.1 Gestalt Psychology

Max Wertheimer, a Czech-born psychologist founded the beginnings of the Gestalt school of thought when he had an epiphany about the perception of movement, a principle that is applied even in technology today (Hergenhahn & Olson, 2005, Encyclopaedia Britannica, 2009). His revelation brought forth a persuasion that previous analyses of psychological events by breaking it down into separate elements were erroneous. Alongside Wertheimer, Wolfgang Köhler and Kurt Koffka worked together to study thinking, perception and learning, basing their work on Immanuel Kant's theory that perception is influenced by a person's experience and their subsequent organisation of knowledge. They believed that learning was a cognitive phenomenon resulting from the interpretation that when presented with a problem, a person's mental state becomes unbalanced. Acting as a motivational force, learning seeks solutions to solve the problem to bring back equilibrium. This was in line with the law of Prägnanz and supported by the theory of the Zeigarnik Effect that incomplete tasks had a bigger influence on memory because it motivated the search for a solution to bring mental balance and a general sense of satisfaction, and meaning (Hergenhahn & Olson, 2005). This meant that learning experiences would be personally satisfying and therefore no external reinforcement was required. This basic principle can be interpreted to mean that individuals can be guided to seek solutions by finding meaning in relationships and patterns in prescribed problems, so that they can have insightful learning. In doing so, their curiosity and passion for learning is fueled, thus achieving a goal of holistic education in fostering a desire for life-long learning.

The Gestaltists were also fervently against elementalism and believed that human experience was a holistic phenomena of meaningfully configured stimuli. Therefore, reality was based on perception, which is influenced by the organisation of sensations that are generated as a reaction to stimuli. In this stage, known as the pre-solution period, learners would cognitively run through a few hypotheses until a suitable solution was found, bringing insight. This led to the widely quoted statement "the whole is greater than the sum of its parts". However, this is a misconception as argued by C. C. Pratt who presented that what was originally said by Köhler was that "the whole is different from the sum of the parts" (cited in Notterman & Drewry, 1993). This was inspired by Köhler's belief that when the word "whole" is substituted as "solution", the principle could also be applied to problem solving whereby a learner is able to experience an intellectual realisation when they are able to look beyond the individual

components in a presenting problem and suddenly organise a solution. In applying Köhler's theory to holistic education, learning materials that aspire to engage individuals in holistic learning should include the presentation of all information so that the learner can see the problem as a whole before there can be meaningful learning.

Köhler's study of ape behaviour and his interpretation of insightful learning also had a major influence on holistic education. Through his work, he characterised insightful learning as having the following characteristics (Hergenhahn & Olson, 2005):

- The development between the pre-solution periods to the acquisition of a solution happens suddenly.
- The person's behaviour based on the solution is effortless and error-free.
- The person retains the solution for a long time and converts it into a principle.
- The principle is transposed and applied to other scenarios, not out of habit but through relation.

Köhler's explanation of insightful learning laid the foundation for one of the fundamental goals of holistic education where individuals are expected to develop the capacity to understand concepts, retain knowledge and apply it to other situations as part of a wider web of knowledge. His recognition of the importance for individuals to transpose and apply learned principles through understanding relationships contributed to Miller (1996) and Forbes' (2003) perception of learning. As they determined the characteristics and elements of holistic education, they drew on Köhler's theory for inspiration and expressed that connection was an integral part of holistic learning. The Gestaltists applied connection and relation to education by encouraging increased focus on the design of specific discipline techniques that corresponded to an overall vision of learning, thus helping students to connect information through integrated curriculum. They also believed that an individual's behaviour and physical reality was influenced by their subjective reality, formed by their beliefs, values, needs and attitudes (Hergenhahn & Olson, 2005). Based on this theory, holistic education's aim to cultivate a person's values will result in appropriate behaviour that can be transposed to other situations.

One of their other contributions to holistic education is in their opposition of rote memorisation that was advocated by behaviourists. Wertheimer, cited in Woodworth and Sheehan (1964), highlighted the importance of productive thinking in education and emphasised that repetitious drills of information would cause students to depend on rules and not draw on their own intelligence. In translating his notion into holistic education, the design of educational content should therefore be able to challenge learners and exercise their intelligence by encouraging them to connect and interpret information for their own understanding instead of memorizing information.

2.1.2 Cognitive Psychology

While Gestalt psychology gained popularity, the early beginnings of cognitive psychology was launched through Jean Piaget's publication of *The Child's Conception* in 1920 (WGBH Educational Foundation, 2001). However, it was only through his publication of *The Moral Judgment of Children* in 1932 that the school of thought became popular (Allpsych, 2003). Piaget based his work on the proposition that individuals learned through action and doing as they played an active role in the discovery of knowledge (De Corte & Weinert, 1996). He stressed that the action did not have to be a physical effort but could also be a mental effort, an operation he labeled interiorisation. His proposition meant that it was important for holistic education to provide learning experiences where individuals can be actively engaged in thinking or doing. He also advocated that individuals constructed knowledge and understanding through various means and as a result of their exploration of their environment. It is through this notion that the principle of providing ways of helping individuals learn through process and not content; as well as his encouragement for educators to pay special attention to the ways individuals think that is applicable to the holistic classroom. In applying Piaget's theories and principles to holistic education, collaboration is significant, but this significance is increased when educational institutions implement the theories of Piaget's contemporary - Vygotsky.

Vygotsky differed from Piaget in that he viewed learning as a process of appropriation based on a learner's interaction with another person's culture that stimulates them to explore "the zone of proximal development" (ZPD) so that knowledge can be progressed (De Corte & Weinert, 1996; Schunk, 2008). He implied that individuals had an innate array of capabilities concerning their perception, attention and memory, which are transformed through their social and educational experiences. Thus, learning is

shaped and influenced by a person's social and cultural environment. Vygotsky's ZPD is defined as the "distance between the actual development of a child as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p.86 as cited in Schunk, 2008, p.245). Referring to the potential of an individual, the notion influences holistic education as it purports that when an individual is provided with suitable learning conditions and support, they are able to engage in authentic learning that is socially meaningful. Such a learning experience then contributes to the development of an individual and their full potential. Vygotsky also had other beliefs that line up with the approaches of holistic education. These beliefs are:

- An individual's personality can be developed through education.
- Education is for the facilitation of developing an individual's creative potential.
- A learner's active involvement will lead to more effective learning.
- Through collaboration, an individual gains more knowledge.
- Teaching and learning methods have to cater for individual differences.

2.1.3 Narrative Psychology

Another development that can be applied to holistic education are the theories of narrative psychology - the philosophy which argues that the meaning and nature of human conduct and experience can be arranged into smaller stories that are constructed, obtained and communicated (Sarbin, 1986). A remark by C.S. Lewis (1952) effectively summarises its fundamental ideology that the one thing in the whole universe that a human knows best is oneself and their own story.

Narrative psychology maintains that a person is guided by self-stories - tales of one's life that is told to self as well as others in an attempt to organise mental information that helps them to understand their world; reveals who they are and their subjective realities. The self-stories also provide a person with a background for their present situation and

affects how they move forward into the future. Therefore, as part of the goal of holistic education, the learning experience should stimulate individuals to better themselves by providing them with the opportunity to look at their self-stories as a whole so that they are able to know their place in the world. When they understand their place, there is also an increase in their potential to identify areas in their lives that requires change and growth.

One of the core principles of narrative psychology is that human stories are organized in consideration of time, sequence of events and temporality (Sarbin, 1986). This translates to mean that a person finds personal meaning through the interpretation of the connection between their activities, time and sequence. It is based on this understanding that some authors believe that human lives have narrative structures (MacIntyre, 1981; Carr, 1986; Sarbin, 1986). Carr (1986) who drew from Husserl's theory of time consciousness where humans experience time through "an interrelated configuration" of the past, present and the future, advocated that the human experience could be presented through narrative stories. He believed that life was not made out of isolated events but as a whole, a notion analogous to the theories advocated by Gestalt psychology. As such, he emphasised that a person's present only made sense when framed against their past and viewed as a passage to the anticipated future. As the person attempts to comprehend their present, they might seek to impose narrative structures on their experiences. Sarbin (1986) proposed that it was a result of these narrative structures that influence how individuals think, dream, connect with others and make moral choices.

The works of a philosopher Charles Taylor was also influential to the development of narrative psychology. Similar to Sarbin, his belief was that a person's self and their morality could not be separated and was defined in reference to others in society (Taylor, 1989). He asserted that humans felt the need to pursue and feel connected to what they considered as important or good. In addition, he believed that stories were able to confer meaning by influencing how a person sought after the good. Its potential is especially evident in myths and fairytales that are told to children in hopes that it would instill a desire for seeking what is good/moral and to aid their understanding of the connection between events, people, the world and themselves (Howard, 1991; Polkinghorne, 1988; Langelier & Peterson, 1993; McAdams, 1993) In applying these beliefs to holistic education, narrative self-stories can then be viewed as a practical approach to help people feel connection through creativity and imagination so that they

may be able to better relate to others, understand themselves, know their place in the world and seek what is considered to be morally right.

2.2 Collaborative Learning and Self-efficacy

No one individual in the world exists alone all of the time. As highlighted in the psychology and learning section (see Chapter 2.1), it is clear that relationships and collaborations are pivotal to an individual's development. Although having risen to prominence in separate studies conducted by Vygotsky's (1978) and Schmuck and Schmuck (1979), it is suggested that the origins of collaborative learning date back to the early 1900s stemming from theories of Gestalt psychology when Kurt Koffka studied how interaction and interdependent relationships between individuals affected or varied the way people come to form meaningful views of the world around them (Johnson & Johnson, 1994). Defined as learning that occurs when individuals observe others in "the context of social interactions, experiences, and outside media influences", collaborative learning promotes several qualities that are endeavours of holistic educations. The most notable of these qualities include the development of teamwork; strong bonds between individuals and the creation of a culture of diversified thinking patterns in both individuals and groups (Betz & Hackett, 1981). Such learning enables collaborators to develop the habit of having differing points of view, which could allow more efficient and effective completion of tasks that would otherwise be undoable by an individual. Through the different points of views offered by collaborators, individuals develop the habit of observing information that presented in its entirety and reflecting on the relationships and patterns within the information. Through such an observation and reflection process, they are then able to make informed decisions and a holistic learning experience is promoted.

Numerous studies have presented convincing evidence to show that the effects of using collaborative strategies are far more positive than when compared to individual learning strategies when it comes to supporting learning. (Lumpe & Straver, 1995; Johnson & Johnson, 1994). Dollard and Miller (1941) expounded that when individuals observe and mimic the behaviours of others within a collaborative setting and recognise that a specific action has been learnt, they are rewarded with positive reinforcement and their ability to retain the new knowledge is enhanced. Such reinforcement and retention is essential in the holistic development of an individual. For instance, this theory could evince in situations whereby a young child learns to maintain silence and respect in a

place of worship or when an older sibling learns to care for an infant through observing the actions of their parents. As a result of this foundational theory, the influence of the collective agency on an individual is undeniable, and vice versa.

Besides contributing to knowledge retention, positive reinforcement as part of a collaborative learning experience also improves an individual's self-efficacy. Invented and popularised by Bandura (1995) who held the belief that self-efficacy acts as a mediator of achievement, he defined it as the anticipation by one's self, concerning their ability to succeed in a particular task. He further explained that the focal point of the self-efficacy theory was "the dynamic interplay between self-referent thought, action and affect", thus influencing an individual's belief in their own capacity to perform a specific task which determines how they feel, think, motivate themselves and behave (Bandura 1977; 1986; 1997). Paired with confidence, or one's ability to behave in a certain manner to achieve a desired outcome, this forms the foundation for personal motivation and well being which affects multiple aspects of a person's life, and is therefore significant as part of their holistic development.

Since the coining of the term, researchers have gone on to evaluate the use of Bandura's self-efficacy theory in a wide range of settings especially where it concerned the understanding of behaviour. However, Bandura (1997) was careful to not allow his theory to be blown out of proportion and emphasised that rather than being a general quality possessed by individuals, self-efficacy was to be assessed on a case-to-case basis by which individuals may display or develop in some tasks or behaviours and not in others. For instance, higher social self-efficacy would allow an individual to have enhanced abilities to participate in social interaction. Likewise, self-efficacy when achieved in a higher-order task such as brain surgery has the similar effect of boosting confidence and bettering one's ability, aiding successful completion of the specific task. Bandura (1997) also asserted that while an individual's self-efficacy beliefs and their ensuing behaviour can be transformed by a myriad of informational sources, four specific sources have been identified as being the most influential in affecting a person's sense of self-efficacy. They are, performance accomplishments; vicarious learning; social persuasion and emotional arousal (Klassen & Lynch, 2007; Pajares & Urdan, 2006; Schunk, 2004; Usher & Pajares, 2006).

Performance accomplishment makes for the first of the four influential sources of information and is also known as mastery experience or enactive attainment. Based on a person's previous success with regard to the performance of a specific task or behaviour, self-efficacy then acts to strengthen their current experience and is considered the most influential source because success is dependent on personal practice and experience. Accordingly, if an individual has been unsuccessful in the past or received negative assessments of ability, it can hamper and lower self-efficacy beliefs. While failures lower self-efficacy, occasional failures do not hamper self-efficacy as much as a lack of success will (Bandura, 1997).

Vicarious learning takes its place as the second of the four influential sources of information and occurs when a person observes and learns from another person's behaviour or actions. For instance, a person will be more inclined to attempt or engage with a task if he observes another individual being successful at the same task. The other person's successful completion then acts as a driving force to motivate the learning individual and is best exemplified when the successful individual is observed to be rewarded for the task similar to the one that the learning individual has to complete. Besides being a driving force, the exemplified reward and success also encourages the learning individual to reflect on his past experiences to make sense and meaning in the foreign situation. Although vicarious learning can take place in a variety of collaborative situations, its impact is most effective if the learning individual observes a peer of equal standing succeed in the task. An example of such learning can be found in a situation where young students are involved in a new physical activity such as rock climbing. While they might feel positive about attempting the activity after watching instructors scale the rock wall, the young students might feel more assured if they observe their fellow classmates succeed in the same task.

The third influential source of information is that of social persuasion. As its name suggests, self-efficacy is increased when an individual receives positive reinforcement from others for a behaviour exhibited. Conversely, self-efficacy decreases when an individual receives criticism for their efforts. Such encouragement or criticism corresponds to a human being's basic senses and can manifest through verbal, written, visual or kinesthetic feedback. As such, persons assuming a position of power and influence over others may unknowingly or even intentionally affect change that has far-reaching consequences. Bandura (1997) believed that individuals suffering from lower

or already low self-efficacy are more susceptible to either positive or negative reinforcement. However, the impact of social persuasion on self-efficacy is the most influential when trustworthy individuals provides the learning individual with feedback that is specific, realistic and at appropriate moments.

The fourth and final source of information comes from within the learning individual and refers to their psychological / affective states and their ability to control negativity that is related to their given task. This ability to control negativity does not come naturally and must be learned so that individuals are able to control and turn negative responses such as fear into positive feelings of confidence. As individuals learn to control this negativity, Bandura (1997) explained that emotional and bodily sensations experienced by the individual plays a significant role in increasing their levels of self-efficacy. For instance, if a person experiences pain sensations while engaging in a particular behaviour, that individual is less likely to participate in the behaviour again. It is therefore important to ensure or at least lessen the frequency of situations that causes conflict within the individual's psychological / affective states as they may result in low levels of self-efficacy which extends to lowered levels of participation in tasks and lessened outcome expectations.

Considered as being the most telling evidence in evaluating self-efficacy, a person's judgment of their own self-confidence can also be referred to as perceived self-efficacy and plays an important role in determining their choices and decisions, level of persistence and energy spent on specific tasks. These then affect task performance, which in turn also affects self-efficacy. From this, it can be ascertained that self-efficacy not only affects an individual's self-confidence but also mediates their analysis of their personal knowledge, strengths, and prior performance in similar or related behaviour (Pajares, 1996; Pajares & Miller 1995; Pajares & Schnk, 2001; Phan & Walker, 2000; Oliver & Shapiro, 1993). As an extension of this relationship, Bandura (1997) also regarded that an individual's perception of a task and its varied difficulty levels affect their judgment of personal efficacy. This is especially evident when an individual finds himself facing a familiar task. Having completed a similar task before, the individual can decide that he has the knowledge and skill required for successful completion of the task at hand, thus contributing to high self-efficacy and a willingness to invest more effort in completing the task. However, there can also be situations where individuals recognise the similarity of a task but overestimate their own expertise and capability to

solve the task at hand. When this misjudgment occurs, their future decisions and self-efficacy can be impeded should the task fail. (Bandura, 1997; Clark, 1999). Clark (1999) further elaborated that overconfidence causing a failure of a specific task could be a result of high-perceived self-efficacy combined with a lack of investment of mental effort on a novel task. This is because unanticipated challenges would naturally require a larger amount of mental effort and the amount of invested mental effort is correlated to a person's perceived self-efficacy for specific tasks. Pajares and Miller (1995) further simplified the notion, contending that individuals who perceive themselves as not possessing the adequate knowledge and skill tend to invest less effort in a particular task. This most often occurs when the task is viewed by individuals as complex and new.

As part of the endeavour to design for experiences that promote the holistic development of an individual, it is crucial to examine how the experiences can strengthen an individual's self-efficacy. This is because an individual's belief in his own capability or his perceived self-efficacy plays a crucial role in his everyday functionality and quest for knowledge and skill. As self-efficacy is largely a social construct, its genesis and subsequent development is reliant on social interactions and is especially critical as a young child develops. With vicarious learning being a primary source of information for self-efficacy, a child is dependent on the judgment of other significant persons in their life such as their parents, caregivers, teachers and peers to learn and grow. Their level of self-efficacy in turn affects their decision making process and determines how the child engages in or avoids a task, their ability to rebound from failure and their overall wellbeing (Aronson, 2002). Therefore, parents play a vital role in nurturing self-efficacy as part of the child's holistic development. Parental influence on self-efficacy is also advocated by Margolis and McCabe (2006) who identified that the relationship between collaborators can heavily influence a child's development. For instance, a child develops a higher level of self-efficacy if the parent affords adequate care but does not excessively protect him. While a child's self-efficacy can be developed at home, Bandura (1997) and Ellyard (2002) also suggested that it can also be developed in a variety of situations outside of the home such as their school and through other informal settings. In consideration of the transforming influence of collaboration and its overall ramifications on an individual's development and wellbeing, holistic learning experiences need to provide for opportunities that are socially meaningful so that there are a variety of sources where the individual's sense of self-

efficacy in various aspects can be strengthened. Such experiences also need to consider current and past trends in order to captivate and stimulate its targeted audience so that there is engagement and persuasion to invest their time and mental efforts. As this research intends to seek opportunities to provide holistic learning experiences for young preschoolers, based on the reflection of past and current trends, the opportunities can be made available through video games, online media and imaginary play encounters.

2.3 Imaginary Play

For most people, self-efficacy begins in the home early on in their lives and it is then through various experiences later on in their lives that personal self-efficacy changes. As a child, self-efficacy develops through exploration and play amidst interaction with those at home. While the term play may mean different things to persons of varying age groups and backgrounds, Rubin, Fein and Vadenberg (1983) suggested that there were six key attributes that defined an individual's activity as play:

- The motivation for an individual to engage in the activity comes internally
- The focus of the activity is on the process instead of its end results
- The activity is stimulated by a child's curiosity and propensity to ask questions
- Is based on non-literal motivations
- Dynamic and not subject to external rules
- Represented as intentional engagement rather than accidental activity.

In interpreting their suggestions, designs of holistic learning experiences should include opportunities where individuals can intentionally engage in child directed activities that engages their imagination and creativity. The emphasis of such activities should also be on the individuals' approach, exploration and participation in the activity instead of its outcomes. The outcomes while desirable are considered additional benefits that do not impact on the individual's ability to acquire knowledge.

The definition of play was first defined by Spencer (1873) as an activity used to expend excess energy not used in fulfilling basic needs. It was then redefined by Lazarus who suggested that play served as an activity to help an individual relax and feel revitalised from the daily toils of life (Verenikina, Harris, & Lysaght, 2003). Over time, there have been more than a few notable scholars who have contributed to developmental play research and include people such as Freud, Piaget and Vygotsky. Freud regarded play as a symbolic manifestation of a child's psyche and recognised that play was important to a child's development because it acted as an outlet for behaviour which would otherwise be frowned upon in real life (Rubin et al., 1983). On the other hand, Piaget and Vygotsky's theories were based on the view that play was a developmental precursor to symbolic thought.

According to Piaget (1962), developmental changes occur in an individual when they are able to explore their surroundings and adapt as the need arises. This adaptation is said to occur when the individual experiences assimilation and accommodation as part of their exploration. Assimilation takes place when the individual is able to understand new external information, while accommodation occurs when he alters his previous understanding to accept the new information. Piaget (1951) suggested that play exploration by a young child was egocentric and starts out as being a solitary event. As such, it does not fulfill the requirements of adaptation. However, this changes when the child is about four years old as he begins to engage in what Piaget (1962) describes as symbolic play, where the child understands that elements of their play can be replaced with something else (Rubin et al., 1983). In his studies on children and play, Piaget identified two separate types of play where individuals are engaged in games with rules and games without rules. He observed that games without rules are most common during early childhood while games with rules combined with symbolic play at a later stage during the child's life. This stemmed from his belief that individuals developed in sequences that were determined biologically and that these sequences transferred to how children engaged in play activities that affects their self-efficacy (Piaget, 1962).

Another prominent character in studies on play was Roger Callois, who, unlike Piaget, studied play and games amongst both children and adults. His stance disagreed with Piaget's in that he believed that all forms of play, be it in adults or children were subject to a rules continuum between "*paidia* (rules of structure) and *ludus* (rules for winning)" with the former being the space within which childhood make-believe play occurs

(Henricks, 2011). Callois believed that play was unproductive by nature and did not produce any goods or money.

Moving away from Callois and Piaget however was Vygotsky (1978), who believed that play was symbolic of a person's culture and society and as such focused his studies on the individual rather than the form of play itself. According to his theory, play in children is the acting out of unrealisable needs and that imagination was the defining characteristic of play. Vygotsky also advocated that through creating imaginary situations, individuals create a means of developing abstract thought and this begins when a young child unintentionally experiences the interaction and relation between a plaything's identity and its attached meanings. Commonly known as symbolic; fantasy or pretend play, this development typically begins in a child's second year and is theoretically the beginning of a child's exploration into abstract and symbolic thinking (Harris, 2000; Piaget, 1962; Rubin, Fein, & Vandenberg, 1983). Examples of such play occur when children substitute objects, transform identities of persons or simulate events (Garvey, 1977; Rubin, 1982; Harris, 2000; Singer & Singer, 1990). These kinds of play according to Vygotsky (1978) operate within boundaries or internal rules set by children using their knowledge of their real world and can influence the child's representational abilities, social cognition, theory of mind, and linguistic development, amongst others (Leslie, 1987; Göncü, 1993; Taylor & Carlson, 1997, Singer & Singer, 1990).

Through play, children are able to develop and strengthen their self-efficacy when they have better knowledge of their self and the world around them. As one of the goals of holistic education is for individuals to recognise their own strengths and weaknesses, while developing a passion for transformations, the inclusion of imaginary play that strengthens self-efficacy is an important component to their development. Their development is aided by exploration, discovery and make-believe but does not occur solitarily. Therefore, parents and collaborators play an important role in developing a child's future language, cognitive, social and emotional processes through observation and intervention that is in line with a child's developmental capabilities. Together, these elements help a child to actively participate in his world, which aids mastery and control, thereby increasing competence and self-efficacy. With the emphasis on academic achievements in today's society and the overriding goal of holistic education to develop well-rounded individuals, it is important to help a child to learn through play.

This can be incorporated into their learning experiences and can be achieved using technology as a vehicle to combine collaborative learning and play. It will also help to develop a child's self-efficacy so that they are confident to explore further and develop as a holistic individual.

2.4 Understanding Holistic Education

In the endeavour to design interactive experience for preschoolers that promote holistic learning, an understanding of the different interpretations of what constitutes holistic education is imperative. As the research focuses on Singaporean preschoolers, it is also important to identify Singapore's Ministry of Education's persuasion on the matter. Holistic education in Singapore's context refers to education that develops a child's ability to "process information, discern truths from untruths, connect seemingly disparate dots, and create knowledge even as the context changes" (Heng, 2012). The Minister for Education, Mr Heng Swee Keat (2012) further elaborated that holistic education is not about a focus on academic development but is also about character and values development to ensure students understand and practice resilience in the face of difficulty. He also acknowledged that values should be infused across the entire education system and not just through standalone lessons. As such, "inquiry-based learning" as well as "critical and inventive thinking; civic literacy and information; and communication skills" have been introduced into the Singapore school curriculum (Heng, 2012). This direction set by the ministry encapsulates the interpretation of holistic education as echoed by Ravitch (2007, p.115), Forbes (2003) and Miller (1996).

Ravitch (2007, p.115) defined holistic education as "education that focuses on the whole child" and not just in the development of their cognitive capabilities and comprehension. In addition, their physical well-being as well as their social and emotional intelligence is developed. In the pursuit of holistic education, the usual significance of knowledge acquisition is diminished and students are often engaged in interdisciplinary lessons. Ravitch (2007) further suggested that while schools set a precedence for the way students learn and face future challenges by training them to think holistically, this should also be cultivated beyond the education system. This is also my belief as a researcher and is the genesis for *Connecting Dots* where holistic learning should also be the responsibility of parents.

Forbes (2003) contended that there is no consensus as to the real definition of holistic education and that not one specific quality can be used to qualify an educational program as holistic. However, he suggested that the aim of holistic education is “Ultimacy” - the highest state of a person’s being such as a stage of development, or a phase of life that is desired, or an engagement. These two terms encompass religious and psychological perspectives as well as theories of human development (2003, p.17). While religious knowledge is valued as part of holistic education, it is not permitted to be a part of the holistic curriculum in Singapore as it is considered a secular state (Ministry of Education, 2000). However, there are no restraints in families training their young in religious knowledge at home and within religious communities.

2.4.1 Elements of Holistic Education

Miller (1996) presented that the aim of holistic education is to instigate in students a desire for learning and to engage them in holistic thinking by solving problems through informed decisions. He further identified elements that made up holistic education, which will also form the foundation for this research’s approach.

2.4.1.1 Balance

Miller (1996) noted that although it is possible to focus on single aspects of a child’s development at a time, educators should be mindful that other aspects could also be vital to the child’s growth. He enumerated factors of traditional education curriculum that needed to be balanced as part of the endeavour for holistic education. These factors are:

- Less individual work and more group collaboration.
- Less rote learning of content and a deeper understanding of how to process content.
- Combining knowledge and imagination so that the webs of information can be formed, interpreted and understood.
- Instead of approaching problems in a linear and rational manner, encourage intuitive thinking and merge it with rational reasoning so that solutions to problems are not too mechanical or too ungrounded.

- Less focus on specific discipline techniques and strategies but more focus on how they correspond to wider concepts of learning and the overall vision.

Miller (1996, p. 5) emphasised that besides the underlying factors mentioned above, educators should also include overarching visions to link content and lesson objectives so that students can get a sense of “interdependence and personal wholeness” through the education process. This endeavour to balance traditional education curriculum is even more attainable with the advancement of technology and the incorporation of digital media in schools. While Miller’s concepts are applicable in the school context, it can also be applicable to generic media content that aims to promote holistic learning.

2.4.1.2 Inclusion

Miller (1996, p. 5) also demonstrated that there are three orientations that education systems prescribe to: “Transmission; Transaction; and Transformation”. Learning through a transmission orientation, a student receives and acquires knowledge through reading texts or listening. This orientation is widely used in traditional learning methods and comparable on some levels to mimicry. It requires content to be broken down into small units to aid mastery of content through rote memorisation and understanding. Although this orientation is able to give learners the information they need, it only creates a one-way transmission of skills and knowledge and does not encourage reflection and analysis of new knowledge (Miller, 1996).

The transactional orientation is the model most prescribed by modern education systems. It takes on a more interactive approach and requires learners to actively participate in solving problems or inquiring for information aided by educators. This orientation conditions students to be problem solvers who are able to think rationally and behave intelligently (Miller, 1996).

The transformation model aims to develop the student as a whole being. In this model, educators use scenarios and tools that encourage collaboration between students. They are prescribed problems that have to be solved using creative but relevant knowledge. This orientation molds active learners who engage in a learning process that is personal and socially meaningful (Miller, 1996).

Miller (1996) emphasised that as part of the holistic curriculum, all three models of learning should be included in varying forms and not one model should be used exclusively. In applying these concepts to holistic learning, interactive media as part of an individual's learning experience improves the possibility for the three models of learning to be included. This is to ensure that learners are given the opportunity to participate and find their preferred way of acquiring knowledge, therefore engaging them in a well-rounded process.

2.4.1.3 Connection

A view shared by Forbes (2003) and Miller (1996) was that the aim of holistic education is to reduce fragmentation through relationships and connections. Miller (1996) identified contexts in which learners could be engaged in to help them examine and understand their place in the world:

- Using techniques such as metaphors and visualisation combined with traditional linear methods of thinking, learners are able to better analyse and apply intuition in the acquisition of knowledge.
- Creating situations where learners are able to practice and apply interpersonal skills and contribute to their community and society.
- Creating opportunities where learners can explore the relationship of their being as part of the web of life.
- Creating scenarios where learners can recognise their true self and ego as part of being connected to others, thus discouraging competition amongst peers and society.

When individuals are made aware of these relationships, they are equipped with the necessary skills to connect and transform the relationships where appropriate (Miller, 1996). As the transformations occur, individuals are able to better understand themselves and the world around them, thus providing them with a starting point where improvement and growth can transpire. The attempt to encourage individuals to connect and transform relationships can be facilitated through interactive media content. Because interactive media has the potential to incite imagination, individuals are more

likely to engage in a learning experience where they can see how information relates to wider concepts and analyse its associations and their own positions. When they understand their own position in relation to presented information, they are likely to apply their prior knowledge and question how they can progress, thus enhancing the potential for the holistic development of the individual.

Using the above elements identified by Miller, a guide has been designed to adapt its concepts so that it can be applied to a framework that can be used to design new media that promotes holistic learning. The designed framework and the research is important because the advancement of technology and its trends presents opportunities to transform the way children learn and develop for a better future.

2.5 Media Technology, Trends And Its Influence On Holistic Education

To develop new media that can enhance potential for growth, it is then necessary to examine media technology's trends. While there is a wide range of users who may today be proficient with digital technology, a prevalent term encountered when analysing media technology trends is that of a digital native. This term was first introduced by Marc Prensky to define users of technology who were born during or after the digital age - beyond 1960s. Referring to the generations born after the baby boomers, he noted that their offspring have the tendency to be exposed to technology early on in life. Besides the early exposure, their children also learn how to use technology at a much faster pace. He also emphasised that digital natives "were fluent in the digital language of computers, video games and the Internet" (Prensky, 2005, p.8). This view was also shared by Palfrey and Gasser (2008), Theilfoldt and Scheef (2004) as well as Havenstein (2008) who further explained that digital natives had access to digital technology networks and are on a quest to further advance their already strong technological skills and knowledge. Prensky (2001) also identified that digital natives had a stronger desire to learn through experiments, collaboration and social connections. This observation by Prensky is especially important to consider when designing interactive media experiences that aim to promote holistic learning.

Learning with the aid of technology exposes a learner to a situated learning experience that is supported through social relationships in complex and authentic situations (Stein, 1998). Such an experience allows technology to be integrated with a holistic pedagogy

by helping learners make sense of their context and experience so that they can learn how to act responsibly. Lave (1996) concurred that being immersed in a situated learning experience, learners will have a strong learning foundation, which aids future knowledge transfer. This is based on the belief that learning, thinking, and knowledge acquisition are results of people participating in activities situated in a “socially and culturally structured world”, a notion that echoes Vygotsky’s theories (Lave, 1991, p. 67).

As digital technology become more affordable, children are gaining access to digital media at an earlier age and over a wide variety of platform choices. It has been reported by Linebarger and Walker (2005) as well as Krcmar, Grela, and Lin (2007) that children as young as 9 months old are being exposed to media content as parents find ways to entertain and educate their young. However, research has shown that toddlers are unable to take full advantage of media content as they are unable to relate information presented through the media to their own reality, thus producing a phenomenon known as the video deficit effect (Anderson & Pempek, 2005; Hayne, Herbert & Simcock, 2003; Schmidt, Crawley & Anderson, 2007; Troseth, Saylor, & Archer, 2006).

In order to overcome the video deficit effect, Troseth et al (2006) discussed the need for media content to gain the trust of young viewers through points of familiarity while instigating the young to view characters portrayed in the media content as socially relevant. By doing so, media producers have the potential to significantly influence how children learn from media. However, they should also be aware that these potentials come attached with moral and ethical responsibility. Cleveland and Striano (2008) recommended that social cues were included in media content to help children learn. For example, by having characters such as *Dora The Explorer* address viewers directly, their attention is better engaged. This was also suggested by Troseth et al (2006) who further argued that verbalisations by a responsive communication partner could also increase the learning potential of a young child. This approach was also shared by Singer and Singer (1988), Wright, Peters and Huston (1990), Fender et al (2010), Richet et al (2010) and Barr, Zack, Garcia and Muentener (2008) who observed that children who had a parent co-viewer that demonstrated scaffolding techniques influenced by Vygotsky’s ZPD theory had higher levels of attention and comprehension of media content (Vygotsky, 1978 p.86 as cited in Schunk, 2008, p.245)

With this in mind, the LIFE Center developed a notion of joint media engagement (JME), where spontaneous and designed experiences through social interaction could support learning and promote meaningful connections. These experiences can include “viewing, playing, searching, reading, contributing, and creating, with either digital or traditional media” (Media and Learning Group at SRI, 2010). Such experiences gives media producers an opening to consider how content can be used to “augment social processes in learning” and through the inclusion of familiarity and an opportunity for unique media experience, holistic learning can be encouraged.

Rideout, Foehr and Roberts (2010) noted that media content that was once limited to just the television at specified times was now readily available through new technology such as mobile phones and iPads, not restricted to geography or time. With the convergence of old and new media technologies, an immense volume of information is available through a multitude of communication channels and opens up limitless possibilities in how people can intuitively consume and produce media. It is therefore favourable to examine media’s history and define trends that are prominent so that current needs can be met and people can proactively make preparations for societal and personal growth.

Shih (1998) and Turkle (1995) advocated that with the diverse range of technology and editing software available, people are becoming producers facilitated by the practice of bricolage - their capacity to learn and manipulate objects in their virtual environment for their own pleasure. Today, personal and authentic experiences are highly valued as evidenced by the increase in demand for distinctive and unique products that are not mass-produced (Carrol & Hannan, 2000). This phenomenon is also evident in the media industry where a desire for personally crafted niche videos such as amateur short films or spoofs of music videos and films are gaining popularity even if they are not perfect in execution. With the establishment of Web 2.0, content generated by users can also be shared on a peer-to-peer basis, giving individuals creative license and semiotic democracy that is exhibited through media channels such as Youtube and Vimeo (Stark, 2006).

As technology integrates, the lines guiding media platforms are also blurred. Television shows are now available online through the Internet and books can be read electronically. Besides the increase in media exposure and forms, users are also observed to be engaged in a trend known as media multitasking. This is evident in a

study by the Kaiser Family Foundation (Rideout & Hamel, 2006), where it was found that children were exposed to approximately 8 hours of media content, but compressed into 5.5 hours by being engaged in more than one medium at a time. Patricia Greenfield (cited in Wallis, 2010) outlined three categories of media multitasking:

- An interaction between real life settings and the use of technology. For example, Internet surfing on the mobile while eating.
- Utilising more than one type of media at the same time, for example having the television set on while working on the computer.
- Being engaged in various tasks within one medium, for example having a Youtube playlist streamed in the background while playing an online game that has its sound effects on mute.

With this trend on the rise, researchers are concerned about its effects. A study by Schmidt, Pempek, Kirkorian, Lund and Anderson (2008) found that when a young child was placed in a room with toys and the background television was turned on, their attention span on what they were playing with were shortened and less focused. It reveals that while humans have the capabilities to occupy themselves with various activities at the same time, one's attention is divided into smaller components and can significantly influence the person socially and psychologically. A more significant finding reported was that the quantity and more importantly, the quality of parent-child interactions were reduced as a result of background television (Kirkorian, Pempek, Murphy, Schmidt & Anderson, 2009). The effects of the media multitasking trend should be evaluated especially when designing for interactive learning experiences that are to promote holistic learning. This is because the potential for target audiences to learn through media content can significantly decrease if the media experience is badly designed and requires prolonged attention spans. However, the potential can also significantly improve and intensify if the media experience features short yet connected interactive activities that can maintain the interest and focus of the target audience.

Besides the opportunities and risks referred to in the trends mentioned, media technology also encourages users to explore and experiment with their own identities and roles, but this is accomplished at the risk of social psychological effects such as

“disinhibition” where users are no longer concerned about how they are being portrayed or judged by others; and “deindividuation” when users unconsciously adopt behaviours or thoughts displayed by a group in order to feel accepted (Atkinson, 2002). As such, media literacy is important for people of this highly mediatised society for their personal as well as societal development and well-being. This need is even more imperative as more people are no longer satisfied being mere consumers, but start to produce their own work through media channels such as blogs, video blogs (vlogs) and podcasts.

Media literacy is defined by two attributes - functional and critical (Buckingham et al., 2005). Functional media literacy establishes the various skills and technical knowledge required to access media information. Critical media literacy on the other hand, describes the abilities of a person to understand, analyse and evaluate messages being transmitted. Media literacy should not only concern adults but should be cultivated in the young as part of their learning experience.

It has been suggested that children who do not have adequate exposure to digital media and Web 2.0 technologies will be disadvantaged in the future, thus making it important for technology to be considered as part of their educational experience (Greenhow & Robelia, 2009). By employing media technology such as cameras, iPads and computers, the potential for a child’s appreciation, comprehension and how they encounter and interact with their surroundings can be enriched because technology enables users to think differently and have wider access to resources (Yelland, 2007, p134). As such, children are able to gain knowledge through multimodal ways that make knowledge acquisition a more meaningful process. The multimodal ways of knowledge embraces both new and traditional forms of learning, enabling a child to discover their identity through exposure to play and creative expressions. Marsh (2005) believed that media technology aids the development of a child’s social identity and allows them to engage in a dynamic and shared experience. Marsh also stressed that while it is conventional for adults to shape a child’s culture based on their own set of beliefs and values, it is also important to give children the opportunity to create their own practices and opinions. This active engagement and sense of control will motivate the child to have a passion for lifelong learning which achieves a goal of holistic education. This multimodal approach was met through *Connecting Dots* where preschoolers were given the

opportunity to acquire knowledge in multimodal ways by combining various types of technology and resources (See Chapter 3.3.3.1).

In a study conducted by Smith (2002), it was observed that young children who interacted with technology as part of their play and learning had deeper and more meaningful experiences. This was contributed to the opportunities provided by new media that allowed the young to be an active participant. Yelland (2007, p37, 50) supported this observation and also emphasised that technology should be used as part of a child's learning journey as it allowed them to learn in "a nonthreatening and playful manner" while developing their self-esteem, self-efficacy and engage in team work and collaborations". This ideology takes reference from Jean Piaget's theory that through play and sensory-motor experiences, children learn how to understand and formulate new ideas and knowledge (De Corte & Weinert, 1996). It was through these theories that this research realised the importance of giving children the opportunity to be engaged in fun and creative activities as part of the multimedia experience.

Through technology, holistic education is supported through the enabling of immediate access to a wide range of information, thus encouraging self-directed learning through exploration and social collaborations. Shepard (1993) presented that because media technology and its artifacts are products of a wide range of discipline such as science, visual arts and social studies, it could aid a student's awareness and understanding of wider and disparate concepts and their connections. This again, is a goal of holistic education. By nurturing the significance of balance through holistic education with the aid of media technology, children are afforded a strong foundation that can be further developed as they grow older and become responsible citizens of the future. This foundation can also be facilitated when the same sense of balance is applied to the design approaches of new media technology.

2.6 A Holistic Approach To Human Computer Interaction Design

It has been observed that users were tolerant of bad interface designs if they were still able to achieve their end objectives (Laurel, 1986). However, such interfaces caused users extraneous emotional stress, which affect their well-being (Shedroff, 2002). This led to traditional interface designs to take into consideration a user's cognitive and physical needs, giving momentum to usability studies and the development of quality standards by the International Standard Organisation (ISO)(Jordan, 2000; Nielsen,

2000; Preece, Rogers & Sharp, 2002). ISO/DIS 9241-11 defined usability as "the extent to which a product can be used by specific users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use" (Bevan, 2006). With this definition, designers focused on designing interfaces that were easy to use in an attempt to achieve user satisfaction (Olsen, 2003; Norman, 2004). Early usability studies prioritised behavioural observation and placed little emphasis on the feedback of user's experience due to a reservation against introspective evaluation (Nielsen, 1993). As a consequence, a user's subjective experience was not widely studied and ignored.

However, with a desire for interaction designs to be more influential, interaction designers soon saw the importance for designs to consider its users' social and emotional qualities (Laurel, 1986). This notion was solidified with the findings of Reeves and Nass' (1996) research which demonstrated that users in interacting with computers displayed emotional and behavioural responses similar to when they interacted with other social beings in real life. As a result of such findings, the Human-computer Interaction (HCI) community began to address the social and emotional qualities of users which saw the beginnings of the new frontier - Affective computing and designs which aimed to elicit natural responses and give users a positive experience (Picard, 1997; Picard & Wexelblat, 2002; Khaslavsky & Shedroff 1999; Laurel, 1991; Norman, 2004). In an attempt for interfaces to employ a more holistic and inclusive approach, emphasis was placed on pleasure and fun experiences, giving birth to the concept of Funology, a term used in 2002 at a Computer-human interaction conference workshop (Malone, 1984; Carroll & Thomas, 1988; Blythe et al, 2003; Monk et al. 2002).

Wright, McCarthy and Meekison's (2008), drawing from Vygotsky's theories alongside other psychological theories, believed that experience resulted from a dynamic interaction between a person and their environment. Experience, therefore could not be designed, but with a good understanding of the potential users, one could design for an experience. To aid this design process and enable designers to think and talk about experience, they presented a holistic, constructional and pragmatic framework of independent characteristics that when connected formed experience. Also known as the four threads of experience, they were identified as compositional; sensual; emotional and spatio-temporal (Wright, McCarthy & Meekison's, 2008, p46).

The compositional aspect referred to the narrative structure of the elements that formed the experience and also considered the “action possibility, plausibility, consequences and explanations of actions” of such elements (Wright, McCarthy & Meekison’s, 2008, p47). The sensual aspect referred to how our five senses and feelings reacted when engaged with a situation or a product’s aesthetic appearance. The emotional aspect motivated people to reflect back on their experience and ascribe value judgments of their emotional response such as satisfaction or disappointment. The spatio-temporal aspect considered that actions and events happened within a time and place that shared a parallel association as constructed by the persons involved in the experience. In understanding the four individual yet connected aspects, designers were able to better design for an experience.

Similar to theories from narrative psychology, Wright, McCarthy and Meekison (2003) also presented that experiences were constructed and understood through a person’s “reflexive and recursive” sense making process. By communicating the experience either to others or one self, a person reflexively makes sense of their experience. It is also a recursive process because human beings are constantly engaged in trying to seek the meaning and significance of their experiences.

The HCI community was slow to adopt fun and positive experiences as research topics due to the perception that it had little relevance to interaction efficiency. At the same time, some researchers saw it as a superficial theory that lacked substance (Light, 2004). Monk et al (2002) proposed that part of the reason was because the HCI domain of usability was founded on theories of cognitive and emotional psychology, which accentuated negative emotions and limitations in cognition. As a result, positive emotions were not prioritised. However, as the influence of technology increased in the entertainment sector and in the lives of people, research on Funology picked up momentum. Known as the science of enjoyable technology, Funology aimed to develop designs that engaged users through fun and enjoyment as a usability element (Blythe, 2004; Carroll, 2004; Blythe & Wright, 2003; Monk et al, 2002). Designing for positive and engaging experiences is especially important when designing for young children and as the HCI community realises that children take play seriously, the concept of funology is gaining recognition (Dix, 2004). It is said that a lot of effort is required to be put into producing interfaces that are to be effortlessly enjoyed. This can then also be true that in order to create and design interfaces for pleasurable experiences, the

inclusion of fun and enjoyment as part of usability has to be taken seriously. As such, holistic and interactive media experiences that attempt to engage young children should be designed and developed with content that provides them with fun and pleasure.

There are no formulas for designs to be fun and engaging, but through the analysis of real-life experiences, designs can be informed so that such experiences can be achieved. Schneiderman (2004) suggested that fun experiences could be distinguished into two categories, fun-in-doing and fun-in-not-doing. In the latter, a person feels a sense of enjoyment when they are engaged in interaction that is not goal-oriented. Fun-in-doing on the other hand, is goal oriented and is a sensation obtained when engaged in activities that are either physical, or mental. Examples of physical interaction could be playing a musical instrument or being involved in a craft activity. Mental interactions on the other hand, could be achieved through being involved in solving problem.

A thorough understanding of these two categories as well as the different psychological perspectives; elements of holistic education and the trends of media technology can be utilised to ensure that the approach to the designs of interactive media provides a learning experience for learners that is not only fun and engaging, but is capable of contributing to the holistic development of individuals for a better society and future.

2.7 Summary

In the endeavour to promote holistic learning through the use of media technology so that learning approaches can remain current and engage young children, it is essential to understand what holistic education stands for and how it is influenced by psychology. Theories from Gestalt psychology have played a big role in the development of holistic education and advocated that students can be guided to recognise relationship and patterns in learning material for insightful learning (Hergenhahn & Olson, 2005). However, this is only likely to happen when all the necessary information is presented as a whole. The Gestaltists also recommended that learning does not occur through rote memorisation of information (Woodworth & Sheehan, 1964). Instead, true learning happens only when knowledge is acquired, understood, retained and transferred to other situations. The concept was later embraced by Miller (1996) and Forbes (2003) who were prominent figures in the advancement of holistic education and expressed that connection was a requisite of holistic learning.

Theories from cognitive psychology also influenced holistic education through Piaget's beliefs that knowledge is constructed through the process of exploring a person's environment (De Corte & Weinert, 1996). Therefore the process of learning is more important than content. The emphasis of learning processes was then expanded through the works of Vygotsky who added that beyond the exploration of a person's environment, knowledge acquisition is also affected by their culture and social relationships (Vygotsky, 1978, p.86 as cited in Schunk, 2008, p.245). This meant that the potential for authentic learning occurs through collaboration where learners can be scaffolded to achieve better understanding as compared to learning on their own. Additionally, Vygotsky believed that education could develop an individual's personality and their creative potential. However, it required the learner to play an active role in a collaborative learning experience that could be modified so that it was unique to the individual.

Another viewpoint in the field of psychology that has influenced holistic education is narrative psychology, which believes that people find meaning through the construction, acquisition and communication of stories. This is best encapsulated in the words of Jean-Paul Sartre (1965, p.56 as cited in Bruner, 2004) who wrote that "a man is always a teller of tales, he lives surrounded by his stories and the stories of others, he sees everything that happens to him through them and he tries to live his life as if he were telling a story". It is this notion in narrative psychology that suggests that human lives have the potential to be changed through stories. Therefore, stories can be used in holistic education to help learners understand themselves and their place in the wider world so that individuals can recognise and determine ways that they could develop so that they can achieve their full potential.

Through the understanding of theories from psychology, it was also identified that an individual's ability to learn holistically can be enhanced when collaboration forms part of the experience. Finding its roots from theories of Gestalt psychology and later popularised by Piaget and Vygotsky, collaborative learning is defined as learning that occurs when individuals observe and interact with others. Through the observation and interaction, individuals might be rewarded with positive reinforcement for mimicking behaviours and therefore increasing their willingness to acquire new knowledge. Besides strengthening an individual's potential to learn, collaborative learning also provides opportunities for improving an individual's self-efficacy, referring to an

individual's anticipation and belief concerning their ability to succeed in a task. By increasing a learner's self-efficacy, their development as a whole being also improves as it affects their daily functions; feelings; thoughts; motivation and behavior. Additionally, it also encourages the individual's attitudes towards life-long learning. The analysis of its theories revealed that there were four sources that affected an individual's sense of self-efficacy and they are:

- performance accomplishments: based on past success in specific tasks
- vicarious learning: based on the observation of others' success in specific tasks
- social persuasion: based on positive or negative remarks from others
- emotional arousal: based on the individual's ability to control how they feel towards the execution and implementation of tasks.

One of the ways that self-efficacy can be increased within collaborative learning experiences is through the inclusion of imaginary play. There are many interpretations of the definition of play as it has evolved through the understanding of various scholars and researchers such as Freud; Piaget; Callois; Vygotsky; Rubin, Fein and Vadenberg. However, it is through Vygotsky's (1978) explanation that my research finds its position. Viewing play as an individual's exploration and acting out of their unrealisable needs, Vygotsky asserted that imagination was an important characteristic of the activity where the individual would develop their abstract thinking skills. These skills can then assist them in better understanding themselves and their position in the world. Through the exploration with other collaborators as part of their imaginary play, their self-efficacy can be strengthened which also influences their development in other areas such as cognition, language and emotional well-being. Therefore, in the quest to develop well-rounded individuals, it is imperative to include imaginary play as part of the holistic learning experience.

Holistic education aims to focus on the development of a child as a whole being and to inspire life-long learning. In order to achieve these goals, *balance, inclusion and connection* have been identified as elements within learning experience that are pivotal for the promotion of holistic learning. In balancing learning experiences, there should

be an increase in the focus of collaborative encounters where imagination and intuition play a role in the learning process. Miller (1996) also advocated that learning occurs through three orientations of transmission; transaction and transformation. When individuals learn through transmission, they acquire knowledge through textual forms and is the most commonly used method in traditional education. When learning through the transaction orientation, individuals are engaged in interactive participation where they are trained to solve problems through rational thinking. The final orientation of learning is the transformation model where collaboration is critical so that the learning experience is personally and socially meaningful to the learner. While the three orientations can be taken into account separately when designing learning experiences, Miller emphasised that for a learning experience to be holistic, all three orientations should be included. The final element of connection as part of a holistic learning experience should attempt to assist individuals in recognizing and understanding relationships in wider contexts. When individuals can understand these relationships, they are able to better understand themselves and their place in the world. This is very important as it is fundamental to their own development and well being.

Because the process and experience of learning is more important than content in holistic learning, its approach can be supported with technology and new media so that individuals can be immersed in holistic learning experiences. With the increase in abilities, availability and affordability of technology, media developers are given the opportunity for new ways of disseminating content. One such way is through interactive media where storytelling and interactive activities become mediums through which holistic learning can be promoted. In recent times, the approach to the development of human computer interaction designs have also adopted a holistic perspective where user's social and emotional qualities are also considered (Laurel, 1986). In adopting the holistic approach, interactive media designs are persuaded to include fun and pleasure so that engagement in the experience can be maintained. Such engagement would then increase the opportunity for individuals to learn through experiences and processes that promotes their holistic well being and development.

With a better understanding of how people learn and the advancement of technology; communications and media landscapes, the values and norms surrounding education and literacy are being modified. This has led me to question if new media in the form of an interactive website that allows for personalisation of media elements could be used to

promote holistic learning. To answer the question, an initial holistic interactive framework was identified so that it could be applied to the designs of interactive media experiences. The framework is as follows:

Balance: Interaction, website and content design should give users the opportunity to combine knowledge and imagination.

Inclusion: Interaction, website and content design should allow users to collaborate with others in solving problems so that learning can be personal and socially meaningful.

Connection: Interaction, website and content design should include integrated topics so that users can see how information and knowledge is related to wider concepts and assist users in understanding their position in relation to the world.

Besides the initial holistic interactive framework, the design of interactive media would also embrace the following characteristics as identified from theories and perspectives expounded in the literature review:

- Deriving from theories of Gestalt psychology, holistic learning should be evidenced by retention and transfer of knowledge.
- Cognitive psychology demonstrates that holistic learning should place emphasis on the learning process and collaborative experiences instead of content.
- Motivated by the theories of narrative psychology, interactive media content can use storytelling as part of the learning experience to help individuals understand themselves and their potential.

Finally, collaborative experiences provide opportunities for the strengthening of self-efficacy through activities that are familiar. However for the learning experience to truly promote holistic learning, it requires the incorporation of teamwork and communication as well as fun so that individuals remain engaged in the process. The application of these characteristics and the initial holistic interactive framework are further explained in Chapter 3.

3. Methodology

This study examined how the three elements of balance, inclusion and connection as identified by Miller (1996) and the other theories identified in the literature review could influence the design of new media so that technologically savvy children could be afforded the opportunity to be engaged in a holistic learning experience. Miller's three elements were elaborated into an initial holistic interactive framework with detailed design elements that was then used to develop an interactive website prototype, also titled *Connecting Dots*, that considered the emotional and social qualities of its target users - Singaporean Preschoolers and their families (See Table 2). The research was designed to investigate its effectiveness in engaging children in a holistic learning experience.

The *Connecting Dots* website prototype was developed using development processes well accepted in the fields of HCI (See Figure 3) and featured various stages of assessments for its design, and development of its numerous components such as the scripts, song recordings and animations. When the first interactive website prototype was complete, it was then evaluated through a pilot test where a few issues in the website prototype was identified. As these issues had the potential to affect the overall interactive experience, the prototype was modified before it was used to evaluate the initial holistic interactive framework through six user tests. This chapter details the design; research questions; methods; ethical considerations and limitations of the study.

3.1 Research Design

In this research, a qualitative study was conducted. The study involved different disciplines such as human-computer interaction (HCI), psychology and education (see figure 2) and valued the personal learning and emotional experience of research participants through their interaction process with the interactive activities in the website prototype, *Connecting Dots*. Besides the participants' experience, the research was also interested in how their interaction with the media content influenced their ability to learn in a holistic manner. This required in-depth data that had to be collected through qualitative methods that took into account their subjective experiences resulting from their interaction with *Connecting Dots*.

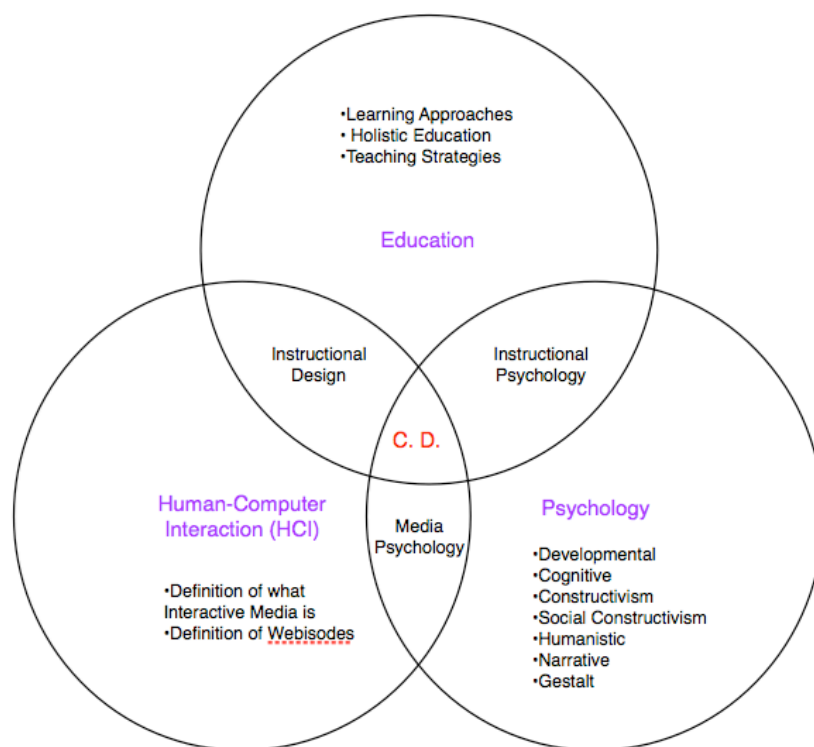


Figure 2. Venn Diagram showing interdisciplinary nature of *Connecting Dots*.

Because the nature of the project required an artifact in the form of a website prototype to be developed, development processes already proven in the field of HCI were applied (see figure 3). These processes were appropriate for the research as the nature of its inquiry was concerned with practice and reflection to seek new solutions (Cockburn, 2008). The new solutions would then be presented as recommendations so that future interactive websites for holistic education can be further developed.

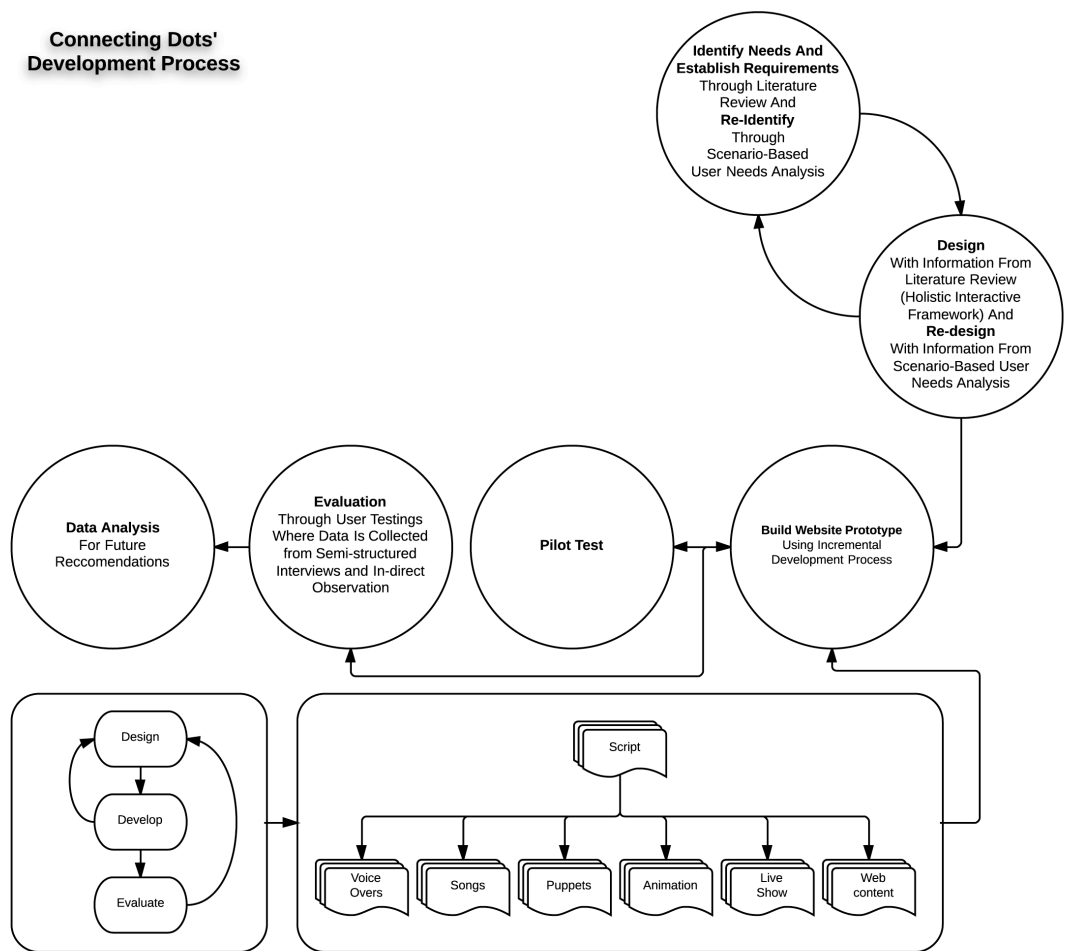


Figure 3. Development Processes of *Connecting Dots*.

The stages of the development process began with the identification of the needs and requirements of the research, which was informed by the literature review. A basic interactive framework was designed and evaluated using a scenario-based analysis to ensure that the framework would meet the requirements for the study. Based on this analysis, the information was then used to elaborate on the basic framework and an initial holistic interactive framework was re-designed to form the basis for the development of the website prototype. In the stage where the website prototype was developed, an incremental development process was used because of the need for a variety of elements to be developed and incorporated in increments for the entire website prototype to be completed. The website prototype was then tested and evaluated through a pilot test and user tests where participants' interactions were recorded on video to determine the capacity for the initial holistic interactive framework to promote holistic learning. Data was also collected from the participants through semi-structured interviews and observations. Finally, the data collected through the evaluations were analysed to determine new solutions that would form a new holistic interactive

framework as recommendations for future development of interactive media for holistic learning.

The following table shows a summary of the methods that were carried out as part of the research and a description of what was analysed (see Table 1).

Table 1. Summary of methods for *Connecting Dots*

Method Approach	Description
Semi-structured Interviews	Data determined if participants had a balanced and inclusive experience through an interactive website that allowed them to create personalised media elements.
Observations	Data determined if the interactive website promoted holistic learning where participants connected and transferred learned concepts to real life situations.

3.2 Research Questions

Considering problems stemming from a focus on meritocracy and the recognition of the importance of holistic education for a well-rounded technology-savvy society, the primary research question that was asked by this research was:

- How will the content, interface and interaction designs of an interactive website developed using the framework of balance, inclusion and connection promote holistic learning?

To support and answer the primary question, the following sub-questions were also asked:

1. How will personalisation in the interactive website encourage knowledge acquisition that is balanced?
2. What kinds of experiences will preschoolers encounter through the collaborative interaction between themselves, their parent and the interactive website?
3. What evidence will the preschoolers demonstrate to show transfer of concepts or themes from the interactive story?

The questions were guided by the theories identified in the literature review, which influenced the approach and design of this research (see figure 4). The first sub-question would identify how the learning experience was balanced with the addition of personalised media content. The second sub-question would describe how the collaborative interactions would contribute to a learning experience that is inclusive. Finally, the third sub-question would verify the importance of connection on a child's ability to connect learned concepts to their personal life can contribute to a learning experience that is holistic.

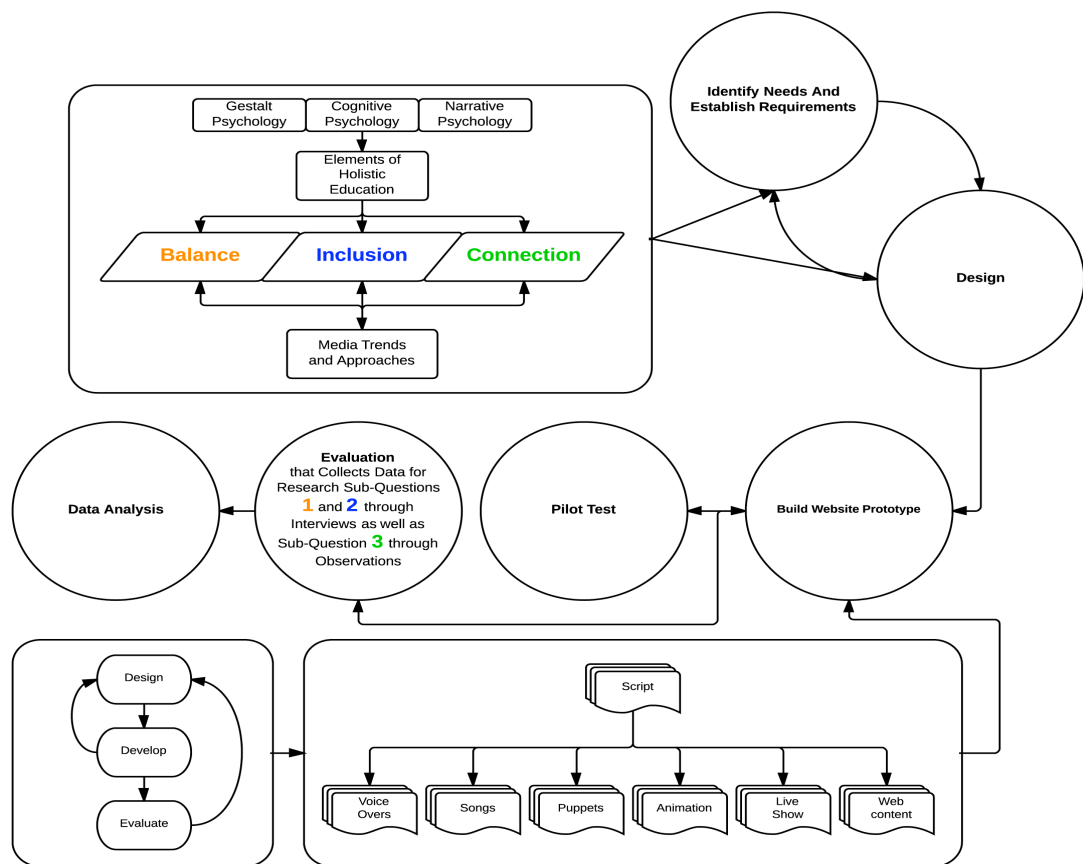


Figure 4. How Theories and Holistic Interactive Framework from Literature Review Influences the Research Approach and Design

3.3 Research Methods / Procedure

In this section, the methods used in the different stages of the development processes of the study are described. These stages include:

- identification of user needs and establishment of requirements
- design of solution
- development of website prototype
- initial evaluation through pilot study
- evaluation through user tests and observations
- data analysis

3.3.1 Identify Needs and Establish Requirements

The research required a website prototype to be developed so that the research questions could be answered. In the first stage of the development, the needs and requirements of the website prototype were reviewed over two phases as the research progressed.

The first phase relied on the literature review and identified the target audience for the study as Singaporean preschoolers and their parents. This was based on the finding that there was a lack of ICT training amongst preschoolers despite an increase in the young being exposed to media and ICT at an early age. The parents of preschoolers were also targeted based on the finding that there was a reduction in quality and quantity of parent-child interactions (Kirkorian, Pempek, Murphy, Schmidt & Anderson, 2009). Based on this selection of target audience, the initial needs and requirements of *Connecting Dots* was to entice Singaporean children aged four to six and their parents through content that was specific to the culture of Singaporeans. The design of the website prototype would encourage them to collaboratively interact with media elements that would provide them with a holistic learning experience.

The second phase in this stage was completed through a scenario-based user needs analysis based on the first design of the basic interactive framework. Instead of gathering information through interviews or surveys, the scenario-based user analysis method was used. Scenario-based user analysis of an interactive website are narrative descriptions that consider envisioned and possible alternative ways target users might behave while interacting with the designed interactive website (Rosson & Carroll, 2002). Applied in the early stages of development, the scenario-based user analysis can promote the identification of how users and the products influence the learning experience and its information can be used to guide the development of the website so that the designs are optimised for user experience. The limitation of this method of analysis is its focus on characteristics of interactive tasks instead of its designs. However, as this limitation is acknowledged, the incremental development process used in the building of the prototype stage compensates for this shortcoming. The method of analysis in this study was executed through three narratives that described potential users, their motivations, capabilities, settings and how they would accomplish tasks in order to achieve goals of the interactive website (See Scenarios One - Three). This analysis provided a deeper understanding of the potential users and how they might interact with the website so that the design of the initial interactive framework could be fine-tuned.

Scenario One

Jasmine, aged five and her mother Freda are part of the user test held in their homes. They are alone and there are no other distractions in the immediate environment. She is excited to start and takes the lead in the interaction. Although quiet, Freda provides Jasmine with moral support by encouraging her as she interacts with *Connecting Dots*. At the start of the user test, Jasmine notices the introduction page that shows a list of instructions. She reads the instructions out loud and can read all the texts on her own. She commences interacting with the pages by visiting them in the order stated by the instructions. Selecting the button with an icon of multiple people, she sees a page that shows brief information about the characters. She reads the texts and decides to select the link to see more information about the characters. When the information loads, Freda reads out the texts and when there are words that Jasmine could not understand, she sought clarification from Freda. Freda would then explain to her the meaning of the words and to ensure that Jasmine understood, she would ask Jasmine to re-explain the words in her own understanding and provide an example of how the word could be used in a sentence. When Jasmine has read all the information about both the characters, she would move on by selecting the button with an icon of a paint palette. Here, Jasmine would read all the texts and view all the examples before proceeding to create her own craftwork. At the start of the craft activity, Jasmine and Freda would plan their designs and collect all the materials required. Together, Jasmine and Freda would find imaginative ways to incorporate materials to make three-dimensional designs. Following the instructions, Jasmine would then take a photo of her craftwork with the assistance of her mother who would then assist her in saving and uploading the image. Once her image is uploaded, Jasmine would proceed to watch the interactive video. The image of her craftwork would then appear in the background of the animation. Throughout the interaction, Jasmine would take charge and interact with the activities as required. Freda would assist her by providing suggestions and explanations where required. She would also consistently encourage Jasmine in her work and decisions.

Scenario Two

Jasmine, aged five and her mother, Freda are part of the user test held in their homes. Jasmine is not in a good mood as Freda has just reprimanded her. Even after being given some time to calm down and some cajoling, Jasmine is still reluctant to begin the interaction and only does so after Freda initiates the activity by taking control of the mouse. Once interaction with *Connecting Dots* begins, Jasmine notices the introduction page and its instructions, she forcefully takes control of the mouse and begins to try to read the instructions out loud. However, Freda is upset by Jasmine's actions and again reprimands her for her bad behaviour. Freda decides to leave Jasmine alone with the interaction, which results in Jasmine being unable to fully comprehend the instructions. As an extension of this debacle, Jasmine randomly clicks on several icons expressing her displeasure. She then clicks on the play button on the page showing the interactive video. She pays no attention to the video content and continues to randomly click on buttons when asked to participate in the interactive tasks.

Scenario Three

Jasmine, aged five and her mother Freda are part of the user test held in their homes. They are alone and there are no other distractions in the immediate environment. She is excited to start and takes the lead in the interaction. However, Freda feels uncomfortable in giving full control to Jasmine. Instead, she orally guides Jasmine on what to do throughout the interaction. At the start of the user test, Jasmine notices the introduction page that shows a list of instructions. Instead of encouraging Jasmine to attempt to read the texts, Freda reads it out loud for her. When there are words that Jasmine does not understand, she does not seek clarification from Freda. Selecting the button with an icon of multiple people, she sees a page that shows brief information about the characters. She reads the texts that provides a brief overview of both the characters and moves on to selecting the button with an icon of a paint palette. Here, Freda reads all the texts and tells Jasmine what to do as they proceed to create her own craftwork. Jasmine would immediately start on her craftwork and create a two-dimensional piece using just coloured pencils. She only spends ten minutes on the task before moving on to the next task of taking a photo of her work and uploading the image. Again, this task would be completed under Freda's instructions. Once Jasmine's image is uploaded, Jasmine would proceed to watch the interactive video. The image of her craftwork would then appear in the background of the animation. Throughout the interaction, Freda would take charge and instruct Jasmine as required.

3.3.2 Design of Solution

In this development process, the design of the solution was completed over two phases. The first phase of the design resulted in a basic interactive framework that featured three generic elements of balance; inclusion and connection based on the information from the literature review and from the identification of needs and requirements. In ensuring balance, the designs of the website's interaction, interface and content should provide users with the opportunity to combine knowledge and imagination. The element of inclusion within the interactive experience was designed to be achieved through the provision of opportunities for collaboration where problem-solving skills are encouraged so that learning is personally and socially meaningful. Finally, the interactive experience should be designed for connection by assisting users to see how knowledge is related to wider concepts and to help them understand their position in relation to their world. In addition to the three basic elements, the following were also designed to guide the development of the website prototype:

- The overall design is to be clean yet visually enticing.
- The colours for the layouts are to be limited so that emphasis is drawn to the media elements and personalised content
- The layout is to be intuitive to allow easy navigation and orientation.
- Media used in *Connecting Dots* will accommodate users by including playback control abilities.
- Content will be clear and succinct.
- The fonts used will be legible.

Based on the three basic elements and the design guide, the first prototype was developed. The following images show the different pages of this first prototype (See Figures 5 - 9).



Figure 5. Website Prototype Version 1 - Home Page.

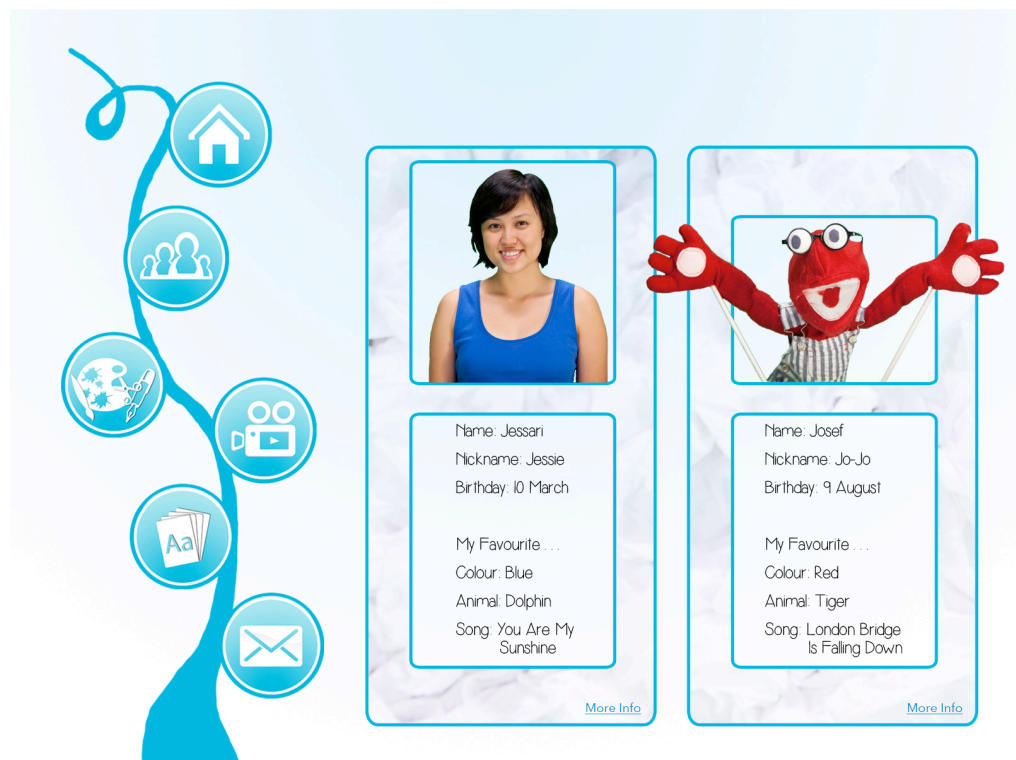


Figure 6. Website Prototype Version 1 - Characters Page.



Figure 7. Website Prototype Version 1 - Characters Page / Detailed information.

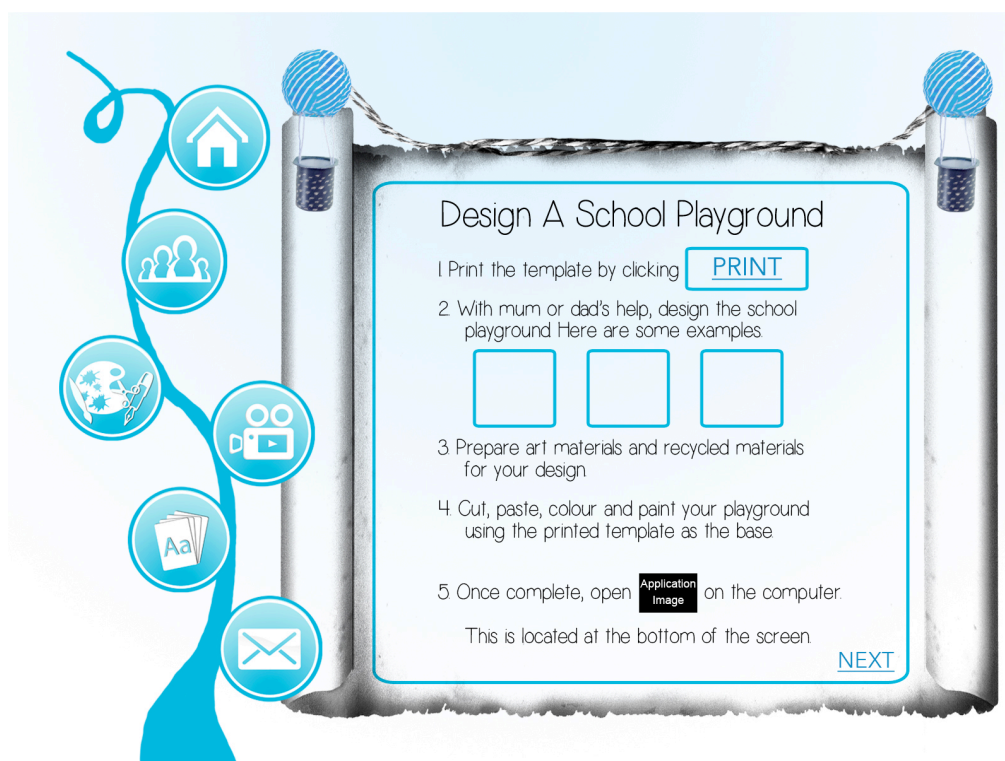


Figure 8. Website Prototype Version 1 - Craft Page.



Figure 9. Website Prototype Version 1 - Flashcard Page.

When the first prototype was developed, it was evaluated against the information from the scenario-based user needs analysis. With a deeper understanding of potential users, their behaviours and its influence on interaction and the learning experience, a second phase of the design commenced. In this second phase, the elements of the basic interactive framework and its applications were altered to present a more comprehensive guide. Table 2 shows the second designed solution which resulted in the initial holistic interactive framework that would influence the interaction, content and interface designs of the website prototype (See Table 2).

Table 2. Initial Holistic Interactive Framework for *Connecting Dots*

Main Framework	Media Content	Website Interface Design	Interaction Design
Balance: Users should have the opportunity to combine knowledge and imagination.	<ul style="list-style-type: none"> - Educational content should provide users with opportunities to interpret and construct meaning for their own knowledge acquisition. Rather than spoon-feed users with a plethora of information, content should encourage users to engage in imaginative thinking to find solutions and research for information. - Balance between simple and complex subject matter for target audience. - Balance between entertaining and educational materials. 	<ul style="list-style-type: none"> - Website design should not be cluttered and filled with too many colours. There needs to be a balance between conventional usability designs and stimulating designs for young children. - Design should also bring balance by including white spaces to encourage and give space for users to engage in imaginative thinking. - Balance between simple and complex designs. - Ensure that there are no slow loading flash elements. - Where appropriate, include larger design elements to attract attention. - Ensure design depths are balanced using shadows, gradients and shapes, so users will view website as realistic. 	<ul style="list-style-type: none"> - Interaction should include some elements of surprise. - Balance between simple and complex interactions and navigation where appropriate.
Inclusion: Allow users to collaborate with others in solving problems so that learning can be personal and socially meaningful.	<ul style="list-style-type: none"> - Content should provide users with learning material that will allow users to learn through the three learning orientations: <ol style="list-style-type: none"> 1. Transmission (Through text that can be read or listened to). 2. Transactional (Through engaging users in problem solving). 	<ul style="list-style-type: none"> - Where appropriate, interface should allow users to customise parts of its design so that it will be personally meaningful. - Include elements of familiarity in visual designs for target audience so that learning will be personally meaningful. 	<ul style="list-style-type: none"> - Interaction should provide opportunities for users to collaborate with a peer / parent or teacher so that learning can be socially meaningful. - Interaction can include some repetition, but it has to be balanced with elements of surprises. - Provides users with opportunities to explore

	<p>3. Transformational (Through collaboration where creative thinking is encouraged).</p> <ul style="list-style-type: none"> - Where appropriate, users should be able to analyse content and change content options as they acquire knowledge. - Include elements of familiarity in content for target audience so that learning will be personally meaningful. 	<ul style="list-style-type: none"> - Include obvious call-to-action elements that will help users in their problem solving. - Include a user customised cursor that changes as cursor hovers over web buttons. This will allow users to recognise these areas as “clickable”. 	<p>their complex yet connected skills.</p> <ul style="list-style-type: none"> - Include sound effects that are triggered according to user interaction.
<p>Connection: Aid users in seeing how knowledge is related to wider concepts and understand their position in relation to the world.</p>	<ul style="list-style-type: none"> - Create opportunities for people to see and understand the connection between mind and body through physical exploration. - Consider Cultural and Social Cues 		
	<ul style="list-style-type: none"> - Create opportunities for users to explore and understand integrated topics. - Create content that helps users to understand their own true nature. - Create content that exemplifies and encourages the development of interpersonal and social skills. 	<ul style="list-style-type: none"> - Designs should reflect themes and elements that are connected throughout the entire website. - Designs should encourage user’s appreciation of reality and their world. 	<ul style="list-style-type: none"> - Create opportunities where interpersonal and social skills can be developed.

This initial holistic interactive framework was then used as the foundation for the second prototype, which was developed to meet the specific guidelines through its different design aspects. The evidence of the specific guidelines being met by the designs of the second prototype are detailed in Appendix A while the following images show the designs of the second prototype and its evolution from the first (See Appendix A and Figures 10 - 17).

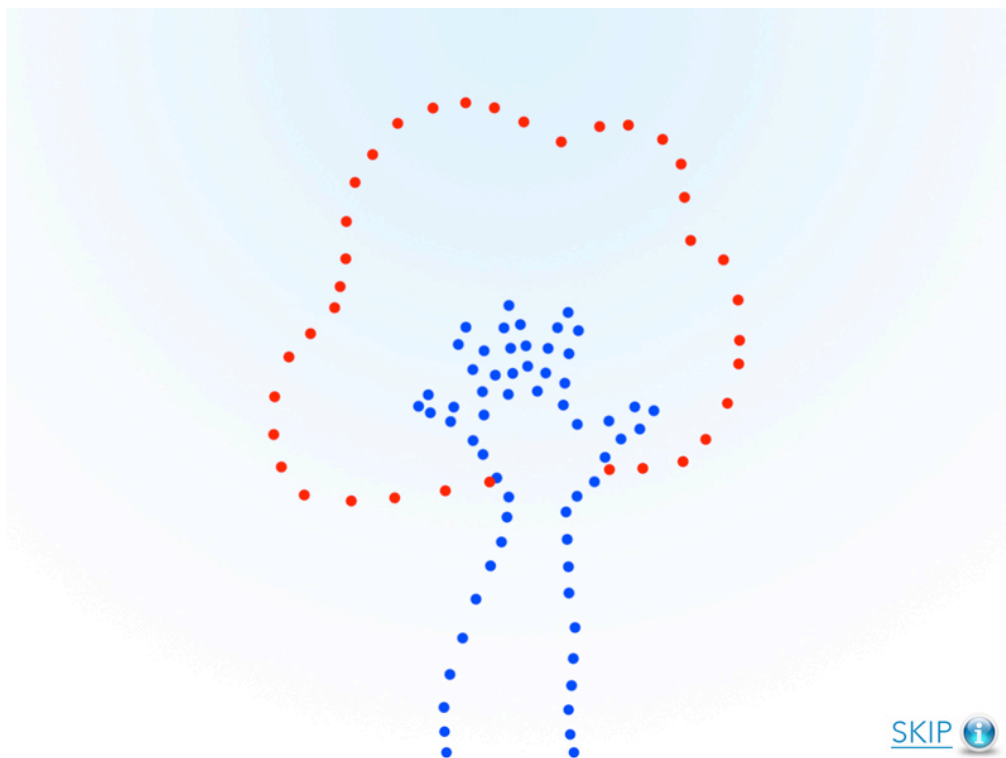


Figure 10. Website Prototype Version 2 - Splash Page.



Figure 11. Website Prototype Version 2 - Instructions Page.



Figure 12. Website Prototype Version 2 - Home Page.

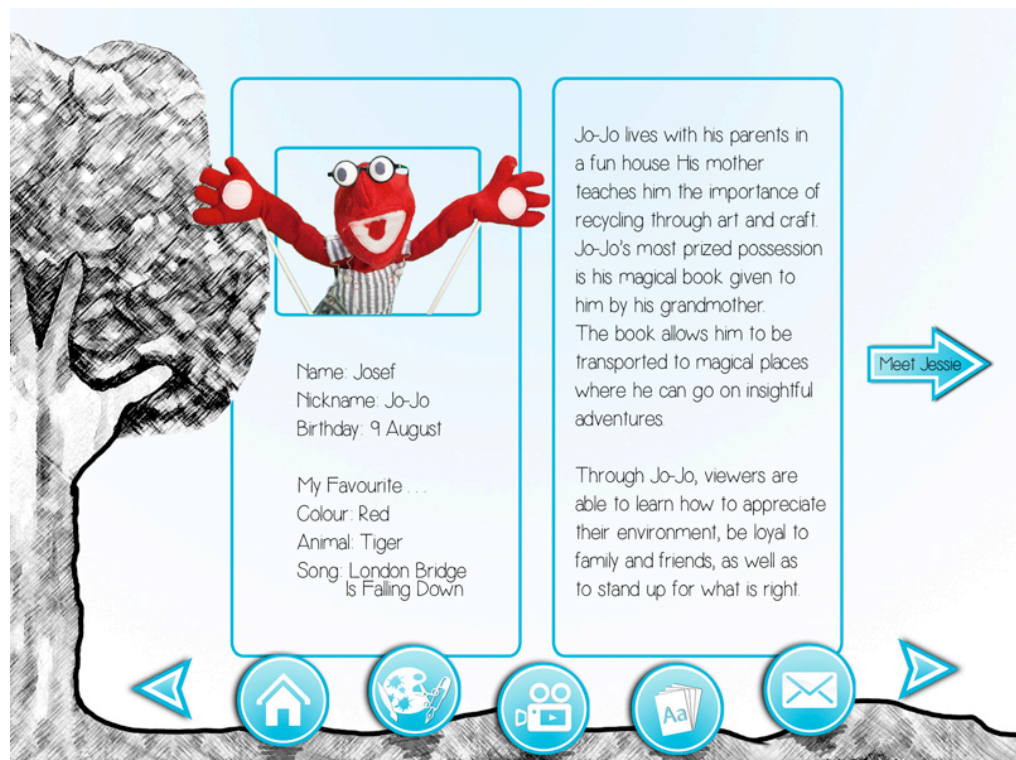


Figure 13. Website Prototype Version 2 - Home Page / Jo-Jo's Detailed Information.

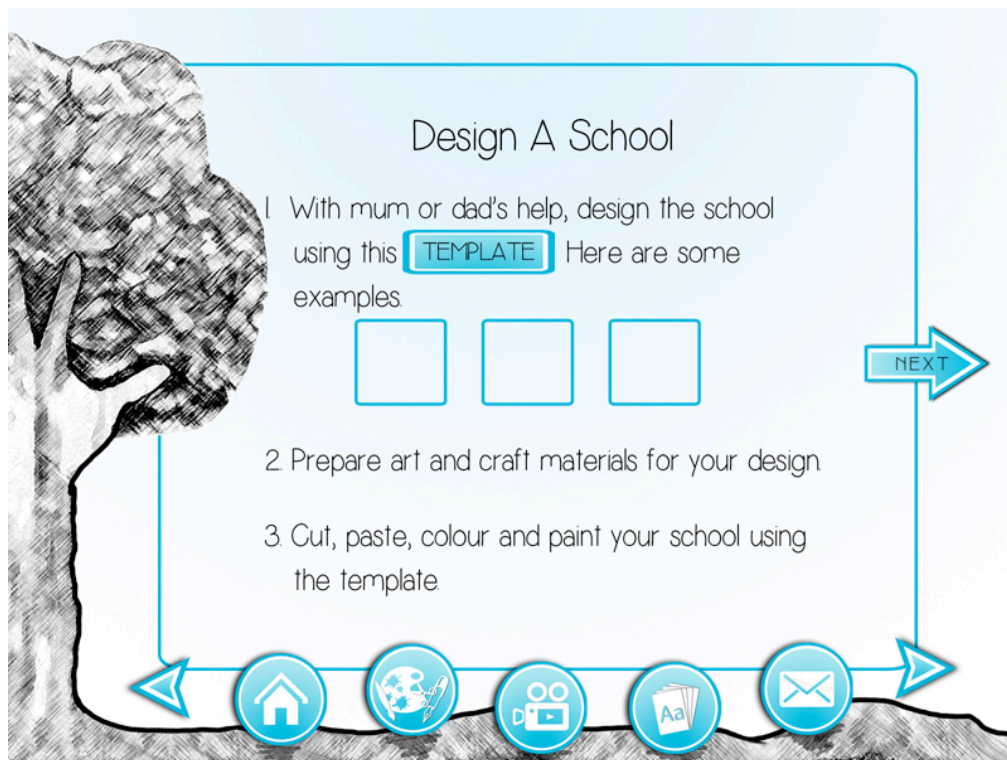


Figure 14. Website Prototype Version 2 - Craft Page.



Figure 15. Website Prototype Version 2 - Interactive Video Page.



Figure 16. Website Prototype Version 2 - Flashcard Page.



Figure 17. Website Prototype Version 2 - Flashcard Page / Kind.

3.3.3 Development of Website Prototype

The next stage in the development process was the building of the second prototype based on the initial holistic interactive framework. Here, an incremental development process was used to complete the development of *Connecting Dots*.

3.3.3.1 Website Prototype Description

Connecting Dots is a website prototype with interactive activities situated within a 5-minute webisode. Webisodes are short media episodes distributed over the Internet (The Computer Language Company Inc., 2012). The webisode in *Connecting Dots* was created in English and comprised of live actions, a song and an animated interactive story. Keywords featured in the webisode were also presented in interactive flashcards in the three mother tongue languages as recognised by the Ministry of Education: Malay, Tamil, and Mandarin (Dixon, 2009; Lee, Goh, Fredriksen & Tan, 2008). The decision to include the three languages followed the initiative by the Ministry of Education to facilitate racial harmony amongst its students by encouraging the learning of conversational languages beyond English and their mother tongue language (Ministry of Education, 2008). The keywords in various languages in *Connecting Dots* were supposed to encourage the preschoolers to have an interest in learning their own mother tongue language. At the same time, by exposing the preschoolers and their parents to words in languages different to their own, they would be encouraged to have better appreciation of their friends who are not of the same ethnicity. This is in line with a holistic education goal, where people are able to understand their place in the world and practice interpersonal skills within their community.

Connecting Dots valued the voices and perspectives of the preschoolers and was concerned with providing them with opportunities to feel a sense of ownership in their learning process. To achieve this, preschoolers were given a hands-on craft activity to complete with aid from their parent which was then processed digitally and embedded into the interactive webisode. The craft activity was supposed to aid holistic learning by cultivating their problem solving skills; helping them to combine knowledge and imagination to form new information and allow them to understand how concepts can be linked to contribute to an overall vision. It also exposed the preschoolers to the three orientations of acquiring knowledge so that their learning would be personally and socially meaningful.

3.3.3.2 Incremental Development Process

The development of the website prototype was broken down into various segments which was then integrated at the end following the incremental development process. With this approach, partial yet functional components of the system were developed in sections (Cockburn, 2007). The reason for selecting the incremental development approach was because the nature of the website's components required incremental compositing to complete the full website (see figure 18).

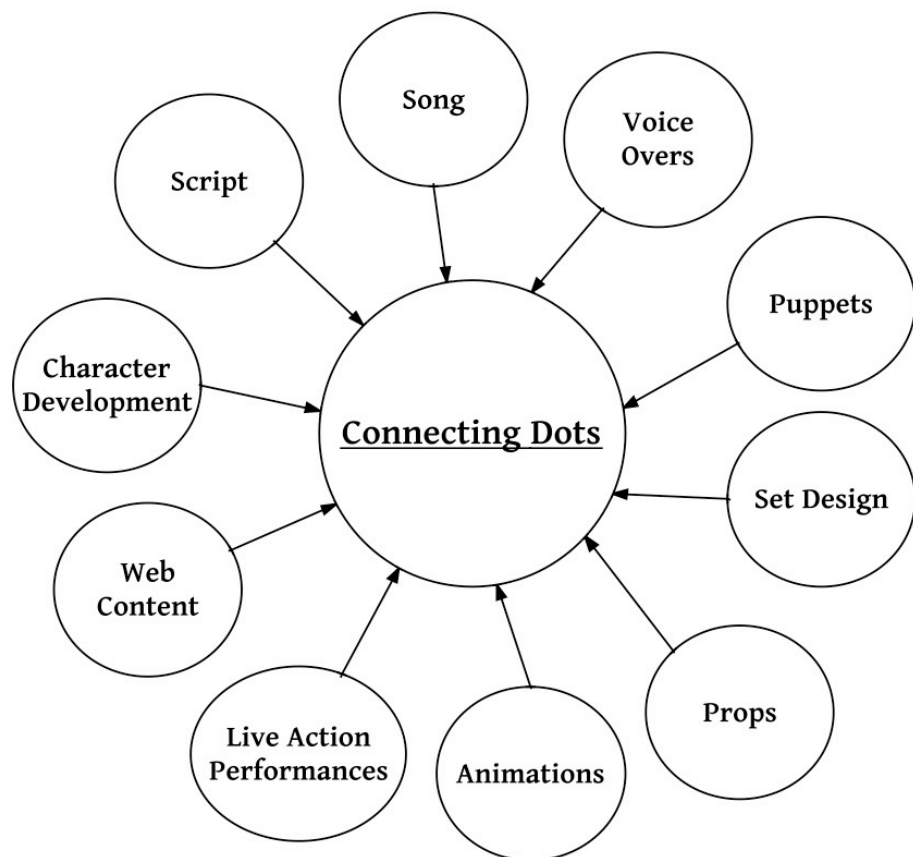


Figure 18. Components making up *Connecting Dots*.

For example, the live action performances could only be recorded when individual components such as the songs and voice-overs were recorded and the puppets were designed and constructed. When the live action performances were recorded and edited, they were then composited with the animation videos to make up the webisode which became part of the website. For this reason, the development of the website prototype could be better managed if its development followed the incremental development process.

A majority of the web content was developed in the design stage of the development process, thus leaving the remaining media content to be the focus of the incremental development process. The media content of *Connecting Dots* is a composition of various individual yet dependent components that would affect the overall development process. Each component was developed through evaluation phases, which consisted of design, develop and evaluate loops that were repeated until an ideal version was available. The final version of the individual components were then incrementally added to make up the complete website prototype. The following describes the individual components and what was achieved in the order that it was completed as part of the incremental development process.

Character Development

The foundation of the interactive media content and its influence on the learning experience is dependent on the characters within the narrative story. While it is possible for content designers to simply design a character without much consideration of its traits, its effect on the narrative necessitates attention to be afforded to the development of the character's traits. As part of the character's development, details of individual characters such as their physical appearance; personality; environment; motivations; likes and dislikes; as well as the character's relationship to others are expounded and evaluated. This development exercise was completed for the main characters of *Connecting Dots*, Jessie and Jo-jo. The thorough details from each character's development then became the blueprint that was used to develop the script and were also influential in the designs for the puppet, set, props and wardrobe.

Script

Using Jo-jo and Jessie's background information from their development, Jo-jo was selected to be the main character who would go on a learning adventure to learn the main lesson of *Connecting Dots*. The narratives of Jo-jo's learning adventure were weaved based on the stages of Vogler's (1998) *Hero's Journey* model. The development process of the script for *Connecting Dots* started with defining the stages of Jo-jo's journey before it was developed into the script's first draft. After two evaluation phases, the stages of the hero's journey and Jo-jo's journey were:

- The ordinary world - Jo-jo enjoys having regular play dates at home with his best friend Jessie. In his world, Jo-jo is always at the centre of attention as he is

an only child. His parents work hard to provide him with everything that he wants.

- The call to adventure - When Jo-jo's mother told him that she was preparing his favourite chocolate chip cookies, she reminded him to share them with Jessie when she arrives.
- Refusal of the call - However, Jo-jo was indignant and refused to share. Voicing his displeasure, he gave the excuse that she should not be given any cookies as she broke her promise to him and was late for their play date.
- Meeting with the mentor - Just as Jo-jo voiced his displeasure, Jessie rushed in and apologised to him. Besides being his best friend, Jessie is also regarded as his mentor, especially in this lesson that Jo-jo is about to learn.
- Crossing the threshold - Jo-jo crosses the threshold in his journey when Jessie tried to explain the meaning of being kind. As he was still confused, Jessie thought that they could learn about its meaning by going on their storybook adventure. Upon hearing Jessie's suggestion, Jo-jo agrees and passes her the special storybook passed down by his grandmother.
- Tests, Allies and Enemies - As Jessie and Jo-jo enter their storybook adventure, they assume roles within the story as part of their journey. In this adventure, Jessie plays the role of Phoebe, while Jo-jo plays the role of Chris. Through the characters in the story, Jo-jo continues his learning journey. The test in this journey takes place when Chris and Phoebe notices Janice on her own and crying. Janice is an ally of Chris and Phoebe and the test for them is to decide on how they should react. The potential enemy in this journey could be the self-serving attitudes of Chris and Phoebe should they choose to ignore Janice.
- Approach - The approach in the journey takes place when Chris and Phoebe make up their minds to find out what happened to Janice.

- The Ordeal - As Chris and Phoebe approach Janice, they find out that her money was missing and that she did not have any money to buy food for lunch. At the same time, Janice was starting to feel sick with worry and hunger. The ordeal in this journey for Chris and Phoebe was in their attempt to help Janice, but knowing that they themselves had limited resources.
- The Reward - The reward for Chris and Phoebe happened when they found solutions to Janice's problem and were able to stop her from feeling sad and crying.
- The Road Back - The road back in Jo-jo's learning journey occurs when they complete the storybook adventure and return to their ordinary world where Jo-jo is reminded about Jessie's unpunctuality.
- The Resurrection - The stage of resurrection starts when Jo-jo's mother finishes baking and the plate of delicious cookies appear in front of them. Here, Jo-jo has to decide if he is going to apply the lesson learnt through the storybook adventure about sharing. At the same time, he must find it within himself to forgive Jessie for being late.
- Return With The Elixir - When Jo-jo makes the conscious decision to forgive Jessie and shares his cookies with her, he has a renewed understanding of what it means to be kind and is able to personally find examples where he can apply his new knowledge.

With Jo-jo's hero's journey defined, it acted as the skeleton of Connecting Dot's narrative. The first draft of the script was then written by adding supplementary details to the different stages. The script was then evaluated five times before the final script was developed (See Appendix B).

Song

The purpose of the song in Connecting Dots was to signify the transition between Jo-jo's ordinary world and his storybook adventure. In developing the song, it was decided that it would be more advantageous to use a melody that was already familiar to the target audience instead of a brand new composition so that it would aid recognition.

Five popular nursery rhyme melodies were considered and evaluated, but the final selection was to use the tunes of *Twinkle Twinkle Little Star* that finds its origins in the French melody *Ah! vous dirais-je, Maman* (Buckley, 1997; David Steinberg Journal, S. W., 2004). The tune is a universally recognised melody and can also be found in other popular children nursery rhymes such as *Baa, Baa, Black Sheep* and the *Alphabet Song* (Paquet, 2011; The Windsor Star, 2012). Using the melody as its foundation, the lyrics to the song were then written. These lyrics were evaluated three times before the final version was chosen. The final version of the lyrics is:

Little stories to be shared, listen close and be prepared. Solve the puzzles, think it through, you can solve them with the clues. Little stories to be shared, listen close and be prepared.

With the lyrics finalised, the song was recorded through different individual tracks using a guitar and ukulele. The participant who performed the role of Jessie sang the vocal track for the song. Finally, the recording was mixed so that the song would be audible. The completed recording of the song was then used in the edit for the completion of the interactive video.

Voice Overs

The finalised script was broken down into sections and the dialogue that were required for voice-overs were extracted into a separate voice-over script and checklist. This allowed the voice-over talents to easily recognise requirements and assisted in the recording process. During the recording process, each recorded track was immediately evaluated and where necessary, certain tracks were re-recorded. At the end of the recording process, the tracks were edited and mixed for audibility.

Puppet

The development of the puppet that represented Jo-jo was dependent on the information from the character development. A range of puppet types such as finger puppets, glove puppets and rod puppets were considered. However, it was decided that a rod puppet was better suited for Jo-jo's character due to its size and versatility. The rod puppet was developed over five evaluation phases that tested different head shapes; types of eyes; hand designs; materials and wardrobe choices. The first four phases of the puppet was created using materials in shades of blue. However, as the research progressed and the

planning of the production process commenced, it was determined that the materials with shades of blue would be incompatible. This was because the video components would be recorded in a green screen television production studio and there was potential for some of the blue tones to cause problems during the post-production edit. To avoid this from happening, red material was used for the final puppet instead which also influenced the wardrobe choices for the puppet. The following images show the different processes and phases of the puppet development (See Figures 19 - 22).

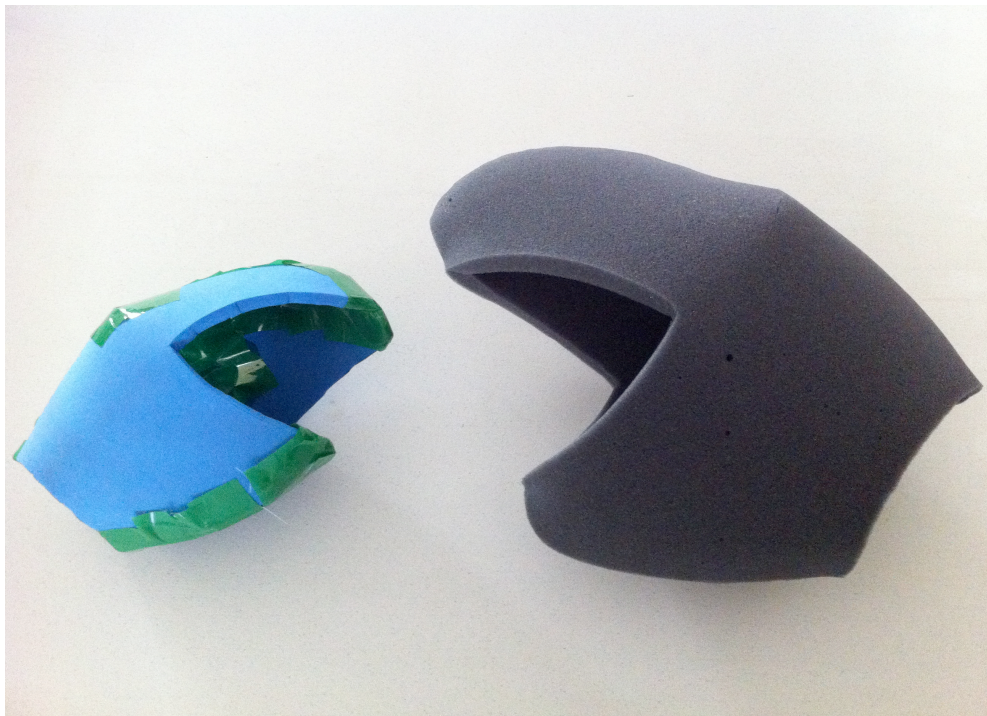


Figure 19. Phase One: Testing Materials And Size Of Jo-jo's Head.



Figure 20. Phase Two: Testing Pattern and Material For Jo-Jo's Body.



Figure 21. Phase Four: Completed Puppet for Jo-jo's Character Version 4.



Figure 22. Final Phase: Development and Wardrobe Choices For Jo-jo.

The puppet design with striped overalls was selected as the final version to represent Jo-jo in *Connecting Dots* as the darker blue overall was too dark and would be affect the general look of the design.

Set Design

The set design for *Connecting Dots* was also influenced by the character design as the location of the interaction between Jessie and Jo-jo was set in Jo-jo's fun house where he lived with his parents. Filled with his favourite colours of red and blue, his favourite play room was lovingly decorated by his mother and filled with all his favourite things and hand made toys created in collaboration with his mother who believed in teaching him about recycled art (See Figure 23).



Figure 23. Jo-jo's Play Room Prototype.

As part of the set design, props shown in the play room prototype such as the tree; bunting; flowers; clouds; hot-air balloons; magic book and handcrafted toys that were part of Jo-jo's play room had to be developed. These individual props were created out of recycled materials over several evaluation phases. The following images (See Figures 24 -28) shows examples of some of the props that were developed.

Flowers

Made using sketch paper, glue, old buttons and paint, the designs of the flowers were only finalised after nine evaluation phases (See Figure 24). In each phase, different flower patterns and button combinations were tested until suitable materials provided the desired visual effects were found.

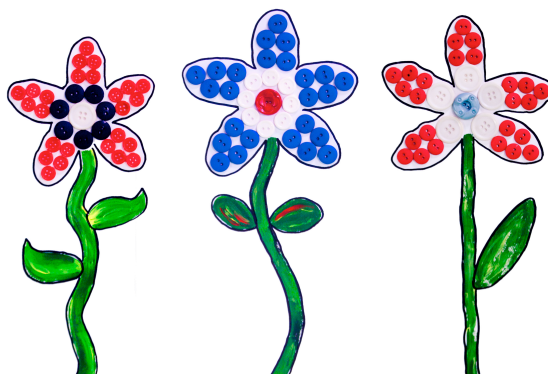


Figure 24. Completed Flowers.

Tree

Made using cardboard, glue, serviettes and paint, the design was only finalised after four evaluation phases (See Figure 25). In each phase, different colour options and materials such as cotton; felt and hobby fill were tested and evaluated until suitable materials that provided the desired visual effects was found (See Figure 26).



Figure 25. Tree - Material Test.



Figure 26. Completed Tree.

Fish Tank

Made using a plastic plate; printing paper; glue; paint; foam; old plastic bags; orthodontic elastic bands and aquarium rocks, the design of the fish tank was finalised after three evaluation phases (See Figure 27). The first phase tested a different design using a cookie jar as the tank. The second phase tested different materials such as bubble wrap and cardboard. In the final and third phase, the design of the fish tank was created following a test of paper mâché techniques (See Figure 28).



Figure 27. Fish Tank - Material and Technique test.



Figure 28. Completed Fish Tank.

Animations

The animations within *Connecting Dots* played an important role in the holistic learning experience of users as the majority of the interactive activities were situated within the animated videos. As part of the animation development, various artwork components had to be created before the animation process could start. These components, such as the designs of characters for animation, backdrop designs, and transition designs underwent a minimum of two evaluation phases before they were incorporated into the animated videos (See Figure 29). The animations were also subjected to five evaluation phases where the animated movement of characters and syncing of visuals to audio files were fine-tuned.



Figure 29. A Frame From The Animation.

Live Action Performances

In addition to the animations, users' holistic learning experiences were supported by video content that included live action performances by talents where the interaction and dialogue between Jessie and Jo-jo could be observed. Using the script as its foundation, various components had to be developed to support the production process of the video content. For example, storyboards and a style board for Jessie's wardrobe

had to be designed so that everyone involved in the production process had a clear understanding of the vision. The storyboard designs were completed and used as a guide. The style board for Jessie was evaluated three times where the effects of various clothing styles and colours were reviewed. When the recording of the live action performances was complete, the raw video footages were compiled and edited. The edited videos were evaluated five times to produce the finalised video segments (See Figure 30).

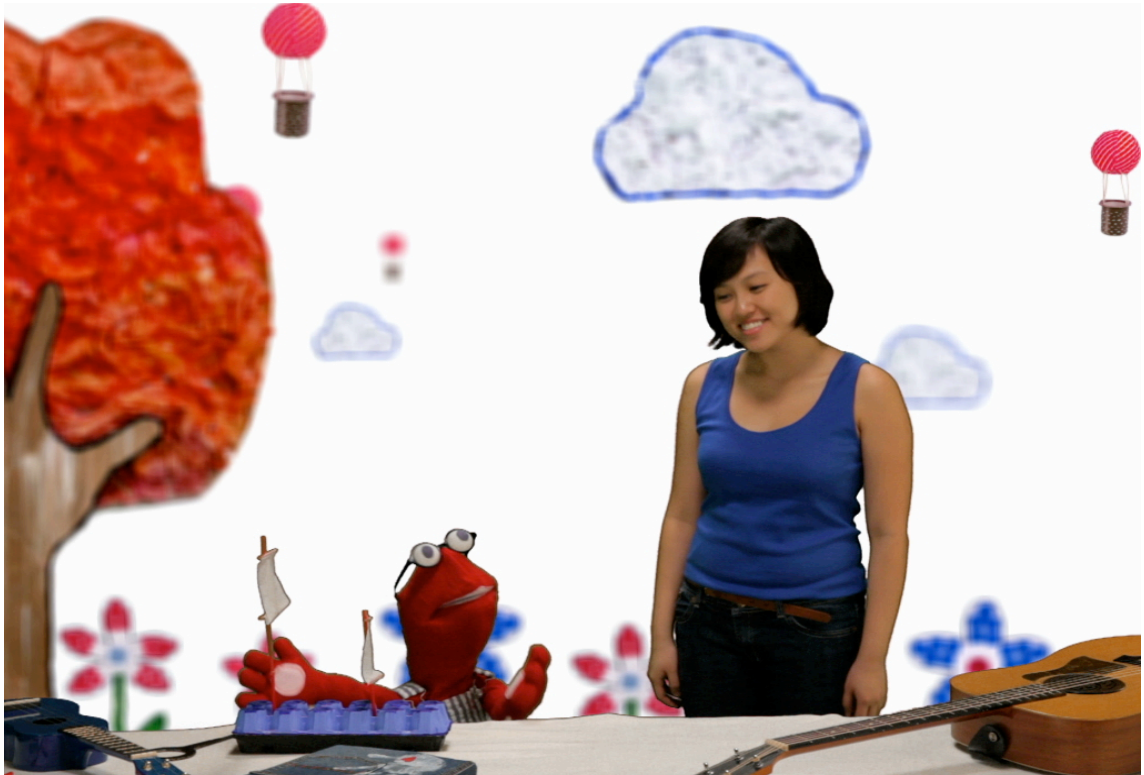


Figure 30. A Frame From The Finalised Video Segment.

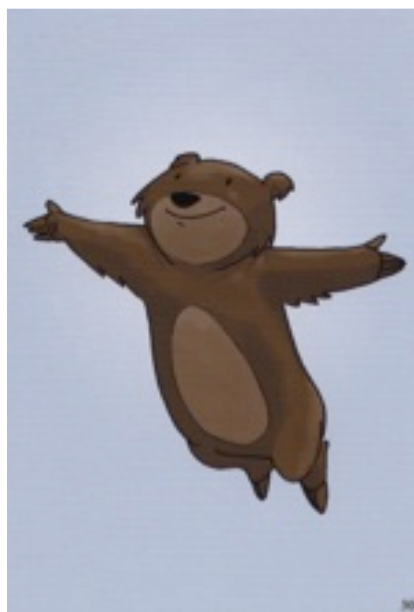
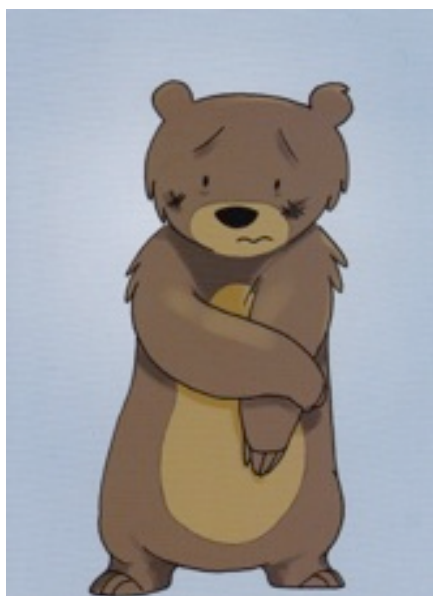
Compilation of Components

The completion of the website prototype development was achieved by compiling the different finalised components such as the animation, video, audio and graphic image files. Developed using Adobe Flash, the website prototype was evaluated thirteen times to eliminate scripting errors.

3.3.4 Initial Evaluation Through Pilot Study

With the completed website prototype, a pilot study was conducted. Although it could have been beneficial to conduct more than one pilot study if data was being collected on the effectiveness of the prototype, the purpose of the pilot study was to purely test the website. Therefore, a single pilot study was sufficient as its aim was to ensure that the website could be navigated by the potential users and determine if the proposed interview questions and interview aids that would be asked and used in the user tests could be comprehensible by the research participants. Interview aids such as The Bears* (St Luke's Innovative Resources, 2010) that were supposed to help participants indicate their emotional responses were tested (See figure 31).







*Used With Permission

Figure 31. The Bears (St Luke's Innovative Resources, 2010)

The pilot study was recorded on video and analysed to determine if further changes to the website prototype and interview questions or tools were required. It was observed during the pilot study that users did not have difficulty in understanding the interview questions or aids. However, they had difficulty determining the buttons to click on in order to select their personal cursor as there were too many buttons on the same page. They were also confused by the arrows on the side of the menu buttons that were meant to help them proceed to the next page as the arrows did not correspond to the icons illustrated on the menu buttons (See Figure 32). For example, if users were on the home page that showed them images of Jo-jo and Jessie, clicking on the arrow on the side of the menu buttons would take them to Jo Jo's character page that showed them his information instead of the craft page.

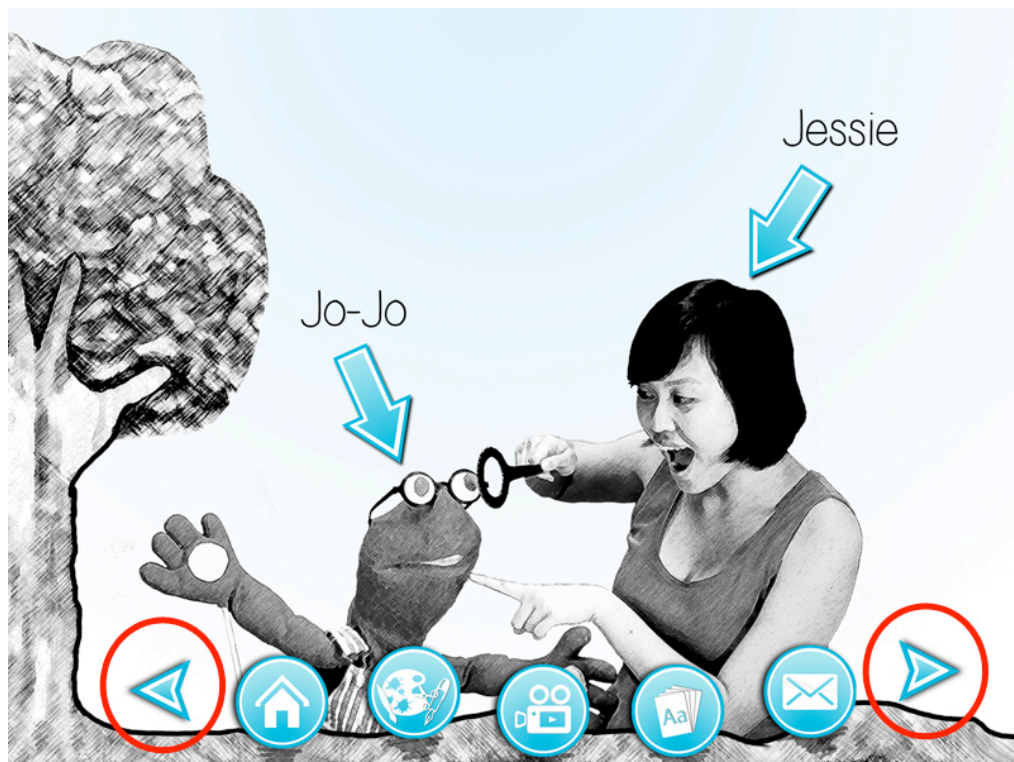


Figure 32. Arrows Causing Confusion

Based on the observations, changes were made to the prototype prior to the user testings. A box outline was added around the instructions and choices for the personal cursor selection and the arrows on the side of the menu buttons were removed (See Figure 33).



Figure 33. Website prototype - Instructions page

3.3.5 Evaluation Through User Tests and Observations

With the finalised website prototype, the evaluation stage of the development process commenced through user testings where participants interacted with *Connecting Dots* before being interviewed. The parent-and-child interactions with the website were recorded on video and supported by data collected from the interviews using semi-structured questions. The data recorded were then triangulated to determine the accuracy of the participant's account of the interactions and ensure that the observations were valid.

After the user tests were completed, parents were required to observe their children over a two-week period and fill in a prepared participant diary. The purpose of the participant diary was to report instances where their child initiated application of acts of kindness or mentioned elements such as the song or characters within the interactive content of *Connecting Dots*. The parent participants were also provided with comprehensive guidelines on how to write and report such instances to ensure adequate information were collected.

3.3.5.1 Participant Information

This research was based on a sample of six parent-child teams. Research within the human-computer interaction community recognises that instead of using large research samples typical to scientific research, a sample of five participants can yield sufficient results. The theory of using a minimum of five participants in studies was based on research by Virzi (1992) who argued that there was a law of diminishing returns. Nielsen (1993) also argued that the use of five participants could reveal up to 80% of usability issues when testing products. However, this is disputed by some as unreliable and the risk of missing potential important issues and its subsequent impact (Woolrych & Cockton, 2001; Spool & Shroeder, 2001; Perfetti & Landesman, 2002). Due to the nature of the study and its qualitative approach, this research engaged six teams for its user testing so that the rich narrative experiences of the users could be collected. The original plan for this research was for five child and parent teams to be involved in the test of the website prototype. It was initially thought that participants that had multiple children present in the home where the user tests would take place would nominate one child to be part of the test. However, in the planning of the fifth user test where there were multiple children present in the home, it became clear that it was impossible to exclude the other children from the experience, as it would detract from the natural

environment of the child participant. As a result, a decision was made to include an additional user test that would be conducted with another set of multiple children participants so that there were at least two user tests that could be analysed to determine how having additional collaborators would influence the interactive experience and the child's learning.

Child participants were expected to be between 4 - 6 years old and there were no age restrictions for the parent participant. Parent participants were expected to have a good grasp of basic English so that they were able to understand instructions and could guide their child in the interactions of the interactive website. They were also expected to have basic knowledge of using computer technology and the Internet technology as *Connecting Dots* was a computer based learning material which had designs that replicated online website navigation. Prior to the study, participants were asked to fill in a background questionnaire that acted as a screening measure to ensure the potential participants met the requirements for this research.

The background questionnaire asked potential participants the following questions:

- Are you a working parent?
- Do you work from home?
- Is the child's other parent working?
- Do they work from home?
- How many children do you have?
- Who is the main caregiver for the child?
- If the main caregiver is not a parent, how often does the caregiver engage in activities with the child?
- What kind of activities are they?
- What kind of activities are they?
- What kind of technology does the family own?
- How often are these used by the child?
- What is the main language spoken at home?
- Please name 3 examples of applications / websites that your child plays with / visits on their own
- Please name 3 examples of applications / websites that you and your child plays with / visit together

Of the thirty-seven potential participants that responded to the invitation to participate, the following six users teams were selected based on their suitability and availability.

User Test Participants 1 - Amy and Alice

Amy, aged 6 was guided in the interactive experience by her mother, Alice. She was confident in her interactions with the instruments and the website prototype as she had prior experience with playing games and watching videos on the family's laptop, tablets, mobile phones and game consoles.

User Test Participants 2 - Permai and Sarah

Permai, aged 5 was guided in the interactive experience by her mother, Sarah. She was only slightly confident in her interactions with the instruments and the website prototype as she had limited prior experience with playing games and watching videos on the mobile phone and computer at school.

User Test Participants 3 - Jeremy and Tom

Tom, aged 4 was guided in the interactive experience by his father, Tom. He was confident in his interactions with the instruments and the website prototype as he had prior experience with playing games and watching videos on the family's computer, tablets, mobile phones and game consoles.

User Test Participants 4 - Laura and Judy

Laura, aged 4 was guided in the interactive experience by her mother, Judy. She was not confident in her interactions with the instruments and the website prototype as she only had limited prior experience with playing on her father's laptop. However, she was proficient in independently selecting and watching videos on the DVD, tablets and mobile phones.

User Test Participants 5 - Rayner and Denise

Rayner, aged 6 was guided in the interaction by his mum, Denise. During the user test, Rayner's older and young siblings who were aged 8 and 3 were present and participated in different points of the user test but did not engage in the full experience. They were not regarded as official research participants as they did not fall in the age group. However, it was not possible to exclude them from being a part of the experience. Rayner was confident in his interactions with the prototype as he was proficient in

playing games and watching videos on the family's computer, tablets and mobile phones.

User Test Participants 6 - Heather, Hillary and Jack

Heather, aged 6 and her sister Hillary, aged 5, were guided in the interaction by their father, Jack. Because they both fell within the age range, they were both regarded as official research participants as it was not possible to entirely exclude either one from the user test. Both sisters were confident in their interactions with the prototype as they were proficient in playing games and watching videos on the family's computer, tablets, mobile phones and game consoles. During their test, their mother, Jane was also present and was involved in the interactions at some points of the user test.

Of the six groups of participants, only two parents were aware of their child's media consumption habits and online activities. The other parents had to ask for their child's assistance so that they were able to complete the background questionnaire.

3.3.5.2 User Tests and Semi-structured Interviews

Prior to the user tests, parent participants were briefed to ensure that they were able to successfully complete the activities and participate in helping their children be co-collaborators. They were given the opportunity to voice their concerns and were introduced to basic computer interaction using the provided computer that was to be used in the user test. They were also given the opportunity to practice on interactions similar to those in *Connecting Dots* so that they could understand how the tasks could be completed. The user tests were conducted in the homes of each child so that a greater degree of naturalism could be achieved. However, this meant that the researcher had limited abilities to control distractions in the home. To minimise some of these distractions, the participants were requested to ensure that all other media forms such as the television or music were turned off. A separate computer belonging to the researcher was also used as part of the user test to ensure that participants would not be distracted by their normal home computer and its activities and functions. To ensure that the participants were able to complete the user test despite having to use a different computer, the interaction design of *Connecting Dots* was simple and universal across various platforms.

The user test was separated into three parts, with the first introducing participants to the interactive website, the characters and the craft activity. The second part of the user test required users to engage in the craft activity and the third gave participants the opportunity to engage with the remaining interactive website and its activities. Throughout the user tests, the facial and verbal responses of both participants as well as their screen activity were captured and a separate video camera on a tripod was used captured their process of creating the craftwork as part of the personalisation of media elements.

Interviews allow for illustrations or explanations of phenomena to be obtained and as such, its strategies are commonly used within qualitative research across various disciplines (DiCicco-Bloom & Crabtree, 2006). While there are different approaches to conducting interviews within qualitative research such as structured, semi-structured and unstructured methods, this study adopted the semi-structured approach. Given the wide implementations of the different interview approaches, its techniques, strengths and limitations have been extensively documented in literature so that the adoption of interview approaches used for each study can be based on informed knowledge (Douglas; 1985; Kvale, 1996; Kvale, 2007). In this study, the structured interview method was not selected as it was expected that every user experience would be different, therefore the use of structured questions across each user test would have limited the identification of distinctions between the different user experiences. At the same time, the unstructured interview approach was not selected as it had the potential for important information that related to identified themes within the initial holistic interactive framework to be unintentionally omitted. Using the semi-structured interview approach, the predetermined but open-ended questions provided a guide to ensure that the information related to the identified themes could be obtained, yet allowing the collection of spontaneous yet in-depth data where users' understanding, meaning and perceptions within the experience could be explored (Ayres, 2008; Carley-Baxter, 2008). The data from the semi-structured interviews were recorded through video instead of just audio in case participants interacted with their craftwork or interview aids as part of their responses.

Child participants were asked to describe their understanding of what it meant to be kind before and after the user test to determine if their understanding was influenced by their exposure to the website prototype. Using pictorial interview aids, they were also

asked the following questions (Interview Questions Set 1) to determine if they were familiar with the presented content:

- Have you ever done dot-to-dot puzzles?
- Can you guess the picture (of this puzzle)?

After the child participants completed their craftwork, they were asked the following questions (Interview Questions Set 2) to answer the first subsidiary research question:

- How did you feel when you finished tracing all the dots?
- How did you feel when you saw the picture of the tree after you traced the dots?
- What do you think was used to make this tree? (Show example)
- Why did you choose the sun / cloud as your pointer?
- Which do you prefer? (Show examples of buttons with text, icons or both together)
- What did you use to make the craft?
- Why did you choose those items?
- Tell me about the different parts of your design?
- Why did you choose this design?
- What colours did you choose for the craftwork?
- Why did you choose these colours?
- What other craft can you make with the items you chose?

At the end of the user test, they were also asked the following questions (Interview Questions Set 3) to answer the second subsidiary research question:

- What did you learn from the story?
- Why did you first choose to ask Chris and Phoebe to pretend that they did not see Janice? or Why did you first choose to ask Chris and Phoebe to go and see if Janice is okay?
- What did you draw on the card for Janice?
- Why did you draw that?
- How did you feel when Chris gave Janice the card that you drew?
- Can you share all kinds of food with anyone? Why?

- What is an apple?
- Which character had an apple from the lunch bag?
- How did you feel when you had to play a game to help give out the food?
- When you were playing the memory game, how did you know if you got the correct answer?
- How do you think Janice felt when Chris and Phoebe were kind to her?
- Can you give me one example of how you can be kind to someone at home?
- Can you give me one example of how you can be kind to someone in school?
- How do you think you will feel if someone did that for you?
- How did it feel having your parents here to help you on the website?
- How did your parents help you understand what to do?
- Will you want to have these kinds of experiences in craft and media again?
- What else would you like to do on the website?

At the end of the user test, parent participants were also interviewed with the following questions (Interview Questions Set 4) as part of the evaluation phase of the research so that their responses could be used to support the responses of the child participants and applied to future recommendations.

- What do you think of the website design? Why?
- How did you feel about the ease of navigation on the website especially when guiding your child?
- Would you rather have buttons with text, icons or both together? (Show example)
- Comment on the ease of understanding the instructions on the craft page and the process of uploading an image of the craft?
- Explain how you felt during the process of taking a photo of your child's craft work with the inbuilt web camera
- Would you rather take the photo with a separate digital camera and then upload the file using either a cable or a memory card reader?
- How can the website be easier for you to use with your child?
- What do you think was used to make this tree?
- How did you feel when your child had to play a game in order for the video to continue playing?
- Do you think it makes a difference for your child when they watch media that

involves puzzles and games as part of the storytelling? Why?

- Do you think it makes a difference for your child when they watch media that includes their own craftwork as part of the storytelling? Why?
- What do you think of being involved with your child's interactive viewing experience?
- What do you think is the impact on learning when you are involved with your child's interactive viewing experience?
- Do you think your child has a better understanding of what it means to be kind after watching the video?
- What do you think of having extra languages in a website like Connecting Dots?
- Have you and your child learned any new computer skills while using Connecting Dots?

3.3.5.3 Parent Observations

When the user tests and interviews were completed, parent participants were requested to observe and report instances where their children initiated application of lessons learned or if they mentioned elements from the content of the website prototype. The duration of the observation lasted for two weeks after each user test and parents were briefed that there was no need for the diary to be filled everyday, but a minimum of seven over the two weeks were required. The parent participants were provided with comprehensive guidelines on how to write and report such instances to ensure adequate information was collected. They were also provided with a range of aids such as images from the website prototype and a printout of the same St Luke bear cards used during the interview to help the child participants identify and discuss their emotions.

The observation and reporting required parents to spend fifteen to thirty minutes each day talking to their child about events of the day. During this time, parents were persuaded to ensure that they had full attention of the child by removing distractions such as turning off all electronic devices. The parents were also requested to fill up their diary entries immediately after talking to their child so that details were not forgotten. Because the story in *Connecting Dots* taught its viewer about acts of kinds, the research diary asked the following questions that guided the reporting of learned concepts that were applied to the children's lives.

- What they did as an act of kindness?
- Who did they do it for?
- Why did they do it?
- How did they feel after doing the act of kindness?

However, if the child participants did not show examples of acts of kindness on the day, parents were requested to talk to their child about the story presented in *Connecting Dots*. The child participants were then asked if they remembered the characters, story or the song sung. If the child participant commented that they remembered, they were asked to describe what they remembered and to describe what the story meant to them. Finally, they were also asked to name an example where they could apply and imitate the actions of the characters.

If child participants could not remember any elements of *Connecting Dots*, parent participants were requested to discuss with their child about the acts of kindness exemplified in the videos. The child participants were then asked to describe examples of how they could be kind to others as well as how they would feel if they were kind to someone else.

3.3.6 Data Analysis

The final stage in the development process commenced after the required data were collected from participants for analysis. *Connecting Dots* was analysed using a constructivist grounded theory approach because the underlying theory that an individual's reality is socially constructed is congruent with my worldview (Guba & Lincoln, 1989). As evidenced by the number of studies in disciplines such as psychology and education that favour the constructivist grounded theory approach, this approach adopted by the study was appropriate as the study was interested in the user experience and how their social relationships and interaction with *Connecting Dots* would influence learning and its ensuing consequences (Jones & Hill, 2003; Pidgeon & Henwood, 1997). With this approach, the observation of users' experience, analysis of data recorded and the reporting of findings were influenced by my position as a researcher in relation to the participants and constructed through my subjective perceptions, beliefs, values and ideologies so that there can be an enriched understanding of how interactive media can promote holistic learning through the holistic interactive framework (Charmasz, 2006; Hayes & Oppenheim, 1997). As part

of an analysis of *Connecting Dots*, all recorded data were transcribed before the following stages of analysis were implemented:

- Initial coding - In this stage, codes were assigned to data and concepts were identified from the codes.
- Memo writing - Meanings and connections were developed from the identified concepts.
- Theoretical sampling - Here, the identified concepts were refined into thematic categories so that connections could be clarified. These connections then formed the foundations for the direction of the findings. The user tests were re-evaluated to determine how participants were affected by the various concepts, categories and connections (See Table 3) and their experiences are further described in Chapter 5.
- Saturation - Saturation happened when it was determined that theoretical insights could no longer be further obtained from data.
- Sorting - Finally, theoretical insights and categories were ordered to develop the new holistic interactive framework

Table 3. Categories and Connections from Analysis

Categories			Alice & Amy	Denise & Rayner	Judy & Laura	Jack, Heather, Hillary, & Jane	Sarah & Permai	Tom & Jeremy
Balance	Concepts	Communication methods	◆		◆	◆	◆	◆
		Learning through Transmission by text	◆	◆	◆	◆	◆	◆
		Number of concepts presented at a time		◆		◆		
		Difficulty level of concepts		◆	◆	◆		◆
	Interactive Tasks	Impact of support on experience	◆	◆		◆	◆	
		Difficulty level of tasks	◆		◆			
		Familiarity + Novelty		◆		◆	◆	◆
		Floor (Minimum) Versus Ceiling (Maximum) Time Limits	◆	◆		◆		
		Delivering information through interactivity	◆	◆		◆	◆	◆
	Media Elements	Power and importance of sound design	◆		◆	◆		◆
		Evoking emotions through presentation		◆		◆	◆	◆
		Prominent designs for Call to action	◆		◆	◆		◆
Collaboration			Communicating and understanding roles	◆	◆	◆		◆
			Personally and socially meaningful experience	◆	◆	◆	◆	◆
			Communication and commitment affects attitudes		◆		◆	◆
			Consider multiple user options		◆	◆		
			Inspire positive development			◆		◆
			Empowering through exemplification	◆		◆		
			Enhance creativity and imagination			◆		

Connection		Transformational experience	◆	◆	◆	◆	◆	◆
		Identification and validation of experiences and emotions	◆					
	New Knowledge	Collaborative learning aids connection	◆					◆
		Desire for perfection hinders knowledge development		◆			◆	
		Additional content reinforces understanding of new knowledge	◆		◆			◆
	Present Information	Imagination aids connection of information	◆					
	Prior Knowledge	Connection increases confidence				◆	◆	
		Familiarity encourages connection which stimulates creativity			◆			◆
	Reality	True understanding / learning happens when there is transfer			◆			◆
		Familiarity encourages engagement and perseverance		◆		◆		◆
		Connection aids better understanding of one's true nature	◆					
	Creativity	Convenience / desire for perfection / intolerance for mistakes affects imagination, creativity and confidence	◆	◆		◆	◆	◆
		Encouraging creativity through communication	◆		◆			
		Influencing creativity through exemplification			◆			◆
		Encourage creativity through motivation and affirmation		◆	◆			
		Effects of misunderstanding information					◆	

Engagement		Stereotypes stifles imagination	◆					
	Music	Music entertains and engages		◆	◆			◆
	Puzzles	Optical illusions allow exploration and discovery	◆			◆		◆
		Engages and keep users excited		◆			◆	
		Familiarity does not inspire users to initiate interaction			◆			◆
	Questions	Questions within collaboration exercises imagination	◆	◆	◆	◆	◆	◆
		Increase engagement by directly addressing users		◆			◆	
	Role / Imaginary Play	Engages and encourages imagination, creativity and progress	◆		◆			◆
		Engagement between collaborators	◆		◆	◆		
		Context and understanding						◆
		Engages through transformational learning orientation	◆		◆		◆	
	Timed Challenges	Promotes creativity and focus	◆	◆		◆		
		Management of expectations					◆	
	Unique Characters	Unique characters, relationships and engagement		◆	◆	◆	◆	◆
	Usability	Misconception about simplicity	◆	◆	◆	◆	◆	
		Standardised and Obvious Call to action buttons	◆	◆		◆		◆

		Obvious transition between tasks / sections	◆	◆	◆	◆	◆	◆
		Obvious signposts	◆	◆	◆	◆	◆	◆
		Obvious feedback during interaction	◆	◆	◆	◆	◆	◆
		Familiar Interactions	◆	◆		◆		
		Personalised cursors were redundant	◆	◆	◆	◆	◆	◆
	Visual Content	Interactivity offers engaging experiences	◆	◆	◆	◆	◆	◆
		Recognition requires a match in expectations	◆	◆	◆	◆	◆	◆
	Exploration	Forced linear exploration reduces enjoyability	◆	◆	◆	◆	◆	◆
		Discover and explore tools prior to activity	◆	◆	◆	◆	◆	◆
		Encourage active hands on exploration	◆	◆	◆	◆	◆	◆
		Explore complex yet connected skills	◆	◆	◆	◆	◆	◆
Holistic Values		Discourage racism, biases, competitiveness and segregation	◆				◆	◆
		Interest in foreign languages does not necessarily evoke respect		◆		◆	◆	
		Develop interpersonal and social skills through role play	◆		◆			
Personally Meaningful		Personalised elements attracts attention	◆		◆	◆		◆
		Include multiple opportunities	◆	◆	◆	◆	◆	◆
		Personally meaningful experiences engages	◆		◆			◆
		Users' initiative to respond, interact and apply knowledge	◆		◆	◆		◆
		Identifying with content affects determination and progress			◆	◆		
		Encourages users to identify with content	◆		◆			

3.4 Ethics Consideration

There were numerous potential ethical issues that could arise from the study because of its creative nature and human involvement including children. As such, the research was guided by the rigorous ethical standards based on the National Statement on Ethical Conduct in Human Research (Australian Government, 2007). The recruitment of participants for the production of media elements were held through word of mouth and open call auditions to ensure that the process was fair and that everyone who applied had equal opportunity. Prior to the open call auditions, elaborate information about the project and selection criteria were made available. Only potential participants who met the selection criteria were considered for the relevant roles. All crew and talents involved in the production were provided with information letters and were requested to respond with written consent before the start of production. Where child participants were part of the production, they were provided with verbal information about the study and their roles. They were requested to give verbal assent before their parents/guardians provided written consent after reading the information letter. The involvement of child participants in the production process were separated into four blocks of forty-five minute recording sessions with fifteen minute breaks in between. During this process, their parent/guardian were also physically present. As part of the agreement for participation in the study, the identities of child participants were kept confidential. This was achieved through the alteration of their voices prior to implementation and ensuring that their faces could not be identified. When adult participants were involved in the production of media elements, their recording sessions were no longer than eight hours with regular breaks for meals and snacks. They were also informed and agreed to give consent for their identities to be revealed. All participants involved in the production of media elements were also informed that they could be sent a copy of the media segments that portrayed their involvement on request, with detailed information on how it could be used as their future reference for work done.

Ethics pertaining to the production of media elements included gaining appropriate permits prior to usage of locations that required permission and ensuring that appropriate measures were in place to reduce the risk of breach of occupational, health and safety standards. In the pre-production stage of the media elements, the researcher also ensured that characters names and behaviours for media segments did not resemble traits of the talents or crew involved in the production. Other ethical considerations related to intellectual property and were met by ensuring that stock materials such as

images; footage; props; music and sound effects used for the production were original creations; royalty free or had written permission for fair use. Computer applications used to create the media elements were also authorised versions and rightfully owned.

Participants for the user tests were recruited through word of mouth and were screened for eligibility. Similar to child participants in the production process, participants under the age of eighteen who were interested in being a part of the study were provided with verbal information before their verbal assent were sought. Their parents/guardians were also provided with information letters about the study and were asked to provide written consent. All participants were informed prior to the study of the extent of anonymity and confidentiality in publication, dissemination and the potential for data to be re-used by other studies. Participants were also informed that the duration of the user tests would be held in three blocks of forty-five minute sessions with fifteen-minute breaks. A factor of ethics was also the confidentiality and security of collected data and information. Through the information letter and consent form, participants were briefed that all information and raw data collected during the study would be treated confidentially and password coded. Their identities and personal information were replaced with pseudo information so that they could remain anonymous (Australian Government, 2007). They were also made aware that information and data collected could be used in future research projects and would be stored securely on Edith Cowan University's premises for five years at the conclusion of the project. After which, the information and data would be confidentially destroyed unless required for further research.

3.5 Limitations

Although this study presented findings that were novel and would influence how future interactive media is designed to promote holistic learning, some limitations were noted. Because this was a Master's research project, there was a shortened duration for the study. Due to the time limits, only one development process was complete. The study would have benefited from an iterative development process where the findings could have been used to develop a second website that could be evaluated by participants to test its validity. Additionally, time limitations affected some usability issues in the website prototype but it did not disadvantage the study as it still allowed data to be collected. Another limitation that had potential to influence the study was the accuracy of responses in the participant's diary. It was a concern that parent participants might

record invented entries in the participant diary so that their child and their parenting competence would be viewed positively. To prevent such a situation, parent participants were briefed and assured before they agreed to the user test that the entries in the participant diary were not going to be used to judge how well their child performed or how well they had trained the child. Instead, the entries would only be reviewed to determine the success of the website in promoting holistic learning. This provided parent participants with assurance and encouragement to report genuine incidents where their child independently showed an act of kindness to others

3.6 Summary

With the identification of theories that influence learning; holistic education; media trends and design approaches, an initial holistic interactive framework was established. The research question then asked by the study was *How will the content, interface and interaction designs of an interactive website developed using the framework of balance, inclusion and connection promote holistic learning?* In order to answer the question, the research had to evaluate the effectiveness of this framework in providing individuals with an interactive learning experience that would promote holistic learning. The evidence of the evaluation would be derived from observations how individuals interacted within the collaborative experience and with the interactive website, as well as how the new knowledge was transferred to their lives. As the answers required reflection of the personal learning experiences as well as the emotional reactions of the research participants, a qualitative study was conducted.

For the evaluation of the framework to transpire, an interactive website based on the initial holistic interactive framework had to be developed using development processes common in the HCI domain. These development processes occurred over the following various stages and phases.

Identification of user needs and establishment of requirements

This stage of the development process was completed over two phases, which identified the target audience as Singaporean preschoolers and their parents. In its second phase, a scenario-based user needs analysis using three scenarios was conducted to help in the identification of how potential users would interact with the interactive experience. This then provided information so that the design of the solution could be catered for the target audience.

Design of solution

This stage of the development process was completed over two phases. The first phase of the solution design was based on the theories extracted from the literature review that resulted in the design of a basic interactive framework. The framework was then used to design the first prototype of the interactive website which was then evaluated against the information obtained from the scenario-based user needs analysis. Based on the evaluation, the second phase commenced and resulted in the initial holistic interactive framework. This revised framework provided a comprehensive guide that was then used in the design of the second website prototype.

Development of website prototype

With the completion of the second phase of design solutions, the next stage of the development process commenced. This process followed an incremental approach as the development of the interactive website relied on the completion of various components. Some of the components could be developed simultaneously while some had to be developed consecutively. The components that made up the finished website prototype were character development information; scripts; songs; voice over recordings; puppets; set designs; props; animations; live action performances; web content. Each of the components were developed through phases of design, develop and evaluate loops that were repeated until an appropriate version was complete. Each component's final version were then composited incrementally until the website prototype was achieved for evaluation.

Initial evaluation through pilot study

The completed website prototype was then initially evaluated through a pilot study to ensure that potential research participants could navigate through the website. The pilot study also provided an opportunity for the proposed interview questions and aids to be tested on potential research participants to ensure that its contents could be understood. From the observations of the pilot study, usability issues that influenced the interactive experience were identified. These issues, although minor were addressed in the finalised website prototype so that the interactive experience could be better refined.

Evaluation through user tests and observations

The finalised website prototype was then evaluated through six user tests where research participants were observed as they interacted with the website prototype and

amongst collaborators. As part of the evaluation process, participants were also asked semi-structured interview questions so that in-depth data of their understanding of the experience and their emotional responses could be recorded.

At the end of the user tests, the evaluation process continued through observations where parent participants had to observe and report on occurrences where their offspring applied the new knowledge gleaned from the interactive learning experience. This took place over two weeks and parent participants were provided with comprehensive guidelines to ensure that the evaluation process could be successfully completed.

Data analysis

The data obtained from the various evaluation procedures were then analysed using a constructivist grounded theory approach. The data collected were transcribed and analysed in the following five stages:

1. Initial coding - where data was separated into codes and concepts.
2. Memo writing - where the concepts were conferred meanings and connections were inferred.
3. Theoretical sampling - where concepts were refined into themes and categories so that the relationships between them could be elucidated
4. Saturation – where the data, codes, concepts and its relationships was re-examined to ensure that there were no more theoretical insights that could be acquired.
5. Sorting – where the new holistic interactive framework was established through the grouping of theoretical insights into categories.

This chapter also considered the ethical responsibilities of the research and the potential issues that could transpire as the various stages throughout the research involved humans and young children. In order to ensure that the research was conducted ethically, it followed the guidelines in the National Statement on Ethical Conduct in Human Research (Australian Government, 2007). Finally, limitations of the research were also acknowledged and where feasible, preventative measures were highlighted to ensure that the research could be validated. At the same time, its identifications also

provided suggestions where future studies could be undertaken based on the analysis and findings of this research.

4. Results and Discussions

From the analysis of the data obtained from the evaluation process, it was identified that interactive media for preschoolers that attempts to promote holistic learning should be designed so that the learning experience is

- personally meaningful
- engaging through imaginary play; active hands-on exploration; usability design; inclusion of questions that directly addresses users; timed challenges; visual content design; puzzles and unique characters
- balanced in its music design as well as the presentation of concepts; interactive tasks and media elements
- a collaborative experience
- an imaginative and creative experience
- able to help individuals connect information through various means

The attributes above were derived from the observations of the interactions between participants and the finalised website prototype and are further expounded and discussed in this chapter.

4.1 Personally Meaningful

In the development of interactive media that promotes holistic learning, my research suggests that learning experiences aided by media content can positively influence progress and development when the learning experience is personally meaningful to users.

4.1.1 Attract Attention With Personalised Elements

Personalised elements in the context of this research refers to features within the interactive media content that can be customised by users according to their preferences. These elements are important as they assist in enticing users to focus on the content

being presented as part of their learning experience. Of the six user tests conducted, four users saw and recognised their craftwork as part of the media content. However, two users were unable to see their craftwork as an integrated component because they failed to notice or carry out instructions which were given at the start of the user test. For example, Permai did not create her craftwork until after the user test was complete, as she had rushed through the content without paying attention to the instructions provided. Rayner on the other hand had completed his craftwork at the stipulated moments during the user test, but did not correctly save the image. In these two instances, stock images were displayed during the user test instead of displaying their personalised craftwork.

Of the four users that recognised the integration of their personalised craftwork in the media content, there were noticeable changes in body language as they continued with their interactive experience. This is evidenced by the following observations:

- After Alice told Amy that her craftwork was on the screen, Amy was observed to rapidly blink her eyes and sat up straight while paying attention to what was being shown. Before her craftwork was pointed out to her, she fidgeted around and played with the mouse device on the table.
- Heather and Hillary realised that their craftwork was integrated within the animation as a personalised element without the help of their parents. Heather and Hillary were then observed to physically lean forward towards the laptop and expressed delight through their laughter. They were also observed to turn to Jack to seek his acknowledgment for their work.
- Jeremy had been talking to Tom during the first few seconds of the animation about the song that was playing. When he turned to face the screen again, he noticed the background and pointed to it. Turning back to Tom, he giggled before returning his gaze to the screen for the rest of the animation until the following interactive task that required his response. However, before he continued interacting with the content, he told Tom, “I just saw my picture”.

Of all the responses, the most prominent response to customisable content was observed when Jeremy realised that his craftwork was incorporated with the animation. The

examples and observations of the user tests demonstrate that the nature of media comprises different components that attempt to capture the attention of users when they interact with the content that is presented. When designed well, the elements balance themselves out and are able to convey messages. Designed badly, and the repercussions could be undesirable. For example, various elements of the media that are bold and screaming for attention can overload the senses of users. This could result in a lack of concentration as they suppress their emotional connection while trying to comprehend information that is being presented. By adding a level of interactivity as part of the interactive experience, the potential for an overloaded sensory experience increases as users could end up concentrating on the completion of tasks or the interactivity. To maintain users' emotional connection with the experience, personalised elements could be implemented within the design of the media content. This draws on the premise that when users, regardless of age, see content that is customised by them, they feel a sense of pride; pleasure; and ownership, thus strengthening their emotional bond and increasing their attentiveness.

4.1.2 Multiple Personally Meaningful Experiences Maintains Engagement

However, attracting the attention of users is only part of the equation. In order for users to learn holistically, they should remain engaged throughout the interactive experience so that new knowledge may be acquired. Arguably, the achievement of prolonged engagement requires more than the inclusion of personalised elements. Here, users may be provided with opportunities, which they perceive as being personally meaningful through the content design and interaction design.

By including content that is familiar to users, they are encouraged to make an emotional connection and perceive their experience as personally meaningful. After Laura's attention was drawn to the test, she noticed that the lead characters in the animation consisted of both a male and female. She then took the initiative and associated herself with female character and commented that it represented her. This additional association indicated that Laura was not only paying attention, but was also actively engaged in the experience through familiarity of content.

Besides the design of content that promotes personal connection, users can also feel connected to the experience through interaction design. For example, although Permai and Rayner did not see their personalised craftwork as part of the animation, they were

still able to maintain engagement with the experience as they participated in the process of capturing and saving images. While Rayner captured the image of his craftwork, Permai captured self-portrait images of herself and Sarah. Because the tasks of capturing and saving were based on similar activities already familiar to them, the process was still personally meaningful albeit not achieving the intended results. Although this could have potentially detracted from their perception of the experience being personally meaningful, a personal connection could still be achieved through their overall experience. This is because, as part of the interactive design, users were tasked with various activities such as making personal choices on behalf of characters in the animation. These decisions were in response to how these characters should react based on the protagonists' situation as well as the memory card activity where users were made to feel like they had contributed in helping the characters obtain their desired food items by correctly completing the memory puzzles. The process of making decisions on behalf of the characters encourages users to go through the same cognitive processes as they would when making the decisions themselves. By placing themselves in the position of the characters, the experience is distinguished from being a personally meaningful story as opposed to a simple story-telling session.

The failed attempts of Rayner and Permai at incorporating their craftwork as a personalised element despite the provision of comprehensive instructions highlighted the importance of ensuring that users were afforded multiple opportunities within the interactive experience to be engaged in personally meaningful experiences. This is to ensure that within the entire experience, users are able to engage in at least one personally meaningful experience even if precise instructions were not followed or activities were skipped. The inclusion of multiple opportunities would also benefit users who completed the entire interaction with more than one personally meaningful experience as it strengthens their confidence and further encourages profound engagement.

This was illustrated by the development and completion of Laura's craftwork (See Figure 34). When she was provided with a range of art and craft materials for the craft activity, she saw that the materials included buttons of different shapes. Upon discovering that the shapes included bear shaped buttons, she exhibited increased excitement and interest in the activity. This caused her to engage with the craft activity, which resulted in an imaginative design. It was later revealed during the interview that

she had a profound love for bears and the buttons appealed to her, thus making the content and the process of creating the craftwork personally meaningful to her. When she was required to take a photo of the completed craftwork and upload the image as her personalised element, her personally meaningful experience was further enhanced, which was again strengthened when the digital image appeared as part of the animation. Laura's multiple exposures to personally meaningful experiences where she identified with content reinforced the messages and lessons communicated through the holistic learning experience. She was later observed to develop new knowledge because of her profound engagement.



Figure 34. Laura's Craftwork

4.1.3 Personally Meaningful Experiences Encourages Identification And Influences Attitudes

When the interactive experience is personally meaningful to users, they are more likely to identify with the characters and with the messages that are being communicated. Users were observed to place themselves in the character's position and imagine how they would respond. This altered perspective was then observed to affect the attitudes of users such as Amy and Laura which determined their overall learning experience and progress. However, this was best demonstrated by the contrasting reactions between Heather and Hillary during the electronic craft activity.

- After trying to draw unsuccessfully, Hillary was ready to give up on the task and commented that they could give Janice a blank card because "she is not real". However, Heather identified with Janice's character and was engrossed

in drawing the card so that Janice “would not cry.” Heather’s identification with the character as a result of the personally meaningful experience became an impelling force for her to progress and complete the task.

- While interacting with the content, Amy felt personally connected to the scenario being portrayed in the animation. When she was asked to choose the actions of Chris and Phoebe, Amy initially commented that they should leave Janice alone. However, through a discussion and the counsel of Alice as her collaborator, Amy changed her perspective and changed her selection to help Janice. During the interview, I tried to find out the reason for her initial choice and Amy said that when she was upset, she preferred to be left alone. Additionally, Alice also clarified that the reason behind Amy’s choice was because she had a similar experience in school between two other friends which left her upset. This shows that she identified with the characters and storyline which in turn affected how she made her selections.
- Laura’s experience being personally meaningful was evidenced when she started identifying with various components within the media. An example of such an instance was when she saw images of the chocolate chip cookies and she mentioned that just like Jo Jo’s, they were also her favourite. As part of her personally meaningful experience, Laura learned different definitions of kindness. She was then observed to take the initiative to progress her new understanding of what it meant to be kind and applied it in her own way. For example, when Judy was drawing as part of the electronic craft activity, she commented that her drawings were not perfect. Laura immediately encouraged her and told her that it was okay. When asked by the video to give examples on how she would be kind, Laura also said that she would be kind to her friend by giving her “a new toy”. This was an example that was not communicated in the content, which demonstrates that she understood and transferred the information so that it was now personally meaningful to her. Laura’s experience illustrates how personally meaningful interactive experiences can influence users to identify with content, which also affects their attitudes towards learning. When Laura’s attitude towards learning was positively influenced, she was able to develop new understanding and applied them in her own approach. This allowed her to encounter multiple cycles of personally

meaningful experiences, which continued to build upon each experience to strengthen her learning.

The experiences of Hilary, Heather, Amy and Laura emphasize the need for users to feel personally connected to the content so that they can encounter holistic learning experiences. By helping users to feel like their experiences are personally meaningful, they are encouraged to identify with the content. When there is identification, their attitudes towards learning can be positively influenced so that the user can progress and develop new knowledge.

4.1.4 Summary

When an interactive learning experience is personally meaningful, an individual can be encouraged to develop holistically. Based on the observations of the user tests, evidence shows that for the experience to be personally meaningful, individuals first have to be attracted to the experience. One of the ways in which this can be achieved is through the inclusion of designs that enables users to customise and incorporate personal elements into the experience. The user tests also showed evidence that when a learning experience is personally meaningful, individuals are encouraged to identify with presented material, which changes their perspectives and attitudes. This was also evident in the initial holistic interactive framework in the following elements:

- Balance - Educational content should provide users with opportunities to interpret and construct meaning for their own knowledge acquisition. Rather than spoon-feed users with a plethora of information, content should encourage users to engage in imaginative thinking to find solutions and research for information.
- Inclusion - Include elements of familiarity in visual designs for target audience so that learning will be personally meaningful.
- Inclusion - Where appropriate, users should be able to analyse content and change content options as they acquire knowledge.
- Inclusion - Where appropriate, interface should allow users to customise parts of its design so that it will be personally meaningful.

In addition to designing interactive media for a personally meaningful experience so that it can influence the individual's perspectives, the analysis of the observations also identified the importance of providing users with multiple opportunities where the experience can be personally meaningful for the user. This encourages prolonged engagement with the presented material, which can influence their perspectives and attitudes towards the learning experience so as to optimise progress. Although this was practiced in the design and development of the website prototype, it was not identified as an element in the initial holistic framework.

4.2 Engagement

The level of success of any form of media designed in line with the principles of holistic learning is dependent on and correlates with the level of user engagement (Conrad & Donaldson, 2004; Franceschi et al., 2009; Jestice, 2009). While engagement may occur naturally, there are no doubt several means by which the level of user engagement may be increased. This study identified that the inclusion of imaginary play; active hands-on exploration; usability; questions; timed challenges; visual content; puzzles; unique characters and music as elements that can be designed to affect user's engagement with the interactive learning experience.

4.2.1 Imaginary Play

Imaginary play in the context of this research does not refer to the conventional notion where individuals dress up in costumes and play with props. Instead, it refers to users being engaged in what Vygotsky (1978) refers to as play, where users play a part in an active learning experience where they adopt roles as part of their interaction and immerse themselves in make-belief scenarios. By assuming a variety of roles, they are encouraged to engage in complex, symbolic thinking and child directed exploration where they take on different perspectives and interpretations as they attempt to make sense of their world and connect it with the information presented before them. When engaged in imaginary play, users are able to progress from understanding their world through a literal frame of mind to an allegorical perspective.

Imaginary play within educational interactive media can be stimulated through the design of content where users are shown examples of imaginary play and symbolism. For example, instead of showing a real telescope used by a human character playing the role of a pirate, a puppet could perform the character and the telescope could be made

out of recycled materials like a cardboard tube from a kitchen roll. Users can also be encouraged to engage in imaginary play through the design of interaction. For example, users could assume the role of a pirate who is on a mission to collect treasures. The collection of treasures could be achieved through games and puzzles within the learning content. By assuming the role as part of their interaction and learning experience, users can be inspired by being endowed with responsibilities and goals to be achieved.

With the craft activity as another example, users could be asked to take on the role of the pirate who has to design a new ship. By including the craft activity that is then integrated as part of the interactive learning experience, users are encouraged to use their imagination to learn and create by manipulating physical materials. This imaginary play enhanced by the addition of physical dimensions within the interaction encourages users to develop their fine motor skills, self-confidence as well as problem solving skills through trial and error. Such tasks provide them with an opportunity for their learning experience to involve their various senses beyond the visual and auditory sensory faculties that are generally associated with learning through electronic mediums.

4.2.1.1 Imaginary Play Engages And Encourages Imagination, Creativity And Progress

The imagination and creativity aptitudes of users are exercised when they are engaged in imaginary play as part of their interactive learning experience. While it was not an explicit goal in the design of the content and interaction, it was observed that two of the users initiated imaginary play as part of their interaction.

- Before starting the craft activity, Alice suggested that Amy could pretend to be an architect who had to plan and design the school. In suggesting that Amy take on an imaginary role, it triggered in her a sense of responsibility and a desire to achieve the goal of completing the school design. While planning her school, Alice reminded her that the craftwork was a blueprint that was an important document for her team of architects and builders. Through their discussion, Amy learnt that the details in the blueprint were crucial to ensuring that her imaginary team could successfully build her school according to her vision. This served as motivation for Amy to think imaginatively which resulted in her adding specific features to her craftwork like colours and textures by using materials such as coloured pasta and rice. Through Alice's

reminder of her responsibility as part of her imaginary role, Amy was given impetus to accomplish the task.

- Laura initiated imaginary play during the craft session when she suddenly took Lucy, her favourite teddy bear that was in a toy box by the table. As she lifted up Lucy, she changed her tone and voice, saying “And then Lucy will say...Yay!”. While Laura was not continuously engaged in imaginary play, there were still occasional moments throughout her learning experience where she was engaged in imaginary play. At one point of her craft session, she sat Lucy on her craftwork and pretended to make Lucy eat the apples off the tree she had drawn with apple shaped buttons. As she did this, Laura imitated eating sound effects and commented “Lucy will catch it later”. Throughout her learning experience, Judy did not discourage Laura from communicating with her teddy bear and participated along in Laura’s imaginary play. Her support in Laura’s imaginary play made a difference in Laura’s ability to imagine and had an impact on her development of her craftwork and progress. Before Laura engaged in imaginary play, her design decisions were based on her real life experience as she wanted to draw a table with a basket of fruits, benches and a playground with bicycles and rocking horses based on what her real school looked like. When Lucy became part of the craft process, Laura was observed to become increasingly jovial which was affirmed by her singing and laughing. She also changed her designs that reflected metaphorical concepts such as adding caves for bears because her school was now “a special school”.

The examples of Amy and Laura imply that imaginary play encourages the employment of a user’s imagination and creativity. When users assume roles as part of their interaction and imaginary play, they feel a sense of responsibility, purpose and confidence, which provides them with motivation to apply themselves in the learning experience. The motivation also pushes them to complete tasks that were set out by the experience design. This motivation incites users to remain focused so that they can achieve progress, which affects their development and learning experience.

4.2.1.2 Imaginary Play Aids Comprehension

For users to remain engaged in the learning experience, they need to understand the context and purpose of their interaction so that there is stimulus for progression. At the

start of the user test, users were asked to select their personalised cursors. The task was introduced on the instructions page where users were told, “To begin, select your magic wand”. All the users except for Amy were unsuccessful in making the selection. Upon reflection, I noted that users were unsuccessful because some did not read the instructions while others had trouble identifying which buttons referred to the magic wand. It might also have been possible that the concept of the magic wand was too abstract and out of place in relation to the rest of the instructions that were literal in nature. If users did not understand the rationality behind the task of choosing the magic wand and were unable to see an incentive in resolving the task, this increases the risk of them disengaging with the experience.

There are several ways of avoiding such an issue in future interactive media design. One plausible solution is to encourage imaginary play at the beginning of the user’s experience that rationalises the tasks and options. Using the magic wand concept as an example, if users are persuaded at the start of their experience to imagine themselves as a fairy or a magician that needed to find the wand to perform their magic, it helps them to understand the context of selecting their magic wand. If the options for the magic wand were not immediately visible, users would be more willing to explore and complete the task. Therefore, the inclusion of imaginary play as part of the holistic learning experience would have assisted in the comprehension of context and purpose so that users are motivated to interact and engage with the experience.

4.2.1.3 Engagement Between Collaborators

The inclusion of imaginary play within a holistic learning experience that involves collaboration can guide the approach of the collaborative experience. During the user test, it was observed that not all interaction between collaborators were as stimulating and supportive of the learning experience for users. This could be contributed to how the older or more competent collaborators perceived their roles and responsibilities within the collaboration. For example, if they viewed themselves to be an authoritative figure within the partnership, they are more likely to supervise the learning experience and direct the progress during their engagement with the child. However, if they viewed themselves as a facilitator, they tend to encourage the child to make their own decisions on how to progress and then provide scaffolding support to help the child progress.

The inclusion of imaginary play and its significance in influencing the engagement between collaborators can be illustrated with Denise and Rayner's experience. Towards the end of the craft session, Rayner wanted to add flowers to his craft but Denise responded, saying "can you put in your flowers and finish it up now? Draw in your flowers that side there... Here, draw in your flowers." By introducing imaginary play at the beginning of the user test, Rayner could have been conferred the position of fairy chief and Denise could be requested to function as his assistant fairy working together to landscape the school's garden. This would have altered the tone of the engagement between them and Denise could be encouraged to be less assertive and would likely suggest "how about we add in the flowers here?". This would then enable Rayner to make the decision on when the craft activity should conclude.

Therefore, by including imaginary play in a similar interactive context, roles and responsibilities can be defined to advocate child-directed exploration within the collaborative experience. This allows the child to direct the approach of the activity as they are empowered by the facilitation of the parent while working together towards achieving new knowledge or a common goal. This gives the child a sense of purpose and increases their engagement, which stimulates further exploration of their capabilities and the interactive content.

4.2.2 Active Hands-on Exploration

As users explore the interactive content, they can be encouraged to participate in hands-on activities so that they are not passively learning through watching a video or listening to a story. Of the six user tests, only one user did not get to participate in active exploration of the interactive media. Judy had control of the mouse from the start of the user test and when Laura asked if she could control the mouse on her own, she was told that she could not touch the laptop. When asked for the reason behind preventing Laura from taking control, Judy commented that it was because she felt that Laura was not familiar with the laptop and was worried that it might get damaged. She added that if the user test were conducted using Laura's personal tablet, she would have allowed Laura to explore the content on her own. As a result, Laura's discovery of the content was based on Judy's initiative instead of her own. The importance of allowing Laura to direct the exploration and interaction is so that the learning experience is personal and engaging. For example, Judy clicked on the character's information page but did not give Laura the choice of getting to know the characters. She also selected the flashcard

page, but only read out the English sentences without playing the audio files or exposing Laura to the other languages. Despite not having actively explored the content on her own, Laura was still able to develop new knowledge as she was still engaged through other factors that were stimulating to her. However, should Laura have been able to personally explore the website, it is likely that there would be increased potential for Laura to acquire more knowledge and by extension, enjoy the entire process more fully.

The impact on engagement when users are actively exploring interactive content was also observed in Jeremy's experience. When Jeremy had control of the mouse, he concentrated on what was happening with the content and sat still in the seat. However, when Tom had control of the mouse instead, Jeremy was observed to fidget in his seat and he did not seem to be as focused.

The observations of Laura and Jeremy's experience therefore suggest that encouraging child-directed active hands-on exploration influences their engagement with the learning experience and their development. This is due to the fact that when users are participating in active hands-on exploration, they become the driving force behind their own learning, which helps them to better engage in the content and contributes to a more pleasurable experience.

4.2.2.1 Forced Linear Exploration Reduces Enjoyability

Users who are proficient in interacting with online media content are inclined to explore websites in a nonlinear manner which allows them to discover information at their own pace. The way the website was designed required users to view information linearly to complete the craftwork before moving on to the interactive video. This linear process was recommended with numbered instructions and the design of the menu buttons that ran across the bottom of the page from left to right, mimicking the way users read. Of the six user tests, Heather, Hillary, Rayner as well as Amy followed the sequence while interacting with the website because they were prompted to do so by their parents.

Amy's initial intent after reading the instructions was to go straight to the craft activity, but when Alice told her to select the Characters page first, she was grumpy and refused to read the extra information. Amy's expressions conveyed her displeasure at having to follow the linear sequence and her irritation was unjustified and could have affected her

engagement in the learning process, especially since it was not imperative for users to first view the character pages.

Her response indicated that when users are forced to engage with content in a linear and rigid way, they are less likely to explore content within the page and the experience becomes less pleasurable. Laura, Jeremy and Permai on the other hand viewed the website in a nonlinear manner and were able to engage with content as they pleased. Laura and Jeremy made the decision to start on the craft activity while Permai took a photo of her portrait instead of her craftwork with the functions of camera. As they were able to interact with the pages that appealed to them first, they were immediately immersed in the experience.

When designing educational interactive content, it is important to consider that users might already be adept at using the computer and have experience with similar content. As such, they are more likely to explore the website in a non-linear manner. By presenting all the content through a linear approach, users might feel frustrated which could affect their engagement with the learning experience. However, when content is presented so that it can be viewed in a non-linear way, users are afforded a pleasurable experience and can be encouraged to maintain engagement in the process. While it is important to promote non-linear explorations, the designs also have to ensure that where necessary, important information that affects the learning experience is featured and well communicated to users.

4.2.3 Usability

A crucial element that affects the levels of user engagement in online media content is usability. Of the user tests that were conducted, results and user feedback revealed that in order to achieve the intended aims, interaction design must strike a balance between being simplicity and complexity. As an extension of the concept of usability, users should ideally be able to track their progress that acts to provide them with a positive and motivating experience. These results suggest that the broad concept of usability can also be achieved by affording uniformity in the design of the various components. Users should also be provided with feedback throughout the experience that adds to their ability in tracking their progress. Finally, transitions between sections makes for another important element in increasing the overall usability of the interactive experience which extends to increasing levels of user engagement.

4.2.3.1 Misconception About Simplicity

When interactive content and tasks are consistently too complex for its intended users, the experience becomes exasperating. Such encounters are also true for the reverse when the designs of interactive experiences are too simple. In the design of the electronic craft activity, the decision to provide simple drawing tools was based on the impression that young users would only create simple illustrations and therefore would not require too many tools that would clutter the design of the interface. However, this decision for simplicity compromised the experience of users and affected their creative ability to fulfill their imagined designs.

- Amy initially started the electronic craft enthusiastically and wanted to draw a “sad girl holding an umbrella” in the rain. But upon interacting with the drawing tools and realising the difficulty in controlling the tools with a mouse, she started feeling frustrated. This was evidenced in the way she scribbled across the entire image while grunting. After a few attempts, Amy requested for Alice to take over the task.
- Rayner, Heather and Hillary decided that they wanted to include words in the electronic card instead of illustrating. However, the tools were too simplified and there were no tools that allowed users to type words. Instead, they had to use the pen tool to write their message to Janice. This became a difficult task because their expectation was to be able to write as though they were writing on paper with a pen or typing. When they saw the irregular lines and forms that resulted, they felt dissatisfied and requested that their parents help them by starting over and rewriting the contents of the card. The results from the efforts of the parents still left them feeling unhappy as the parents also found it hard to control the mouse. In the end, they became increasingly restless and stopped trying.

Based on the reactions of the users and their interview responses, the importance of how users are supported in their interactive experiences is highlighted. In the case of this research, the design of the interactive experience should have been supported by providing users with comprehensive tools that complemented their tasks and content such as stickers; templates or text tools. In assuming that simplicity and a less cluttered interface would benefit younger users, the experiences of users and their confidence

were negatively affected. Therefore, future interactive experiences should incorporate a balance between simplicity and complex designs so that the abilities of users will not be limited by the designs of the experience and they are encouraged to create and engage in a pleasurable experience.

4.2.3.2 Obvious Signposts

When engaged in an interactive experience, users who can clearly track their progress seem to be able to maintain better engagement with their experience. As observed in all the user tests and best demonstrated during Tom and Jeremy's experience, users were not able to track their progress because the designs of the signposts were not prominent. Although the signposts were used in the pages at the start of their interaction, Tom only noticed them towards the end of the user test and was not aware of its purpose. When they finished exploring both keywords on the flashcard page, Tom tried to click on the two small dots to progress. However, this led him back to the main flashcard page instead of progressing as the small dots were only for visual illustration and were linked to the call-to-action menu button for each section. This caused Tom and Jeremy confusion as they repeatedly clicked around the screen and on arrows that cycled through the keywords until they realised that they had completed the section and could move on.

Tom and Jeremy would have had a better experience if the signposts were separate from the call-to-action menu buttons and were featured at the completion of each task. To assist them in the tracking of their progress, the signposts should help users understand their position in relation to the entire activity. This can be achieved by signposts that remind them of their achievements and show users the remaining goals to be completed while allowing users to decide their next course of action and pace of progress. When the signposts are endowed with these characteristics, it ensures users are able to track their learning progress that in turn motivates them and increases their engagement in the presented content and experience.

4.2.3.3 Standardised And Obvious Call-to-action Buttons

The engagement levels of users when interacting with tasks and content is also dependent on their ability to easily navigate and ascertain requirements within their interaction that require their responses. There were several instances where the

prototype could have been improved through the design of the call-to-action buttons to encourage prolonged engagement.

- When the instructions for the user test was presented, Denise and Rayner were unsure of which buttons to select as the buttons were repeated within the instructions and on the menu at the bottom of the page. Their confusion could have been avoided if there were only one set of menu buttons on the instructions page.
- When Amy, Rayner and Heather were on the characters page, they had the impression that they could click on the images of the different characters to load content instead of clicking on the arrow above the images (See Figure 35). When there was no response from clicking on the image, they clicked on different parts of the image before they clicked on the arrow above the characters. This meant that there was an interruption in their engagement as they tried to figure out how to progress to the next step. Even though the arrows were of the same colour to the other call-to-action buttons and the image was in black and white, the space occupied by the image was significantly bigger and therefore was more pronounced than the arrows.

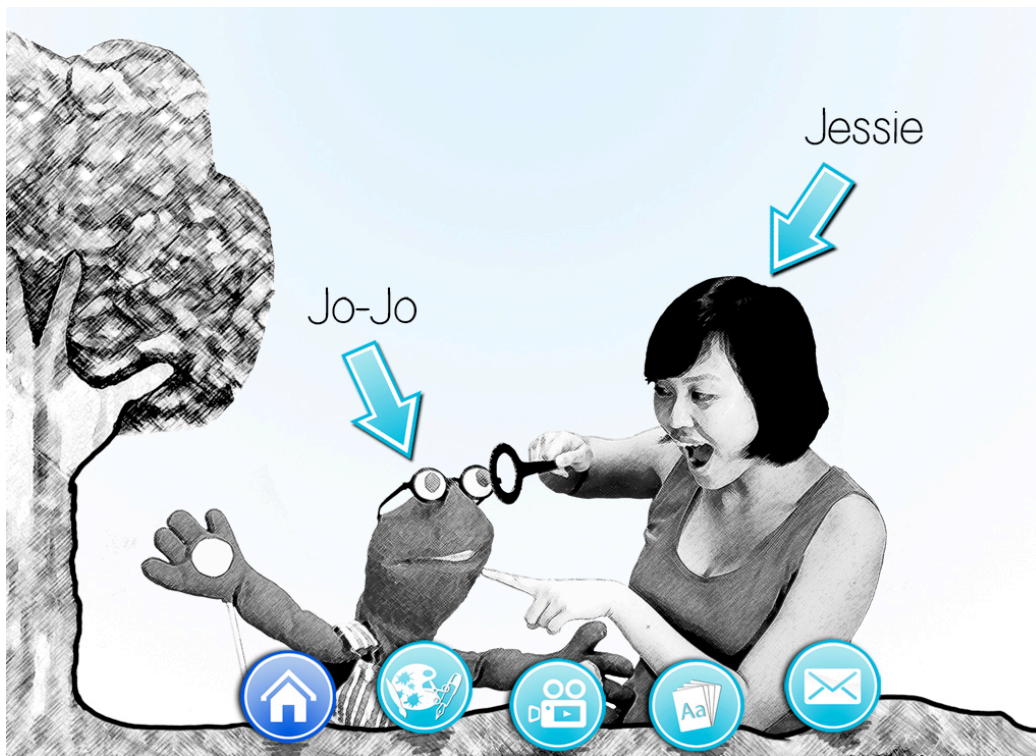


Figure 35. *Connecting Dots* ' Characters Page.

- When users were in the process of capturing and uploading their completed craft, some users appeared to be hesitant in selecting the buttons to carry out the procedure. During the interview, Alice mentioned that the reason behind her hesitation was because she was looking for a button with a camera icon similar to the main call-to-action menu buttons. Instead, the button to capture their image was represented by a similar coloured button which was embedded within a body of text. It was only when she read the instructions again that she realised that the button she had to click on was represented by text that read “Photo” (See Figure 36).



Figure 36. Confusing Call-to-action Buttons.

- The sentiments felt by Alice was also shared by Jack who added that their experience could have been more natural if the call-to-action buttons were only presented at the end of the instructions.

When trying to engage users in an interactive experience, users who are able to interact with ease are more likely to be immersed in their experience. When call-to-action buttons are not obvious, they might not attract the attention of users so that they know when to respond and interact with the information that is presented to them. One way of

ensuring that its design is obvious is to check that the call-to-action buttons are not overpowered by other elements on the page and repeated displays of the same buttons on a single page should be avoided. This reduces redundancy so that unnecessary information is not vying for attention thus causing users to feel disoriented. At the same time, it is important for the design of call-to-action buttons to be standardised so that users can clearly identify areas for interaction. If a majority of its designs feature icons, users would be expecting the other call-to-action buttons to be pictorial and not text based. Denise also reflected that she preferred buttons with only pictorial icons as they were “self-explanatory” and text buttons were “not appealing”. This was an opinion also shared by the other users. When users are able to easily navigate the content and can recognise when action is required within the interaction, they can easily immerse themselves in the learning experience.

4.2.3.4 Feedback During Interaction

When users interact with content but do not see results of their interaction, they are likely to feel irritated and disengage from the experience. This was observed when Jeremy first started on connecting the dots of the puzzle and struggled with connecting blue dots 5 to 11. Because the area of the dots were too small and he was unable to accurately control the mouse, there was no response in the interaction. After several attempts of clicking and dragging the cursor with no response, Jeremy was starting to feel disappointment and frustration. Tom noticed his frustration and reminded him that all he had to do was to click on the dot itself instead of clicking and dragging. When Jeremy tried Tom’s advice and the task responded according to his expectations, he chuckled to himself and continued the task at a faster pace and was observed to be more focused on the task.

When users are part of an interactive experience and are interacting with its content, they expect immediate responses from their interaction. Such responses provide users with feedback where they are able to perceive that there is no dysfunction with the interaction and that they are being rewarded for their efforts. When users feel rewarded, their interaction can be perceived as a pleasurable experience, which encourages them to further invest their time, emotions and effort in engaging with its content and activities. In the design of feedback, interactive media designers should consider the types of feedback that are suitable for the context as well as the various forms of feedback. This ranges from using sound effects to visual effects such as lines being

drawn between dots in the puzzle that are triggered based on the user's interaction. It is however, important to note that the feedback provided should be subtle and not distract the user, causing a shift in their attention. Examples of distracting feedback could be sudden loud jarring sound effects or a sudden flash to a different full sized image on the screen. When users experience a shift in their attention, it causes their engagement with the content and task to be interrupted which defeats the purpose of having feedback to keep users engaged in the task.

4.2.3.5 Transition Between Tasks / Sections

“Perhaps it will make it a [sic] bit much smoother if there are pauses in between” and then “flash something like GAME or CRAFT”. This was a remark by Alice when asked how the website could be better designed. Similar to the inclusion of feedback during interaction, users' experiences can be enhanced when interaction incorporates transitions between tasks or sections of the media content. These transitions will help users to recognise the conclusion of specific activities and motivate progress. This finding was based on the observation of how users responded when they finished viewing the content of each page. There were instances especially in the Flashcard section when users were unsure if they were at the end of the content. As a result, they revisited pages before realising that they could move on. Due to the back and forth checks to determine if they were complete with each section, the flow of their progress was interrupted.

Similar to the inclusion of signposts, the inclusion of transitions in appropriate places within interactive content is important to help users realise their position within their experience. By including transitions in the design of interactive content, designers can stimulate a sense of anticipation and accomplishment for users. These sentiments are then capable of boosting users' attitudes and confidence to encourage them to further explore and engage in the learning experience.

4.2.4 Questions

User engagement is facilitated by the continued attention of users when participating in the interactive tasks. A way in which this can be achieved is to continually address users by asking them questions throughout the task. As suggested by Troseth et al (2006), communication and verbalisation by an individual can increase their potential to engage in the learning experience and acquire knowledge. Therefore, by including questions as

part of the interactive learning experience, users are encouraged to engage and learn. The questions asked can come in various forms, for instance, questions may be asked by characters within the content or can come from collaborators themselves. Here, users will then be able to interact with the task on a deeper level as they are challenged to think of answers to these questions.

4.2.4.1 Increase Engagement By Directly Addressing Users

When users are interacting with media content that addresses them directly, they are more likely to pay attention to what is being communicated. This was observed when Jo-jo addressed users at the end of the interactive video, asking them “Hey kids, would you also like to do the same?”. Jo-jo’s question immediately elicited an answer from Laura who said “Yes” and after a few moments of consideration, she continued that she would be kind to others by sharing her toys. The way Laura responded to Jo-jo mimicked the way she communicated with Judy in real life. From her response, Laura also demonstrated that not only was she engaged in the experience but she had also learnt and transferred knowledge because the example of an act of kindness that she gave was not communicated in the content.

The observation of Laura’s response suggests that when characters or content in an interactive experience directly addresses users, they are encouraged to perceive the interaction as an invitation to engage in dialogue. This invitation induces in users an impulse and eagerness to respond and interact with the content. If Laura’s response and interaction reflected her level of engagement with the learning content even though she was regarded as a passive learner due to Judy having control over the mouse, it can then be suggested that the impact of her engagement and learning could be further enhanced if there were more instances of questions being asked directly or if she had control of her interactive experience. Therefore, the inclusion of questions and content that directly addresses users in the design of interactive content can promote user engagement and enhance the learning experience.

4.2.4.2 Questions Within Collaboration Exercises Imagination

While questions asked by an interactive media character is able to engage and attract attention, interaction with a fellow human collaborator can also act to promote imagination and creativity through dialogue, discussion and the asking of questions.

- During the craft session, Tom would prompt Jeremy with questions while he was developing his craftwork when he seemed unsure of his designs. Because Jeremy wanted to include a playground in his school, he initially designed it according to the school playground from his real life experience. Through the questions Tom asked, Jeremy thought about his varying playground experiences and was encouraged to imagine beyond the playground at his school. This resulted in Jeremy adding features to his school playground design that were imagined and not a part of the playground at his school in real life. For example, he added a canopy over the slide, a bridge structure and a pole where children were able to slide down “like a fireman” (See Figure 37). He also commented that his imagined playground had a monkey bar and a flying fox, but because it was far away from the main playground structure, it was off the piece of paper.

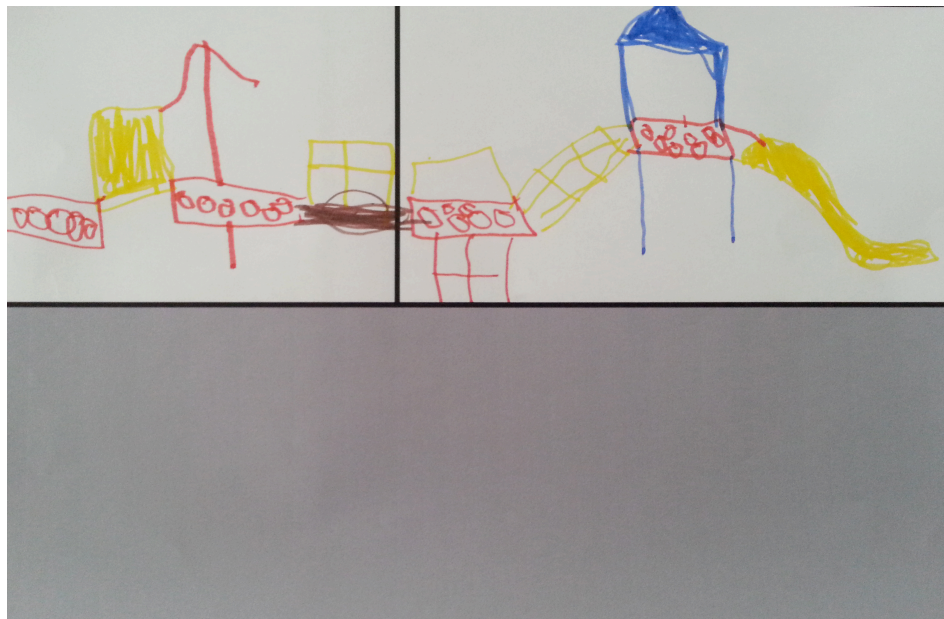


Figure 37. Jeremy's Craftwork.

The illustration of how questions within collaboration can influence imagination is easily demonstrated through Permai's experience, whose experience was a contrast to Jeremy's.

- When Permai started designing her craftwork, Sarah walked away from the table and left her to design the school on her own. Because there was no dialogue and discussion as Sarah was not around to ask her questions to keep her engaged, Permai did not know what she wanted to draw for her craftwork.

The contrast in Permai's and Jeremy's examples illustrate how users can be persuaded to think and engage in imagination when they are asked questions that require them to describe or explain their designs. In scaffolding the experience, parent collaborators can also further engage children by asking them for further clarification on their activities. This then motivates users to think about what they are trying to achieve and how it should be communicated so that there is common understanding. Such collaboration would increase overall engagement in the learning experience and lead to progress of new knowledge.

4.2.5 Timed Challenges

The design of the interactive experience must necessarily consider the aspect of time as already demonstrated in various categories before this. As such, balance has to be struck when deciding on the length of the set tasks. A task that manages to afford this balance is able to promote focus within the participants and aid them in managing their expectations before or during the task.

4.2.5.1 Promotes Focus

The perception of time spent on tasks within a learning experience influences the focus of the learner. When they perceive elapsed time as prolonged, there is potential for users to feel like the task is tedious or boring, thus negatively affecting their engagement. Before the user tests, users were briefed that they would be stopped after every forty-five minutes, regardless of their progress. However, there were no limitations on the length of time they could spend on each task or interaction. During the craft activity, Laura, Permai and Jeremy completed in less than twenty minutes and were mostly attentive to their task. In contrast, Amy, Rayner, Heather and Hillary took approximately twice as long to complete their craft. They only decided on finishing their craftwork when they were reminded of the stipulated forty-five minute session time limit. During their exploratory craft experience, there were moments at the start where they were focused but grew restless as time passed. Examples of these moments were observed when:

- Rayner was especially distracted and spent a portion of his time running around the table or disturbing his siblings who were also participating in some of the activities within the user tests. After twenty-six minutes had elapsed, Denise reminded him that he only had a specific amount of time to complete

his work. This reminder changed his attitude towards the task and he was immediately focused on finishing his work.

- Heather and Hillary spent a total of forty-three minutes on their craft work. Unlike Rayner, they both remained mostly engaged for the majority of the session, only fidgeting minimally. Towards the end as Heather felt a little restless, she remarked that she was tired. Had the craft activity been divided into parts that could be completed in separate sessions that were timed, she could have had a higher level of focus and might not have felt as tired.

When tasks are complex or require substantial effort for completion, users can feel tired or restless which affect their focus and engagement. By separating interactive tasks into smaller activities, users are invited to engage in the activities as they perceive the challenges as feasible. This increases their engagement and balances out the time spent on the different interactive tasks for a more holistic learning experience. Additionally, if the smaller sections are assigned a time limit, users are further encouraged to stay focused as it helps them to feel a sense of urgency and their expectations for the tasks can be managed.

4.2.5.2 Management Of Expectations

The addition of time limits to interactive experiences can encourage users to be focused on the tasks and assist users in managing expectations. The expectations in this context refer to the expectations projected by collaborators and the expectations of the individual user in the learning experience. During Heather and Hillary's user test, it was observed that both users had high expectations of what they wanted to accomplish for the craftwork. This was communicated through their conversations and interactions amongst each other. Because their time was not limited, Hillary had grand plans for her craft that were difficult to execute. Despite having Jack's help, she was unable to complete her craftwork after forty-three minutes. This resulted in her feeling disappointed and she was unable to have her craftwork featured as part of the animation during the user test. Had a time limit been set at the start of their task, Hillary's expectations could have been better managed. This management could be initiated unaided or with Jack or Heather's assistance. By managing her expectations of the craft, her design plans would likely have been achievable within the time limit, thus avoiding incompleteness and a feeling of disappointment.

Time limits can also assist in the management of other collaborators' expectations. For example, in the seven minutes that Permai spent on her craft activity, Sarah repeatedly asked if she was done. She seemed to be rushing Permai to complete the task so that they could progress quickly. This resulted in Permai being unable to add colours to her drawing and limited her chance to draw and think creatively. If Sarah knew that each task had a time limit, she would have let the task run its course and not rush Permai to complete the tasks in the shortest time possible, thus influencing the way they were both engaged in the overall experience.

By adding a time limit to tasks within an interactive experience, the expectations related to the interactive activities could be better managed by those involved in the experience. With the expectations, users can then consider how they will spend their time and skills to achieve the goals set out by tasks. When users are able to achieve and complete their goals, the learning experience becomes pleasurable and personally meaningful, thus increasing their engagement in a holistic learning experience.

4.2.6 Visual Content

When designing interactive media, a user's engagement with the experience might be negatively affected if content designs are chaotic, confusing or not easily understood. It was observed in the following user tests that young users were not as interested in textual content as compared to visual content. This observation was derived from their body language and their willingness to read when information was presented as texts and was particularly evident in Permai's experience. She chose to skip reading a majority of the text despite being capable of reading. This did not only affect how she interacted with the contents, but also affected the potential for acquiring additional knowledge had she read and followed instructions. Her failure to read the text meant that she did not complete the craft activity before watching the interactive video, resulting in a diminished exposure to having a personally meaningful experience.

Similar to Permai, Amy and Rayner had the skills to read on their own but had no desire to read the texts, only doing so on the insistence of their parents. In contrast to their experiences, Laura and Jeremy were younger and were not able to read any of the texts on their own. Therefore, they had to rely on their parents to provide them with information and explanations of the content that were presented as text.

The observations of the different user experiences highlighted the importance of adjusting the ratio of text and visual content according to the capabilities of the target audience. This is in addition to ensuring that visual designs are not cluttered and confusing. In the development of learning experiences for young children, while designs of content should reflect connected themes and elements, there is a need to consider the capabilities of its target users. For example, if users are young and are not able to read, the information should be presented through aural and non-textual visual forms so that they are able to better comprehend and engage in the experience. Besides content being visual, information can also be disseminated through interaction design. In doing so, users will be able to better engage with the information by interpreting and constructing new knowledge. For example, instead of using text or a static image to convey to users that Jo Jo's favourite animal is a tiger, users could discover this information on their own if the static image of the tiger was scrambled as a puzzle that had to be solved.

4.2.6.1 Comprehension And Progress Requires A Match In Expectations

When designing visual content that is meant for user comprehension, visual content needs to match the presuppositions of users so that they are able to progress in their learning experience. This was apparent when the majority of users were unsuccessful in selecting their personalised cursor during the user tests. In the instructions, users were asked to "select a magic wand". However, instead of showing users options of different wands, they were presented with icons represented as images of a Sun and a cloud (See Figure 38). My reflection of the occurrences led to a revelation of the importance of visual design and its influence on user experience. It highlighted the need for caution in designing visual content to ensure that information being presented would match the expectations of users. This seemingly obvious concept was unfortunately overlooked when I was preoccupied with ensuring that the content would be communicated in a fun and creative way to engage users. However, failure to match their expectations rendered it a vain attempt.



Figure 38. Personalised Cursor Selection.

Therefore, when visual designs match a user's preconceived ideas, they are able to recognise and understand the information being conveyed through the imagery. This would then affect how they interact with the overall content that allows them to progress in their learning experience instead of being distracted or feeling a sense of confusion because what they were looking for did not exist within the presented information. For example, if the interactive story calls for users to find and select the chicken on the farm, the visual image provided should match a user's expectations of what a chicken looks like. If a visual image of a duck were used instead, users who were looking out for a chicken would not know that they had to click on the duck. As a result, they would be confused and even feel frustration if the continuation or advancement of the story were dependent on their ability to locate the chicken.

4.2.7 Puzzles

One way of keeping users engaged with interactive media content is to include puzzles as part of their interaction. The excitement of users was palpable when they first saw the connect the dots puzzle on the screen during setup for the user tests. When told that they had to wait before starting as I had a few questions to ask, users audibly expressed their disappointment in not being able to start immediately. The experiences of the following users also suggested that puzzles were even more captivating when it was designed to include an optical illusion.

- Hillary was in the midst of joining the blue dots of the puzzle when Jack commented that he could see a hand in the image. However, all that Hillary and Heather could imagine from the dots presented were leaves and a “tree thingy”. When Heather heard Jack's comments, she took a moment and tried to visualise the hand based on Jack's comments. Scratching her head, she suddenly exclaimed “oh yah!” when she realised that the hand was designed to replace the tree trunk, thus creating an optical illusion.
- In Permai's case, she was not only excited but was engrossed in trying to connect the dots. She concentrated on the task so much that she was unable to respond when Sarah tried talking to her. The only way Sarah was able to get her attention was when she tried to take over control of the mouse. However, this resulted in Permai being upset because she wanted to complete the tasks on her own.

The responses of the users affirms the notion that when interactive media includes puzzles designed with optical illusions in mind, they have an increased potential to not only attract users' attention but are also able to keep them engaged in the experience through surprise and a sense of awe.

4.2.8 Unique Characters

The use of unique characters and their dialogue within media can intrigue and improve users' engagement and focus in the information that is being presented. This can be illustrated in the following example where the purpose of the video is for users to understand, learn and remember the benefits of oral hygiene. Instead of having a flawless looking human character showing users the different steps of brushing and then explaining tooth decay, users are more likely to remember the importance of oral hygiene if the character in the video was a puppet dog or cat that could not eat his favourite food because he was missing some teeth due to decay. The potential for engagement through unique characters could be demonstrated through the experiences of all the users except for Amy as they reacted positively to Jo Jo's character. When he appeared on screens, users either instantly giggled or broke into a smile. Rayner also commented that "it's like the one on tv". While Amy's response was not negative, she seemed indifferent to Jo-jo even though Alice reported in their diary that Amy made several references to Jo-jo and his actions when she had initiated acts of kindness in her daily life.

The responses of users reinforce the importance of character design as part of interactive media. This important component should not be overlooked and has the power to alter the way viewers engage with the content. More than just engagement, by designing characters that appeal to its target audience, they can be encouraged to feel a sense of affinity. This sense of affinity can then aid their perceptions and influence them to embrace the character as a friend or a playmate, thus increasing the opportunity for characters to facilitate their learning.

4.2.9 Music

Music is an important element within media design as its power can be harnessed to determine the experiences of its listeners. At the end of Jessie's singing, Jeremy commented that it "nearly feels like *twinkle twinkle*". His comment reflected that he accurately recognised the tune sung by Jessie. The other users were also observed to

exhibit a change in body language when the music started even though they did not explicitly state that the name of the tune. For example, Laura sat up in her chair when the music came on and bopped her head to its rhythm. Before the music played, Laura was resting her head on her hands in a slouching position. Besides recognising the tune of the music when it happened, some users also remembered the song after the user tests were concluded. These recollections were noted in the diaries written by the parents of Amy, Laura, Jeremy and Heather over different days. If they were able to remember days after the user test that there was a song to the tune of *Twinkle Twinkle* in the video that taught them how to be kind after only one exposure, this observation indicates that the potential for users to remember the lyrics or its message can be improved if they had repeated exposure to the song.

In addition to being memorable, research has shown that when a person listens to music, their left-brain hemisphere processes lyrics while the right brain deals with the tunes of the song (Williams, 1986; Yoon, 2000). In stimulating both sides of the brain hemispheres, a listener's learning facilities are improved. Furthermore, if the tune of the music is already familiar to its listeners, they tend to pay better attention to the lyrics of the song. This means that when music forms part of media content, it can be used to communicate important information, especially if the information is meant to be retained by the listener. This is achievable because music is capable of boosting memory (Klinger, Campbell & Goolsby, 1998; Calvert & Tart, 1993). Recognising this potential, music is often used in the promotion of products through jingles. Its outcome is also observable in children's capacity to remember and learn through repeated exposure to educational songs such as *The Phonics* song or *The Alphabet* song. Therefore, if music has the ability to communicate and boost memory, it increases the potential of a user's ability to remember and transfer knowledge. This transference is an important trait of holistic learning and when interaction media designers are able to understand and harness its different functions and potential, they are able to use music to their advantage. By including music that is also able to evoke moods supported by other elements such as visuals or interaction design, users can be encouraged to make an emotional investment in the learning experience that allows it to become personally meaningful. This experience then improves their engagement and enhances their learning.

4.2.10 Summary

A learner's potential to acquire new knowledge is dependent on their level of engagement with their learning experience and its contents. This engagement was recognised in the early design of the initial holistic interactive framework and evident through the following elements:

- Balance - Website design of site navigation should have a balanced ratio of text to images.
- Inclusion - Include opportunities for users to learn through a Transactional orientation and engage them through problem solving (Miller, 1996).
- Inclusion - Provide users with opportunities to explore their complex yet connected skills.
- Inclusion - Include obvious call-to-action elements that will help users in their problem solving.
- Inclusion - Include sound effects that are triggered according to user interaction so that users are provided with feedback.
- Connection - Designs should reflect themes and elements that are connected throughout the entire website.

Although the elements identified in the initial holistic interactive framework contributed to capturing the attention of users, observations from my research suggested that the elements could be better defined so that future interactive media and learning experiences can be designed to capture and maintain user engagement. When the age groups of target users are young children, one of the ways that affects the level of user engagement is through the stimulation of a child's imagination. If imaginary play were included in content and interaction designs, it is likely to increase user engagement as it encourages imagination and creativity while aiding the child's comprehension of concepts that may be foreign to them. The inclusion of imaginary play would also promote the practice of collaboration between children and their parents. Effective user engagement can also be achieved by increasing active learning through a hands-on

approach in the interactive tasks. Active learning, by extension allows users to familiarise themselves with online media and be responsible for their own learning experience. Additionally, the interactive tasks should be user friendly in terms of not being overly complex which runs the risk of confusing and frustrating participants. To further aid users' comprehension and increase levels of engagement, the interactive tasks could be divided into parts and separated with questions to keep users reminded and interested in the task at hand. Good time management will also allow users to remain focused on tasks. Importantly, the design content of the entire interactive experience must strike a balance between key elements of visual, auditory and kinetic stimulation. This can be done by implementing design in areas of visual content; music; puzzles and characters within the task.

4.3 Balance

When designing interactive media that engages users, it is also important to balance its designs so that it does not cause users to be distracted from the holistic learning experience. From the observations of the user tests, it was evident that there were three main areas in designs that required special attention: concept design; interactive task design and media element design.

4.3.1 Concepts

While it is not uncommon to find media that contains purely entertaining or educational content, interactive media that are aimed at encouraging holistic learning should include both types of content. Within the presented content, there needs to be a balance where simple and difficult topics such as friendship, bullying, sharing and emotional intelligence are addressed. It was observed that some concepts were too difficult for young users to understand on their own. However, as the intention was to include difficult concepts to encourage collaborative learning, it was assumed that in addition to the explanations within the media content, parents would take the initiative to assist their children in their understanding when presented with concepts that were new or complicated. This collaborative learning experience was evidenced in five out of the six user tests.

- The parents of Laura, Jeremy and Permai played a major role in helping them comprehend information and progress in their learning experience. This was

because Laura and Jeremy were not able to read texts on their own while Permai did not want to read and relied on verbal instructions from her mother.

- In contrast, Amy and Rayner read the texts out loud on their own and Alice and Denise were able to assess their abilities in pronouncing or understanding content provided respectively. This gave them the opportunity to translate and scaffold their learning through explanations and discussions. After reading the information on the craft page, users were asked to implement the information through tasks that required them to create their craft designs, take a photo of their craft and upload its image. While Amy and Alice were successful in their execution of tasks, Rayner and Denise were unsuccessful in uploading their image despite understanding the content provided as they were unable to remember the different steps of the instructions.

From the observations, the cruciality of information communication and the variety of components to achieving balance was highlighted as it significantly affected user experiences. When presenting media for a holistic learning experience, it is necessary to include a balance of simple and difficult concepts so that users are exposed to opportunities for progress in their knowledge. More than just ensuring a balance in the level of difficulty in concepts, a balance also needs to be achieved in the number of concepts that are presented at a time. The balance in how concepts are presented can assist in user understanding and engagement in the learning process so that they are able to develop new knowledge.

4.3.2 Interactive Tasks

The value of interactive media is that it encourages users to actively discover information and interpret it for their own understanding. In designing for interaction, care has to be taken to ensure that it does not distract from the communication of information. This is especially important when the purpose of the interactive media experience is to engage users to promote holistic learning.

4.3.2.1 Delivering Information Through Interactivity

When users are engaged in nonlinear exploration, there is an increased potential for them to overlook information that is crucial to their learning experience. During the user test, some of the users missed out on getting to know the characters because they had

skipped the pages where the characters were introduced. If getting to know the characters was crucial to their overall learning experience, users who missed this information would have been disadvantaged. In this instance, the video's interaction design could have included interactive activities at the start of the video that allowed users to find out about Jessie and Jo-jo. For example, instead of telling users through text that Jo-jo's favourite animal was a tiger, the information could be written as part of the interactive video's script to allow users to explore this information through a sliding tile puzzle. By including interactivity in the dissemination of information, users can be encouraged to actively engage with the presented information. It was observed that when users started the interactive video experience, all the children were easily distracted as they were only passively engaged. This was because the video did not include any interactive components at its start. Had the video started with an interactive activity instead of making users passively watch a short video clip as part of the interactive video's introduction, their interest and focus could have been better stimulated.

Therefore, in designing media for a holistic learning experience, interaction designers should consider ways of ensuring that crucial information reaches its intended audience. One way of doing this is to present important information through short interactive tasks where users are able to actively engage with content and personally discover information for their own understanding. However, in planning for interaction, a balance in the frequency of interactive activities within the entire interactive video is also imperative so that the flow of information is not constantly interrupted, causing users to feel disconnected from the experience.

4.3.2.2 Difficulty Level Of Tasks

Besides balancing the frequency of interactivity, the difficulty level of interactive tasks should also be carefully considered. During the user tests, Amy and Permai both viewed the connect the dots puzzle as too simple but had opposing reactions.

- Amy wanted to skip the activity but on the insistence of Alice, reluctantly completed the task.

- Permai on the other hand was excited to start and wanted to complete the puzzle independently without help, ignoring Sarah when she tried to be involved in the learning process.

While it is good for users to develop knowledge independently, collaboration plays a big role in holistic learning and should therefore be encouraged. In the designs of interactive tasks to encourage collaborative learning, a measure of difficulty should be included so that users feel challenged but can be empowered through the collaboration. If users deem the tasks as too simple, they might find the experience boring and skip the tasks. The omission from the experience may also be true for users who find that the tasks are too difficult, thus affecting their confidence and causing them to avoid the task. When users skip interactive tasks for their various reasons, they might miss out on the opportunity for their learning to be enhanced. Additionally, if the difficulty levels of the interactive tasks are too simple, besides its influence on user's engagement, the opportunities for collaborative learning is also diminished. When interactivity is designed to promote engagement and collaboration, the inclusion of difficult and simple tasks ensures balance within the process. However, this measure of difficulty should not be unmanageable such that it causes users to feel despair. By providing users with tasks that are challenging, they can be coaxed to explore their complex yet connected skills. For example, the electronic craft activity in the user test was supposed to help users explore their ability to imagine, draw and control a computer mouse or track pad. During the interaction, all the users including the parents felt that the electronic craft activity was too difficult. As a result, three children did not personally attempt the activity or gave up not long after trying and the task had to be completed by the parents. Only Jeremy, Permai, Heather and Hillary completed the task with minimal or no assistance from their parents despite also sharing the sentiments that the task were too difficult. The reason users felt that the task was too difficult was because of the limited tools provided which affected their ability to explore their complex yet connected skills. This demonstrates that when designing interactive tasks, while balancing the number of simple and difficult interactive tasks, it is important to ensure that the task and the discovery of complex yet connected skills can be achieved with collaboration by providing the necessary support. These supports can come in various forms such as the inclusion of extra informative tips; tutorials; usability of tools; giving users the opportunity to explore tools before the task and even through the inclusion of activities that users are already familiar with.

4.3.2.3 Familiarity + Novelty

One way to engage users is to boost their confidence through the design of tasks that they are familiar with. Before the user test started, the children were shown a printout of a puzzle. When asked what it was, they all recognised the activity and said that they had completed similar connect the dot puzzles before. They were also shown a screenshot of the prototype's connect the dot puzzle and some users commented that they only saw a tree. During the user test, as they joined the dots and the outline of the image formed, some were surprised by the image of a hand representing the tree trunk. While they were familiar with the type of puzzle, they were observed to be better engaged in the experience when they saw the optical illusion. This enhanced engagement was evidenced by their exclamations of surprise and how the illusion became a talking point amongst the users.

The second example of how users' engagement and collaborative learning experience was influenced through balancing elements of familiarity and novelty was observed in the way users responded to the memory game activity. When they realised that the memory game was a familiar activity, a majority were eager to start and had assumed that it followed conventions based on their previous experience. Because of their assumptions, some were confident and did not pay attention to Jessie's instructions. During their interaction, they were intrigued after their first few reveals indicated that they had the wrong answer even when they found a matching pair. The surprise element in the familiar memory game was the added task of finding the matched pair specified by individual characters (See figure 39). By including this element of novelty into the familiar memory game activity, users were encouraged to collaboratively explore information and engage in analytical thinking to problem solve so that they could progress. When they finally found the solution and progressed, not only did they feel a sense of achievement but their confidence was also influenced.

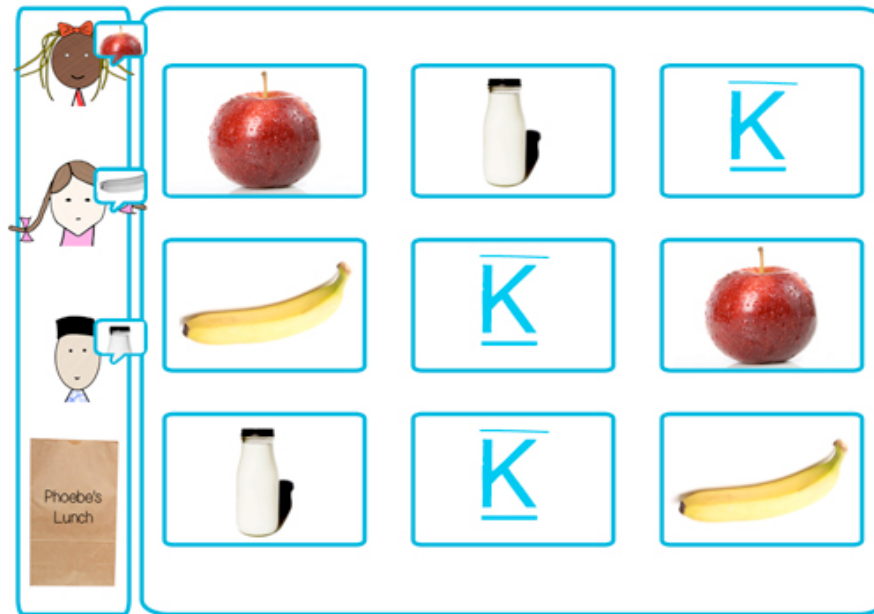


Figure 39. Memory Game.

- This confidence was particularly apparent in Heather and Hillary’s responses as they each suggested and tried solutions to the perplexing activity. As they finally found the first correct matched pairs and progressed to the second character, both girls pumped their fists in the air while exclaiming “Yes!”. With their confidence boosted, the remaining two tasks seemed simple and were completed at a faster pace.
- It was also observed during the user test that although Jeremy was familiar with the connect the dots puzzle, he hesitated to start interaction on his own. Instead, he turned to Tom and asked how they should continue. It was only after Tom’s explanation of the rules based on the instructions that Jeremy started interacting with the puzzle. His behaviour demonstrated that while users might feel a sense of familiarity, they may not necessarily initiate interaction.

The experiences observed illustrate that when engaging young users in an interactive holistic learning experience, the inclusion of interactivity that is balanced can enhance their interactions. In balancing interactivity, designs should feature familiar interactions, but include surprise elements. If the interactive designs emulate activities that they are already familiar with, users can feel empowered and are likely to interact with the content. However, too much familiarity can also render their experience as unexciting. Therefore, the inclusion of elements of novelty can surprise users and sustain their

attention, as they will not be accustomed to interaction conventions that can be expected or memorised. This will provide them with opportunities to exercise their imagination and problem solving skills by interpreting and constructing meaning through different approaches, while encouraging engagement, exploration and collaboration. The observations also suggest that while familiarity is able to boost users' confidence so that they are willing to engage, designs should also incorporate ways of inviting and enticing users. For example, this could be achieved by including a glow or a flicker to the first dot that users are supposed to start the puzzle from. When the designs of media elements entice users to respond, there is a higher potential for users to commit to the interaction and learning experience.

4.3.3 Media Elements

When encouraging users to explore interactive media so that their learning experience can be personally meaningful, media elements need to be balanced. Through its presentation and design, users can be emotionally stimulated so that they are encouraged to imaginatively think and explore content. By exploring, they are then able to interpret the information for their own understanding and learn from it.

4.3.3.1 Evoking Emotions And Creating Impressions Through Presentation

To ensure that there is a balance in the design and presentation of media, there should be a mix of simple and complex designs so that users can be engaged in a positive learning experience that is enjoyable. Although a majority of the prototype's design was simple, some of its elements were perceived by users as cluttered. Rayner, Heather and Jeremy in particular, found it difficult to find certain dots and numbers as they were placed too close to others when they were interacting with the connect the dot puzzle. When Jeremy connected the lines from the third to the fourth blue dots, he experienced a brief moment of hesitation (See circled area in Figure 40). However, when the lines finally joined, he turned to Tom and with a concerned tone commented that he had passed a red dot. Jeremy's hesitation was attributed to his impression that because the blue dots were divided by a red dot, he might have to link the lines to the red dot instead. By having the different coloured dots in such proximity, users were confused, which then developed into frustration for some, as they did not receive any feedback or response from their interaction when they clicked on the wrong dots.

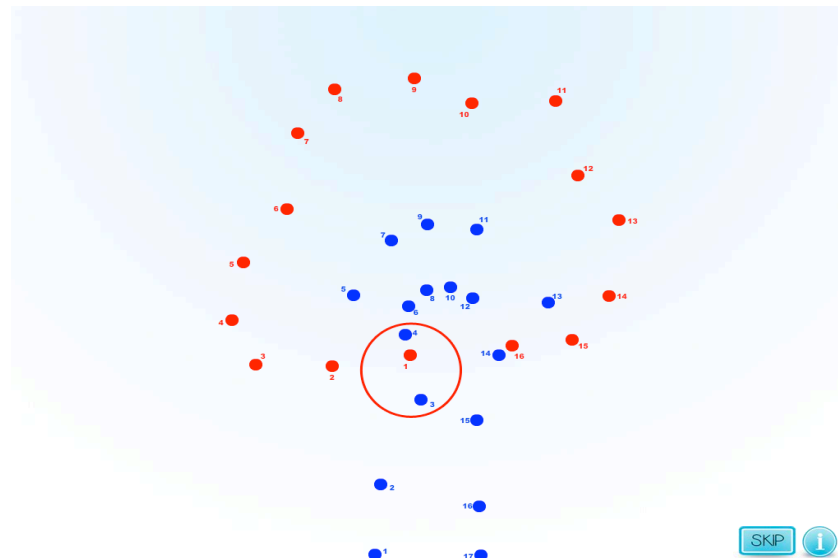


Figure 40. Connect The Dots Puzzle Design.

Their experiences show that even within simple designs, sufficient white space between elements is necessary so that designs will not look cluttered. This is especially important when developing more complex designs so that users are afforded the space to imagine, think creatively and explore designs. In addition, conventional usability should be considered so that interaction becomes a more positive experience for users. For example, besides increasing the space between individual dots and ensuring there are no overlapping or adjacent dots, the size of each dot and accompanying numbers could be increased so that users can clearly understand and make decisions on how they will interact. In doing so, the presentation of design elements within interactive content can evoke positive emotions in users such that they perceive the experience as constructive and worthwhile. Such emotions and perception then affects how they engage and learn through the interactive content.

4.3.3.2 Power And Importance Of Sound Design

Similar to other forms of video content, interactive media is an amalgamation of various components that are synthesised to tell stories. While its distinction is in its added dimension of interactivity, visual and aural components also play a part in communicating to and engaging target users. As visual components are usually the initial attributes first noticed, a higher emphasis can sometimes be erroneously placed on it, with less time and budget spent on the creation and design of aural components. However, the designs of aural components are just as important and can positively or negatively influence how users engage with the media.

The influence and importance of balanced sound design was particularly apparent when users played the memory game in the user tests. Of the six user tests conducted, Amy, Heather, Jeremy and Laura were negatively affected by the sound effect used when they found the wrong pair. This was because the sound effect that was meant to sound like an adorable blend of young children saying “uh-oh” sounded scary to them. When the sound effect was first played, all four were startled and were observed to physically flinch. While Amy, Heather and Jeremy continued with the game after their initial shock, Laura’s reaction was consequential. After listening to the sound effects play a few times as she and Judy got the answers wrong, Laura lost interest in the activity and said that she did not want to continue. Judy immediately told her that she would complete the task on Laura’s behalf so that they could move on. Her response showed that she recognised Laura’s fear and dislike of the sound and to be protective, Judy completed the task because they were unable to skip it. As this happened, Laura was observed to be disengaged as she stared blankly at the screen. She was also unresponsive when Judy tried to engage her and continued to display the same behaviour until the task was complete.

The observations show that sound design can influence users’ experience and determine the way they engage with media content. When designing aural components for media, there are many technical factors that should be balanced, for example, audio levels and equalisation for audibility. However, interaction media designers should also consider the appropriateness of each aural component. Similar to ensuring that lyrics of songs are suitable for the target users, the type of sound effects used should also be reviewed. For example, if the target users are young children, the design of aural components used in media content that is attempting to convey kindness should not be scary like the sound of witches cackling. The sound of witches cackling however, is more suitable for a Halloween interactive video aimed at older users. The importance of reviewing suitability of sound design is because audio can evoke and stimulate emotions, thus affecting the user’s experience. When they encounter positive experiences supported by balanced aural and visual media elements, users are more likely to engage and explore the content so that their learning can be personally meaningful.

4.3.4 Summary

The initial holistic interactive framework suggested that users should be encouraged to combine knowledge and imagination through the following elements so that they can be engaged in a holistic learning experience:

- Balance - Balance between entertaining and educational materials.
- Balance - Balance between simple and complex subject matter for target audience.
- Balance - Balance between simple and complex interactions and navigation where appropriate.
- Balance - Interaction should include some elements of surprise so that users will not be accustomed to interaction conventions that can be expected or memorised. This will provide them with opportunities to exercise their imagination and problem solving skills by interpreting and constructing meaning through different approaches (Rational and Intuitive).
- Balance - Website design should not be cluttered and filled with too many colours. There needs to be a balance between conventional usability designs and stimulating designs for young children.
- Balance - Design should also bring balance by including white spaces to encourage and give space for users to engage in imaginative thinking.
- Balance - Where appropriate, include larger design elements to attract attention, but keep a balance with white space and other elements
- Balance - Balance between simple and complex designs
- Inclusion - Include opportunities for users to learn through a Transmission orientation and engage them through texts that can be read or listened to (Miller, 1996).

- Inclusion - Interaction can include some repetition, but it has to be balanced with elements of surprises.

While these elements promote balance within a holistic learning experience, this study identified that there are three main areas that can be refined for further application so that future interactive media designs can be balanced to support a holistic interactive learning experience. The first main area is in the design of concepts where there needs to be a balance between educational and entertaining material; the application of simple and complex topics as well as the way concepts are presented. The second area is in the design of interactive tasks where consideration is required to ensure that the necessary information reaches its target audience without being lost in the busyness of the interactive experience. Additionally, attention also has to be paid to the difficulty of the interaction and its conventionality so that users will remain attracted to the experience. The final component of interactive media that requires balancing is in the design of media elements. When the presentation of media elements can successfully provide users with a positive and pleasurable experience, the engagement levels of users can also be sustained.

4.4 Collaboration

Besides being a personally meaningful experience, to further aid holistic learning, interactive media should also provide opportunities where there is collaboration between direct and indirect participants so that users are able to have a socially meaningful experience.

4.4.1 Personally And Socially Meaningful Experience

My research suggests that interactive media aimed at promoting holistic learning should be designed to include collaboration so that users' learning experiences can be enhanced. Besides giving users the opportunity to be supported as they complete tasks, the collaborative interactive experience also aspires to expose users to a significant, memorable and enjoyable encounter. When users explored the interactive content in partnership with their parents, they were observed to be able to achieve complex tasks with greater confidence due to the support afforded through the collaboration. This was observed when Amy; Heather and Hillary; Jeremy and Laura were able to successfully upload their craftwork and explore the interactive content with their personalised background. Through their joint efforts with their parents, users were exposed to

socially meaningful encounters that were significant to their individual learning experience. Judy verified this significance when she reported in the written diary that Laura had remembered the experience one week after the user test. She was playing with her iPad when she asked if she could play on her father's laptop with him so that like Judy, he could help her draw something for the girl in the video to make her happy. She also added that she wanted her father to see the funny cookies video which indicated that Laura remembered and enjoyed the experience with Judy and desired to share the same experience with her father. It also showed evidence that she retained information from the interactive content.

By designing interaction that advocates users to accomplish tasks and acquire knowledge with the help of a collaborator, the learning experiences of users become socially meaningful. The individual users can further translate such social experiences so that it also becomes personally meaningful to them. When the experience is both socially and personally meaningful, their learning is enhanced and the experience becomes more memorable. The process of translation can be initiated internally by the individuals themselves or triggered within the collaboration of users. When individuals relate new information developed through the collaborative effort to prior knowledge, they are translating their new knowledge so that it is personally meaningful to them. This process of translation as a result of collaboration usually occurs when users discuss content, reflect on their past experiences and scaffold information for comprehension. Their shared experiences and knowledge can result in an added measure of significance to their personal learning. When this significance enhances the overall learning experiences of individuals, they are more likely to remember the collaborative experience as well as the new knowledge.

4.4.1.1 Empowering Through Exemplification

One of the means through which collaborative learning can assist users in translating presented content into personal knowledge is through the process of scaffolding. While there are different approaches to scaffolding information such as reviewing; questioning and explaining, knowledge can also be constructed through exemplification. During the craft activity, Laura had ideas that she wanted to implement in her design. However, she did not have the confidence to execute these ideas on her own. As part of the collaboration, Judy scaffolded Laura's learning by explaining and demonstrating the use of some of the art materials provided. For example, after Judy demonstrated how to

secure a three-dimensional button to the paper template, Laura attempted the task on her own as she tried to complete her craft design.

By demonstrating and providing examples, Judy facilitated Laura's development of self-efficacy through a vicarious learning information source by modeling that the task can be successfully executed (Schunk, 2004). As a result, Laura's observation of its positive outcomes boosted her confidence and belief that she too could achieve similar results. When Laura carried out the task on her own and managed to succeed, her sense of efficacy was further developed. Therefore, through Judy's exemplification, Laura was empowered to achieve her desired craft result. Their experiences indicate the significance of including collaborative tasks in interactive experiences so that users can be provided with the opportunity for their learning to be scaffolded through exemplification, thus giving them a socially and personally meaningful experience.

4.4.1.2 Identification And Validation Of Experiences And Emotions

Collaboration is an important feature of a holistic learning experience where development of a person's whole being is encouraged. It is especially important when the targeted learners are young children who might require assistance to help them understand complex subject matters. When users were asked to decide on the actions of Chris and Phoebe while Janice was crying, Amy and Jeremy decided that they wanted the characters to walk away and ignore her. Because the user test was a collaborative experience, their parents were able to immediately ask them to explain their decisions. Although the content included advice on how ignoring Janice was an incorrect choice, the parents had an opportunity to further explain and nurture their learning.

- Upon hearing Jeremy's choice, Tom took advantage of the moment and explained to him that when someone was upset, it was honourable to show concern, even if the person was not their friend. It was later revealed during the interview that there was a time when Jeremy cried in school and others had ignored him except for one girl.
- Like Jeremy, Amy initially indicated that the characters should ignore Janice and was observed to display negative emotions. Within a period of thirty-five seconds, she had asked Alice six times if she should do the correct thing and select the choice where the characters checked on Janice. Instead of telling

Amy to select the correct answer, Alice recognised that her questioning was a reaction to a real life situation which was later revealed in the interview. Alice shared that not long before the user test, Amy's female best friend from school had a misunderstanding with her male best friend. Because she wanted them to be able to play together, Amy decided to find solutions to get her two best friends on talking terms again. However, when she succeeded in doing so, she was ostracised from their playtime and conversations. This caused Amy to feel hurt and as a result, when asked if the characters should see if Janice was okay, Amy wanted them to ignore Janice based on her personal experience. Because Alice had recognised that Amy was despondent, she was able to persuade Amy and proceeded to ask her how she would have felt if she were in Janice's position. Through their communication and collaboration, Alice validated Amy's experience by not dismissing her emotions and its influence on her present behaviour. Instead, she helped Amy to mature in her thinking and behaviour by encouraging her to place herself in the position of others.

Amy and Jeremy's learning experience and their subsequent development was able to transpire because of their collaborative experience. Within the collaboration, their parents could immediately help them to identify and validate their experiences and emotions when opportunities presented themselves. Had the children been on their own, there would have been potential for them to engage with the content in less meaningful ways. This is because the presentation of complex learning content aimed at children's social and emotional development requires individuals to reflect on their experiences so that there can be growth. Their progression is dependent on the children being able to first identify and reflect on their experiences and its ensuing emotional responses. This identification and reflection can be facilitated through their interactive engagement with content. However, if they are unable to articulate or explain their emotions or experiences, their development may be negatively affected as they find their own ways of understanding or making sense of their experiences. Therefore, it is necessary for interactive media that promotes holistic learning to include collaboration as part of the experience design. Through the collaboration with a parent or more competent individual, they are able to help the child identify and validate their experiences and emotions. In doing so, their learning experience becomes personally meaningful which aides in their development of social and emotional intelligence (Petrides & Furnham, 2000; Ashkanasy & Daus, 2005).

4.4.2 Consider Multiple User Options

In the design of interactive content, opportunities for collaboration should include multiple user options as part of the user's exploration. If the content and interaction design of the prototype had considered and catered for multiple users, Rayner and Heather's experience would have been enhanced.

- The design of the prototype assumed that when users were working together, they would make joint decisions for progress. However, it was observed that when Rayner and his siblings were collaborating with Denise's help, that assumption was incorrect. The siblings found it difficult to communicate and come to a consensus when making decisions in response to the interaction. As a result, they had frequent arguments amongst themselves, which distracted them from the task.
- In Heather's instance, Jack had an understanding of how the sibling's personalities and communication methods could affect their overall experience within the collaboration. As a preventive measure, he suggested at the start of the user test that they should take turns to have control of the mouse and the girls negotiated on who attempted tasks first.

In the review of Heather and Hillary's experience, I realised that the prototype and its interaction design could be improved by including multiple user options in its endeavour to promote collaboration. Users could be given a choice at the start of the user test to indicate how many users will be participating in the interactive experience. The number of users selected would determine the types and designs of tasks and difficulty levels that would have to be completed. Some of the tasks could be designed to be attempted together while others could be attempted individually within the group which would contribute to the overall result and experience. Using the electronic craftwork as an example, there are various approaches so that tasks could be designed to be inclusive for multiple users. One of the ways is to replicate Heather's experience where she illustrated a majority of the drawing with Jack's assistance, but left the finishing touches to be completed by Hillary. As Heather was the older of the girls, she seemed to be more assertive and made the decisions for the entire design, only delegating a small portion of the task to Hillary. If this approach is adopted in the interaction design, the multiple users will work together on an individual task where

they allocate responsibilities. Another approach is for the interaction design to split the task into portions depending on the number of users selected at the start of the experience. If they had selected three users, the task would be designed so that it could be split into three equal portions. In this scenario, instead of showing a single image to represent the electronic card, users could be informed that there are three sides to the card that has to be filled and each user is responsible for one side. Alternatively, the difficulty of the task could be altered so that the single image could be split into three sections that feature a common connecting element. In this instance, multiple users are each responsible for their individual task and are encouraged to communicate so that their designs can be subsequently combined to form a single image, yet allowing their imagination and creativity to be exercised.

The significance of collaboration on holistic learning necessitates its inclusion in interactive media. With its inclusion, the development of interaction and content for educational interactive media should consider the environment where the interactive experience will be implemented; its potential of having additional participants beyond targeted users and its influence on their overall experience. For example, if the media is to be used in a school environment where students are expected to work in pairs, there is a possibility that there are some groups where there might be three users. If the interactive content and its tasks are only designed for a two-user team, the additional member of the team might not be engaged in the full experience. Similarly, if the interactive experience is conducted in a home environment that has three children in a similar age group but the interaction design is only developed for a single parent and child collaboration, the other two users might feel left out or might not benefit as much from the experience. To prevent such occurrences, the designs of content and interaction within collaborative interactive experiences should allow users to indicate the number of collaborators at the start. The design of the experience can then be manipulated to accommodate the number of users. Approaches to achieving this accommodation could include the division of interactive tasks into separate yet complimentary portions or asking users to join efforts on a single task. However, should the objective of the interaction be designed so that users work together for a specific single task, the content design needs to prompt and remind users to share the responsibility in the interactive process. To achieve this, users should be made aware of their roles within the collaboration and encouraged to communicate amongst stakeholders in the experience.

4.4.3 Importance Of Communication And Awareness Of Roles For Positive Development

When interactive content is designed to assist users in understanding their role within the interaction as well as encourage conversation between collaborators, the potential for a user to learn can be improved. Although the design of the prototype used in the user test was not developed to give users specific instructions on how to communicate within the collaboration or indicate specific roles for users, some parent users seemed to be aware of its influence on their child's development. Parents like Alice, Judy, Jack and Tom were observed to initiate ways of helping their child determine responsibilities through role-play and discussion.

- In their discussion during the craft activity, Alice helped Amy to understand her role when she had to design the school by suggesting that she was an architect leading a team of builders. Through their discussions, Amy learnt that the completed craft depicting her school could be perceived as a blueprint so that other members of her team could build the school according to her design. When she understood her role as an architect and the concept of the blueprint, Amy approached the craft activity with confidence, which shaped and guided her design decisions.

Like Amy, Laura and Jeremy benefited from the collaborative experience afforded through the user test as they were unable to read text content on their own. Had they explored the prototype on their own, it would have increased the chance that they might not have attempted the tasks and it would have been a missed opportunity for their learning experience.

- In Laura's case, Judy's guidance and the evolution of their conversation helped Laura to understand the requirements and responsibilities within the interaction. As a result, Laura was able to confidently make suggestions for her school design and they were able to successfully progress to the next section of the interactive task.
- This progression was also observed when Jeremy and Tom executed their tasks aided by their dialogue. For example, when it was time to take a photo of the craftwork, Tom and Jeremy discussed and decided that Tom would control the

camera functions on the computer while Jeremy held up his craftwork. As Tom was about to select the capture button, Jeremy provided him with a verbal countdown that gave Tom an indication of when the capture button should be clicked so that they were able to successfully capture the image.

- Similar to Jeremy's experience with the image capture, Heather and Hillary required a higher level of support from Jack in the process, as they could not understand why their image and movements were reversed on screen. Through their communication, Jack explained how to position the craft so that they could successfully capture the image. Besides the process of capturing their craft image, Jack, Heather and Hillary assisted each other in different capacities to collaboratively complete their experience. When Hillary was unable to complete the connect the dot puzzle on her own because she was unable to find certain dots, Jack and Heather called out the numbers of the following dots that had to be joined. This boosted Hillary's confidence and she was able to complete the puzzle. During the craft activity, Heather and Hillary worked individually on two pieces of craftwork instead of combining their efforts. When Hillary thought that she needed assistance, she would get Jack's attention and discuss her requests or ideas. She had imagined a three-dimensional design and wanted to create them using foam popsicle sticks (See Figure 41). However, it was difficult to affix them to the paper provided and she needed Jack's help. When Jack helped her, Hillary's creativity was encouraged and she tried to find alternate ways to create her craftwork when their initial plans and solutions were unsuccessful. Her determination and confidence was not affected even when Heather and her mother, Jane discouraged her because she knew that she had Jack's support. Because of the collaboration, Hillary had the confidence to think outside of the box and managed to find a solution on how to join the pieces of foam to form a slide structure. To ensure Jack knew how to help her, Hillary demonstrated using the foam so that Jack could help her realise her designs. While Jack collaborated with Hillary on her craftwork, Heather worked independently. However, she still benefited from being a part of the collaborative experience when she witnessed that Hillary had succeeded in creating a three-dimensional craft. Hillary's success then inspired her to also include a three-dimensional, pop up butterfly in her school garden (See Figure 42).



Figure 41. Hillary's Craftwork.



Figure 42. Heather's Craftwork.

The collaborative experiences encountered by Amy, Laura, Jeremy, Heather and Hillary was a contrast to the experiences of Rayner and Permai.

- When interacting with the connect the dots puzzle, Rayner was excited when the designs of the puzzle were revealed as a result of his interaction. In his excitement, he tried to engage in conversation with Denise but she did not reciprocate. Instead, she told him to hurry up in completing the task. Rayner

was then observed to be less enthusiastic and focussed when completing the puzzle. His eagerness and focus remained low at the start of the craft activity but started to improve towards the end of the craft session when Denise started to communicate and help him with this craftwork, while reminding him of his goals.

- In Permai's case, Sarah initiated collaboration at the start of the interactive experience. However, Permai was not interested and wanted to work independently. As they continued with their interaction, Sarah gradually stopped in trying to collaborate with Permai. Instead, she made fun of Permai's choices and decisions, thus diminishing the potential for Permai's learning experience to be enhanced. Due to various factors, Permai did not attempt the craft activity until the end of the user test. At this point, Sarah had walked away and left Permai on her own. With the cessation of the collaborative experience, Permai no longer had anyone to encourage or inspire her to imagine and develop her ideas.

The experiences of the users illustrate the need for communication and collaboration so that there can be positive outcomes especially when tasks or content feature challenges that attempt to engage users. To provide them with an effective holistic learning experience through interactive media, users need to recognise their roles and the importance of communication within collaboration. This recognition can be aided with the inclusion of collaborative tasks where users are able to explore their roles and responsibilities through content and interaction design. At the same time, collaborative tasks can also stimulate conversation amongst users in the interaction process. However, it takes commitment from users involved so that communication can occur. The analysis of the user tests suggests that when users communicate and understand roles within the collaboration, they might feel a greater sense of confidence, ownership and purpose. This affects their attitude and engagement in the participation of the interactive learning experience. Through their participation, the interaction then becomes an enriched experience that is personally and socially meaningful. As a result users can be further encouraged to engage in creative thinking and imagination which could lead to positive outcomes in their knowledge development.

4.4.4 Summary

Collaboration was identified as an important feature of holistic learning and included in the early design of the initial holistic interactive framework through the following elements:

- Inclusion - Include opportunities for users to learn through a Transformational orientation and engage them through collaborative experiences where creative thinking is encouraged (Miller, 1996).
- Inclusion - Include Interaction that provides opportunities for users to collaborate with a peer / parent or teacher so that learning can be socially meaningful.
- Connection - Create opportunities for users to explore and understand integrated topics.
- Connection - Create content and interaction that encourages users to consider cultural and social cues
- Connection - Create content that exemplify interpersonal and social skills.
- Connection - Create opportunities where interpersonal and social skills can be developed

In addition to the above elements, the study also demonstrated that within a collaborative experience, older or competent collaborators can empower users in their development through exemplification and assist them in making sense of their experiences. This is supported by theories of cognitive psychology and suggested by Piaget that an individual constructs knowledge as they explore their environment and the relationship within that environment (De Corte and Weinert, 1996). This belief was also held by Vygotsky who advocated that learning was influenced by an individual's social and cultural environment (Vygotsky, 1978, p.86 as cited in Schunk, 2008, p.245). Therefore, in designing for holistic learning, interactive media designs should include collaboration, but also consider how users will encounter the interaction so that it can be

an inclusive experience for all participants where roles and responsibilities are clearly defined.

4.5 Imagination And Creativity

The human mind is made up of a complex system and the ability for an individual to learn and remember is dependent on the process of how presented information is absorbed, restructured and interpreted (Egan, 2013). This process, advocated by Bruner (1986) as constructing or composing, is assisted through imagination and creativity where connections between pieces of information can be discovered and explored first hand so that the child takes on an active role in their own learning process. By engaging a child's imagination and creativity, especially through imaginary play, as part of their learning experience, they are encouraged to consider information and content through varying perspectives, thus enhancing their potential to develop in a holistic manner.

4.5.1 Influence Imagination Through Exemplification

When designing interactive media to promote holistic learning, imagination and creativity can be encouraged amongst users through content and interaction designs. In asking users to participate in creative interactive tasks, they should be supported with necessary content such as examples that can inspire imagination. Users involved with the user test were encouraged to be imaginative in their creation of the physical and electronic craftwork. The content provided to support and aid users' understanding included textual instructions and visual examples of the craftwork that were deliberately created to show designs filling only the white section of the template (See Figures 43 to 45).

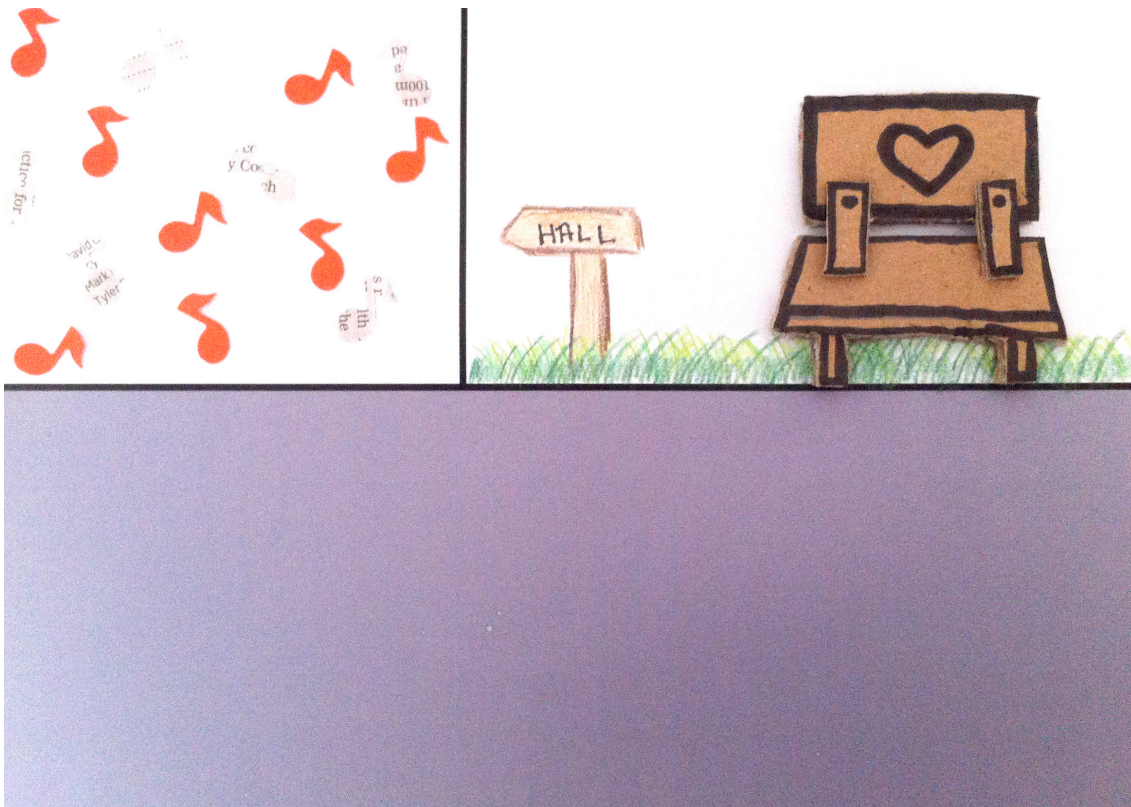


Figure 43. Craft Example 1.

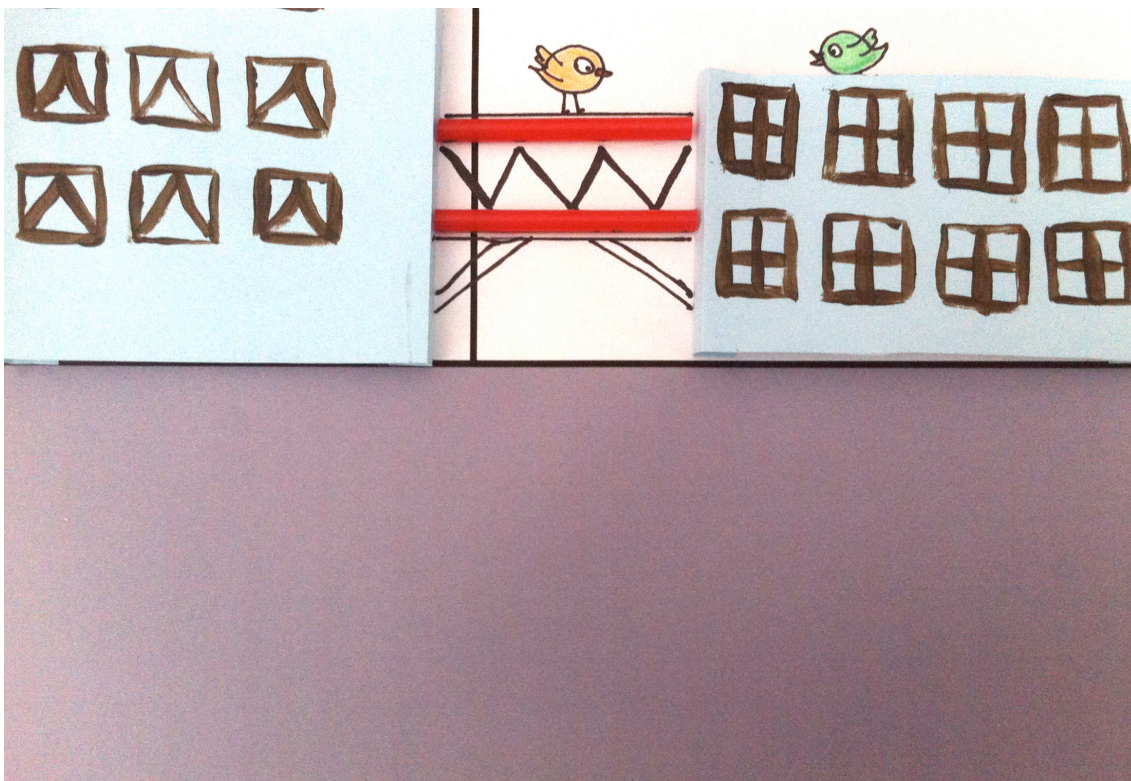


Figure 44. Craft Example 2.

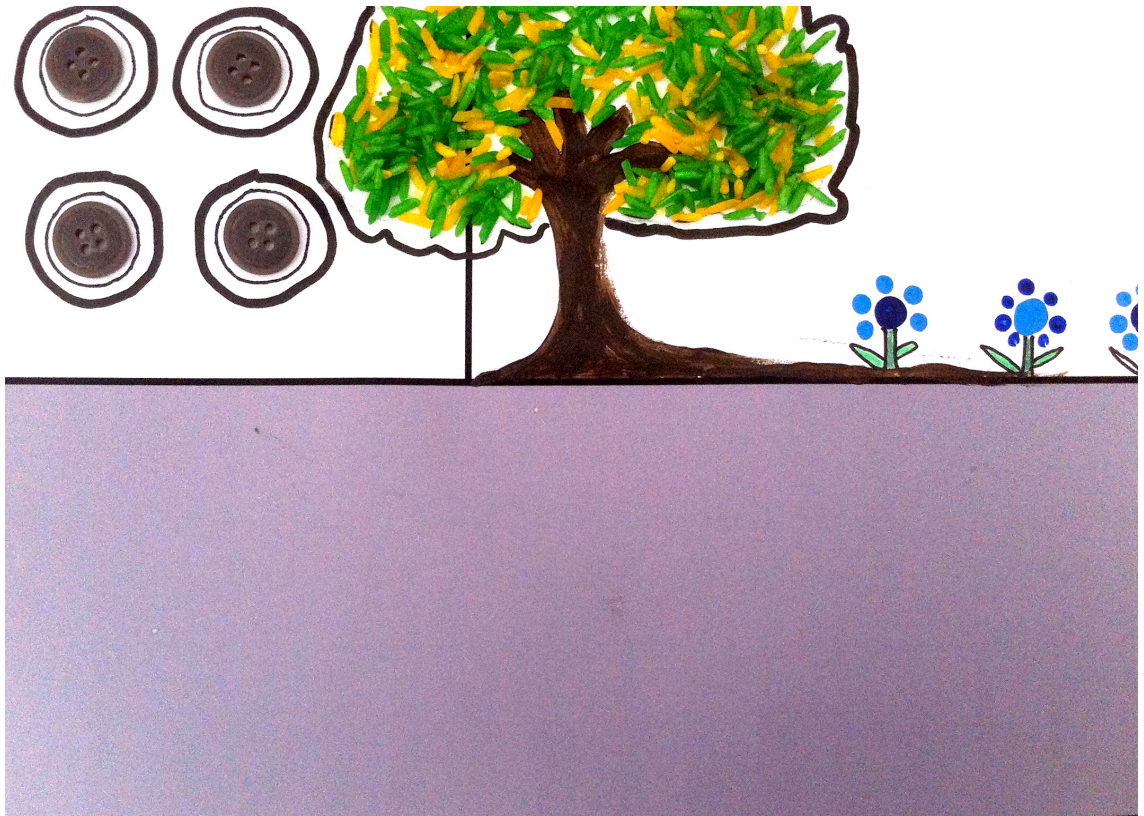


Figure 45. Craft Example 3.

The intent of the examples was to determine if users would adhere to or explore the boundaries shown in the examples. Of the six user tests, Jeremy and Permai took reference from the examples and stayed within the boundaries.

- While Tom was reading the instructions, Jeremy asked him what craftwork meant. Because there were visual examples provided, Tom was able to show Jeremy representations of the craft. Upon examination of the visual examples, Jeremy asked if he had to draw pictures. Tom clarified that they did have to draw, but only in the white space. As Jeremy worked on the first section of his craft, he was suddenly hesitant and turned to ask Tom if he could draw across the middle line visible on the template. When Tom told him that he could, Jeremy continued the task and drew a tunnel that extended his playground design (See Figure 37). When asked in the interview, Tom commented that he told Jeremy to draw in the white space based on the examples. Although this arguably acted to limit Jeremy's potential to be imaginative, his designs still showed indications of his creative thinking.

- Permai's craftwork on the other hand was a direct reproduction of the provided craft example (See Figure 46). Although her attitude towards the task can be attributed to varying factors, her reaction also demonstrates the influence of content support on users' imagination.

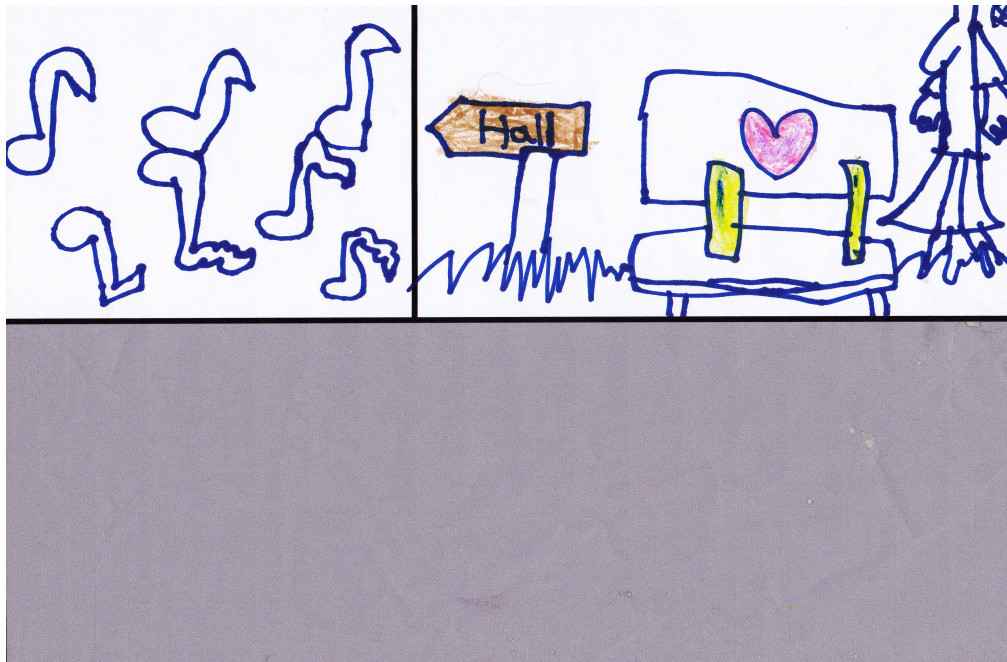


Figure 46. Permai's Craftwork.

Therefore, content that supports interactive tasks should be designed to encourage and motivate users to challenge boundaries. In doing so, users will exercise their imagination and ability to think creatively. Using the straight vertical line that separates the white space of the template into two sections as an illustration, the line could be changed into a curved line and placed in the middle of the page. The content that supports the interactive task in this instance would include examples of designs that show the curved line as an integrated feature in different representations such as a playground slide; window or wall decoration. To prompt users to engage with their imagination, examples provided should include a wide range of designs that show evidence of boundaries being challenged. Therefore, being part of the content, these examples serve several purposes by which they can be used as aids to scaffold understanding as well as influence imagination so that users are able to translate content presented into information that is personally meaningful.

4.5.2 Encourage Imagination Through Communication, Motivation And Affirmation

A child's success in learning holistically is dependent on their learning experience being personally and socially meaningful where they can be engaged in communication with others as their advocate. It is within this collaboration where they can be persuaded to think innovatively and explore new ideas. This persuasive experience and its effect was indisputable in the collaboration between Laura and Judy. During their craft activity, Laura was initially nervous and unsure of what she wanted to do, but with Judy's encouragement and contribution, she was able to think outside of the box in the representation of her "special school" (See Figure 34). Judy did not pass judgement or sneer at Laura's imaginative design of caves and bears. Instead, she coaxed Laura's creative thinking skills by asking her to explain reasons for her design ideas. Additionally, Judy was also generous with her praises when there was progress in the craftwork, thus affirming Laura's belief in herself to accomplish the task and further engage in creative thinking. As a result, Laura's school design was the only one amongst the users that was not inspired by her school setting in real life.

Although the designs of all the other users were based on their reality, some designs still showed hints of creative thinking. Jeremy, who like Laura, was encouraged to think imaginatively as a result of the collaboration with his father, produced one of these designs. When Jeremy made a mistake in his drawing, he turned to Tom and asked "It doesn't matter right?" as though he was seeking assurance. When Tom assured him that it was all right and did not force him to erase the mistake or start again, Jeremy was encouraged to use his imagination. He then thought of a solution to modify his upside down platform handle into a climbing net (See Figure 37). This illustrates that when Jeremy was assured that his mistakes were negligible or at least able to be overlooked in this instance, he was able to engage his imaginative thinking and apply it to his designs through image manipulation.

The encounters of Jeremy and Laura demonstrate that imagination can be reinforced when children are engaged in a collaborative learning experience that embraces motivation and encouragement. In the absence of unnecessary mocking or criticism, the child's confidence is fostered when they receive verbal affirmation. This notion is in line with Bandura's (1997) self-efficacy principle that people can be influenced through social persuasion to be confident and give their all into tasks when they receive verbal

encouragement from others. Besides boosting confidence, the verbal affirmations or motivations from collaborators also function to reward or acknowledge the effort put in by users, thus advocating the desire for progress. That being the case, besides prompting collaborators to be verbally supportive in the child's learning experience, interactive media content can also be designed to provide such support. For example, the design of the content can include an interactive character that will verbally acknowledge their progress. In addition, virtual rewards such as conferring of points, stars, prizes, or bonuses can be implemented as supplementary motivation so that users can be spurred to exercise their imagination and creative thinking.

4.5.3 Convenience / Desire For Perfection / Intolerance For Mistakes Affects Imagination, Creativity And Confidence

While encouragement and rewards can promote imagination amongst users, the notions of convenience, a desire for perfection and an inability to accept errors can induce the opposite outcome. Such consequences were observed in Amy, Rayner, Permai, Heather and Hillary's experiences which is evidenced by their responding behaviour and completed craft work.

- During the electronic craft activity Alice had control of the mouse as she wanted the artwork to be perfect. However, Amy was adamant in drawing on her own but when she made a mistake, Alice burst out in laughter. As a result, Amy's confidence and creativity were negatively affected and Amy lost patience in the activity.
- Rayner's experience was comparable to Amy's as Denise took control to speed up the process and erased his attempted electronic drawing as it did not look acceptable. In an earlier incident, Rayner wanted to create elaborate three-dimensional buildings out of straws for his craft. However, Denise told him to simply draw the buildings instead as it would be faster. When Rayner insisted on using the straws, she swiftly bent a straw to form an arch, suggesting to him that he could use it as his building (See Figure 47). Her approach in rushing the process and the way she communicated with Rayner during the activities negatively influenced his confidence. This also affected Rayner's focus and his desire to progress during the interaction. As a result, Rayner occasionally walked away from the table which disrupted his learning experience.



Figure 47. Rayner's Craftwork.

The influence of a desire for perfection and convenience was also observed in Hillary and Heather's experience. Unlike the other users, their encounter clearly illustrated how contrasting support from collaborators affected their ability to engage in creative thinking. This salient contrast was attributed to the girls having both parents with differing approaches being involved in the process as well as their interactions with each other.

- When their mum, Jane, heard their plans for the craft, she told Hillary that while she had good imagination, the ideas would not work. She also commented that Hillary should create two-dimensional craft pieces as it was more viable. On the other hand, her father Jack, was willing to assist Hillary in the exploration of her three dimensional craft. Throughout the activity, Jane and Heather constantly reminded her to simplify her designs. But with child-like determination and persistence, Hillary continued with her plans. Coupled with Jack's encouragement that it would not be an issue if her craft did not look perfect, her imaginative ability was observed to be improved. This was verified in the way she was able to promptly find alternative solutions to her designs when her attempts were unsuccessful, as well as the way she orally

defended her designs and solutions. For example, when Heather criticised her playground slide structure and laughed that it did not have stairs for children to climb on, Hillary retorted that the children could climb the tree next to the slide and jump onto the slide's platform (See Figure 41).

- Heather's experience was also affected by her own desires for her work to be perfect. While she was finishing with the top half of her craft, she exclaimed that she was going to draw a playground in the space at the bottom. However, as she realised that she had earlier accidentally created smudges on the bottom, her facial expression and body language were observed to change and she said that she no longer going wanted to draw. After Jack tried to encourage her to think of ways to salvage it, Heather was able to think of a solution to decorate the smudges by drawing heart shapes over it (See Figure 42). Heather's experience demonstrates how her personal desire for perfection had hindered her potential. However, with Jack's support, she was able to overcome the barrier and engage with her imagination to develop her capabilities.
- Amongst the users, Permai's reaction to criticism and her desire for affirmation was the most prominent. When she was in the process of selecting colours to draw Janice a cake in the electronic craft activity, Sarah requested for it to be in purple. When yellow appeared on screen instead, Sarah expressed disgust at the colour that shocked Permai and caused her to respond quickly that she was drawing a piece of chicken. Permai's response seemed like an attempt to cover up for the mistake so that Sarah would not disapprove of her effort. In a second incident, Sarah laughed and commented that Permai's drawing looked more like fish instead of chicken. When this happened, Permai immediately clicked on the Done button without saving the image. She also did not complete her drawing and there was a shift in her mood and attitude towards the rest of the user test. She was observed to be distracted and impatient in her other interactions and gave up when she faced difficulty or was unsure. When it was time to create the craftwork retrospectively, Permai's attitude was also influenced and she decided to copy the craft examples provided (See Figure 46 and 43). During the interview, she revealed that her reason behind the copying was because she did not want to get it wrong.

The observations based on user interaction and its repercussions illustrate that when users allow their desire for perfection and convenience to manifest, it negatively influences the child's confidence and their ability to be creative. The same effect can also transpire when users are intolerant of mistakes. To aid a child's creative potential and their ability to find alternative solutions to their problems, collaborators play an important role in their interactive media experiences by assuring and encouraging explorations. Instead of mocking or dismissing choices and decisions, users should be encouraged to celebrate imperfections so that it does not become a stumbling block to discovery of new knowledge. Instead, when users are not pedantic about imperfections they are able to look at things differently which acts to improve their imagination. When their imagination is improved, they can also be more creative. Besides including prompts and reminders for users, the design of content can also train users to embrace imperfection. The representation for props or other media elements can feature intentional unpolished imagery or designs. For example, when users are asked to create an electronic card, the design of the card template could feature a tear on the page. The design of Jo-jo's puppet character could have also featured unparalleled eyes or non-symmetrical spectacles, or parts of its body could be made up of different patches. In featuring intentionally flawed designs, users will be less likely to focus on their own imperfections, as it is no longer as prominent as compared to viewing their designs next to a flawless design.

4.5.4 Stereotypes Stifle Imagination

Besides encouraging users to embrace imperfection and exploratory experiences, a child's imagination and their development can also be influenced by projections of stereotypes. These projections could be a result of their own understanding and expectations but could also be conferred through others like a collaborator or characters within the media content. The latter was observed when Rayner was designing his craft. He expressed that he was creating the sea on the bottom half of the template with boats and various other elements. However, Denise stopped him from implementing his design and commented that he could not have the sea as part of his design because his school was not by the seaside. As he continued with the task, Rayner struggled while he tried to change his design and was observed to be disappointed. After some deliberation and suggestions from Denise, he decided that he still wanted to draw water on the bottom half of the template but referred to it as a pond instead (See Figure 47). However, he struggled with his design as the bottom portion of the craft had deviated

from his original plans. When Denise voiced her opinion about the impracticality of a seaside school, she projected her personal stereotypical views that there were no schools by the sea onto Rayner. This affected his imagination as it had not initially occurred to him that he could not have a school by the sea. In his bid to please Denise, he unenthusiastically changed his design and approach, which appeared to be suppressed, compared to the potential of his initial elaborate plans.

In designing interactive media, users can be encouraged to engage with their imagination by including designs that show non-stereotypical imagery and designs. For example, instead of using human characters in the storyline to illustrate friendship between three friends, the characters could all be represented by a variety of animals or insects that might not be ordinarily perceived as good friends, such as a house fly, a cat and a scarecrow. The setting in which these three friends are having fun together could also be illogical like in outer space. By including unconventional designs in the creation of interactive media, users are urged to suspend rationality, and instead be engaged in an imaginative experience.

4.5.5 Summary

The development of a child as a holistic being requires them to be exposed to experiences and content where their imagination and creativity can be exercised. Such experiences can be achieved with the assistance of interactive media where content exemplification can contribute to how children can develop their imagination and creativity. Content provided should inspire and encourage users to challenge boundaries and stereotypes so that their learning and development can be enhanced. Their development should then be supported by the collaborative experience where imagination can be encouraged through communication, motivation and affirmation. It was also observed that convenience, a desire for perfection and an inability to accept mistakes can negatively influence confidence and users' ability to be creative. Therefore, collaborators play an important role in motivating and affirming users so that their confidence can be boosted and they are encouraged to explore new ideas.

4.6 Connection

When users are engaged in an interactive experience that exercises their imagination, their potential for learning is enhanced as imagination facilitates the learning process through connection of information.

4.6.1 Connection To Prior Knowledge Assists In Understanding True Nature

As users connect presented information from the content to their prior knowledge, it not only promotes engagement in the learning process but helps them to better understand their true nature so that there can be development (Miller, 1996). During the craft session, Amy had the opportunity to reflect on her prior knowledge as she designed her school. Similar to the other users except for Permai and Laura, Amy's design was derived from her personal school experience. However, as she was encouraged to engage with her imagination, she was able to design a school that communicated her ideals, thus revealing her true self and perceptions. As part of her ideal school, Amy decided to draw three classrooms, each one representing the standard pre-school levels of nursery, kindergarten one and kindergarten two in the Singapore education system. She also decided to decorate the nursery class in rainbow colours because it had to excite young children (See Figure 48). However, the colours used to decorate the rooms for the older children only required one colour. Her reasoning and design decisions indicated that she recognised and related to the feelings of anxiety when young children were new to a school and knew the importance of helping them to enjoy and integrate in their environment. She also commented that because she was only a designer and not a teacher or the principal, it did not matter what the students or staff thought about the designs. Because even if they were to be of the opinion that the single-coloured classrooms were boring, she would not have to face them on a daily basis. Her reasons for not caring about what others thought of her designs demonstrated that she was confident and felt that her ideas were absolute. This presented a good opportunity for Amy to learn that it is important to consider the needs of others and to work as team player.



Figure 48. Amy's Craftwork.

In her school design, Amy also illustrated different mats for the children to sit on. In the nursery and kindergarten one classrooms, the mats were all the same size, colour and shape. The kindergarten two classrooms on the other hand had some mats that were bigger than the others, one was donut-shaped and she created a special big “silver-y red” table which she said was reserved for a special student. When asked who the special student was, Amy clarified that only the top student in the class could use the table. She also added that she was one of the special students and that the other mats were for students who were academically inferior. When asked how she differentiated which of them were inferior, she immediately responded that they were the individuals who were selected to participate in extra lessons at school to catch up academically with the rest of the class. Amy's responses and comments revealed her perceptions and true nature that have been accustomed by exposure to unhealthy competition and segregation through her life experiences. As the issue of unhealthy competition and segregation are principles that oppose the objectives of developing a child holistically, an opportunity was presented by the interactive experience for Amy to develop new knowledge and understanding of acceptance and desegregation. However, this development can only take place when Amy reflects on her experiences and connects them with the information presented by the content so that she can better understand her true self.

In the participation of an interactive experience that is intended to develop users holistically, they have to first notice and acknowledge content before engaging with it. This engagement occurs when users connect presented information to their prior knowledge, which then allows them to reflect on their experiences. The process of connection can be guided through content design where the attentions of users are captured through elements of familiarity that links to their prior knowledge. When the design of the experience also promotes the use of imagination, it facilitates reflection of the connected information and prior knowledge where users can be encouraged to have an appreciation for their life experience and their world. This reflection can be instigated by the individuals themselves or triggered through the aid of characters in the content or through a collaborator. It is through the user's undertaking of the reflection that allows them to ascertain their true nature and capacity. While it is possible for users to go through the motions of an interactive experience without gaining any benefits, there is potential for their interactive experiences to be an agent of change in their development. However, the outcome of their development is dependent on their ability to connect content and reflect on their prior knowledge so that their true nature and perspectives can be revealed.

4.6.2 New Knowledge

Holistic learning is evidenced when an individual acquires new knowledge in their lives. This new knowledge is developed when users make a conscious decision to understand content by connecting presented information to their prior knowledge and reflecting on their existing perception of their true self. This learning experience was evidenced when Laura started understanding and making associations from presented information to her existing perception of her experiences.

- While discussing the craft activity examples, Judy pointed out to Laura that there were birds on the building similar to the birds at her school in real life. Judy then encouraged her to think and describe her favourite parts of her real school so that they could find inspiration for their craft design. When Laura was accustomed to the concept of connecting and reflecting on her experiences, she transitioned into initiating further connections on her own. Indications of this transition occurred when Laura pointed to Phoebe and Chris in the animation and said that they represented herself and her male cousin. She also asked if the voice of Jo-jo belonged to someone that she knew and

exclaimed that the cookies in the video were also her favourite. Finally, when Jo-jo asked if they would also be kind to others, Laura immediately agreed and said that she would be kind by giving her friend “a new toy”. As she became familiar with connecting presented information and reflecting on her experiences, she was also able to translate the lessons learned and her understanding so that it could be applicable to her own life. This was later evidenced in the observation diary where Laura was able to demonstrate her understanding of being kind to others.

Another example that verifies how learning is determined by a child’s ability to connect and reflect can be described by Jeremy’s experience.

- When Jessie gave users the different examples of being kind, Jeremy commented that being kind meant that a person was “being nice.” This was a marked difference from his understanding at the start of the user test as he was unsure of its definition. Tom then prompted him to connect this new understanding to his reality by asking him how else he could be kind to those around him. After a moment of silence, Jeremy decided that he could share his cookies and his favourite sandwich. He later translated this into his own reality which was evidenced by the number of times Jeremy accomplished acts of kindness such as sharing his banana bread with his older sisters and pouring a glass of water for his father without being asked when he noticed that his father was tired after returning from work.

The evidence showing how different users succeeded in executing acts of kindness in their real lives demonstrate that true learning can only transpire when there is a transfer of new knowledge into real life practices. For the transfer to happen, the design of content needs to include elements of familiarity and opportunities for imagination so that learners are able to connect presented information with their prior knowledge for their own understanding. This understanding is evidenced when users are able to personally connect presented information to their own lives. While collaborators or characters within media content can initiate this connection, the onus is on the learner to eventually make their own independent associations. When this transition occurs, the learning experience becomes personally meaningful for the learner and their connected experience facilitates in their process of learning holistic values.

4.6.3 Summary

As individuals successfully connect pieces of information as part of their learning experience, their potential to learn holistically increases. This occurs when individuals are engaged in experiences where their imagination is exercised. Carr (1986) believed that life was not made out of single events but an incorporation of all the events as a whole. Based on this notion and the theories of Gestalt psychology that influenced holistic education, the importance of connection as part of a holistic learning experience was highlighted and included in the initial holistic interactive framework through the following elements:

- Inclusion - Include elements of familiarity in content for target audience so that learning will be personally meaningful.
- Connection - Create content that helps users to understand their own true nature.
- Connection - Designs should encourage user's appreciation of reality and their world.

However, the understanding of connection influenced by the designs of interactive media and its repercussions on the holistic learning experience was further refined by the study. It was observed that the holistic learning process comprises of different stages where users have to acknowledge presented content; connect it to their prior knowledge, and reflect on the connected information so that they can form new knowledge based on their understanding. When the new knowledge is formed and transferred to their lives, their development completes the cycle to become a holistic experience.

4.7 Holistic Values

The goal of holistic education is to inspire values in individuals so that they can grow and develop in a well-rounded manner. Besides inspiring values such as respect, one of the goals of holistic learning is to develop the interpersonal and social skills of learners. This goal can be achieved through the design of media content and tasks as part of an interactive learning experience. When Laura and Judy were engaged in the craft activity, Laura initiated role-play when she included her favourite teddy bear. As part of her collaborative efforts, Judy participated in role-play and pretended to eat the imaginary apples off the tree after Laura made the bear eat one. This also prompted Laura to do the same and the cycle continued until Laura initiated change. Through Judy's participation in this short yet significant experience, she was able to exemplify and engage Laura in multiple holistic principles such as sharing; being kind; learning to be patient when taking turns as well as the conventions of communicating within a collaboration where all participants in the experience are considered coequal contributors. Their experiences and the resulting principles that were learned and then further applied by Laura establishes the value of including collaborative experiences where role play is encouraged. By creating content and designing interaction that includes similar experiences, the opportunities for the development of interpersonal and social skills of learners is increased, thus enhancing their learning experience. In addition to the designs of content and interaction, the successful acquisition and learning of holistic values is also highly dependable on the collaborators that are part of the experience.

4.7.1 The Role Of A Collaborator

Collaboration as part of an interactive media experience is paramount to a young child's potential to learn holistically as it is within this collaboration where young children can be influenced to understand and put into practice holistic values such as respect and kindness. It was observed through the user tests that interest and understanding of media content alone was insufficient for young children to acquire and practice holistic values. However, children were more likely to practice these holistic principles when the collaborators first demonstrate them. For example, despite four of the user groups showing interest in the different languages that were presented, their interest did not spontaneously translate into them learning how to respect the language and the cultures that were represented.

- Rayner and his siblings as well as Heather and Hillary were excited to listen to the sentences in different languages because they thought that they sounded silly. As they mimicked the sounds, they broke out in giggles while their parents watched passively without discouraging them from making fun of the languages and the culture.
- Similar to their responses, Permai was also observed to make fun of the language and culture, but the motivation behind her response was non-identical. Although she was initially disinterested in viewing the Flashcard pages, her interest was piqued when she saw the text. This was because she could recognise three of the four languages presented due to her cultural background. Permai and Sarah were observed to be attentively listening to the audio of the sentences that she recognised. However, as they were about to select the Tamil version of the sentence, Sarah mocked the language which caused them both to burst out in peals of laughter. Sarah's response and the subsequent reaction from Permai clearly demonstrate the role and influence of an older collaborator on a young child holistic development.
- This influence was also substantiated by Tom and Jeremy's interaction when exploring the flashcard page. As this was the first time that Jeremy was exposed to the various languages besides English. He erroneously thought that they were all Chinese and Korean texts but Tom took the opportunity to introduce to him the different languages by playing all the clips on the first flashcard. When they moved on to the second flashcard, Jeremy said that he did not want to listen to the other languages because he could not understand them. Instead of forcing him, laughing at him, or trying to make the experience appealing by making fun of the languages, Tom insouciantly said that it was not a problem and moved on.

Of all the children that explored the flashcard page, Jeremy was the only one who did not feel a need to ridicule the languages that he did not understand. His reaction as well as the reaction of the others seemed to be a reflection of their parent's reaction to the different languages. In the case of Heather, Hillary and Rayner, although their parents did not initiate ridicule, they did not actively end the antics and were also observed to also smirk at their reactions.

The observations illustrate that the process of learning holistic values is influenced not only by the child's interest and comprehension of content but is also dependent on the attitudes of their collaborators as part of their learning experience. For children to learn how to respect other cultures, beyond the demonstrations provided by the interactive content, respect needs to be inculcated through the actions and exemplification of the collaborators. Similarly, young children can learn that they should be kind to others through illustrations within interactive content. However, if the principle of being kind is not practiced and demonstrated by parents or older siblings at home, the young child will be less likely to translate this learned principle into their own reality. For such collaborations to be effective, individuals within the partnership have to recognise that they have different roles and responsibilities to fulfill. When their roles are recognised and are acknowledged by the individuals, they are more likely to be committed to their tasks in aiding the process of collaboration, thus improving the child's holistic learning experience. The promotion of comprehension and commitment of responsibilities can be achieved through the design of interactive content by including a collaborator's manual which clearly explains their specific roles before the user experience.

Because collaboration is pivotal to holistic learning, collaborators play an important function in the experience and should be aided in the interactive process through role-play where interactive tasks can be designed to provide them with opportunities to support child users in their discovery of holistic values.

4.8 Emergent Findings

An additional finding of the study was reported by Judy more than two months after the user tests had concluded and showed evidence of the effectiveness of interactive media designed using a holistic interactive framework. Although *Connecting Dots* was designed using the initial framework, it had prolonged influence on Laura's holistic development. Judy reported that despite Laura's single exposure to the interactive content, she still remembered certain parts of the video such as Jo-jo's character and the lesson of sharing cookies. Her recollection of the video was unexpectedly expressed when Laura's grandmother was watching television at home and Laura wanted to watch her favourite television program on the same television. When her grandmother refused to change channels, Laura told her that she should share by changing channels because Jo-jo shared his cookies, shocking Judy and her grandmother. If Laura's experience demonstrates that while there are loopholes in the design of the initial holistic

interactive framework, the effectiveness in promoting holistic learning, transfer and long term consequences through the analysis of the evaluation and the design of the new holistic interactive framework should increase the potential for enhanced holistic learning. The new holistic interactive framework is described in the next chapter (See Chapter 5).

5 Recommendations

The initial interactive framework translated from Miller's (1996) concept of balance, inclusion and connection as attributes of holistic education was a good foundation for the development of a website prototype. This developed prototype was used to evaluate the effectiveness of the interactive framework in providing young preschoolers with a holistic learning experience, which is documented by the transference of concepts learned from the interactive media into practical life experiences. Based on the experiences of participants during the user tests, their interviews and their documented participant diaries, a new holistic interactive framework has been identified. While the fundamentals of Miller's balance, inclusion and connection can still be found in parts of the new holistic interactive framework, the elements of the new framework has been expanded to include new features so that it can be better applied to interactive media designs and make a difference in the holistic learning experience of a child.

Similar to the initial interactive framework, this new framework is broken down into categories of media content; website interface design and interaction design. However, the elements that make up the new framework will not illustrate specific characteristics as it is only meant to be a guide. Instead, what the new framework suggests are general elements summarised from the observations the users experiences. Where the elements of the new interactive framework can be applied to different categories, they are illustrated by the dots (see Table 4). By providing a guide instead of specific characteristics, interactive media designers are afforded the opportunity to interpret how the new holistic interactive framework will be expressed in their interactive media designs.

Table 4. New Holistic Interactive Framework And Its Influence on Content, Interface and Interaction Design

New Framework (Elements)		Media Content	Website Interface Design	Interaction Design
Personally Meaningful Experiences		◆	◆	◆
	Attract user attention by allowing customisation	◆	◆	◆
	Prolong engagement through multiple personal connections	◆	◆	◆
Engagement	Imaginary Play	◆	◆	◆
	Include opportunities for imaginary play and child directed exploration	◆	◆	◆
	Active hands-on exploration	◆	◆	◆
	Encouraged users to personally engage with tasks	◆	◆	◆
	Cater for non-linear exploration	◆	◆	◆
	Usability	◆	◆	◆
	Provide adequate support for tasks	◆	◆	◆
	Include obvious signposts	◆	◆	◆
	Include progress tracking	◆	◆	◆
	Include obvious call-to-action buttons	◆	◆	◆
	Provide users with immediate visual or aural feedback	◆	◆	◆
	Include transitions between major tasks or sections	◆	◆	◆
	Questions	◆	◆	◆
	Include frequent questions that directly addresses users	◆	◆	◆
	Provide tips such as question samples or conversation starters	◆	◆	◆
	Timed Challenges	◆	◆	◆
	Break down complex tasks into smaller time-specific tasks	◆	◆	◆
	Managing expectations	◆	◆	◆
	Visual Content	◆	◆	◆
	Reflect connected themes throughout the design	◆	◆	◆
	Enhance learning through interactive visual effects	◆	◆	◆
	Consider capabilities of users to determine amount of text to images ratio	◆	◆	◆
	Ensure designs matches users' expectations of imagery	◆	◆	◆

Balance	Puzzles	Include puzzles and where appropriate, feature optical illusions	◆	◆	◆
	Unique Characters	Characters helps with user identification	◆		
	Music	Place bigger emphasis on the choices and selection of music	◆		
	Concepts	Balance concepts within content so it is entertaining and educational	◆		
		Include complex concepts as well as simple concepts	◆		
		Balance presentation of concepts	◆	◆	◆
	Interactive Tasks	Balance the frequency of interactive tasks to avoid disconnection	◆		◆
		Balance difficulty levels so that there are both simple and complex explorations	◆		◆
		Balance familiar interactions with novel elements	◆	◆	◆
	Media Elements	Create user impressions through presentation of elements	◆	◆	◆
		Balance audio levels and equalisation within media elements	◆		
		Consider how sound design can evoke emotions and reactions	◆		
Collaboration	Provide opportunities where interaction require collaborative efforts for completion		◆	◆	◆
	Encourage discussion, reflection and comprehension		◆		◆
	Provide opportunities where experiences and emotions can be identified and validated		◆		◆
	Include multiple user options to encourage equal opportunity		◆	◆	◆
	Provide opportunities for development of interpersonal and social skills		◆		◆

Imagination and creativity	Provide examples showing boundaries being challenged	◆	◆	◆
	Intentionally feature imperfect designs to promote imagination	◆	◆	◆
	Include tips and reminders for tolerance of imperfections and mistakes	◆		
	Include unconventional designs that challenges stereotypes	◆	◆	◆
Connection	Include familiarity within content	◆		
	Include opportunities for reflection of experiences and prior knowledge	◆		◆
	Give users the opportunity to present or illustrate their personal ideals	◆		◆
	Encourage users to reflect on their true self and transfer new knowledge to real life practices	◆		◆

Personally Meaningful Experiences: Attract user attention by allowing customisation

The inclusion of personalised elements in an interactive experience can attract the attention of users by drawing on the emotional connection that occurs when they see content that is customised according to their preference. This emotional connection is based on the notion that when users see content that have been personally created or chosen, a sense of pride; pleasure; and ownership is evoked. These feelings experienced by the user then strengthen their emotional bond and keeps them immersed in the learning experience.

Personally Meaningful Experiences: Prolong engagement through multiple personal connections

When users are provided with multiple opportunities where their interactive experience can be personally meaningful, their engagement in the experience can be prolonged so that there is potential for a deeper level of understanding and learning. Multiple opportunities also mean that if users accidentally overlook a task, there is still potential for at least an encounter where the experience can be personally meaningful. However, if a user has multiple personally meaningful experiences, their engagement and learning can be further enhanced.

Personally Meaningful Experiences: Include elements that users can identify with

The potential for users to feel a sense of connection is increased when they can identify with the characters and content within the interactive media. Through the identification, their perspectives and attitudes towards how they interact with the learning material can be positively influenced so that there is progress and development.

Engagement - Imaginary Play: Include opportunities for imaginary play and child directed exploration

When interactive experiences include imaginary play where users take on roles, they can develop a sense of responsibility and mission. Through imaginary play, users are able to better understand the context and purpose of their interaction. During engagement with interactive experiences that are designed to be collaborative, there is potential for the interaction to be biased towards older / more competent users due to various reasons such as convenience or dominance. This could affect how less competent users engage in the learning experience and their overall development. By including imaginary play as part of the interactive experience, the approach for

collaboration can be guided so that exploration of content and learning can be child-directed. This would then motivate them to engage in the experience and encourage them to imagine, create and develop their skills and knowledge.

Engagement - Active Hands-on Exploration: Encouraged users to personally engage with tasks

By including interactive activities where users are not just absorbing information as passive viewers, they are persuaded to actively engage with the content and learning experience. Through active hands on exploration, users can take the responsibility for their own learning and development, thus increasing their focus and engagement with the experience.

Engagement - Active Hands-on Exploration: Cater for non-linear exploration

When users are forced to interact with media content in a linear manner, their learning experience is not as enjoyable and could be frustrating for the user. By allowing users to explore non-linearly, they can decide on the pace of their development and the way they want to interact with the content. This helps them to maintain engagement with the interactive experience. However, the freedom in interaction might also mean that information could potentially be overlooked. Therefore important information that could influence the overall experience needs to be well communicated.

Engagement - Usability: Provide adequate support for tasks

In the design of content for young learners' holistic learning experiences, it was initially thought that it would be in their best interest if designs were simple. However, it was observed that at times, simplicity could be detrimental to their engagement. Therefore designs for the interactive learning experience should feature a balance between simple and complex designs so that users can be challenged. Where there are complex designs, necessary support should be afforded to users so that their abilities and their engagement with the experience will not be negatively affected.

Engagement - Usability: Include obvious signposts

As users interact with the content and experience, it is not uncommon for them to feel unsure of their position within the entire activity. When this happens, their engagement could be negatively affected, as they might be distracted in trying to recognise if particular interactive tasks have been completed or determine when to move on in the

interaction. To avoid such unnecessary distractions, the design of interactive media should include signposts that are obvious to users. Ideally, the signposts should be separate from the menu buttons and include reminders of achievements and show remaining goals to completion.

Engagement - Usability: Include progress tracking

When signposts are designed to remind users of their achievements within the interactive experience and show remaining goals to completion, it allows users to track their progress and understand their position in relation to the entire activity. This ability to track their progress can function as a motivator to engage users in the learning experience so that there can be completion.

Engagement - Usability: Include obvious call-to-action buttons

When users are able to navigate around content with ease, their engagement in the experience is improved as trying to find their way around the content does not distract them. To aid user's navigation, content designs should include obvious call-to-action buttons. When its designs are obvious, it can attract the attention of users so that they are able to clearly determine where to click and interact. This can be achieved through different ways such as having interesting designs that appeal to users and ensuring that the size of call-to-action buttons are not overpowered by other elements presented on the page.

Engagement - Usability: Provide users with immediate visual or aural feedback

Users expect immediate responses to their interaction when engaging in an interactive experience. These responses can be in visual or aural forms to provide them with feedback so that they know that their investment of time and effort in the experience is rewarded. If feedback is delayed, users might think that there is something wrong with their interaction that could cause them to disengage from the experience.

Engagement - Usability: Include transitions between major tasks or sections

While interacting with media content that features different activities or sections requiring a shift in the way users interact with content, the design of interaction should include transitions in appropriate places. For example, if users are interacting with a puzzle that requires listening skills and are then expected to draw electronically, there should be an indicator that signals the shift between the two interactive activities. By

including transitions, users can anticipate the start of a task or section and recognise when it is complete. The provision of transitions would also encourage users to feel a sense of anticipation and accomplishment that influences their engagement in the learning experience.

Engagement - Questions: Include frequent questions that directly address users

Engagement in an interactive learning experience is influenced by the ability of its content to continually maintain the attention of users. This prolonged attention can be achieved through content and interaction designs where users are asked questions that are directly addressed to them. If these questions are frequent throughout the learning experience, it helps users to feel connected to the interaction and encourages dialogue, thus increasing the potential for them to engage in the learning experience.

Engagement - Questions: Provide tips such as question samples or conversation starters

When interacting with media content within a collaboration, the inclusion of questions as part of the learning experience can also promote dialogue and interaction within collaborators. As users and collaborators interact, there is potential for them to think and communicate ideas as part of their discussions. Through this thinking and communication process, the imaginations of users are exercised, which encourages them to engage in the learning experience. As part of interactive content's design, tips such as question samples or conversation starters can be provided to inspire dialogue and engagement.

Engagement - Timed Challenges: Break down complex tasks into smaller time-specific tasks

In the design of interactive media that endeavours to provide users with a holistic learning experience, there needs to be an inclusion of complex interactive activities and designs to challenge the knowledge and understanding of users. However, some of these complex interactive activities can be perceived as too difficult for users and becomes a stumbling block to their learning. Breaking complex interactive activities into smaller tasks that are time-specific could circumvent this. In doing so, users can be encouraged to perceive the complex tasks as manageable and perceive the time challenges as goals that can be achieved when they give the task their full attention that is only required for short periods. This improves their focus on the tasks and motivates them to engage in the experience. However, the time challenges should be balanced so that users do not

feel too rushed in their learning experience. By adding timed challenges, users can be encouraged to achieve their goals on time.

Engagement - Timed Challenges: Managing expectations

Besides promoting focus, timed challenges can also promote management of expectations by all who are involved in the learning experience. Through the timed challenges, users are able to assess how they are going to expend their time and consider their skills required to complete the challenges. This allows them to engage in the experience so that the tasks can be successfully completed. Upon successful completion, the experience becomes pleasurable, which further enhances their engagement in the learning process.

Engagement - Visual Content: Reflect connected themes throughout the design

When designs are not connected, they might cause a break in the flow of understanding and be perceived as irrelevant to the overall experience. This could cause confusion amongst users as they are presented with too many different concepts and designs that are not synthesized. Therefore, content design needs to reflect themes and elements connected throughout the overall design so that users can be engaged in a pleasant experience that is not confusing.

Engagement - Visual Content: Enhance learning through interactive visual effects

While content can be engaging through visual presentation, the experience can be enhanced with the inclusion of interactivity. Through visual content that are interactive, users are given the opportunity to actively interpret and construct their own understanding from the information presented, thus enhancing their engagement.

Engagement - Visual Content: Consider capabilities of users to determine amount of text to images ratio

While designing the interactive experience, designers should not be absorbed in trying to balance the text to visual image ratio but consider the capabilities of the target users so that they can comprehend information. If users are too young and are unable to read, a balanced text to visual image ratio is irrelevant as they would not be able to understand the text. Instead, if information is presented through visual and aural representations, they are able to comprehend the presented information and engage in the learning experience.

Engagement - Visual Content: Ensure designs matches users' expectations of imagery

When presenting information through visual representations, the visual designs need to match user's expectations. If these representations do not match their expectations, confusion can occur when they are unable to recognise and understand the information being conveyed through the imagery. However, if they understand the information and meanings being conveyed, they are encouraged to maintain engagement in the interactive experience.

Engagement - Puzzles: Include puzzles and where appropriate, feature optical illusions

User's attention and engagement in the learning experience can be enhanced through the design of interactive activities replicating puzzles that have to be solved. When the puzzles include optical illusion as part of its design, the experience encountered by users as they interact with the puzzle can attract their attention and promote engagement through curiosity and surprise.

Engagement - Unique Characters: Characters helps with user identification

The responses of users during the user test reinforce the importance of character design as part of interactive media. This important component should not be overlooked as it has the power to alter the way viewers engage with the content. More than just engagement, by designing characters that appeal to its target audience, they can be encouraged to feel a sense of affinity with the characters. This sense of affinity can aid their perceptions and influence them to embrace the character as a friend or a playmate, thus increasing the opportunity for characters to facilitate their learning.

Engagement - Music: Place bigger emphasis on the choices and selection of music

Music can boost memory, communicate important information and increase potential for users to remember and transfer knowledge learnt through the song. By including music that also evokes emotions, users can be persuaded to be further engaged in the learning process. Therefore, in the design of the learning experience, a bigger emphasis should be placed in the selection and choices of music so that the relevant emotions can be invoked. Through the music used in the content, important concepts can also be designed to be part of the lyrics so that users can be persuaded to remember information learned through tunes of the interactive experience.

Balance - Concepts: Balance concepts within content so it is entertaining and educational

In the design of interactive content for young users that promotes holistic learning, a balance of entertaining and educational content is required so that users can be engaged in a fun experience but can still be challenged in their knowledge and understanding. If the learning experience is not enjoyable, there is potential that users will have no desire to engage with the experience.

Balance - Concepts: Include complex concepts as well as simple concepts

A balance between simple and complex concepts should also be presented as part of the learning content design so that the users are challenged to think and understand. If the experience only presents simple concepts and users do not feel challenged by the content, users could perceive the experience as boring. This same perception can also occur if users find that they are unable to understand any of the presented information. Therefore a balance in the design of concepts within the media content is important.

Balance - Concepts: Balance presentation of concepts

Besides ensuring a balance in the types of concepts as part of the learning experience, it is also important for the design of the interactive experience to ensure that there is a balance in how concepts are being communicated. When too many concepts are communicated at the same time, user's engagement can be negatively influenced which would also affect the way they explore the learning content.

Balance - Interactive Tasks: Balance the frequency of interactive tasks to avoid disconnection

When designing media for holistic learning experiences, interaction designers should consider ways of ensuring that crucial information reaches its intended audience. One way of doing this is to present important information through short interactive tasks where users are able to actively engage with content and personally discover information for their own understanding. However, in planning for interaction, a balance in the frequency of interactive activities is imperative so that the flow of information is not constantly interrupted, causing users to feel disconnected from the experience.

Balance - Interactive Tasks: Balance difficulty levels so that there are both simple and complex explorations

In the designs of interactive tasks to encourage collaborative learning, a measure of difficulty should be included so that users feel challenged but can be empowered through their collaborations to complete the tasks. If users deem the tasks as too simple, they might find the experience boring and skip the tasks. However, if users are provided with tasks that are challenging, they can be coaxed to explore their complex yet connected skills. When designing interactive tasks, besides balancing the number of simple and difficult interactive tasks, it is important to ensure that the task and the discovery of complex yet connected skills can be achieved within the collaboration where users are provided with necessary support for their exploration.

Balance - Interactive Tasks: Balance familiar interactions with novel elements

The inclusion of interactivity that is balanced can enhance interactions within a learning experience. In balancing interactivity, designs should feature familiar interactions, but include surprise elements. If the interactive designs emulate activities that users are already familiar with, users can feel empowered and are likely to interact with the content. However, too much familiarity can also render their experience as unexciting. Therefore, the inclusion of elements of novelty can surprise users and sustain their attention as they are unable to be accustomed to interactive conventions. The observations of the user tests also suggest that while familiarity is needed to boost users' confidence so that they are willing to engage, the designs of the interaction should also incorporate ways of keeping users surprised so that the experience is not predictable.

Balance - Media Elements: Create user impressions through presentation of elements

When visual designs are deemed too complex, it can be perceived as cluttered, thus causing users to be unable to focus and feel confused or frustrated. Repeated or prolonged exposure to these negative emotions could result in users disengaging from the experience. To avoid these situations, visual interactive media elements should be carefully designed and presented so that users are able to experience positive emotions while engaging in the learning experience. The positive experiences then become a vehicle where their learning can be positively influenced.

Balance - Media Elements: Balance audio levels and equalisation within media elements

Sound design can influence and determine the way users engage with the learning experience. When designing aural components for media, there are many technical factors that should be balanced; for example, the audio levels should be balanced so that users are not exposed to sounds that are suddenly too loud or soft. In addition, audio should also be equalised so that there can be tones and depths which can be used to evoke emotions and impressions.

Balance - Media Elements: Consider how sound design can evoke emotions and reactions

Interaction media designers should also consider the appropriateness of each aural component within the sound design of the interactive content so that the correct emotions can be evoked to motivate the right response from users. If the emotional response required of the users is of happiness, the sounds used in the media should not be slow and melancholic as it evokes the opposite emotions. When the right emotions are evoked, users can then be encouraged to react accordingly.

Collaboration: Provide opportunities where interaction require collaborative efforts for completion

Interaction that advocates accomplishment of tasks and acquiring of knowledge with the help of a collaborator provides a learning experience that is personally and socially meaningful. When the experience is both socially and personally meaningful, learning is enhanced and the shared experience becomes more memorable. Therefore interactive media that aims to provide users with a holistic learning experience that is pleasurable should be designed so that users are encouraged to engage in interactive tasks where new understanding can be developed through collaborative efforts.

Collaboration: Encourage discussion, reflection and comprehension

As part of the interactive experience designs for collaboration, users should be encouraged to discuss, reflect and understand presented content so that learning is personally meaningful. The designs of interaction should specifically consider how user competencies would influence the collaborative learning experience. If the more competent user dominates the collaboration, there is little opportunity for the less competent user to learn based on their own understanding and opinions. Because an

individual's potential to learn holistically is dependent on their ability to comprehend in a personally meaningful manner, the dominance of the more competent user can potentially influence the learning experience in a negative manner. To avoid this occurrence, the collaboration could be designed to encourage discussion and reflection so that less competent users are afforded the opportunity to comprehend the presented content and their experience in a personally meaningful way.

Collaboration: Provide opportunities where experiences and emotions can be identified and validated

Complex learning content aimed at social and emotional intelligence need to be addressed in order for individuals to develop holistically. As part of their development, users need to be able to identify and reflect on their life experiences and emotions so that there can be growth. When these emotions or experiences are identified but cannot be articulated or understood, users might find their own ways of understanding or making sense of their experiences. Through the collaboration with a parent or more competent individual, they are able to help the child or less competent individual identify and validate their experiences and emotions. In doing so, their learning experience becomes personally meaningful which aides in their development of social and emotional intelligence.

Collaboration: Include multiple user options to encourage equal opportunity

The significance of collaboration in holistic education necessitates its inclusion in interactive media that promotes holistic learning. With its inclusion, designs of interaction and content for educational interactive media should consider the environment where the interactive experience will be implemented. Depending on the environment, the designs also need to take into account the potential of having additional participants who might want to be part of the learning experience and determine how the additional participants will influence the collaboration and experience. In designing interaction and content, the designs could include multiple user options so that everyone involved in the collaboration can have equal opportunity to interact with the experience.

Collaboration: Provide opportunities for development of interpersonal and social skills

When the learning experience needs to accommodate for additional collaborators, the design of the experience needs to provide opportunities where everyone involved can

have equal opportunity. Approaches to achieving this could include designs of separate yet complimentary interactive tasks where users are prompted and reminded to share the responsibility in the interactive process. As part of the experience, users should be also be made aware of their roles within the collaboration and encouraged to communicate amongst stakeholders where they can develop their interpersonal and social skills.

Imagination and Creativity: Provide examples showing boundaries being challenged

Imagination and creativity can be encouraged amongst users through content and interaction designs where users participate in interactive tasks that are creative in nature. In asking users to participate in such tasks, they should be supported with necessary content such as examples that encourage and motivate them to challenge boundaries. These examples provided should also include a wide range of designs showing different ways where boundaries are challenged. In doing so, users can be inspired to exercise their imagination and think creatively.

Imagination and Creativity: Intentionally feature imperfect designs to promote imagination

When users are preoccupied with an unhealthy desire for perfection, their confidence and ability to imagine and be creative can be negatively affected. The designs of interactive media can promote imagination and creativity through its designs by intentionally showing imperfection. For example, the representation for props or designs of certain media elements can look unpolished. In doing so, users can be inspired to embrace imperfection so that their confidence can be boosted.

Imagination and Creativity: Include tips and reminders for tolerance of imperfections and mistakes

Collaborators play an important role in aiding an individual's creative potential through assurance and encouraging exploration. Instead of mocking or dismissing choices and decisions, collaborators can celebrate imperfections. When this happens, users are encouraged to look at things from different perspectives which improves their ability to imagine and be creative. By reminding users to be tolerant of imperfections and mistakes, progress in the learning experience can be encouraged.

Imagination and Creativity: Include unconventional designs that challenge stereotypes

Besides encouraging users to embrace imperfection and challenge boundaries, a user's imagination and their development can also be influenced by projections of stereotypes. These projections could be a result of an individual's own understanding but could also be projected by others involved in the learning experience. Through the content, interface and interaction designs, users can be encouraged to engage with their imagination by including unconventional designs. Through the inclusion of unconventional designs, rationality is suspended and users can be engaged in an imaginative experience.

Imagination and Creativity: Include encouragement and reward engagement in creative tasks

As part of the aim to exercise the creative abilities of users, collaborators should be prompted to encourage and motivate less competent users through verbal affirmations. These affirmations reward or acknowledge the effort put in by users and supports their learning experience by instilling in them a desire for progress and recognition. The same support can also be achieved through designs within the content and interaction where progress can also be acknowledged through virtual reward systems or interactive characters. When users are encouraged and rewarded for their efforts, their confidence can be boosted which then influences their ability to engage in imaginative thinking.

Connection: Include familiarity within content

The potential for an individual to learn holistically is improved when they feel a sense of connection to the learning experience and content. To aid this connection, content can be designed so that there are elements within the experience that are familiar to the users. Through familiarity, users are encouraged to feel a sense of affinity and can identify with the presented information.

Connection: Include opportunities for reflection of experiences and prior knowledge

Connection plays an important role in the learning process and when aided by familiarity, users are encouraged to engage with the learning experience through connecting presented information to their prior knowledge and experience. However, this is only the beginning of the learning process where users recognise that there is a connection to what they already know. If their engagement is maintained at this level, their learning is only superficial and its influence on the user is minimal. For learning to

be profound, users have to be engaged in the process where they reflect on the connection between presented information and their prior knowledge. This reflection can be initiated by the user themselves or assisted by the inclusion of interactive experiences that require users to participate in imaginative thinking that is associated to presented information and their prior knowledge.

Connection: Give users the opportunity to present or illustrate their personal ideals

When users connect and reflect on their experiences and prior knowledge, they are able to gain new understanding on the concepts presented as part of the learning experience. However, as the goal of holistic learning is for the development of the individual as a whole being that is evidenced by practical outcomes, there must be a catalyst of change where individuals can develop a better understanding of themselves and their world around them. While there are many ways that the catalyst can present itself, interactive media designs can facilitate this process by providing opportunities within the experience where users can present or illustrate their personal ideals in reference to the concepts being presented. In the process of presenting their own ideals, users are compelled to realise their true self and knowledge so that there can be change.

Connection: Encourage users to reflect on their true self and transfer new knowledge to real life practices

Holistic learning occurs when an individual acquires and applies new knowledge to their own lives. When users understand content by connecting presented information to their prior knowledge and reflect on their true self as a result of the interactive experience, true learning can transpire. This is evidenced when users are able to connect presented information to their own lives and transfer the new knowledge into real life practices. While this transfer can be initiated by others involved in the learning experience or the media content, it is important for individuals to eventually make their own independent associations. This can be facilitated through the design of interactive experiences where users are encouraged to reflect on their understanding and true self. Once the reflection and transition occurs, the experience becomes personally meaningful and their connected experience lends to a profound and holistic learning experience where there can be positive change in the lives of the users.

6 Conclusion

In anticipation of the eventual worldwide adoption of holistic education, an understanding of how knowledge can be acquired is essential. Embracing the advent and continual advancement of technology and borrowing from the theories of psychology, an initial holistic interactive framework of balance, inclusion and connection was designed. The framework was then developed into a website prototype titled *Connecting Dots* and evaluated to determine the effectiveness of the framework in promoting holistic learning. The data collected with *Connecting Dots* and its analysis answered the following sub-questions:

How will personalisation in the interactive website encourage knowledge acquisition that is balanced?

Through incorporating personalisation in the interaction, users were afforded a personally meaningful experience where their imagination and creativity could be exercised so that their knowledge acquisition is balanced. At the same time, rather than utilising traditional methods of teaching or learning such as rote memorisation, learning individuals were allowed to interpret presented information and construct their own meaning when presented with simple and complex concepts. In addition, the task of personalising interactive content provided them with an opportunity for an experience that was as fun as it was educational.

What kinds of experiences will preschoolers encounter through the collaborative interaction between themselves, their parent and the interactive website?

By including collaborative interactions as part of the learning experience, users were engaged in an inclusive experience that was personally and socially meaningful. Additionally, their problem solving skills were also engaged through the activities and tasks required of them so that the content could be personalised to their preferences. Through the design of the content, preschoolers were engaged in the three learning orientations of transmission, transactional and transformational. In the transmission orientation, individuals participated in visual and aural learning of texts while the transactional orientation engaged their problem solving skills. Finally, the collaboration between parent and child encouraged the transformational learning orientation where they worked together to improve interpersonal and social skills as well as creatively analyse and understand information.

What evidence will the preschoolers demonstrate to show transfer of concepts or themes from the interactive story?

Connection is an important component of holistic learning and is evidenced when a learner successfully transfers learned concepts to show their understanding of how differing concepts may be linked. Exposure to the content and interactions in *Connecting Dots* gave individuals the opportunity to understand their true nature and aspire to change. This resulted in all users exhibiting the transference of learned concepts such as carrying out acts of kindness, thus validating their ability to understand integrated topics, their position in the real world and to be able to apply learned concepts in their real lives.

The answers to the three sub-questions verify that the initial holistic interactive framework of balance, inclusion and connection can successfully promote holistic learning. However, observation of how users interacted with the developed website revealed flaws in the initial holistic interactive framework. It was observed that designs of interactive websites that strive to promote holistic learning should not have image designs that are entirely realistic through balancing shadows, gradients and shapes. As a holistic learning experience also endeavours to encourage imagination, it is expected that this can be achieved through content design that contravene stereotypical and literal assumptions through the agency of creative and unconventional imagery.

It was also observed that personalised cursors that were supposed to provide users with an enriched personally meaningful experience was redundant. Only Amy was able to successfully select her choice of a cursor while the other users did not select their personalised cursor because they either did not finish reading instructions or were unable to decipher which buttons to select. In the end, the feature became a distraction and was seemingly redundant to their experience.

On the other hand, another feature that was thought to be redundant and not included in the development of the prototype was requested by users to be included in future interactive media experiences. Users commented that content should feature voice-overs for texts as it would help young children better focus and understand especially when there were words that they could not read. However, this audio feature needs to be controlled by users so that they can decide when they want to utilise it. Should future interactive experiences include this feature, the design of the other content and activities

should be examined to ensure that collaboration will still be viable as it greatly influences the success of a young child to be able to learn holistically.

The analysis of the observations conducted during the evaluation stage has also established that the initial holistic interactive framework of balance, inclusion and connection should be revised to be more effective in promoting holistic learning. The revision of the framework resulted in an expanded and new holistic interactive framework providing general elements that can be used to guide content, interface and interaction designs (see Table 5).

Table 5. New Holistic Interactive Framework

New Framework (Elements)		
Personally Meaningful Experiences		Attract user attention by allowing customisation
		Prolong engagement through multiple personal connections
		Include elements that users can identify with
Engagement	Imaginary Play	Include opportunities for imaginary play and child directed exploration
	Active hands-on exploration	Encouraged users to personally engage with tasks
		Cater for non-linear exploration
	Usability	Provide adequate support for tasks
		Include obvious signposts
		Include progress tracking
		Include obvious call-to-action buttons
		Provide users with immediate visual or aural feedback
		Include transitions between major tasks or sections
	Questions	Include frequent questions that directly addresses users
		Provide tips such as question samples or conversation starters
	Timed Challenges	Break down complex tasks into smaller time-specific tasks
		Managing expectations
	Visual Content	Reflect connected themes throughout the design
		Enhance learning through interactive visual effects
		Consider capabilities of users to determine amount of text to images ratio
		Ensure designs matches users' expectations of imagery
	Puzzles	Include puzzles and where appropriate, feature optical illusions

	Unique Characters	Characters helps with user identification
Balance	Music	Place bigger emphasis on the choices and selection of music
	Concepts	Balance concepts within content so it is entertaining and educational
		Include complex concepts as well as simple concepts
		Balance presentation of concepts
	Interactive Tasks	Balance the frequency of interactive tasks to avoid disconnection
		Balance difficulty levels so that there are both simple and complex explorations
		Balance familiar interactions with novel elements
	Media Elements	Create user impressions through presentation of elements
		Balance audio levels and equalisation within media elements
		Consider how sound design can evoke emotions and reactions
	Collaboration	Provide opportunities where interaction require collaborative efforts for completion
Encourage discussion, reflection and comprehension		
Provide opportunities where experiences and emotions can be identified and validated		
Include multiple user options to encourage equal opportunity		
Provide opportunities for development of interpersonal and social skills		
Imagination and creativity	Provide examples showing boundaries being challenged	
	Intentionally feature imperfect designs to promote imagination	
	Include tips and reminders for tolerance of imperfections and mistakes	
	Include unconventional designs that challenges stereotypes	
Connection	Include familiarity within content	
	Include opportunities for reflection of experiences and prior knowledge	
	Give users the opportunity to present or illustrate their personal ideals	
	Encourage users to reflect on their true self and transfer new knowledge to real life practices	

As one is able to ascertain from the table above, by including elements from the new holistic interactive framework in the design of content, interface and interaction, future interactive websites for preschoolers can be bettered to deliver an experience that is both educational and entertaining at the same time so as to further promote holistic learning.

Future Research

Throughout academia and in other relevant arenas, copious research has been conducted on topics that touch on education, technology, human computer interaction and young children and yet, when compared to the available material on these topics, there has been arguably little research conducted on a combination of the interrelatedness between holistic education, and how current and future technology has come to affect the way young children learn and grow. As it has been the intention from the beginning of this research, a central objective of this study was to act as a springboard for future research into similar or relevant areas of study. In fulfilling this role, the findings of this research act as a foundation for research into knowledge acquisition by children through the use of current and future technological means. For instance, the following represents a short list of potential research that will be able to utilise and/ or build upon this original research:

- Preschoolers' responses to character development and its influence on their holistic learning experiences
- Distinctive attributes of collaboration between a child, parent and online media that enhances holistic learning
- Cross-cultural collaboration between international preschoolers using web platforms
- Integration of the new holistic interactive framework into other media such as multiplayer games, smart phone applications and interactive television programs in order to promote wider opportunities for holistic education
- Integrating the new holistic interactive framework and virtual reality to teach emotional literacy in young preschoolers

As education systems around the world begin to adopt or learn to better enhance holistic education, albeit at their own pace, there is a void between technology and current education techniques that needs to be bridged. At the same time, the development of a child is very much a shared responsibility between a society, its education system and a child's familial relations. These different factions work simultaneously to maintain a

delicate balance between encouraging and pressuring a child. In light of this, my research aims to alter the paradigm of the relationship shared by these factions, importantly between parents and children, especially in result-driven societies such as Singapore, China and South Korea. It has been noted that a majority of parents in such societies do very little in educating children. Besides pressuring children to do better at school, the roles of an educator and mentor are very much left to teachers. It is hoped that through this and future research, parents will be encouraged to become more involved in the development of their children, both academically and holistically.

Importantly, besides these two important points, it is expected that this research and any future research it spurs will contribute towards the betterment of educating children, their well-being and by extension, the betterment of society as a whole.

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APPENDICES

Appendix A

Evidence of framework in *Connecting Dot's* Content Design

Main Framework	Media Content	Evidence in Connecting Dots
Balance: Users should have the opportunity to combine knowledge and imagination.	Educational content should provide users with opportunities to interpret and construct meaning for their own knowledge acquisition. Rather than spoon-feed users with a plethora of information, content should encourage users to engage in imaginative thinking to find solutions and research for information.	By giving users options to choose as part of the interaction between characters, users are provided with the opportunity to construct their own meaning and find solutions to help the characters, aided by prompts of the characters. By inviting users to also create a card to cheer up a victim of bullying and writing a thank you letter to their parents, users are also encouraged to engage in imaginative thinking in the construction of meaning.
	Balance between simple and complex subject matter for target audience. (Text, animation, sounds)	The subject matter for the episode will be balanced in educating users about simple subject matter such as sharing and complex subject matter of Acts of Kindness.
	Balance between entertaining and educational materials.	Through the artwork and storyline, the content will be both entertaining and educational.
Inclusion: Allow users to collaborate with others in solving problems so that learning can be personal and socially meaningful.	Content should provide users with learning material that will allow users to learn through the three learning orientations: 1. Transmission (Through text that can be read or listened to.) 2. Transactional (Through engaging users in problem solving) 3. Transformational (Through collaboration where creative thinking is encouraged).	1. The presentation of the story is through video, therefore learning will be through listening. At the same time, Keywords such as 'Kind' and 'Share' will appear as flashcards so that users are able to learn its spelling and its meaning. 2. The interactive options and art and craft engages users in problem solving as they have to find ways to create and upload their artwork. 3. The artwork is completed in collaboration with a parent and child which gives them a learning experience that is transformational as collaborative creative thinking will result in a tangible piece of craftwork that is integrated into the animation.

	Where appropriate, users should be able to analyse content and change content options as they acquire knowledge.	The ability for users to choose options as part of the interaction gives them the opportunity to analyse and change content as they learn.
	Include elements of familiarity in content for target audience so that learning will be personally meaningful.	Content includes a school setting that users are familiar with. The artwork that the users create that is then included in the animation will also create points of familiarity. Other elements of familiarity are in the inclusion of trees, clouds and props as part of the set. These elements will allow users to have a personally meaningful learning experience.
Connection: Aid users in seeing how knowledge is related to wider concepts and understand their position in relation to the world.	Create opportunities for people to see and understand the connection between mind and body through physical exploration.	The craftwork provides opportunity for users to understand the connection between their mind and body. Through cutting, pasting, drawing and colouring, users are able to see how physical exploration can bring their imagination to life.
	Consider Cultural and Social Cues	Users are informed by characters in the story that when sharing food with others, one has to be careful as some might have food restrictions due to health and cultural reasons. The sharing of food and other examples of acts of kindness in the episode also causes users to be aware that there are cultural and social cues at play when interacting with others.
	Create opportunities for users to explore and understand integrated topics.	Users are exposed to how sharing/kindness can be integrated to help victims of school bullying feel better. This gives them the opportunity to explore and understand integrated topics
	Create content that helps users to understand their own true nature.	By giving users the options to choose how the characters of the story should react when faced with a bully as well as talking points in the story for child-parent interaction, the content helps users to understand their own true nature.
	Create content that exemplify and encourages the development of interpersonal and social skills	Through Jo-Jo's mother's encouragement to share muffins, Jessie's account of how she helped others and through the animation story based in a school setting, the content exemplifies and encourages development of interpersonal and social skills.

Evidence of framework in *Connecting Dot's* Interface Design

Main Framework	Interface Design	Evidence in Connecting Dots
Balance: Users should have the opportunity to combine knowledge and imagination.	Website design should not be cluttered and filled with too many colours. There needs to be a balance between conventional usability designs and stimulating designs for young children.	<p>The majority of colours used in the design of the website and its various elements are in blue, red, and white. While there are some elements that include brown, these are minimal and are only used in places to help create an illusion of reality.</p> <p>There is also a balance between conventional and stimulating usability designs as evidenced by the Main navigation placed on the right side of the screen.</p>
	Design should also bring balance by including white spaces to encourage and give space for users to engage in imaginative thinking.	All pages will include sufficient white spaces. For example the index page and even in the webisode page.
	Balance between simple and complex designs.	<p>Icons and Elements of the website might seem simple at a glance, but upon closer inspection, users will be able to notice that there are complex textures present, although subtle.</p> <p>Majority of the website is designed to be as simple as possible as the activities and the tasks required by users to interact with the webisode are already complex.</p>
	Ensure that there are no slow loading flash elements	Only the video segment in the webisode will require a slightly longer waiting time due to file size, but as this prototype is tested offline, there will not be any lag while waiting for internet data.
	Where appropriate, include larger design elements to attract attention, but keep a balance with white space and other elements.	This is evidenced in the main navigation tool and the call to action buttons. The main stage/area for the webisode playback and contact page is also large, but kept in reference with white space.
	Ensure design depths are balanced using shadows, gradients and shapes, so users will view website as realistic.	The website employs a variety of shapes and the design uses the depth of field illusion to create a more realistic space. Where appropriate, there will also be shadows for designed elements.

	Website design of site navigation should have a balanced ratio of text to images.	The main navigation tool is made up of icons that are simple to understand. These icons are also explained in the Initial launch of the website. At the bottom of the page, there are also text only navigation hyperlinks that can be selected. Although this is slightly unconventional as majority have text links placed at the top of a page, the designer is confident that users are able to navigate through the website as there are also voice prompts when users hover over areas that can be selected.
Inclusion: Allow users to collaborate with others in solving problems so that learning can be personal and socially meaningful.	Where appropriate, interface should allow users to customise parts of its design so that it will be personally meaningful.	This is evidenced in the main website interaction where users are allowed to customise part of the animation elements using their craftwork.
	Include elements of familiarity in visual designs for target audience so that learning will be personally meaningful.	<p>The main website navigation features a tree branch that helps children to associate it with familiar children nursery rhymes such as Jack and the beanstalk.</p> <p>The index page of the website also features a familiar activity to the target audience - Trace and Join the dots.</p> <p>In addition, the website also features elements of nature that users are familiar with (trees / clouds).</p> <p>The personalisation of the animation elements will also aid users in feeling a sense of familiarity.</p>
	Include obvious call-to-action elements that will help users in their problem solving.	Where interaction is required, large call to action buttons / arrows / other elements will appear big.
	Include a user customised cursor that changes as cursor hovers over web buttons. This will allow users to recognise these areas as “clickable”	Users have a choice between two cursors when they finish going through the instructions page. When they hover over a “clickable” area, the mouse changes to their desired cursor.

Connection: Aid users in seeing how knowledge is related to wider concepts and understand their position in relation to the world.	Create opportunities for people to see and understand the connection between mind and body through physical exploration.	The index page where users have to use a mouse to physically connect the dots in order to see what it is and its beauty will help people to realise the connection between their mind / imagination and their body. This is also exercised when users created physical craft items that are embedded into the website to aid in the completion of a larger picture.
	Designs should reflect themes and elements that are connected throughout the entire website.	The main elements that connect the webisode and the rest of the website are its colour scheme and the elements of clouds and hot air balloons.
	Designs should encourage user's appreciation of reality and their world.	The design draws users' attention to elements in nature which encourages them to appreciate their reality and their place in the world.

Evidence of framework in *Connecting Dot's* Interaction Design

Main Framework	Interaction Design	Evidence in Connecting Dots
Balance: Users should have the opportunity to combine knowledge and imagination.	Interaction should include some elements of surprise so that users will not be accustomed to interaction conventions that can be expected or memorised. This will provide them with opportunities to exercise their imagination and problem solving skills by interpreting and constructing meaning through different approaches (Rational and Intuitive).	Young users will be surprised when they first realise they have to not only create artwork digitally, but also physically. These activities will be exercise their imagination and problem solving skills.
	Balance between simple and complex interactions and navigation where appropriate.	The interaction within the site is simple but it also includes complex interactions in the form of personalised elements for the animation.
Inclusion: Allow users to collaborate with others in solving problems so that learning can be personal and socially meaningful.	Interaction should provide opportunities for users to collaborate with a peer / parent or teacher so that learning can be socially meaningful.	The need for parents to guide their child with the craft and the embedding of craftwork to personalise the elements in the animation will give users the opportunity for learning to be socially meaningful.
	Interaction can include some repetition, but it has to be balanced with elements of surprises	The surprise elements in this website will be evidenced in the form of a memory game that helps to distribute lunch items to characters of the animation.
	Provides user with opportunities to explore their complex yet connected skills	Through the craftwork and subsequent requirement to take a photograph of the work and embed it in the animation, users are provided with the opportunity to explore their complex and connected skills.
	Include sound effects that are triggered according to user interaction. (This will provide feedback to users)	When users hover over the “clickable” areas, sound effects are played to provide them with feedback.
Connection: Aid users in seeing how knowledge is related to wider concepts and understand their position in relation to the world.	Consider Cultural and Social Cues	In the interaction choices that users have to make in order to help the characters of the story, users are encouraged to consider cultural and social cues.
	Create opportunities where interpersonal and social skills can be developed	Through the storyline and the interaction between child and parent as part of the activities, opportunities are provided for users to develop their interpersonal and social skills.

Appendix B

Connecting Dots Script Final

by

Michelle Tan

FADE IN:

INT PLAYROOM

Jo Jo is playing in his favourite playroom. He pushes a toy ship around and is caught up in his own little world when his mother suddenly calls out for him.

JO JO
Dun-dun-dun This is your
captain speaking...

MUM
Jo Jo! I'm baking you
some chocolate cookies!

JO JO
Yippee!!! my (emphasize
and drag) favourite!

MUM
But please share them
with Jessie!

Jo Jo looks at the clock on the wall and realises that Jessie is late. He immediately changes emotions from happy to upset. He becomes increasingly irritable and impatiently mumbles to himself.

JO JO
Hmm Jessie... I wonder
where she is...

Beat.

Jo Jo looks at the clock again.

JO JO
It is now 1.45pm and she
is still not here... so
much for wanting to play
with me...

He turns towards the door and shouts out loud to his mother.

JO JO
Mum... I don't want to
give Jessie any cookies
because she is late!

MUM

Remember the last time you
shared your fried chicken
and you felt so happy
after?

JO JO

But she promised she would
be here at 1.30 and...
and... I don't like it
when people break their
promises! Even if I wanted
to share, I can't because
she is not here!!

Just as Jo Jo screams that she is not here, Jessie rushes
in with the guitar on her back. Panting, she apologizes and
offers him an explanation.

JESSIE

Oh Jo Jo, I'm sorry I'm
late... I know you don't
like it but there was an
emergency.

Jo jo is still upset and turns the other way.

JESSIE

Come on Jo Jo... I'm
really sorry... and I
secret to share with you.

Upon hearing that Jessie has a secret to share, Jo jo perks
up and leans in to Jessie to hear her secret. She bends
towards him and tells him the secret.

JESSIE

The secret is, something
interesting happened... I
felt bad for being late,
but I also felt happy at
the same time. I think it
was because I was kind to
someone.

Jo Jo scratches his head and asks Jessie what she means.

JO JO

Kind? What do you mean
kind? And how can you
feel bad and happy at the
same time? You are
confusing me!

JESSIE
Well... how about I tell
you a story?

Jo Jo changes his
emotions and excitedly
exclaims. He passes
Jessie a book...

JO JO
A story? Here here...
Lets use grandma's magic
book!

JESSIE
O... Kay!

JO JO
But first we have to sing
our song!

Jessie picks up her guitar and Jo Jo sings along.

TOGETHER
Little stories to be
shared Listen close and
be prepared. Solve the
puzzles, think it through
You can solve them with
the clues. Little stories
to be shared Listen close
and be prepared.

ANIMATED TRANSITION

ANIMATION

Jessie opens up the book to reveal a blank page.

JESSIE (VOICEOVER)
This is a story of two
good friends... Phoebe
and Chris.

EXT. SCHOOL

Chris and Phoebe are playing at the school playground with
a few other friends. One of the girls, Janice, is standing
in a corner on her own and crying.

PHOEBE (JESSIE'S VOICE)
Hey Chris, is that Janice
there?

CHRIS (JO JO'S VOICE)
Hmm... yes it is and she
looks like she is crying.
PHOEBE (JESSIE'S VOICE)
I wonder what's
happened...

CHRIS (JO JO'S
VOICE)
What should we do?

SPLASH SCREEN WITH OPTIONS

Jessie appears on screen and asks users to choose between the following options. When users mouse over an option in text, Jessie's voice reads out what it is.

1. Chris and Phoebe should pretend to not see Janice and continue with what they were doing.
2. Go to Janice to see if she is okay.

JESSIE
Please help Phoebe and
Chris choose which action
they should take. Should
they pretend that they
did not see Janice and
continue with what they
were doing? Or should
they go to Janice to see
if she is okay?

If users choose the first option. Jessie appears to tell them to try again.

JESSIE
If Phoebe and Chris
pretend that they did not
know that Janice is
upset, they might miss
out on a chance to help a
friend. Please choose
again.

JESSIE
This is a good choice
because Janice will not
be alone and her friends
might be able to help
her.

When users choose the last option, the animation continues.

EXT. SCHOOL

Phoebe and Chris goes up to Janice to find out what is wrong.

PHOEBE (JESSIE'S VOICE)
Hey Janice... are you
okay?

Janice shakes her head, still crying.

CHRIS (JO JO'S VOICE)
Why are you so sad?

Janice continues crying and tells them why she is upset in between sobs.

JANICE
I lost my money for lunch
and I am scared that my
mummy will scold me when
she finds out. Also, I'm
starting to feel sick
because I am
too hungry.

Phoebe whispers to Chris that they should make Janice a card to cheer her up.

PHOEBE (JESSIE'S VOICE)
Hey Chris... we should
try and cheer Janice up
and we can also help her.

CHRIS (JO JO'S VOICE)
But... How?

PHOEBE (JESSIE'S VOICE)
Hmm... maybe we can make
her a card and share our
food?

CHRIS (JO JO'S VOICE)
That's a good idea!

Chris agrees and asks users to help make an electronic card.

CHRIS (JO JO'S VOICE)
Can you help us make a
card to cheer Janice up?

SPLASH SCREEN WITH OPTIONS

Jessie gives instructions on how to make the e-card.

JESSIE

Decorate this card with
the following tools. When
complete, click on the
Done button to give
Janice the card.

EXT. SCHOOL

When the card is complete, Phoebe and Chris hands Janice the card. Phoebe also pulls out her lunch bag and shares the food with her friends.

CHRIS (JO JO'S VOICE)

Hey Janice, we have
something for you.

PHOEBE (JESSIE'S VOICE)

And here... we can share
my lunch.

SPLASH SCREEN WITH OPTIONS

There are three snacks (Characters have a speech bubble over their heads to show which items they prefer. Users play a memory game by selecting the character and then finding the food item determined by the speech bubble). Phoebe's lunch bag is highlighted and becomes the focus of the screen.

JESSIE

Help to distribute the
food items from Phoebe's
lunch bag. Click on each
character and play the
memory game. Find the
food item that Chris,
Phoebe and Janice wants.

Remember kids, when
sharing food with others,
be careful as some people
might not be able to eat
all kinds of food due to
health and cultural
reasons.

EXT. SCHOOL

Just as they take their food, Ms Sarah comes along and asks why Janice was crying.

MS SARAH

Janice, why are you
crying?

Janice shakes her head. Ms Sarah turns to Phoebe and Chris.

MS SARAH
Girls, can you tell me
what happened?

TRANSITION

INT. PLAYROOM

Jo Jo is engrossed in the story and feels nervous for the Chris. Jo Jo starts panicking and Jessie tries to calm him down.

JO JO
WAIT A MINUTE!!! Will the
teacher think that Phoebe
and Chris made Janice
cry? What if they get in
trouble for nothing?

Jessie tells him that it is alright to tell the teacher what has happened.

JESSIE
Jo Jo... slow down, its
okay. If Phoebe and Chris
have done nothing wrong,
they should not be
scared. By telling a
teacher when someone is
upset, they are being
helpful and kind, not
just to Janice, but also
to the teacher!

Jo Jo asks users...

JO JO
Hmmm... helpful to the
teacher too?

Jo Jo scratches his head as if confused.

TRANSITION TO SHOW TIME
HAS PASSED

INT. PLAYROOM

Jo Jo also remembered that there is one example when he helped a teacher and that he felt happy after but did not realise that it was a result of being kind.

JO JO

Hmm... Now I know what
you mean when you say
that you feel happy after
helping someone. I felt
happy the other day when
I helped to take some
books for my teacher, but
I did not know that I was
happy because I was kind.

Jo Jo suddenly pauses and sniffs around, thinking out loud
that the cookies are done.

JO JO

MMm... I think the
cookies are done...

Just as he says that, he looks down and notices the plate
of cookies. Jo Jo looks at the cookies, then looks at
Jessie.

JO JO

You know, I was actually
upset with you because
you were late. You know
how I don't like it when
people are late.

JESSIE

Sorry but I was late
because I was trying to
be kind to those around
me... Just like Chris and
Phoebe.

JO JO

Oh yea? How?

JESSIE

Well... I was spending
time with my grandparents
and wanted to help them
with the housework.. and
on my way here on the
train, an old lady came
onboard the train with a
lot of bags and looked
sick! So I offered her my
seat and helped her carry
her bags home!

Jo Jo calms down again.

JO JO

Well, since you were
being kind, I'll forgive
you for being late and we
can share the cookies.

JESSIE

Oh Jo Jo, you're so kind,
thank you. Hey, can you
think of any other ways
to be kind?

JO JO

MMmm... I can't think of
anything now.

JESSIE

Well, we can help your
mum with housework...

JO JO

And keep my playroom
clean!

JESSIE

Yes! And we can also say
thank you to your mum for
baking your favourite
cookies, or write a thank
you letter to your
grandparents or dad for
working so hard and
buying you toys and your
favourite things.

Jo Jo invites users to also do the same.

JO JO

That is a good idea! Hey
kids, would you also like
to do the same? What can
you do to be kind to
others?

FADE OUT:

THE END