



**NANYANG
TECHNOLOGICAL
UNIVERSITY**

**LEARNING EFFICACY AND USER ACCEPTANCE
OF A GAME-BASED SOCIAL SKILLS LEARNING
ENVIRONMENT**

**TAN JEAN LEE
WEE KIM WEE SCHOOL OF COMMUNICATION
AND INFORMATION
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OF A GAME-BASED SOCIAL SKILLS LEARNING
ENVIRONMENT**

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ABSTRACT

Social maladjustment places children at risk in early life as they are integral to many emotional, behavioral and psychological problems. If left untreated, these negative consequences may be precursors of serious problems in adulthood such as adult psychopathology and criminality. The possible deleterious effects of social skills deficits have underscored the importance placed on social skills programs in schools. To address the issue of acquisition of social skills, a Web-based game, as a specific instantiation of educational games for social skills training in a classroom setting was developed for this research. The game, *Socialdrome*® is aimed to intentionally teach children to identify and manage feelings, exercise self-control, solve social problems and negotiate conflict situations. Specifically, the research seeks to design and evaluate the game based on instructional and game design principles and investigate the learning efficacy and user acceptance that the children derive from the game-based learning environment, *Socialdrome*®.

The Game Design and Evaluation Model, which was influenced by the Crick and Dodge's Social Information-Processing Model, Kolb's Experiential Learning Theory, Gagné's Events of Instruction and Keller's ARCS Motivation Model, was developed to provide a frame of reference for the design and evaluation of the game as a pedagogically meaningful tool for learning and entertainment. The model was constructed on the postulate that learning is a constructive process, anchored in an experiential game-based environment with real-life examples and social problems usually experienced by children in their everyday interactions. Both formative and summative evaluation studies were carried out. Study I was undertaken to evaluate the game prototype during the start of the development to ensure that the game attributes

were successfully embodied in the final game prototype. Two methods, heuristic evaluation by prospective users and participatory design, were adopted to elicit feedback and ideas to assess whether the features of the game pose playability and usability issues to the young users and to translate the children's contributions into game design directions.

For Study II, a summative evaluation methodology was constructed drawing from research streams of educational, game design, human computer interaction and information systems academic communities. Quantitative data collection was adopted in a formal school setting to examine how the distinctive immersive game features affect the learning efficacy and user acceptance among the participants. The study established that the game was effective in promoting social skills knowledge acquisition. It demonstrated that increasing playability influences playfulness in gameplaying and the importance of reflecting playfulness as an intrinsic factor in shaping an individual's acceptance of a game. Game design researchers should place high priority on the two success factors, playability and playfulness, when designing gaming tasks. Three variables, gender, gaming experience and gaming self-efficacy, introduced in the research, had no effect on behavioral intention. By combining these two approaches, the study provided evidence about the educational efficacy and impact of the game and a better understanding of the users' profiles, experiences and behavioral intention to use the game.

CHAPTER 1 INTRODUCTION

1.1 Background and Motivation

1.1.1 Social Skills Training

Social skills can be viewed as “the specific behaviors that an individual uses to perform competently or successfully on particular social tasks”(Gresham, Sugai, & Horner, 2001, p. 333). Children who display social skills consistently across settings and times are believed to be assessed by others as being socially competent (Rubin & Rose-Krasnor, 1992). Socially competent children are able to skillfully coordinate the multiple processes and resources available to them to meet social demands within a specific context, for example, home or school (Iarocci, Yager, & Elfers, 2007). They are able to acquire and maintain satisfactory interpersonal relationships, gain peer acceptance, make friendships and terminate negative interpersonal relationships (Gresham, 2001; Parker & Asher, 1987). On the other hand, socially maladjusted children often find it hard to maintain positive social interactions, solve social problems, handle conflicts and navigate the challenges of the different school settings. These children are usually ignored and rejected by their peers (Crick & Dodge, 1994). The psychological distress of not forming lasting relationships can contribute to social isolation, reduced self-esteem, mental health problems and impact on quality of life (Beauchamp & Anderson, 2010; Evans, Axelrod, & Sapia, 2000). Simply put, social competence is a powerful predictor of school adjustment, success in school and later success in life (Meadan & Monda-Amaya, 2008).

The possible deleterious effects of social skills deficits have underscored the importance placed on research to examine the effectiveness of interventions for children experiencing difficulties in social adjustment (Bierman et al., 2010; Elias,

Gara, Schuyler, Branden-Muller, & Sayette, 1991; Kazdin, Bass, Siegel, & Thomas, 1989; Kazdin, Esveldt-Dawson, French, & Unis, 1987; Sarason & Sarason, 1981). A meta-analysis of 8521 documents on randomized control-group design experiments conducted by Lösel and Beelmann (2003) revealed that a majority of the social skills training confirmed the benefits of treatment. Many universal school-based programs to improve social competence and reduce aggressive behavior have been evaluated for the past three decades, for example, Fast Track PATHS curriculum (Bierman et al., 2010) and Incredible Years: Dinosaur Curriculum (Webster-Stratton & Reid, 2004). These curricula focus on content-related to emotional literacy, problem-solving anger management and friendship skills (Webster-Stratton & Reid, 2004). Interventions during the early years in school when behavior is the most malleable, have a higher probability of success in circumventing these serious problems and reducing future ones than interventions in adolescence, after antisocial outcomes have become inevitably entrenched (Dodge & Pettit, 2003; Flannery et al., 2003).

Typically, most traditional social skills training programs are delivered in a face-to-face manner with children, focusing on peer relations, decision-making and problem-solving (Hennessey, 2007). While this approach has shown to be effective in enhancing social skills in children, issues such as intensive teacher training, adequate time taken for mastering the programs, the basic set of prerequisite competencies that the trainers should have and measures to insure fidelity and quality control of the training should be considered (Rotheram-Borus, Bickford, & Milburn, 2001). Labor intensiveness and cost of implementation increase with increased number of participants (Lane, 1999). Teachers usually want to address their students' needs for social skills instruction but struggle to deliver these social skills instruction as they are

usually hard pressed for time to attend to other instructional priorities (Leffert, Brady, & Siperstein, 2009).

Research has leveraged on the use of technologies to bring novel experiences to learners and ease teachers' task on infusing social skills instruction into their curriculum (Hobbs & Yan, 2008). Technology-mediated training may provide answers to problems apparent in conventional or traditional social skills training. These intervention strategies can optimize available resources as they can provide multiple opportunities for children to learn and practice the social skills in a consistent manner (Fenstermacher, Olympia, & Sheridan, 2006). A computer system also allows repetition of learning tasks without the fatigue sometimes associated with instructors (Parsons & Mitchell, 2002). In addition, the use of technology augments the efforts of the instructors, rendering it possible to conduct the skills training with a bigger number of students in the classroom, thus avoiding the unintended consequences associated with peer aggregations in a group format of children with externalizing problems (Arnold & Hughes, 1999). Clearly with the advancement of different interactive computer-based platforms, there is an increasing interest in providing children with powerful learning environments to foster optimal learning processes (Smeets, 2005).

1.1.2 Potential of Computer Games

Over the years, the perceived potential of computer games in offering unparalleled opportunities for deep, engaged learning have led gaming to mature from a marginal activity toward one with broad foundation of interest and enthusiasm (Begg, 2008). Many studies have pointed to the changing characteristics of today's children that spend their lives surrounded by digital tools and their preferences for games (Oblinger, 2004; Prensky, 2007; Prensky, 2010). As a result of this exposure to an

environment saturated with digital technologies, today's children think and process information differently from their predecessors (Prensky, 2007). The children, who have been called the Net Generation or digital natives, are growing up with a pastime that demands interaction and have become bored using books as a medium of learning (Annetta, 2010; Becker, 2007). Therefore, to motivate children to learn in schools, an increasing number of educators have acknowledged the potential of adopting computer games into classrooms (Becker, 2007). Emergence of this new paradigm of digitally mediated learning commonly known as "digital game-based learning", a phrase coined by Prensky (2007), entails the recognition that games represent experiential learning spaces for imparting skills and concepts (Annetta, 2008; Prensky, 2007; Squire, 2008).

It is unsurprising that children find the interactive features, simulations and immersive environments in games both enticing and engaging (Gunter, Kenny, & Vick, 2008). Educational games, which typically require the use of logic, memory, problem-solving, critical thinking skills, visualization and discovery, generate increased level of children's interest in subject matters (Annetta, 2008). Indeed the growth in technology has created novel and exciting alternative approaches to traditional delivery methods to meet needs of a newer generation of children with their preference for the emerging computer games (Shaffer, Squire, Halverson, & Gee, 2005). The pervasiveness of computer games has challenged and influenced our basic assumptions of learning environments as games can enhance student engagement and promote a learner-centered learning environment (Watson, Mong, & Harris, 2011). If games meet quality criteria and demonstrate that they are effective to support the teaching-learning process, educators will be more willing to embrace the adoption of games in their daily didactics and integrate games into schools, the predominant arena for learning (Dondi & Moretti, 2007; Shaffer et al., 2005).

Advances in technology have made it possible for creation of games to support learning in domains such as Mathematics (Kebritchi & Hirumi, 2008), Geography (Tüzün, Yılmaz-Soylu, Karakus, Inal, & Kizilkaya, 2009), Computer Science (Papastergiou, 2009), Biology (Annetta, Mangrum, Holmes, Collazo, & Cheng, 2009). Games have been used for therapeutic purposes for the treatment of special-needs groups such as the use of cognitive-behavioral treatment for various disorders (Brezinka, 2008), psychotherapy of children with emotional and behavioral problems (Vorderer & Bryant, 2006), improving attention capacity of children with mental retardation (Rezaiyan, Mohammadi, & Fallah, 2007), providing opportunities for children who have attention deficit hyperactivity disorders (ADHD) to have more self-control and be more successful in social functioning and reducing unwanted hyperactive behaviors (Houghton et al., 2004).

1.2 Research Gaps and Objectives

The purpose of this research is to design and analyze how educational games for social skills training affect learning outcomes and user acceptance. In the context of this research, educational or learning games are defined as “applications using the characteristics of video and computer games to create engaging and immersive learning experiences for delivering specified learning goals, outcomes and experiences” (de Freitas, 2006, p. 9). Specifically this research presents a social problem-solving game, *Socialdrome*®, which is developed as a specific instantiation of game-based social skills learning environments. The game is developed with the aim of offering an engaging and pedagogically sound learning environment for enhancing social skills of primary school-going children. The game seeks to intentionally teach children to identify and manage feelings, exercise self-control, solve social problems and

negotiate conflict situations. A scan of the literature elicited two crucial research gaps which would be addressed by two research objectives.

1.2.1 First Research Gap

The first research gap identified is there is a pressing need to develop frameworks and approaches to support practitioners in the design and evaluation of educational games (Connolly, Stansfield, & Hainey, 2009; de Freitas & Oliver, 2006). Researchers have reported that that the initiatives on game-based learning explicitly focusing on assessing the quality of learning games is almost non-existent, as there is a lack of an existing theoretical model or framework to unify all the different aspects of evaluation (Dondi & Moretti, 2007; Fu, Jensen, & Hinkelman, 2008). Good quality games should be able to address both the education dimension on how to achieve the learning objectives, and the ludic dimension on how to achieve the desired gaming experience (Echeverría et al., 2011). As a result, most educational games are produced without the application of coherent theory of learning or scientifically rigorous studies and implemented in the classrooms without established guidelines (Shaffer et al., 2005; Watson et al., 2011). Arguably, it is necessary to have suitable frameworks to facilitate the provision of educational games with pedagogical sound features that are lacking in most existing games (Moreno-Ger, Burgos, Martínez-Ortiz, Sierra, & Fernández-Manjón, 2008). Dondi and Moretti (2007) also found that developing criteria to assess learning games is complex and presents problematic aspects due to difficulty and subjectivity of the evaluation processes. Mayer (2011) recommended that in order to provide guidance to game developers, it would be useful to build a scientifically rigorous research base with research-based design principles and research-based theories of learning to ensure the effectiveness of educational games. This sentiment

was echoed by DeLeeuw and Mayer (2011) that a value-added approach to games research aiming to identify instructional design strategies or features to improve learning, should be undertaken.

Kebritchi and Hirumi (2008) in their review on educational games discovered that less than half of the authors who produced the games reported pedagogical foundations for their games. The other authors either described unclassified pedagogical strategies or did not report any theories or strategies explicitly. To bring about engaged learning, ideas, designs and strategies that game designers incorporate in games should be guided by strong theoretical foundations (Dickey, 2005; Kafai, 2006). Law, Kickmeier-Rust, Albert, and Holzinger (2008) propounded that a lack of sound instructional models, based on pedagogical standards and didactical methods, is viewed as a weakness in most educational games. A lack of uptake of games in formal learning contexts may be due to inadequate evidence-based research on evaluations of educational games which led to the viewpoint that games are regarded as peripheral to classroom practices (de Freitas & Oliver, 2006).

An approach commonly taken in current research on commercial games is to design and evaluate games using game design principles which focus on user experience and usability (Desurvire, Caplan, & Toth, 2004; Koeffel et al., 2010; Korhonen & Koivisto, 2007; Laitinen, 2006). While user experience requires an understanding of player enjoyment, usability deals with the interface (controls and displays); mechanics (interacting with the gameworld); and gameplay (problems and challenges) (Sweetser & Wyeth, 2005). Heuristics developed from these principles to identify problems in games do not assess whether the games educate the targeted users.

With a slew of commercial games hitting the market, there are games that have been repurposed for application in the classrooms. As these games strive to uphold

compelling goals of interactive entertainment, the depth of instructional contents and strategies are usually overlooked (Hirumi & Stapleton, 2009). Playing these entertainment games leaves the learners entertained but without any meaningful learning that is valued as in formal education (de Freitas & Oliver, 2006; O'Neil, Wainess, & Baker, 2005; Prensky, 2010). To address the identified research gap, the first research objective is as follows:

RO 1: Design and evaluate the game prototype based on instructional and game design principles with sub-objectives that include:

- Uncover perceptions of target users on the playability of the game.
- Elicit design ideas and concepts for the creation of game modules that meet the needs of the target users.

To fulfill the first research objective, the research seeks to develop an approach to design and formatively evaluate a game prototype that is conceptualized and built based on an educational model which integrates concepts from educational psychology, instructional principles, game design principles, human-computer interaction and information systems studies. Principles of a user-centered approach using participatory heuristic evaluation and participatory design will be adopted to keep the needs of the users foremost in the design process. Unfortunately, a problem in most circumstances is the user is seen as an “end-user”, a mere peripheral, usually the last person to be considered only when the product is ready for use (Shackel, 2009). Designing for children is different from designing for adults. Piaget propounded that children fundamentally experience and understand the world differently from adults (Bruckman & Bandlow, 2003). Evaluating a game with children from the envisioned user group is

a way to enhance the quality of a game and to ensure that it is well-received by the representative users (Barendregt & Bekker, 2004). The feedback and contributions of the users will then be translated into the design directions of the game.

1.2.2 Second Research Gap

The second research gap is the need to study the effects of social skills games on the users. A scan of the literature available on online databases such as EBSCOHost, ScienceDirect, Educational Resources Information Centre (ERIC), Association for Computing Machinery (ACM) Digital Library, reveals that there is a relative dearth of empirical studies on games for social skills acquisition. There are commercial games not specifically produced for educational use but implemented for training of social skills of children. For example, massively multiplayer online role-playing games could be used for learning social skills such as how to coordinate, cooperate and participate in sociable interaction with people (Ducheneaut & Moore, 2005; Ducheneaut, Yee, Nickell, & Moore, 2006; Whippey, 2011). A shortcoming in this approach is that these games were designed for entertainment, without taking into account psychological and educational considerations. Moreno-Ger, Burgos, Martínez-Ortiz, Sierra, and Fernández-Manjón (2008) posited that commercial games, such as the SimCity and the Civilization sagas, could be repurposed for education due to their rich and detailed contents but should be used with care as some of the concepts in these games may be oversimplified and may lead to wrong conclusions.

The research stream on user acceptance of new technological systems is a mature research area in contemporary information systems literature. Through tracing the user acceptance research, the acceptance of educational games as learning tools is

hardly studied or virtually unknown (Bourgonjon, Valcke, Soetaert, & Schellens, 2010).

The above identified research gap points toward the value of research in developing parallel robust evaluation methodologies to assess educational efficacy and user acceptance of games so as to offer a more complete understanding on designing games for social skills training and thus close the identified second research gap. In response, this research conducts two approaches of evaluation. Thus, the second research objective is as follows:

RO 2: Investigate the learning outcomes and user acceptance that the children derive from the game-based learning environment with sub-objectives that include:

- Determine the extent of increase of children's social skills knowledge through participation in the game-based learning environment.
- Examine whether user differences affect the learning gains of children that participate in the game-based learning environment.
- Investigate the interrelationships among the two factors, playability and playfulness, that affect user acceptance of the game-based learning environment among children.
- Examine whether user differences affect acceptance of the game-based learning environment among children.

It is important to assess whether the game-based learning environment is able to achieve its educational efficacy and whether user differences affect the learning gains. Further as the game-based learning environment is designed for hedonic purposes, the question is no longer only about its effectiveness but should extend to

how well its design is able to afford users with an engaging experience (Dickey, 2005). Investigating the experience when users interact with a game has been the subject of much emphasis in the human computer interaction (HCI) community (Koeffel et al., 2010). The concept of user experience has been further developed for evaluation and design of games (Jegers, 2007; Sweetser & Wyeth, 2005). Researchers have shifted their focus on principles that go beyond usability and have studied the playability for games with respect to how users experience games as fun, entertaining and enjoyable (Desurvire & Wiberg, 2010). To make games playable for the users is to identify the criteria or attributes of games that collectively contribute to enjoyment and pleasure (Yannakakis & Hallam, 2007). Interaction with the system could then create a state of playfulness and a great deal of satisfaction in the users (Woszczyński, Roth, & Segars, 2002). The experience of playfulness will increase the likelihood of adopting the system in future (Lin, Wu, & Tsai, 2005). User experience of playfulness is therefore considered as important in shaping behavioral intention and acceptance of games (Fang, Chan, Brzezinski, & Xu, 2005). Prior work has stressed the importance of variables related to user differences, such as gender differences, gaming experience and gaming self-efficacy, in the adoption of new technological systems (Blumberg, Rosenthal, & Randall, 2008; Chang, Lee, & Kim, 2006; Chen, Chen, & Yen, 2011; Ha, Yoon, & Choi, 2007; Ong & Lai, 2006; Venkatesh, Speier, & Morris, 2002; Wang & Wang, 2008). These studies have produced mixed results and it is therefore inconclusive whether a priori differences have influence on behavioral intention to use new systems.

Hence, to fulfill the second research objective, the research entails the implementation of a summative evaluation of the game in a formal classroom setting. Research methodology will be devised to examine how the distinctive immersive

game traits or features affect learning outcomes and user acceptance of the participants, paying particular attention to user differences.

1.3 Outline of Thesis

The thesis report is organized into seven chapters as depicted in Figure 1.1.

Chapter 1 presents the background and context of the research, research gaps and research objectives. Chapter 2 offers a literature review on traditional and technology-mediated social skills training, game-based learning, principles and practices of design and evaluation of games. Chapter 3 discusses the educational model on which the game is conceptualized and built, and details the design of the game. The model integrates concepts from educational psychology, instructional design, game design, information systems and human computer interaction principles. Chapter 4 explicates Study I which entails a formative evaluation carried out on the game prototype during the early part of the game design process. It describes the heuristic evaluation and participatory design approach involving the participation of the prospective users as users, testers, informants and design partners.

Chapter 5 describes how the final game prototype is developed based on the results obtained from Study I and after undergoing several iterative cycles of testing and evaluation. Chapter 6 explicates Study II which is the summative evaluation of the final game prototype. It describes the research methodology, the research objectives and hypotheses development, the research design, procedures, data collection protocol, results and discussion of the findings. Finally, Chapter 7 brings the entire research to a close by comparing this research with other related research, discussing the implications for game design and implementation, contributions, limitations of the research and recommendations for future study.

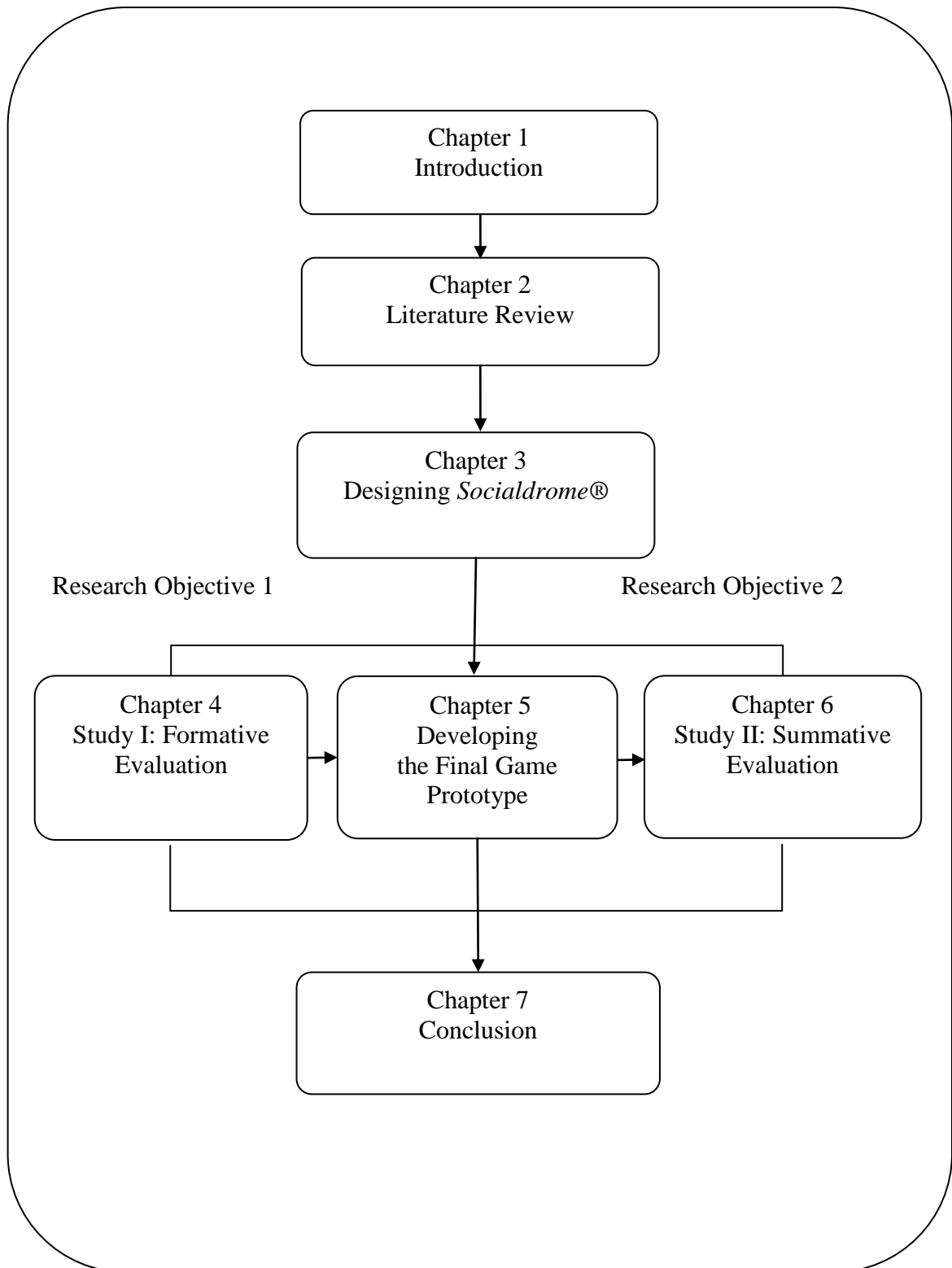


Figure 1.1. Structure of thesis

CHAPTER 2 LITERATURE REVIEW

This chapter provides a review of traditional and technology-mediated social skills training as the game-based learning environment designed for this research targets the learning of social skills. This is followed by a discussion on game-based learning, approaches and guidelines for game development, principles and practices of game evaluation and limitations of game-based social skills training.

2.1 Acquisition of Social Skills

2.1.1 Social Adjustment of Children

To a large extent, children face a host of complex and challenging social situations in schools and this has given rise to the concern on the quality of children's social relationships (Crick & Dodge, 1994). Children may encounter difficulties in communicating their physical and emotional needs to their peers and significant adults due to their inadequate knowledge of social rules and inability to appraise social situations (Quinn, Kavale, Mathur, Rutherford, & Forness, 1999). Middle childhood, the period of life between 8 to 11 years, is considered an important developmental stage for children as they spend an increasing amount of time with their peers. They interact in social contexts, whether working in groups at the classrooms or playing rule-based games at the play fields (Hebert-Myers, Guttentag, Swank, Smith, & Landry, 2006). At this age group, they are expected to be autonomous and able to handle the complexity of social situations without a high degree of structure and support from their key adult care-givers (Landry, Smith, & Swank, 2009). Having a sophisticated repertoire of social skills and an interpersonal problem-solving capacity contribute to success in the management of everyday social interactions (Spence,

2003). Besides positive outcomes such as peer acceptance and positive peer relationships, social skills are essential for academic achievement and teacher acceptance (Lane, Menzies, Barton-Arwood, Doukas, & Munton, 2005).

Research has identified that social maladjustment places children at risk in early life as they are integral to many emotional, behavioral and psychological problems such as social phobia (Spence & Donovan, 2000), aggression (Nangle, Erdley, Carpenter, & Newman, 2002), depression (Segrin, 2000), oppositional behavior, loneliness and social dissatisfaction (Parker & Asher, 1987, 1993). If left untreated, they may be predictive of maladjustment in school and poor academic performance (Jones, Sheridan, & Binns, 1993). Empirical findings by Malecki and Elliot (2002) lent support that social skills are positively predictive of concurrent academic achievement and future academic functioning. Longitudinal analysis by Welsh, Parke, Widaman, and O'Neil (2006) revealed that social and academic competence influence each other reciprocally over time.

In fact, the negative consequences of impairment of social skills seem to be precursors of more serious problems in adolescence and adulthood such as dropping out of school, juvenile and adult criminality, and adult psychopathology (Bongers, Koot, Van der Ende, & Verhulst, 2008; Cowen, Pederson, Babigian, Izzo, & Trost, 1973; Dodge & Pettit, 2003; Parker & Asher, 1987; Trentacosta & Shaw, 2012). In short, these studies suggested that there is a link between social maladjustment in childhood and later life difficulties.

2.1.2 Theoretical Underpinnings of Social Skills Acquisition

Empirically-based procedures that are effective in the assessment and treatment of social skills deficits in children have their underpinnings in several theoretical

models. Widely cited are the operant, social learning and cognitive-behavioral theoretical approaches (Elliott & Gresham, 1993). Theories in cognitive and social psychology such as attribution, decision-making and information-processing theories have given rise to social information-processing theories which have remained at the forefront of many intervention programs (Dodge & Crick, 1990; Ladd, 1999). Social information-processing theories are built on the premise that social cognitions are the mechanisms that influence the social behaviors of children. These theories offer a model on how children process and interpret social situations and how misunderstandings may contribute to increased likelihood of maladaptive behavior.

The Social Information-Processing Model, developed by Crick and Dodge (1994) is widely adopted in empirical studies to conceptualize social skills training, (Arsenio & Lemerise, 2004; Burgess, Wojslawowicz, Rubin, Rose-Krasnor, & Booth-LaForce, 2006). This model organizes steps of social problem-solving to explain children's social adjustment into a six-step nonlinear process: (1) encode external and internal social cues, 2) interpret and form mental representation of cues, (3) clarify goals, (4) access from memory possible responses, (5) select the most positively evaluated response, and (6) enact the behavior. The model serves as an important guide for intervention programs and has potential for contributing significantly to the understanding of children's social adjustment. Children are considered as active agents who apply their social knowledge to guide the processing of social information (Dodge & Pettit, 2003). Within social interaction, children enact behavioral responses based upon processing external and internal cues using their social knowledge (Cory, Dattilo, & Williams, 2006). Berk (2009) purported that social problem-solving affects social competence profoundly as children who are prosocial in their behavioral

characteristics, interpret social cues accurately, formulate goals that enhance peer relationships and have effective problem-solving strategies.

2.1.3 Social Skills Training

Social skills training for children is a form of structured program necessary to help them display prosocial behavior, increase emotional awareness, establish positive relationships and reduce aggressive behavior toward their peers (Bierman et al., 2010; Hennessey, 2007). It has been strongly endorsed that an important approach to intervene with children who either are at risk in engaging in anti-social acts, or already have displayed aggressive behavior is to offer them structured social skills training (Bullis, Walker, & Sprague, 2001; Daunic, Smith, Brank, & Penfield, 2006). Not surprisingly, these concerns on preventing the development of at-risk and anti-social behaviors have extended to children with regular development and no particular clinical concerns (Parker & Asher, 1987).

Universal school-based social skills training, which consists of practices to support desired behavior for all students, is recognized as beneficial and this has galvanized an increase in the implementation of these programs for students' effective life functioning in schools (Bierman et al., 2010). Design of universal interventions for use with a broadly defined group (e.g. classroom or an entire school) focuses on increasing the prosocial behavior of children and youth across a diverse spectrum of individuals (Bullis et al., 2001). Unlike targeted interventions designed for at-risk children, universal interventions are intended to typically impact a large population of students. It is without question that schools represent the most important setting in the lives of children for them to establish skills in initiating and maintaining interpersonal

relationships and developing skills that are crucial for peer acceptance (Evans et al., 2000; Gresham, 1988).

2.1.4 Technology-Mediated Social Skills Training

Innovation and flexibility in the instructional delivery systems have resulted in the fueling of diffusion of emerging technologies in the learning context (Nworie & Haughton, 2008). These technology tools hold potential promise for educational use as children are captivated by the visual, aural and dynamic features present in technology-rich environment (Kennewell & Beauchamp, 2003). The potential of technology-mediated applications has led researchers to harness their usefulness for the social development of children. These techniques to impart social skills have grown to be more sophisticated over the last 10 to 15 years (Scattone, 2007).

Novel techniques are emerging to integrate new technologies into social skills instructions. In using digital media, a multidimensional forum for the creation of digital social stories can be structured to allow teachers to implement specific target behaviors to meet children's functional needs (More, 2008). Practices using video-modeling interventions, whereby individuals watch video recordings of skills displayed by another person, help them to achieve the target social behavior in a visually tangible manner (Gul & Vuran, 2010). Barakova, Gillessen, and Loe Feijs (2009) developed an interactive multi-agent platform consisting of building blocks to teach social skills to autistic children. Using the interactive blocks, games were created with the intention for the children to observe the "social" behavior of the blocks and understand the elements of social interaction.

Technology-mediated training may address problems apparent in conventional or traditional social skills instruction. It offers opportunities for children to experiment

a set of particular skills in relative safe and non-threatening settings, thus minimizing potentially threatening and frightening “real world” consequences (Griffiths, 2002; Parsons & Mitchell, 2002). Technology-mediated training has the capability of allowing children to practice repeatedly before testing out in the real life settings (Parsons, Leonard, & Mitchell, 2006). Fenstermacher, Olympia, and Sheridan (2006) provided empirical evidence that the non-intrusive coaching style of a computer-facilitated social skills program allows children to view interactive “real-world” video scenarios and maintain gains in behavioral enactment of social problem-solving skills.

2.2 Game-Based Learning

Many researchers, practitioners and learning theorists have examined the role of games in education and have emphasized that children can understand concepts and skills through the integration of games into the instruction process (Egenfeldt-Nielsen, 2007; Gee, 2007; Prensky, 2007; Squire, 2008; Virvou, Katsionis, & Manos, 2005). Games present students with a learner-centered model of instruction where a “learning by doing” strategy is adopted instead of “learning by listening” (Garris, Ahlers, & Driskell, 2002). This emerging model puts primacy on designing immersive experiences for learners through experimentation and problem-solving (Squire, 2008).

Research has been growing in support of games as intrinsically motivating learning environments to engage players in learning activities. A pilot evaluation using mobile game-based learning revealed that principles of engagement and motivation incorporated into the game created an immersive experience for children in the learning of concepts (Facer et al., 2004). Students made significantly more learning gains by participating in a game-based learning context compared to those in the traditional school context (Tüzün et al., 2009). The study undertaken by Papastergiou

(2009) also showed that the gaming approach was more effective in promoting students' knowledge of computer memory concepts and more motivational than the non-gaming approach. Virvou, Katsionis, and Manos (2005) carried out a study to compare the educational effectiveness of an educational virtual reality game, *VR-ENGAGE*, with an educational software that does not incorporate game characteristics. Not only did the results show that the game was more motivational and educationally effective than the conventional educational software without game characteristics, but it also revealed that disengaged students with motivational problems benefited the most from the game environment.

2.3 Approaches for Developing Games

Gee (2007) propounded that well-constructed games bring about deep learning. The act of simply inserting academic contents inside games does not guarantee that they will meet educational goals. From the start of the design process, sound pedagogical foundations and good game design principles should be considered carefully. Approaches to designing from the learning theory viewpoint, designing from the instructional design viewpoint, designing from the player interaction viewpoint, designing from the user-centered viewpoint and designing using a participatory design approach are outlined to encapsulate the basic design requirements for educational games.

2.3.1 Designing from the Learning Theory Viewpoint

Researchers have examined psychological theories of learning and purported that they have important implications for designing successful learning activities (Markopoulos & Bekker, 2003a). There is a wide array of learning theories founded on

a diversity of philosophical assumptions concerning human learning (Green & Piel, 2002). Johnson and Huang (2008) recommended that an eclectic collection of learning theories is necessary for designers to fully maximize the capabilities of game technologies. Hung (2001) proposed that a perspective of complementing the use of the different learning theories based on the different instructional objectives and learning contexts should be taken as each theory is useful in a different context.

In the context of this research, computer games can be mapped onto two dominant psychological paradigms, behaviorism and constructivism. The first generation game design was offered by the traditional computer-assisted instruction in the 1960s in which participation by learners was characterized by a passive, stimulus-response process (Semple, 2000). The term “instruction” clearly connotes a very directed and controlled approach to teaching. The game design is influenced to a large extent by the behaviorist’s perspective which assumes learning occurs when the learner unreflectively practices a skill using trial and error until a positive response occurs (Egenfeldt-Nielsen, 2007). For example, in a study by Mioduser, Tur-Kaspa, and Leitner (2000), computer materials used in a reading training program were based on the behaviorist principles where tasks are practiced and mastered. This approach which forces students into a “drill and kill type learning” is unpopular and negatively perceived by those in the educational circle (Gentry, 2006). However Ke (2008) in his study using *ASTRA EAGLE*, a series of Web-based games developed to reinforce mathematics standards, demonstrated that computer mathematics drill games were able to enhance students’ positive attitude toward mathematics learning.

Over the years, the emergence of cognitive research literature brought about the change of emphasis to the constructivist approach of learning (Mayes & De Freitas, 2001). Constructivism, a learning theory, originally developed by Piaget, emphasizes

the cognitive development of children (Greeno, Collins, & Resnick, 1996). Learning is viewed as an active process in which learners choose and transform information, construct hypotheses and make decisions, relying on a cognitive structure to do so (Connolly & Stansfield, 2006). To the constructivists, technology augments cognitive activity, bringing about a reorganization and extension of the learners' cognition. Technology can be seen as a tool capable of offering new representations of phenomena that would otherwise be impossible, and consequently creating new understanding in the learners (Cunningham & Duffy, 1996). Games should have attributes of constructivism and provide abundant opportunities for exploration, discovery and research as readily favored by Piaget (Ibbitson, 2005). In learning game rules, gameplay and narratives, players are engaged in logical thinking to process information and structure it in their mental schema when they negotiate the virtual gameworlds (Ang, Avni, & Zaphiris, 2008). Based on the constructivist paradigm, *HI FIVES* was an effective tool for students as it allowed them to construct multiuser games and be engaged in active learning (Annetta, 2008).

Aspects of constructivism can be found in experiential learning which is predominant in games. Johnson and Huang posited that "games are known for their experiential learning approach to develop players' knowledge, skills and even change their attitudes" (2008, p. 317). This view is also echoed by Thatcher (1990) who articulated that games are a form of experiential learning where the player engages in an experience. Usually the experience is a dynamic one in which the problems are presented for resolution and decision-making. Built into the game are situations for the player to evaluate and reflect. In an extensive literature search on the pedagogical foundations of educational games developed from 2000 to 2007, Kebritchi and Hirumi (2008) identified that experiential learning is one of the commonly used instructional

strategies adopted. The constructivist epistemology of experiential learning revolves around cognitive reflection upon concrete experience (Fenwick, 2001). Just as there are many theories of learning, there are different schools of thought regarding the approaches to constructivist experiential learning.

An influential constructivist model of experiential learning that is widely referred to is the Kolb's experiential learning model which draws its intellectual origins from Dewey's philosophical pragmatism, Lewin's social psychology, and Piaget's cognitive-developmental genetic epistemology (Kolb, 1984). Kolb defined experiential learning as "a process whereby knowledge is created through the transformation of experience" (p. 38). The experiential learning theory maintains that concrete experience is insufficient for learning to take place, but the experience needs to be reflected and distilled into abstract concepts and tested in new situations. Well-constructed games can connect the players to the real world concrete experiences which is the heart of the experiential learning approach (Kebritchi & Hirumi, 2008).

2.3.2 Designing from the Instructional Design Viewpoint

It is generally recognized that learning theories inform the design of instruction as they offer clarity and direction to the principles and strategies in the instructional design process and define the outcome of instructional materials (McLeod, 2003; Spector, 2001). Gagné, Wager, Golas, Keller, and Russell (2005) pointed out that while educational psychologists hypothesize about the nature of internal mental events with their learning theories and derive principles about the learning process, it is the instructional designers who apply these principles to the design of the external events or instructions to facilitate learning.

The body of literature citing the importance of applying established instructional strategies to design educational games is growing quickly in recent years. Gunter, Kenny, and Vick (2006) argued that if game designs are not based on well-established instructional theories, the end result is the construction of games that cannot serve as educational tools but only able to entertain the players. Johnson and Huang (2008) postulated that grounded systematic instructional design should be applied when designing games so as to achieve effective design outcome.

There are many instructional design theories used by design practitioners to make instructional-strategy decisions. In Christensen and Osguthorpe's (2004) survey of instructional design practitioners, the most frequently cited theories were Gagné's Events of Instructional Model, Merrill's Component Display Theory, Dick, and Carey's model, Keller's ARCS Motivational Model and ADDIE instructional models. However some instructional strategies are better adopted in games than others. The literature suggests that the hierarchies in Gagné's Events of Instruction (2005) correspond to the increasing level of complexities in game design and can be applied to evaluate the instructional validity of games (Gunter et al., 2006). Instructional designers can apply Gagné's principles to gameplay by designing the Events of Instruction for the players to experience and acquire learning.

Another dimension of instructional design that is better adopted in games is motivational design which is specifically focused on making the instructional processes appealing. Keller (2010) synthesized psychological research on motivation and incorporated a systematic motivational design process into his ARCS Model. Four conditions, Attention, Relevance, Confidence and Satisfaction are encapsulated into the model. He argued that instruction cannot be effective if it is not appealing. The ARCS Model is closely aligned to accepted game design principles and is adopted in

several game studies (Dempsey & Johnson, 1998; Huang, Huang, & Tschopp, 2010).

The model can be used effectively with typical instructional design models such as

Gagné's Events of Instruction (Hayashi, Bourdeau, & Mizoguchi, 2006).

2.3.3 Designing from the Player Interaction Viewpoint

The games developed should not only provide learning contents but should be fun and have the motivational appeal to sustain player interest over time. The games designed should support playful learning where the boundaries between play and learning become blurred, and should include core interactive activities such as (a) exploration through interaction, (b) engagement, (c) reflection, (d) imagination, creativity and thinking, and (e) collaboration (Price, Rogers, Scaife, Stanton, & Neale, 2003). Hong et al. (2009) envisaged that playfulness and learning could be viewed as two ends of a continuum. Players will not learn at the extreme of playfulness and will not experience fun on the other end of learning. Thus, essentially, the challenge is to design educational games to obtain the balance between delightful play and bringing about learning (de Freitas, 2006).

To make learning fun, Malone and Lepper (1987) explored the enjoyable aspects of games and provided a taxonomy for characteristics of fun environments based on four main factors: challenge, fantasy, curiosity and control. Three interpersonal factors, cooperation, competition and recognition, were also suggested to further increase engagement of children and to produce higher levels of sustained interest in the activity. However Malone and Lepper (1987) cautioned that to ensure instructional effectiveness of the game, considerations should be given to the interactions between the features and the overall aesthetic appeal of the design environment, if not, an incoherent and unappealing cluster of these features will result.

An important decision to ensure that the player has an optimal learning experience is the identification of the right genre to create a suitable interactive environment to meet the specific goals of the game (Moreno-Ger et al., 2008). There are many genres that are played in a single-player mode such as strategy games, action games, adventure games, sports games, simulation games and role-play games (Gros, 2007). Over the years, game design has increased in sophistication and now massive multiplayer games (MMOGs) which incorporate narrative, multi-player environments, representations of three-dimensional spaces, and interactive elements are gaining immense popularity (Dickey, 2007; Schrader & McCreery, 2008). Examples of such games are *World of Warcraft*, *Lineage*, *Toon Toon*, *Everquest* (heroic fantasy), *Anarchy Online* (futurist science fiction), and *Motor City Online* (classic car racing) (Dickey, 2007; Griffiths, Davies, & Chappell, 2004). However online single player games are still popular, relevant and useful for learning in classrooms depending on the contexts. This can be illustrated with *Space Station Leonis*, a hybrid simulation-cum-role playing game, designed for the learning of National Education in Singapore classrooms, which was created as a single player game due to the limitations of bandwidth to support real time in-class playing (Chee, 2007). *Prospero's Island* designed to provide a "gateway" into Shakespeare's *The Tempest* is a single player game as the purpose was for the individual student to experience the process of self-discovery (Squire & Jenkins, 2003).

2.3.4 Designing from the User-Centered Viewpoint

The HCI community, in its pursuit of developing user-centered interactive systems, has propounded that the methodologies in design should be driven by knowledge of target users. It should not conveniently accept the central tenet that a

single design fits all (Markopoulos & Bekker, 2003a). Constructing user profiles based on the game designers' self-inferential user definitions or developing distorted conceptions to suit design challenges contribute to problems in the design process (Antle, 2006; Zerfass & Hartmann, 2005).

In addition, traditional user-centered design has been criticized for focusing too much on HCI principles pertaining to adult users and neglecting on issues related to children (Markopoulos & Bekker, 2003a; Shneiderman & Plaisant, 2010). To ensure that good quality games are designed to contribute positively to children's development, sound HCI methodologies should be dedicated to address the needs of children. Designing for children brings with it different sets of demands and challenges, as children have different perceptions and make sense of the world around them differently from adults (Ruland, Starren, & Vatne, 2008). Their ideas of pleasure and fun when they interact with technology may likely be different from what the adults can anticipate. What children expect and how they make meaning in computer applications may not be aligned to the designers' assumptions (Good & Robertson, 2006).

Children at different ages interact differently with technological systems due to their varied cognitive and emotional developmental needs, skills and knowledge (Markopoulos & Bekker, 2003a). Markopoulos and Bekker purported that younger children between 3- and 7-years of age do not have fully developed reasoning skills, so the products developed for them should be based on concrete concepts. On the other hand, they pointed out that older children between 8- and 12-years of age have started to develop a sense of logic, reasoning and simple abstractions, and so more complex and challenging concepts can be integrated into the products. It is important to conceptualize and design the game to meet the characteristics and needs of a specific

age group, as expanding to suit a bigger age audience will most likely make it suitable for no one (Oosterholt, Kusano, & Vries, 1996).

In developing games for children, user-centered design practices call for involvement of children in the game design process, as it is agreed that children can provide useful insights (Hanna, Neapolitan, & Risdén, 2004). A common mistake in designing products for children is not involving the potential users for which the games are intended due to the traditional power structure of the “all-knowing” adult and the “all-learning” child (Druin, 2002). In their research to evaluate concepts for new computer games, Hanna, Neapolitan, and Risdén (2004) concluded that that even in the early concept stages of the product development life-cycle, children could effectively evaluate the appeal and potential of game concepts.

2.3.5 Designing Using a Participatory Design Approach

A pervasive approach used by many researchers to allow the needs of the users to be central in the design of a new technological system is participatory design. This approach not only advocates that the users are knowledgeable and skillful to participate in the user-designer collaboration but the active users’ involvement is beneficial for the creation of satisfying applications (Triantafyllakos, Palaigeorgiou, & Tsoukalas, 2010; Zaphiris & Constantinou, 2007). Many past studies have established participatory design guidelines and techniques for the development of new technology artifacts, learning tools and computer systems that are situated in HCI principles.

Participatory design approaches have been carried out with children, for example, Kids and Teacher Integrated Evaluation (KaTIE) facilitated a child-designer-teacher conversation (Pardo, Howard, & Vetere, 2008). The child-designer dyad allowed the designer to know first-hand the children’s understanding of the concepts

and ideas conveyed in the applications. Using an informant-based design approach with children, Brederode, Markopoulos, Gielen, Vermeeren, and Ridder (2005) were successful in mapping the needs of the children into the design of the game mechanics, plot and interaction of an augmented reality computer game.

Some existing participatory design approaches are geared toward the design of pedagogical contents, for instance, a multimedia language tool for teaching Greek (Zaphiris & Constantinou, 2007). Some require the participants to have some technological knowledge of specific technological tools or programming languages so as to create digital contents (Triantafyllakos, Palaigeorgiou, & Tsoukalas, 2006). For example, participants created “hypermedia” stories using the online tool, 1001 stories (Garzotto, 2008). Some approaches call for the inclusion of another group of stakeholders, the adult experts (Read et al., 2002). These adults usually are either domain experts that can feed information on their domain knowledge or technical experts that can bring literacy in technical issues (Pardo et al., 2008; Roda, 2004). As a result, the participating teams become either multi-disciplinary or intergenerational design teams (Garzotto, 2008) which comprise both adults and children (Pardo et al., 2008). Others require the engagement of the participants over an extended long duration of time, for example, the KidStory project by Druin and Fast (2002) and IDR methodology by Winters and Mor (2008), which is not feasible in evaluation studies with restricting tight deadlines and budget constraints.

2.4 Evaluation of Games

Evaluation carried out during the design process is known as formative evaluation. It is a technique typically conducted to address interface design, gameplay and instructional issues with the intent to improve (Papastergiou, 2009b). On the other

hand, summative evaluation is a procedure performed at the end of the development phase on the finished product and is usually associated with evaluating the impact or effect of the system (Shiratuiddin & Landoni, 2002). Some methods of evaluation relevant to this research are discussed in this section.

2.4.1 Usability Evaluation

Usability evaluation techniques involving actual users are far more complicated and difficult to carry out but the results are more reliable (Zerfass & Hartmann, 2005). For example, recruiting children as evaluators may pose problems as they have shorter attention span compared to adults (Tan, Goh, Ang, & Huan, 2011). The findings of these tests are then translated into design guidelines to be used as input for the design process (Barendregt & Bekker, 2004). To further shape usability evaluation practice, Markopoulos and Bekker (2003b) developed a framework for the assessment of usability testing methods for children with different capacities and characteristics. The dimensions in their framework included the components that constitute the methods, the criteria for assessing the usability testing methods and the special characteristics of the children as test participants.

It is advocated that researchers should be cognizant of the diversity of the target user groups and ensure that the usability testing methods are customized to meet the needs of the children (Höysniemi, Hämäläinen, & Turkki, 2003). Often, adults do not understand what children want as they differ in their perspectives and opinions of interactive products from children (Read & MacFarlane, 2006). Designers should not second-guess the users and make assumptions about their needs and wants as they can never completely predict user behavior (Desurvire et al., 2004). Further, the children are able to identify the motivating features of the interactive products based on their

experiences of what they find enjoyable and how they learn (Nousiainen & Kankaanranta, 2008). As children have a voice that should be heard and valued, perspectives, action and attitudes should be gathered directly from them as proxy-reporting is inadequate. (Borgers, de Leeuw, & Hox, 2000)

Virvou (2008) argued that that if a game is less usable, then children would not like to play it. In the realm of application design, the definition of usability by the International Organization for Standardization (ISO) refers to the extent to which the users can achieve effectiveness, efficiency and satisfaction in a specified context of use (Gulliksen, Harker, & Steger, 2001). Generally, usability addresses the game controls, screens, menus, displays and other interface elements through which players utilize to interact with the game (Korhonen & Koivisto, 2006; Laitinen, 2008). So the game interface should be easy to learn and use without inducing confusion to players. It also refers to the degree of accessibility to which players can learn, control and understand a game without the need of referring to a manual (Desurvire et al., 2004; Pinelle, Wong, & Stach, 2008).

2.4.2 Evaluating User Experiences

Evaluating games like other entertainment technologies remains a challenge as there is a need to acknowledge that there are fundamental differences between games and productivity applications (Fernandez, 2008). Pagulayan, Keeker, Wixon, and Fuller (2003) pointed out that productivity applications are tools to make tasks easier to use and increase the productivity of the users. On the other hand, games are designed to enhance the pleasure of the process of playing. If games are too easy to use, they will lose their appeal. They should be designed such that players do not achieve the goal too quickly without much effort. Deliberately imposing constraints on

the user behavior contributes to making the attainment of goals more challenging and fun (Pagulayan et al., 2003). As games are about fun, enjoyment and immersion (Koeffel et al., 2010), the focus is shifted from usability analysis to user experience analysis (Fernandez, 2008). Gameplay is about an experience that transforms the perceptions and attitudes of players toward the game. Past work on game designs has used the concept of playability in the evaluation of game experience (Sánchez, Zea, & Gutiérrez, 2009a).

Sánchez et al. (2009a) argued that analyzing the quality of games using usability is insufficient to describe the full optimal player experience. Fabricatore, Nussbaum, and Rosas (2002) described playability as similar to the general concept of usability when applied to games. This viewpoint is also echoed by Järvinen, Heliö, and Mäyrä (2002) who purported that playability can be developed as a collection of criteria to evaluate a product's gameplay or interaction. It refers to the guidelines regarding how to implement the necessary attributes for the desired gameplay or interaction. Put differently, playability functions as a similar evaluation tool and research discipline as usability. Good playability is possible when players understand the gameplay and are able to control the gameplay (Fabricatore et al., 2002).

There have been few attempts to evaluate games by bringing the concepts of usability and playability into a unified framework. Researchers have studied playability evaluation using a set of design heuristics. The first playability heuristics for games were developed by Malone and Lepper (1987) to help designers consider the interaction between the game features and the overall motivational appeal of the game activity. The checklist of heuristics included challenge, fantasy, curiosity and control. Desurvire, Caplan, and Toth (2004) categorized heuristics into gameplay, game story, game mechanics and game usability which have similarities with

Federoff's heuristics (2002) on interface, game mechanics and gameplay. Gameplay, mobility and game usability are incorporated in Korhonen and Koivisto's (2006) core playability model for mobile games. The GameFlow Model by Sweetser and Wyeth (2005) was an attempt to integrate playability heuristics into a validated model for game enjoyment. The core playability heuristics, concentration, challenge, skills, control, clear goals, feedback, immersion and social interaction, were drawn mainly from Csikszentmihalyi's flow theory (1991) and the literature on user experience and usability.

Another concept that links closely to user experience is perceived playfulness which is defined as "the perceived hedonic value amplified by fun, excitement, creativity and pleasure accruing from use of the system" (Çelik, 2011, p. 393). It represents a state of short-lived cognitive experience felt by an individual (Chiang & Lin, 2010). Playfulness implies a belief that interacting with a system would bring about enjoyment or cognitive absorption (including concentration and curiosity) (Ahn, Ryu, & Han, 2007). Hence a person will feel more or less playful at various times when he or she interacts with the system.

Games can be viewed as a hedonic system which is able to provide pleasurable experience to the individuals and able to encourage prolonged use (van der Heijden, 2004). In contrast to productivity applications developed to satisfy benchmarks of efficiency, effectiveness and satisfaction, game designs highlight players' feelings of fun, enjoyment and engagement over their performance (Lee, 2006).

One way to assess the hedonic disposition of games is to study the playfulness aspect. When players are in a state of playfulness, they find the gameplay intrinsically interesting and play them for pleasure without seeking for extrinsic rewards (Moon & Kim, 2001). Studies have been conducted to empirically demonstrate perceived

playfulness plays an important role in behavioral intention to play (Terzis & Economides, 2011; Wang & Wang, 2008).

2.4.4 Evaluating Learning Outcomes

O'Neil, Wainess, and Baker (2005) argued that without an investment in evaluation and collection of clear evidence of impact, games could likely be dismissed as gadgets for fun without any instructional value. From an educational perspective, evaluation of games can be carried out by assessing the measures that detect the desired learning outcomes, which can be regarded as indicators for the evaluation (Wilson et al., 2009). Typically in educational settings, the ultimate goal for users of a system is to attain the specific learned knowledge, skills and attitudes. (Wilson et al., 2009). Assessment of learning could be the users' cognitive ability to solve problems, users' application of knowledge learned, users' attainment of different levels of expertise of skill acquisition and attitudinal changes (Garris et al., 2002; O'Neil et al., 2005).

Educators in instructional settings such as Kebritchi, Hirumi, and Bai (2010), Yip and Kwan (2006), Liu and Chu,(2010) and Ke and Grabowski (2007), had evaluated games by investigating learning achievement through performance tests which were typically used to judge the quality and quantity of learning. Pre-tests were used to determine learning outcomes prior to the intervention and post-tests to examine learning outcomes after the intervention. A social skills knowledge test could be designed as a criterion-based measure to assess learning outcome of children that undergo social skills training (Pfiffner & McBurnett, 1997). It could focus on the specific skills covered during the training or classes and could be used by teachers to determine the specific concepts that the children have learned.

Social skills knowledge is widely used in empirical studies as it has been considered as a predictor of response among children who received the social skills treatment (DeRosier & Gilliom, 2007). Prior studies, for example by Beaumont and Sofronoff (2008) and Laugeson, Frankel, Mogil, and Dillon (2009), have shown that the treatment group improved significantly in knowledge of social skills compared to the control group. Findings of DeRosier and Gilliom (2007) demonstrated that improvements in social skills knowledge predicted improvements in outcome measures on assertive problem-solving, clinical maladjustment, school maladjustment, emotional symptoms and personal adjustment. Transfer of social skills knowledge to real life settings was evident as indicated by the clinically significant improvements in reports of social interaction and home behavior problems by parents of children who participated in the social skills training (Pffiffner & McBurnett, 1997).

2.4.5 Evaluating User Acceptance

Though games may be appealing, the acceptance of computer games for learning cannot be taken for granted (Bourgonjon et al., 2010). There is a need to look at factors or barriers that obstruct the straightforward adoption of video games in schools (Bourgonjon, Valcke, Soetaert, de Wever, & Schellens, 2011). A substantial body of research within the information systems field abounds with different research streams to evaluate new technological systems by examining user behavioral intention to use the new systems. There is a strong relationship between behavioral intention and actual behavior (Moon & Kim, 2001) as research has shown that behavioral intention eventually brings about the actual use of a system (Lau & Woods, 2009). Different sets of acceptance determinants have been explored to study user acceptance of new information technologies (Venkatesh, Morris, Davis, & Davis, 2003).

Understanding the determinants influencing behavioral intention to use instructional games can guide instructional game designers to develop more entertaining games. Ongoing information systems research has adopted various theoretical models to explain individual intentions in technology adoption in a wide variety of settings. Each model has its own distinct roots and is based on different antecedent variables.

One of the well researched models is Ajzen and Fishbein's Theory of Reasoned Action which is drawn from social psychology. It argues that individuals' attitudes and subjective norms influence and shape their behavioral intent to perform a particular behavior (Sheppard, Jon, & Warshaw, 1988). The more positive the determinants are, the more likely will the individuals perform the behavior. Intention, the cognitive representation of an individual's readiness to perform a certain behavior is considered as an immediate antecedent of behavior (Shin, 2010). The Theory of Planned Behavior extended the Theory of Reasoned Action by examining perceived behavioral control as an additional determinant of intention and behavior (Lee & Tsai, 2010). Perceived behavioral control is similar to self-efficacy which refers to the judgement of an individual's capabilities to execute specific courses of action (Mathieson, Peacock, & Chin, 2001; Venkatesh et al., 2003). The Technology Acceptance Model (Davis, 1989), specifically adopted by many researchers to explain computer usage behavior, emphasizes the antecedents which predicts user acceptance of new systems. It has been consistently validated across different technologies such as online games (Lee & Tsai, 2010), the world wide web (Moon & Kim, 2001) and learning objects in e-learning systems (Lau & Woods, 2009).

2.5 Limitations Associated with Game-based Social Skills Training

It should be noted that computer games are not panaceas for the problems that arise in social skills training as they have their limitations and drawbacks. Common in computerized social skills programs is the question of whether the skills and behaviors learned in the computer setting will generalize to the real settings like the playing field and the playground. For generalization of problem-solving to actual life situations, there should be close similarity between the *in vivo* and simulated problems created with the aid of computer programs (Bernard-Opitz, Sriram, & Nakhoda-Sapuan, 2001)

Though sophisticated technology such as virtual reality attempts to create a more effective training environment to be implemented in a real world setting, limitations still exist. The inability to imitate the emotional qualities in humans affects the realism of the characters in the games (Li & Campbell, 2010). If the characters in the games are not regarded as believable or real, the immersive experience is ruined. Virtual worlds like *Second Life* present immersive, rich experiences by blurring the boundary between what belongs to the real world and what is virtual but it cannot fully replicate the real social world in the same way and can never approach the level of fidelity as social interactions in the real world (Boulos, Hetherington, & Wheeler, 2007; Kass, Burke, Blevis, & Williamson, 1993).

Although games are popular among the young generation, they are frowned upon by politicians, educators, media professionals and critics because of their negative effects (de Aguilera & Mendiz, 2003). Many of them are against children's and youths' engagement with games as they view gameplaying as a time-consuming and addictive activity (Chumbley & Griffiths, 2006). Concerns of the negative consequences of playing games on the health of game players are not new (Schott & Hodgetts, 2006). The commonly held assumption is games are seen to provoke

escapism, and excessive gaming is a move away from reality (Calleja, 2010). Fears and anxieties have emerged that the popular gaming phenomenon would create a generation of isolated and passive “mouse potatoes” that prefer to plant themselves in front of their interactive computer screens playing games instead of kicking balls in the field or engaging in other healthy activities (Kline, Dyer-Witthford, & Peuter, 2003). However Griffiths (2004) emphasized that many of these reviews of research conducted indicate that negative consequences of gaming are usually associated with groups that are excessive users and there is no evidence of serious acute adverse effects from moderate gaming.

There are limits to what these games can achieve as they cannot equal the skills, knowledge and experience of a mental health professional (Goh, Ang, & Tan, 2008; Wilkinson, Ang, & Goh, 2008). As the full potential of the games could only be achieved under the guidance of a therapist, the possibility of games replacing the therapist is low (Brezinka, 2008). In studies on computer-aided psychotherapy that uses psycho-educational video games to aid "traditional" face-to-face therapy, review of the data showed that these interventions would produce better results when augmented with face-to-face contact for those with mental health problems (Marks, Cavanagh, & Gega, 2007). In a study by Sharry, McDermott, and Condron (2003), a computer game *Relax to Win* was used as a therapeutic protocol to teach relaxation skills to treat anxiety problems in children. The game was a useful “prop” for the therapist but was not a replacement for a quality therapeutic process. In another study by Delclos and Kulewicz (1986) using computer games, it was established that the students reached a plateau in their problem-solving ability and only the intervention of the teacher could advance them past the plateau.

No doubt there still exist reservations on whether computer games are able to alleviate behavioral problems on their own. Despite the shortcomings of computer games, what is clear is that researchers should continue to develop the positive potential of integrating games for social skills training, while remaining aware of the possible unintended negative effects and limitations.

2.6 Summary

In sum, the chapter addresses five research issues. The first issue covers the growing area of the purposes and approaches of social skills training carried out thus far. Social skills training has emerged as a frontline treatment to remediate interpersonal deficits of children. The review emphasizes the theoretical principles that underlie social skills training to enhance prosocial behavior. A widely adopted model used to conceptualize social skills training is the Social Information-Processing Model. The second issue deliberates the advances in technology which have given rise to technology-facilitated social skills training, hence presenting novel learning opportunities for children to acquire social skills. Unfortunately the ludology of games in social skills training is still very new and lacking in empirical data.

The third research issue suggests there is a significant revolution in approaches of exploiting game-based environments as instructional tools. Within this context, it is envisaged that games as intrinsically motivating environments have the potential to deliver knowledge, skills and bring about change in behavior and attitudes in children. The fourth research issue delineates the approaches and guidelines for game design and evaluation that are relevant to the study. Attention is given to the necessity of integrating central principles of learning and game design principles into games to bring about productive learning outcomes and playful learning in children. Focus is

also given to user-centered design, involving children, the prospective users, as designers of interactive applications. The fifth research issue delineates the approaches for evaluation of games that are recommended to identify problem areas, draw inferences about the quality of games and to study their effects on the users.

A comprehensive literature review indicates that there is lack of evidence-based research models that assimilate concepts from educational psychology, instructional design, game design, information systems, human computer interaction and social skills training. A multidisciplinary approach is taken in this research so as to draw implications for the teaching and learning of social skills using games. Findings from this review provide support on conceptualizing an educational model with theoretically derived variables and components for integration into the game developed for this research. This model may be used by instructional designers for designing and evaluating games for effective social skills learning and positive gaming experiences.

CHAPTER 3 DESIGNING *SOCIALDROME*®

The research seeks to design and evaluate a Web-based game entitled *Socialdrome*® for enhancing the social skills of children during their years in school. *Socialdrome*® is developed such that it can be embedded in the school curriculum for use by teachers as an educational tool.

The development plan, *Socialdrome*®, encompasses five phases as illustrated in Figure 3.1. Phase 1 involves the identification of an educational model for the design and evaluation of the game. The second phase entails the construction of the initial game prototype. Chapter 3 describes the first two phases. The third phase sees the implementation of the formative evaluation with the details explicated in Chapter 4. Findings from the formative evaluation are then systematically analyzed to synthesize and develop the final game prototype in Phase 4, which is presented in Chapter 5. Finally, the implementation of the summative evaluation of the final game prototype occurs in Phase 5, which is described in Chapter 6.

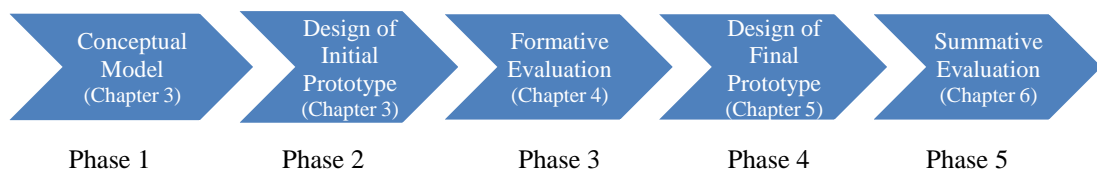


Figure 3.1. Development plan of *Socialdrome*®

3.1 Conceptualizing the Game Design and Evaluation Model

To build the initial game prototype, the first logical step was to conceptualize an educational game model so that the design and evaluation of *Socialdrome*® was grounded within a firm theoretical context. The model would serve as a pedagogical base to clarify the instructional strategies developed in the game to support children's

learning. The proposed model is termed as the Game Design and Evaluation (GDE) Model.

Distilling from the findings of the literature review, it was decided that the GDE model should consist of three stages: input, learning process and consequences, that are similar to the Input-Process-Outcome (IPO) Model by Garris, Ahlers and Driskell (2002). The IPO model, a game model for learning, was selected as it focuses on blending the relationship between gaming and learning, linking instructional strategies, gameplaying and learning outcomes. The model proposes that a combination of instructional contents and game characteristics serve as input. The six game characteristics or attributes identified are fantasy, rules/goals, sensory stimuli, challenge, mystery and control. Next, the process refers to the game cycle which is triggered by the specific game characteristics. Gameplay is a cyclical relationship between user judgments, user behavior and system feedback. Finally, the interaction with the game leads to the training outcomes or specific learning outcomes.

However due to several shortcomings, the IPO model could not be adopted entirely for the purpose of designing and evaluation of *Socialdrome*®. First, the game attributes of the IPO model focused on game design principles but did not include instructional principles. A viable model should be tightly coupled with instructional principles so that the game would be able to achieve the desired instructional goals. As particular emphasis should be placed on instructional design, the pedagogical perspective of the game attributes should be considered so that the designed game learning tasks or activities support the learning processes. Further, the six game attributes (fantasy, rules/goals, sensory stimuli, challenge, mystery and control) covered by Garris and her associates were not suitable as they were not comprehensive enough and had overlap issues. For example, the game attribute, fantasy, allows users

to engage in their imagination and interact in activities that are separate from real life (Garris et al., 2002). Though acknowledging that fantasy is an appropriate component in most games, the attribute lacks comprehensiveness and should not be regarded as an integral key feature for the purpose of designing *Socialdrome*®. Put differently, there should not be a strong emphasis on fantasy elements in the game as players may become too engrossed in an “unreal world”, interacting in activities that are not part of normal experience (Garris et al., 2002). Essentially players of *Socialdrome*® should be able to transfer their learning from the gameworld to the real social world. Another game attribute proposed by Garris and her associates is mystery which evokes curiosity in the users. They highlighted that embedding activities in fantasy contexts also stimulate curiosity in the users. Due to the interrelated and overlapping nature of these two attributes, fantasy and mystery, there is the need to identify a more distinct set of game attributes. Hence, the Events of Instruction (Gagné et al., 2005) and ARCS Motivation Model (Keller, 2010) were integrated to derive the game attributes, which will be elaborated in the next section.

Further, the IPO model disregards individual differences of players. Learners with individual differences have different previous experiences and abilities which will affect the learning process and eventually the consequences (Kebritchi et al., 2010). So evaluating the a priori differences of the intended users will shed light on the matching of the game learning activities with the required learning outcomes and user acceptance, and bring clarity to the quality of games.

Moreover, the IPO model was developed for the design and implementation of effective instructional games and not specifically for the evaluation of social problem solving games. As *Socialdrome*® is a game that fosters positive social relationships of children, it should be grounded with theoretical underpinnings of how children react,

process and interpret social situations. Therefore social information-processing approaches on the link between social cognition and social behaviors of children should be built into the model.

Besides the learning outcomes, there is a need to infuse the concept of user experience and user acceptance as gameplay is an experience that transforms perceptions of players toward the game. Hence information systems and HCI principles will be incorporated to evaluate whether the players have good experiences and perceive the game favorably.

To enhance the IPO model, principles and models from literature on social skills training, instructional design, game design, information systems and HCI were thus integrated to form the GDE Model. The model serves as a suitable lens for instructional designers to design pedagogically meaningful games for social skills acquisition. It also provides a structure for the evaluation of the usability, playability, efficacy and user acceptance of the game as a tool for learning and entertainment.

The GDE model consists of three stages: input, learning process and consequences. The first stage identifies two main categories of input: game attributes and user differences. The game attributes or game characteristics refer to the factors in a game that affect the learning process that instructional designers should be cognizant of. Second, the individual learner experiences a cyclical learning process, made possible by playing the game with its desirable game attributes. Eventually this self-directed gameplaying brings about the intended consequences or output. The effectiveness of the game attributes can be evaluated by investigating the output which can be described in terms of the learning outcomes that are achieved by the players and user acceptance. The GDE Model is illustrated in Figure 3.1 and explained next.

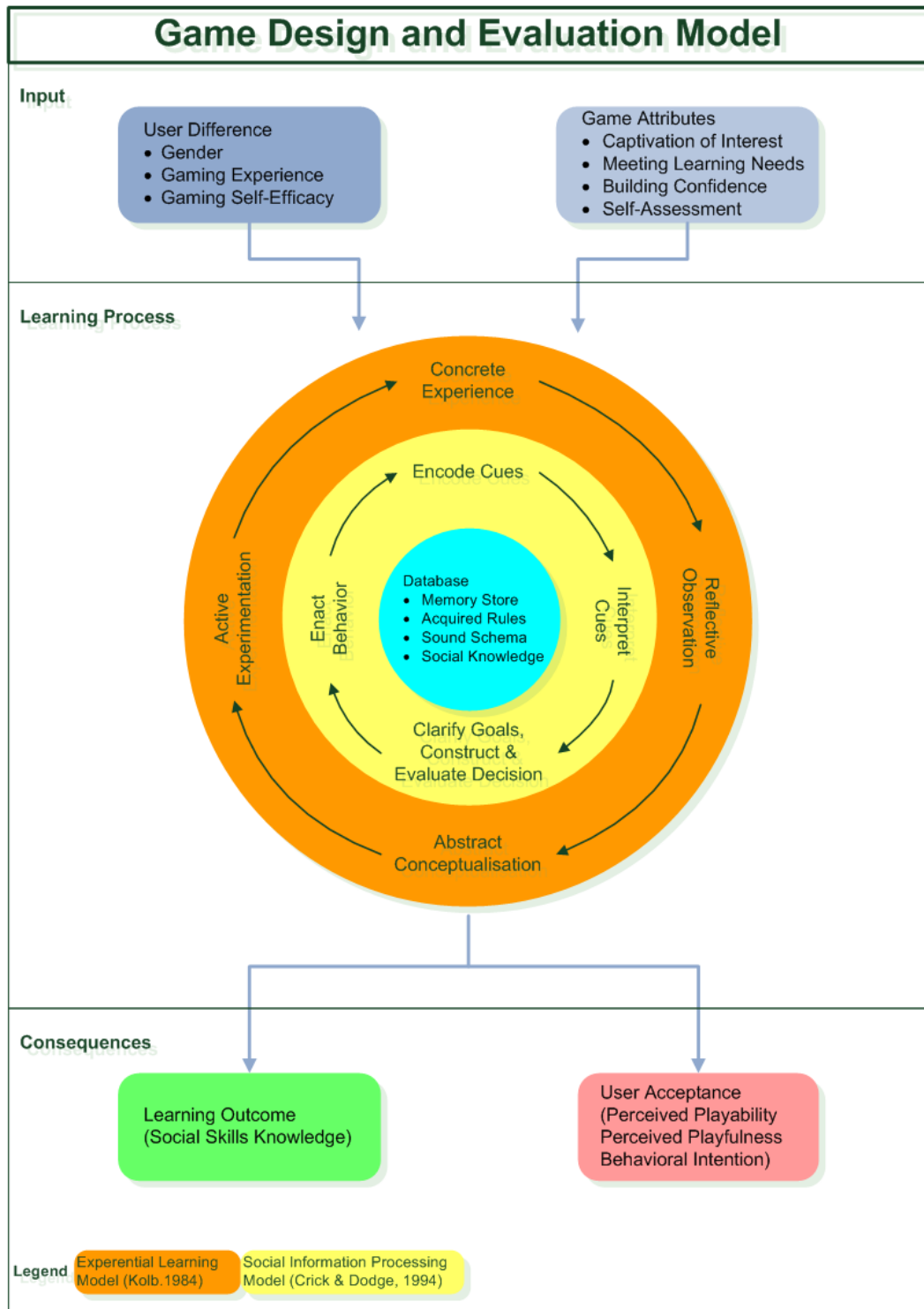


Figure 3.2. Game Design and Evaluation Model

3.1.1 Input

In the GDE Model, the two categories of input in the first stage refer to the characteristics that the learners bring to the learning cycle and attributes in the game that affect the learning process.

User differences. To be included as user characteristics in the model are individual differences in gender, gaming experience and gaming self-efficacy. First, research has indicated that males have a stronger preference toward computer games, greater experience in gaming, more likely to be game-players and show greater confidence than females. (Bonanno & Kommers, 2008; Gentile, 2009; Hartmann & Klimmt, 2006; Lucas & Sherry, 2004; Terlecki et al., 2011).

A factor that shapes male preference for games is the perceptual and cognitive abilities which are prerequisites in playing games (Boyle & Connolly, 2009). Males have an advantage over females in visuospatial reasoning, therefore they are more adept at tasks that exploit their visuospatial skills (Bonanno & Kommers, 2005; Cherney & Rendell, 2010). On the other hand, females exhibiting less prominent visuospatial capabilities, have a preference for concrete, contextualised and repetitive activities that do not demand risk taking (Bonanno & Kommers, 2005). Generally research has shown that there is a difference in preference of type of games between the two genders. Boys tend to lean toward action and stimulation games while girls favor logic and skill-training games (Quaiser-Pohl, Geiser, & Lehmann, 2006).

Next, gaming experience could be assessed by the frequency of use of games, with the “expert” defined as one with above-average frequency of gameplay (Ha et al., 2007). A measure such as the game experience index could refer to years of playing, playing times per week and playing hours in a defined period of time (Qin, Rau, & Salvendy, 2010). Another indicator of experience could be an objective construct

using log data of number of hours spent on the system or it could be measured by subjective perception of the subjects on their use of the system (Castañeda, Muñoz-Leiva, & Luque, 2007). In general, frequent players spending more time on gameplaying, have more gaming experience and often show better game performance than individuals with less experience (Blumberg et al., 2008; Ha et al., 2007).

Finally, self-efficacy, a central concept that emerged from Bandura's (1977) Social Cognitive Theory, is an individual's judgment of his or her capability in a particular domain of functioning and not about the individual's intention (Bandura, 2006). Chen et al. (2011) posits that self-efficacy does not assess an individual's existing skill set, or what an individual has done in the past. Instead it measures one's perception or belief in his or her personal abilities to accomplish a task at hand. Studies on user acceptance of technology have been carried out to demonstrate that computer-efficacy has a positive, direct relationship with perceived usefulness and perceived ease of use (McFarland & Hamilton, 2006). Work has also extended the understanding of computer self-efficacy to operationalize it at two levels: at the general computing level (general computer self-efficacy) and at the specific application level (application-specific self-efficacy) (Marakas, Yi, & Johnson, 1998). In the context of games, a person with high gaming self-efficacy has the confidence to perform the tasks in the gameworld easily.

Game attributes. Game attributes or game characteristics can be considered as factors in a game that affect the learning process. The game attributes are derived from Gagné's Events of Instruction (Gagné et al., 2005) and ARCS Motivation Model (Keller, 2010) which are popular instructional design theories subscribed by many instructional design practitioners (Christensen & Osguthorpe, 2004). Previous work done by researchers, for example, Gunter, Kenny, Vick, and Huang (2006) and Huang

and Tschopp (2010), found Gagné's Events of Instruction and ARCS Model suitable for evaluating the instructional validity of the game as they are in alignment with game design principles.

Gagné's Events of Instruction seek to address the internal and external conditions of learning that are necessary to bring about the five categories of learning: verbal information, intellectual skills, cognitive strategies, motor skills and attitudes (Gagné et al., 2005). Gagné's theory stipulated that internal conditions of learning refer to the state of mind that the learner requires to acquire the new skills, previously learned capabilities and personal goals. On the other hand, the external conditions of learning are the learning environment, the resources and the management of the learning activities, that are required to support the internal learning process. The external events called "instruction", must therefore support the internal events of information processing. A nine-step process called the events of instruction, listed in Table 3.1, could be tailored to achieve the different learning outcomes. Principles of learning motivation from the ARCS model are combined in the game attributes so as to improve the motivational appeal of learning environment (Keller, 2010). This integration of the four dimensions of the ARCS model, listed in Table 3.1, offers guidance in careful blending of game attributes in the game design. Garris, Ahlers, and Driskell (2002) purported that instructional games should enhance both intrinsic and extrinsic motivations. Learners will be motivated to persist in the activity for an extended period and attain learning if they perceive the activity as enjoyable, meaningful and intrinsically motivating (Rieber & Noah, 2008). With the inclusion of Keller's principles of motivation in the game design, learners become self-motivated and self-directed, placing importance on achieving the outcome.

Table 3.1

Comparative Analysis of Gagné's Events of Instruction and ARCS model with Game Attributes of GDE Model

Gagné's Events of Instruction	ARCS Model	GDE Model
		Game Attributes
1.Gain attention	Attention	Captivation of Interest
2.Inform learners of objectives	Relevance	Meeting Learning Needs
3.Stimulate recall of prior learning		
4.Present the content		
5.Provide learning guidance	Confidence	Building Confidence
6.Elicit performance		
7.Provide feedback	Satisfaction	Self-Assessment
8.Assess performance		
9.Enhance retention and transfer of skills		

The nine events of instruction and four dimensions of the ARCS model are integrated into the game attributes of the GDE Model. Gagné's and Keller's ideas share similar elements and connotations that are closely related and suitable for applications in game designs (Gunter et al., 2008). Gagné's skill-building hierarchies fit well with Keller's dimensions and the associations. For example, Gagné's Event 1 'Gain attention' corresponds to Keller's concept of 'Attention', Event 2 'Inform learners of objectives', Event 3 'Stimulate recall of prior learning' and Event 4 'Present the content' correspond to Keller's concept of 'Relevance' and so on, as illustrated in Table 3.1. From the comparative analysis, the four game attributes are identified from the similarities in the concepts (Table 3.1).

The game attributes identified that are critical for learning are 'Captivation of Interest', 'Meeting Learning Needs', 'Building Confidence' and 'Self-Assessment'. A learner-centered approach is adopted as the needs of the learners should take center-stage to ensure the development of rich learning environments (Good & Robertson, 2006). The designed game should be able to captivate the learners' interests, cater to

their learning needs, build their confidence and provide opportunities for them to conduct self-assessment of their achievement.

The combination of the two theories leads to a better approach as Gagné focused on processes that internalize learning and Keller emphasized on motivating learners (Gunter et al., 2006). Arguably, if well-established instructional design theories such as Gagné's Events of Instruction and Keller's ARCS model are applied to game design, knowledge and skills will be more effectively transmitted to the learners. This is the reason why instructional design practitioners tend to rely heavily on instructional design theories to help them make instructional strategy decisions (Christensen & Osguthorpe, 2004). Instructional design theories help designers make sense of complex design situations as they provide a perspective for interpreting, categorizing and explaining the intricacies of instructional design (Yanchar, South, Williams, Allen, & Wilson, 2010).

3.1.2 Learning Process

The learning process refers to the period when the learners are actually engaged in the task (Fernandez, 2008). In the GDE Model, Kolb's (1984) Experiential Learning (EL) Theory and Social Information-Processing (SIP) Model developed by Crick and Dodge (1994) are selected to frame the learning process experienced by the learners.

The Experiential Learning Theory (Kolb, 1984) was integrated into the GDE model as it provides a holistic model of the learning process which emphasizes the integral role that experiences play in the learning process. Despite the fact that Kolb's model of learning has been applied to the design of many instructional practices and tools to accommodate different learning styles of learners, it cannot be used as the only

model in its entirety for the design and evaluation of educational games. It does not provide an adequate grounding for the understanding of the theoretical structure of social problem solving games as it focuses only on the learning processes but not on social-cognitive domains. Another apparent weakness of Kolb's model is learners still need the motive for learning and knowing what should they learn (Lai et al., 2005). For this reason, support in the form of games attributes that contribute to enhancing the effectiveness of the learning process should be incorporated into the proposed model, GDE Model.

Kolb's (1984) EL Model is considered relevant for integration into the GDE model based on the premise that children will experience learning based on the four-stage cyclical model: concrete experience, reflective observation, abstract conceptualization and active experimentation. The learners engage in concrete experience, make reflective observation of the experience, form abstract concepts from the reflections and apply the learning in new situations through active experimentation. Kolb postulated that it is the mental processing and reflection and not the experience alone that builds the deep understanding in the learners. The stages of Kolb's model follow each other in a cycle. Though the stages operate not simultaneously but sequentially, the learners may enter the cycle at any point (Healey & Jenkins, 2000; Kolb & Kolb, 2009).

Drawing from Kolb's four-stage cycle, learners go through a learning cycle (Figure 3.1, Table 3.2). In the first stage, the learners begin the game with a concrete experience such as a designed learning situation. In the second stage, the concrete experience motivates the learners to reflect on their experience. With the new knowledge that they have acquired and their prior knowledge, they mentally process the thinking by posing questions such as "What happened?", "Am I aware of this new

knowledge/skills?” Time is taken for reflective observations about this experience. In the third stage, abstract conceptualization, the learners make generalizations, draw conclusions and insights gleaned from the reflections, addressing questions like: “What does this experience mean to me?” In the fourth stage, the learners apply the new ideas or learning points they obtained through active experimentation in similar and different circumstances and develop new perspectives in their construct of the world. Throughout the goal-directed actions, the learners experience learning and reconstruct insights, modified by the appropriate feedback provided by the game and their reflective observations.

Table 3.2

Comparing Features of the GDE Model with the EL Model

Stage	EL Model	GDE Model (Players' actions)
1	Concrete Experience	The players encounter a concrete experience with a designed learning situation.
2	Reflective Observation	The players reflect on their experience by asking “Am I aware of these new skills?”
3	Abstract Conceptualization	The players make generalizations and draw insights gleaned from the reflections.
4	Active Experimentation	The players apply new learning points and develop new perspectives from active experimentation.

The learning process also includes the components of the Social Information-Processing (SIP) Model developed by Crick and Dodge (1994). As the research involved investigating the learning efficacy and user acceptance of a game that caters to improving social relationships of children, the SIP model should be incorporated into the GDE model as it emphasizes the connection of social cognition in children and how children respond to social situational cues. The SIP model cannot be used on

its own as it was not developed specifically for the evaluation of social problem solving games.

The SIP model is selected to be incorporated into the GDE model as it has a robust basis, inferring from the many empirical evaluations carried out to investigate and verify the links between the social processing constructs and children's social adjustment (Arsenio & Lemerise, 2004; Beauchamp & Anderson, 2010; Fraser et al., 2005; Nangle et al., 2002). The literature abounds with many empirical investigations conducted on validity issues such as testing hypothesized linkages between social-cognitive processes in the SIP model and children's social skills (Burgess et al., 2006; Fraser et al., 2005). The model is a useful tool for social skills training and has potential for contributing significantly to the understanding of children's social adjustment as it links social information processing variables with children's social adaption level (Berk, 2009). As this research investigates social skills knowledge, thus positioning it theoretically within the SIP model would be considered as a meaningful integration on how children apply social knowledge to a variety of cues during interactions within the gameworld.

The SIP model organizes social problem-solving to explain children's social adjustment into the following steps: encode external and internal social cues, interpret and form mental representation of cues, clarify goals, access from memory possible responses, select the most positively evaluated response, and enact the behavior. The game presents situations and scenarios for the learners to practice the components of the SIP Model as depicted in Table 3.3.

At the start, the learners draw from their memory the relevant knowledge gained from previous experience, for example in the form of schemata, to encode external and internal cues. Next, the general mental structure from their previous experience is used

as a guide to interpret, form mental representation of cues and understand the situation presented in the game, which are likely to influence processing at all subsequent steps. As the learners' goal orientations are evoked by their interpretations of cues, the game can provide hypothetical situations for selection of preferred goals or preferences for specified courses of action in the presented situations. The learners access possible responses from long-term memory and construct new behaviors in response to immediate cues in new or novel situations. At this point, faced with decision-making tasks, they make evaluations and select the most positively evaluated response by considering the content of the possible responses, the type of outcomes likely to ensue, the degree of confidence in their ability to perform the responses, and select responses for enactment. Finally in the last stage, they enact the behavior.

Table 3.3.

Comparing Features of the GDE Model with the SIP Model

Stage	SIP Model	GDE Model (Players' actions)
1	Encoding of external and internal social cues	The players encode cues by drawing from memory the relevant knowledge gained from previous experience.
2	Interpretation and mental representation of cues	The players interpret the situation presented based on the mental structure formed from previous experience.
3	Clarification of a goal, response construction and response decision,	The players evaluate and select the preferred response from the hypothetical situations presented.
4	Behavioral enactment	The players enact the behavior.

The SIP model explains the links between children's social-cognitive processes and their aggressive behavior (Burgess et al., 2006). Children suffering from peer difficulties attend selectively to social cues and usually misinterpret others' behavior as being motivated by hostile intent. For example, children who believe that their peers intend to hurt them will place a high priority on retaliation goals in order to get even

with their protagonists (Erdley, Loomis, Cain, & Dumas-Hines, 1997). Their choice of social goals often leads to maladaptive behaviors and failure in their social relationships (Erdley & Asher, 1999; Erdley et al., 1997). Children need to deploy mental operations to process information of social situations which in turn influence their related behavior (Dodge & Rabiner, 2004). They then work through a series of skills to process and encode information and generate behavioral responses. The outcomes of the situations depend on their abilities to perform those particular skills (Arnold & Hughes, 1999).

As learning is defined as a cyclic process through actively constructing knowledge from experience in the gameworld (Garris et al., 2002), depicted in Figure 3.1, the GDE Model emphasizes the meaning of realistic learning tasks using experiential learning. In a single gameplay instance, the learners go through the cycle several times as the learning process is considered as making up of a spiral of cycles (Kolb, 1984). Following a recursive spiral of experiencing, reflecting, thinking and acting, the learners' understanding and learning power is enhanced with each completed cycle (Kolb & Kolb, 2009). The learning of knowledge and skills is anchored in meaningful problem-solving situations encountered by children in their everyday social interactions. To contextualize the problems faced by them, storylines, player and non-player characters in the gameworld relevant and appealing to the target audience would be deployed. The design features and narrative thread in the game-based environment would serve to motivate the children to stay immersed in the game cycle.

3.1.3 Consequences

In the third stage, the consequences of the cyclic learning process are defined by the learning outcomes that are achieved and user acceptance (Bourgonjon et al., 2010; Fernandez, 2008; Garris et al., 2002). These consequences are also influenced by the input, the first stage of the GDE Model. Thus the effectiveness of the game can be evaluated by investigating the consequences that happen.

With the achievement of the learning objectives defined by the game, the desired specific learning outcomes may be attained. Based on the GDE Model, learning outcomes derived from the cyclic experiential process is the social skills knowledge. Fraser et al (2005) posited that accrued knowledge in social skills influences the way children encode and interpret cues, attribute the cause of the social events, construct goals in a social context, and develop behavioral repertoires. Findings from their research indicate that children who received the 'Making Choices: Social Problem Solving Skills for Children' program were able to increase their social skills knowledge and alter the ways they evaluated social information and made social decisions, and produced significant changes in their classroom and peer-related behavior. Therefore it is anticipated that the children after undergoing the game-based social skills training should be able to acquire social skills knowledge.

Another consequence of gameplaying to be considered is the user acceptance among children which is tied tightly with factors influencing user experiences. How users feel about the new technology would affect whether they are motivated to adopt it. Clearly the success factor of user acceptance depends on the experience: the better the experience, the higher the acceptance of the new technology (Shin, 2009). User experiences are influenced by both the hedonic and pragmatic game attributes as well as the individual profiles of the learners (Fernandez, 2008). In the game design field,

playability characterizes and measures the user experience in using a specific game system (Sánchez et al., 2009a). Perceived playability or perceived game usability is defined as a set of attributes or properties that contributes to the achievement of specified goals with effectiveness, efficiency, satisfaction and fun in a playable context of use (Sánchez, Zea, & Gutiérrez, 2009b). Gathering learners' perception on the playability of the four game attributes, 'Captivation of Interest', 'Meeting Learning Needs', 'Building Confidence' and 'Self-Assessment' is important for user experience analysis in games.

Another factor is playfulness which is described as an intrinsic motive or belief formed after an individual's experience with the environment (Moon & Kim, 2001). Perceived playfulness is defined as the degree to which an individual believes that an interaction with a particular system would make him or her joyful (Fang et al., 2005). It has strongly been associated with perceived enjoyment and described as the extent to which fun can be derived from using the system (van der Heijden, 2004).

Evaluation from the aspect of behavioral intention to use the game is examined using the construct, perceived playfulness, which has been identified as an experiential motive in the behavioral intention to use a system (Lin et al., 2005; Moon & Kim, 2001). When individuals fall into a playfulness state, they become immersed physically or virtually in the experience itself and find the interaction intrinsically enjoyable or interesting (Ermi & Mäyrä, 2007; Moon & Kim, 2001). Lin, Wu, and Tsai (2005) argued that when individuals carry out an activity for the intrinsic value of enjoyment and fun, they are more likely to have a favourable feeling toward it, and therefore the likelihood of using the system is considered as high (Lin et al., 2005). The perception that the use of a system is enjoyable will translate into a high degree of intention to use it (Lee, Cheung, & Chen, 2005). Therefore perceived enjoyment or

perceived playfulness, which focuses on intrinsic motivation, is believed to play an important role in users' intention toward, and acceptance of the game (Lee & Tsai, 2010).

3.2 Mapping the GDE Model to the Game Design

Based on the GDE Model, the contents of the game should influence cognition, emotion and behavior of children when they process social stimuli in different situations (Crick & Dodge, 1994). The game should take into account individual differences of children as they enter social situations with different biological predispositions, contextual influences and past experiences (Fraser et al., 2005). Due to these differences, children trying to understand a particular situation may wrongly encode cues, misinterpret the intentions of others and choose aggressive solutions (Arsenio & Lemerise, 2004).

For optimal learning, the game should provide real-world examples and problems for concrete experiential learning as postulated by Kolb (1984) in his Experiential Learning Model. It should allow for reflective thinking and fosters cognitive growth in the users. Opportunities should be given for the users to construct beliefs and ideas and mentally process their experiences.

As emphasized by the GDE model, the game must consist of principles of instructional design to facilitate learning (Gagné et al., 2005) and principles of motivational design (Keller, 2010) that stimulate and sustain the goal-oriented behavior of learners. Conditions of learning, which include presenting learning outcomes, the guidance for learning and opportunities to assess achievement, should be provided to the learners. The game should be intrinsically motivating so to get the users to be highly interested and engaged. The game should contain features and

materials to capture interest, meet the learners' needs, build their confidence and help them attain satisfaction through feedback.

Gagne's model of instructional design can be applied to create game events. These events are defined as instructions embedded in purposeful activities that facilitate learning (Gagné et al., 2005). They will stimulate the processes such as encoding, retention or retrieval, that are required for learning to take place (Driscoll, 2005). Thus these events can be arranged in the game such that learners will master the desired learning objectives and achieve the learning outcomes (Gunter et al., 2006). Good instruction strategies in the game should contain most of these steps but they do not have to occur sequentially, that is, the order of the events may vary depending on the learning objective. Similar to Gagne's events of instruction, these game events are heuristic guidelines and intended to be more facilitative rather than prescriptive (Gagné et al., 2005).

The application of Gagné's nine events with assimilation of Keller's principles of motivation, in the game attributes of *Socialdrome*® is explained below.

Captivation of Interest. The game should capture the interest of the learners and stimulate the curiosity to learn with the following game event:

- Game event 1 refers to situation presentation using game features such as animation, visual and sound effects to gain learners' attention and arouse their interest.

Meeting Learning Needs. The game should meet the personal needs and goals of the learners with the following game events:

- Game event 2 informs learners of objectives and goals so that they know what can be accomplished and see the relevance of the new knowledge and skills.

- Game event 3 stimulates recall of prior learning by presenting appropriate context and scenarios to evoke connection with previous knowledge.
- Game event 4 presents pedagogical content which are organized meaningfully.

Building Confidence. The game is able to help the learners believe and feel that they will succeed and control their success with the following game events:

- Game event 5 provides learning guidance for gameplay and didactic resolution so as to boost confidence of learners.
- Game event 6 elicits performance through practice using the acquired knowledge and skills.

Self-Assessment. The game should help the learners assess and feel good about their performance and desire to continue learning with the following game events:

- Game event 7 provides formative feedback on the learners' performance.
- Game event 8 allows the learners to assess performance through summative feedback.
- Game event 9 enhances the retention and transfer of skills through appropriate opportunities.

3.3 Description of *Socialdrome*®

As depicted in Figure 3.1, Phase 2 was to develop an initial game prototype and this is described in this section. The GDE model guided the development of the initial game prototype with key game elements to facilitate the active engagement and learning of players with the game. The game prototype then underwent formative

evaluation in Study I and findings from the formative evaluation were then systematically analyzed to synthesize and design the final game prototype.

Taking reference from the GDE model, *Socialdrome*® was designed with clearly defined learning objectives to help students develop positive solutions in challenging social situations, particularly in anger-provoking ones. The pedagogical contents of the game were adapted from a training manual and a workbook on social skills training written by Ang and Ooi (2003a; 2003b). The activities presented in the manual and workbook consisted of either physical or paper-based games that range from board games to role-playing ones. These books were well-received by local schools and evaluated with children with promising outcomes (Ooi, Ang, Fung, Wong, & Cai, 2007). The game was not a direct translation from the manual and workbook but designed to be a Web-based single player game that is able to give young users an engaging experience and at the same time fulfill the goal and learning objectives of the game.

The lessons in *Socialdrome*® seek to engage children in social activities in a virtual social world. It is augmented with mini-games, interleaved in the gameworld, which deliver explicit instructions on social skills. The game is designed as an adventure game so that it can offer enjoyment and entertainment to children through exploration, puzzle-solving and accomplishment of defined tasks. The adventure game is an interactive story about the character or protagonist whom the player controls (Adams, 2010).

3.3.1 Target Audience

The target audience selected was primary school children between 9 to 12 years. This age group was chosen as it is during the middle childhood years that the

children's growing independence from parents is obvious and peer relationships are becoming important, with more than 30% of the children's social interactions revolving around their peers (Gifford-Smith & Brownell, 2003). This change in children's peer-relevant social worlds requires new demands and a sophisticated repertoire of social skills to handle a host of challenging social situations in schools (Spence, 2003). Learning social problem-solving skills will help children exhibit more prosocial behavior and reduce their aggressive behavior which are addressed by many existing social skills training programs (Joseph & Strain, 2003). Another reason why this age group was selected is that this group has the capacity to cognitively accommodate more sophisticated problem-solving concepts (Daunic et al., 2006) and complex thought patterns (Piaget & Bärbel, 2000).

The game was designed such that it could cater to the needs of the target users who typically would desire to have more positive relationships with their peers and higher level of self-confidence. Besides imparting social skills, another key consideration was that the game should be well-designed to enhance the prospective users' performance and satisfaction (Guo, Savoy, Byrd, & Salvendy, 2009). The game should be engaging and enjoyable enough to keep the children's attention and meet their expectations as possibly, the exposure to high quality sophisticated commercial games has created high expectations for the game environment in the target users (Baranowski, Buday, Thompson, & Baranowski, 2008).

3.3.2 Game Contents

The GDE model guided the development of the pedagogical contents to include the specific processing components that can be taught to children, as proposed by the Social Information-Processing Model (Crick & Dodge, 1994). The model

organizes steps of social problem-solving to explain children's social adjustment into the following processes: encode external and internal social cues, interpret and form mental representation of cues, clarify goals, access from memory possible responses, select the most positively evaluated response, and enact the behavior.

For the purpose of this research, seven modules were designed for evaluation and research. These modules deal with the core competencies: understanding of feelings, anger coping techniques and social-cognitive skills. The contents specifically target the various cognitive-behavioral difficulties manifested by children during social setbacks.

The core competencies and contents of the seven modules are presented in Table 3.5. The first two modules teach the identification of feelings with focus on those associated with anger. Modules 3 and 4 deal with a range of anger-coping techniques to manage intense emotions and difficult social situations. For the core competency, social-cognitive skills, children are taught how to apply empathy skills in different situations in Module 5. In Module 6, the children are taught social problem-solving skills to help them think in a goal-directed manner before taking action. Module 7 rounds up the game with the integrative session, which serves as a revision of skills learned in the previous modules.

The range of skills and techniques covered in these seven modules, with each module taking about one and a half hours, was sufficient for the students to achieve the intended goal of the game and at the same time able to provide adequate scope for the research study. Previous research using an aggression intervention game by Hobbs and Yan (2008) documented that the intervention phase of three sessions of about 20 to 30 minutes per session was able to produce attributions of behavior change with varying success in children with aggressive behavior. In another study, a therapeutic

3D game by Coyle, Matthews, Sharry, Nisbet, and Doherty (2005) helped children in their anxiety, behavior and social problems after three sessions of 30 to 40 minutes.

Table 3.4

Core Competencies and Contents of the Modules

Core Competencies	Module
Understanding of Emotions	Module 1: Identification of Feelings
	Module 2: Exploring Anger Feelings
Anger Coping Skills	Module 3: Anger Coping Techniques I
	Module 4: Anger Coping Techniques II
Social-Cognitive Skills	Module 5: Empathy Skills
	Module 6: Problem-Solving skills
Summary	Module 7: Integrative Session

3.3.3 Game Elements

The following structural game elements were distilled from the GDE model and incorporated into the prototype.

Narrative. In alignment with the GDE model, narrative enhances the game attribute ‘Captivation of Interest’. It gives a context to the activities in the game and makes learning of concepts less abstract. Embedding narrative in a game provides meaning and importance that increases significance, tension and motivation in playing the game (Pagulayan et al., 2003). Narrative lures the players into caring for the characters and their problems, and serves to captivate their attention. Simulating scenarios are merged into the narrative to increase the fun of learning and enhance the game attribute of ‘Captivation of Interest’. To make the game more relevant and meaningful to the target users, the narrative relates to the life problems typically encountered by them in school, play or home. Strategies and tasks are presented in the game to help children with behavioral difficulties that seem constantly angry as they

usually have difficulty coping with anger in an acceptable manner and may misperceive social situations, leading to misunderstandings and disagreements.

Non-interactive dialogues between non-player characters also qualify as narrative in the game (Adams, 2010). Included in the game environment are non-player characters such as villagers, potatoes, shepherd, farmer, witches, “angry potatoes”, “Frog Jumpy” and “a lonely bear”. Their dialogues with the protagonist contribute to the build-up of the storyline. They are added to the game not only to inject fun and fantasy into the game but to transmit important learning points. For example, “angry potatoes” are added to the storyline to inform that there are others beside the players with anger issues and acquiring anger-coping strategies is essential. Music and sound effects are also purposefully included to the storyline to create feelings of excitement and tension and thus enhance the entertainment value of the game.

Cut-Scenes. A backstory is incorporated into the game to present the background of the character, tells the target users who their character is and the environment that influences the character. This is considered as important for players to achieve full concentration and immersion in the game (Sweetser & Johnson, 2004). To illustrate the backstory, two pre-rendered movie cut-scenes, the introduction and concluding movies, shown at the start and end of the game-playing, supply information on the context of the storyline (Adams, 2010). The cut-scenes were constructed in the game to be a plot hook to arouse curiosity and raise uncertainties leading to the players questioning on what would happen next (Dickey, 2006). They serve to intrigue and capture the players’ attention which is in alignment with the GDE model. Though the cut-scenes are part of the narrative to establish the setting and

uncover the storyline, they are not the main focus for instructions on the social skills which are situated at the gameplay interactions at the seven game modules.

Role-playing. In the ‘Learning Process’ of the GDE model, players should be given opportunities to encounter concrete experiences and deepen their conceptual understanding from their reflective observations. This is possible if they are given roles to play in a virtual world, within which to act out given situations. The act of role-playing in the game serves to influence the target users to be emotionally involved about the characters of the plot and their problems (Pagulayan et al., 2003). When players become their characters, they are put in the shoes of the protagonist and able to experience the gameworld from the point of view of that character. This would bring about the establishment of emotional proximity between the players and the role they are playing, which is characterized as empathy and identification players feels toward their character in a game (Dickey, 2006).

When players have a positive evaluation of the protagonist, they would be more likely to accept the goals the game proposes (Lankoski, 2011). Based on this consideration, players would be willing to identify with a game protagonist if the offered role is attractive to him/her. Thus the design decision made was to give the role of a courageous hero to players of *Socialdrome*®. Further, Hefner, Klimmt, and Vorderer (2007) argued that individuals would be able to reduce or even eliminates their self-discrepancy if they identify with a heroic character or role offered by the game. Their self-concept also improves as they act out the game character’s attributes. Adopting the character’s positive salient characteristics such as being helpful, resilient and determined would eventually bring about positive experiences, which would be fundamental for the overall game enjoyment.

Avatars. When players first log into *Socialdrome*®, they are allowed to role-play the protagonist by selecting any one of the representations of the game avatars. Based on the accounts given to the players, each boy was asked to choose a male avatar from a set of three choices of male avatars with their individual characteristics and likewise, each girl was asked to choose a female avatar from a set of three choices of female avatars with their individual characteristics. This game design decision was consistent with the view by Trepte and Reinecke (2010) that males and females prefer games that provide avatars consistent with their own gender roles. The chosen avatars are used by the players throughout the game.

Missions and quests. The game is divided into seven modules which are referred to as “missions”. The term “mission” is used so that players have a sense that they are commissioned to undertake a special assignment or operation. Each mission corresponds to the learning material from a module. In all there are seven missions for the research study. To add novelty and interest to the experience, each mission is set in different landscapes or environment with a detailed story for the players to explore (Adams, 2010).

Within each mission are quests which require players to navigate in the gameworld to accomplish a task, for example, to solve a mystery or retrieve an object (Gratch & Kelly, 2009). Players have to explore their surrounding environment including the non-player characters and determine the steps to progress toward completion. In each mission, there are about four to five quests for players to navigate. Missions and quests are confidence building measures to help players believe that they can accomplish tasks successfully, which is in line with the GDE model.

Reflection Journal. After completing the activities set out in these quests, players have to submit the learning points acquired in the secret reflection journal. The

journal allows players to think about the purpose of the learning activities and reflect on how to transfer the skills learned to their personal lives, which is associated with game event 9 of the GDE model and Gagné's event to enhance retention and transfer of skills (Gagné et al., 2005). This is also documented in Kolb's Experiential Learning Theory which postulates that reflection is a contributing factor for learning. Thus players are able to carry out the reflection activities within the game without stepping out of the gameworld. The word "secret" is to assure the players that what they write would not be read by their peers, unless permission is granted. However the school counselor considered as the students' confidante, and the researcher would be reading the journal so as to monitor their progress in social skills acquisition. This data would be captured by the game server.

Online guide. The GDE postulates that players should be given guidance for game resolution. This is consistent with Gagné's event of providing learning guidance to the learners (Gagné et al., 2005). In the game, a mythical creature named as *PetTeach* is presented on the interface as the main disguise of an online help system to provide digestible information, hints, clarifications and instructions on gameplay (Bates, Brown, Cranton, & Lewis, 2007). Represented as a mascot, *PetTeach* guides and coaches the avatar as he/she navigates along his/her way to conquer the quests.

Credit points. Relating to the game attribute 'Self-assessment' of the GDE model, players should be given feedback on progress toward completing tasks in the game (Sweetser & Wyeth, 2005). Inclusion of credit points in the form of "mints" serves to reward and motivate players toward achievement of learning objectives. The mints increase in number when players execute the right actions and decrease in number when players execute the wrong actions. The number of mints obtained together with feedback in the form of text, music and visuals, are presented throughout

the game so as to provide continuous content and performance feedback on players' progress, actions and input.

3.3.4 Description of the Initial Game Prototype

The initial game prototype constructed for formative evaluation constituted the introduction movie and the first module, Mission 1 'Identification of Feelings'. The learning objectives are to gain self-awareness and to identify a wide range of human emotions in themselves and others.

The game begins with a pre-rendered introduction movie which is a cut-scene that narrates the backstory of the game (Figure 3.3). The backstory sets the stage on profiling an angry boy and consequences of his angry behavior. The storyline is developed on the premise that the boy has social skills deficits and faces peer rejection due to his aggressive behavior, and acquiring social skills can ameliorate these deficits (Lane et al., 2005).

In the game, the players assume the role of the main character of the plot by inhabiting one of the representations of six avatars (male or female) based on their gender and characteristics attached (Figure 3.4). Some characteristics provided are "outgoing", "shy" and "friendly" personality traits. The players role-play as the protagonist with a wholesome character without behavioral problems and difficulties, and a hero out to protect and saves lives. The goal for the players is to find a way to help their best friend, Roger who has poor social skills and suffers peer rejection, acquire social skills. The players go on an adventure at the Island of Cascara where they meet friends and enemies, negotiate the various obstacles and learn lessons on social skills development. The challenge is for the players to stay on course to retrieve the mission ingredients which are metaphorical objects such as anger meter, hearts and

smiley badges, and to find the power formula to make the magic potion at the end of all the missions. In the process, the players have to update their reflection on their secret reflection journals. Their reflections and the magic potion will help Roger develop core competencies on social skills.

The sub-goal of Mission 1 is for the players to collect the Anger Meter. In the first quest, the scene is set in a small village. The players meet a worried middle-aged lady whose children have difficulty in expressing their feelings (Figure 3.5). The players' action is to render help by matching feeling words with the correct faces. In the second quest, they have to help a girl with her homework by using clues such as words, tone of voice, body language and situation, to identify feelings expressed by people. In the third quest, the players have to group the feeling-words into two categories: pleasant feelings and unpleasant feelings. They meet Tom who raises bears for a living. The players assist Tom to separate the bears into two groups. These bears "carry" certain feeling words and the players are supposed to place them into the two cages, labeled as "pleasant" and "unpleasant" (Figures 3.6).

In the fourth quest, they have to share at least one personal story that is related to their feelings to a bear, before it will pass the ingredient, the Anger Meter, to the players. At the end of the mission, the players are to write their reflections in their secret reflection journals.



Figure 3.3 Introduction movie

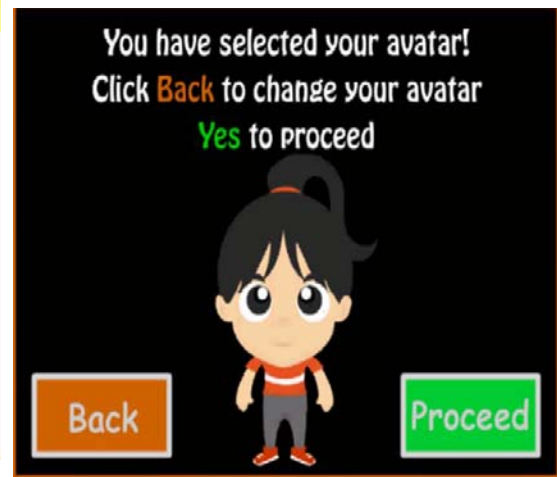


Figure 3.4 Selection of a female avatar



Figure 3.5 Mission 1 Quest 1



Figure 3.6 Mission 1 Quest 3

3.4 Summary

The educational model, Game Design and Evaluation Model, provides a theoretical frame of reference for the design and systematic evaluation of the game. It is anticipated that the identified model will provide support for instructional designers to harness the power of games to engage learners and at the same time achieve educational goals. Drawing from the theoretical underpinnings of the GDE model, key game elements were distilled and incorporated into the game prototype. The prototype was then constructed for implementation of Phase 3, which will be discussed in the next chapter.

CHAPTER 4 STUDY I - FORMATIVE EVALUATION

To address the first identified research gap in Chapter 1, Phase 3 seeks to address the first research objective of designing and evaluating the game prototype based on instructional and game design principles. The sub-objectives are:

- Uncover perceptions of target users on the playability of the game.
- Elicit design ideas and concepts for the creation of game modules that meet the needs of the target users.

Principles of a user-centered approach are adopted in Study I which place the users at the center of the design process during the formative evaluation of the game prototype. The methodology comprises three stages: Stage 1 - Exploratory Play-Testing, Stage 2 - Participatory Heuristic Evaluation and Stage 3 - Participatory Design. The findings and analyses from Study I guided the design team in the development of the final game prototype, *Socialdrome*®, for fostering social skills, which will be discussed in the following chapter.

4.1 Evaluation Methodologies

The value of evaluating the game early in the production stage with representative users to identify the usability and playability problems cannot be understated as this will impact the quality of the game (Barendregt, Bekker, Bouwhuis, & Baauw, 2006; Hanna et al., 2004; Pardo, Vetere, & Howard, 2005). There is a host of evaluation methodologies to inform and support the software design process. Usability evaluation techniques such as analytical or inspection-based methods rely on experts to assess aspects of the design, interface and contents of the games, and solve usability problems (Bekker, Baauw, & Barendregt, 2008; Tsiatsos, Andreas, &

Pomportsis, 2010). These methods include cognitive walkthrough, expert heuristics and usability audit with design guidelines (Zerfass & Hartmann, 2005). Such methods are usually popular as only a small number of expert evaluators are required to predict the problems that users will encounter in the computer games (Baauw, Bekker, & Barendregt, 2005).

Techniques involving target users include diary studies, user observations, heuristic evaluation and participatory design. Using diary studies, data on activities, events and behaviors that occur with a technology, application or service, can be captured. Besides reporting using their own words, users are able to provide proximity and practical relevance of knowledge if they write immediately after the activities (Gotze, Prange, & Uhrovská, 2009). A limitation of this technique is that users sometimes forget to fill in the information or fill them after a period of time thus relying on memory (Bastien, 2010). As deleting incomplete and inappropriate records can dramatically reduce sample sizes, it would be appropriate to start off with a bigger number of participants (Rieh, Kim, Yang, & St Jean, 2010)

Another customary user-centered evaluation approach is the user observation technique where users typically play passive roles as observation subjects in the evaluation process (Vaucelle, Africano, Davenport, Wiberg, & Fjellstrom, 2005). Observation can be carried out unobtrusively or in a non-interfering manner. The evaluators are to set up the observation by specifying the observation goals and user behavior (Brill & Knauss, 2011). However a difficulty faced by the evaluators is that they may fail to get the users to verbalize and think aloud why and how they carry out the tasks when the observation is executed (Callicott, 2002).

Heuristic evaluation refers to a class of evaluation techniques used to examine an interface for usability issues and problems (Delice & Gungor, 2009). The heuristics

developed by Nielsen (1994a) have principles for uncovering usage problems and have since been widely adopted for systematic inspection of user interface design of games. Major advantages of heuristic evaluation include it being inexpensive, intuitive, easy to motivate people to apply it, does not require advanced planning and can be conducted by at least three to five heuristic evaluators during the early design iterations (Nielsen & Molich, 1990). However it requires the development of a predefined set of application-specific evaluation criteria. Unlike diary studies and user observations, these criteria serve as a shared frame for conducting assessment of the technology or application. Another merit of heuristic evaluation is that it can be used in both the design and evaluation phase as it generates good ideas for improvement. In the design phase, the heuristics can be used for detecting problems, verifying and idea-generating (Welle Donker-Kuijer, de Jong, & Lentz, 2010).

The child-centered participatory design approach, pioneered by Druin (2002) and Scaife (1998), endorses the potential value of including children, the prospective users, in the evaluation of interactive applications. This design approach is able to fulfill children's needs and allows the inspection of problems from their standpoint through assigning responsibilities to let them take on active roles (Baek & Lee, 2008; Triantafyllakos et al., 2006). Druin (2002) demonstrated in her research that children can play the role of users, testers, informants and design partners in the technology design process. She strongly advocated the competence of children in giving ideas and suggestions. Techniques such as the KidReporter method (Bekker, Beusmans, Keyson, & Lloyd, 2003) and Cooperative Inquiry approach (Druin, 2002), are used to gather user requirements and support the collaboration and partnership of children in the design process.

4.2 Pedagogical Playability Heuristics

Basing on the GDE Model as described in Chapter 3, a set of design heuristics was developed to guide in the formative evaluation of the game. Thus a thorough literature search of online databases such as EBSCOHost, ScienceDirect, ERIC and ACM Digital Library, was conducted to find suitable heuristics that contain both instructional principles and generally accepted game design principles. Keywords used for searching included a combination of educational games, evaluation, heuristics, assessment, playability and other related terms. The search revealed that there were heuristics developed for entertainment games. For example, those by Desurvire, Caplan, and Toth (2004) and Korhonen and Koivisto (2006), focused on different aspects of the gameplay, game mechanics, entertainment and engagement issues, and were found useful in identifying playability problems in different game genres. However, these heuristics had their shortcomings as they did not address usability problems. Pinelle, Wong, and Stach (2008) argued that neglecting usability issues would result in a negative effect on the overall quality and success of a game. However the heuristics developed by them covered solely a range of game-specific usability problems but did not address design issues related to how to make games fun and engaging for users.

Analysis of the literature suggested that the heuristics developed so far were not suitable to assess educational games as they were not developed based on sound instructional principles. For example, the heuristics developed by Bekker, Baauw, and Barendregt (2008) for evaluating the fun and usability of educational games were lacking in pedagogical aspects in the game design. The review of the literature also indicated that there were pedagogical heuristics, for example, the CIAO! Framework by Jones et al. (1999) and pedagogical usability criteria by Nokelainen (2006),

specially designed for non-game educational software. However there were no heuristics available to guide researchers on designing instructional games to facilitate the learning of players in formal learning contexts. Researchers working on educational games usually did not focus on playability issues but concentrated primarily on evaluation based on learning outcomes such as skill-based, cognitive and affective learning outcomes (Garris et al., 2002).

As a consequence of the limitations in the existing heuristics, a set of Pedagogical Playability (PP) Heuristics was designed to broadly cover significant game usability and playability factors with alignment to instructional design and game design principles. Adherence to established educational practices throughout the design process is an imperative for any educational game to achieve high impact learning outcomes (Dempsey, Haynes, Lucassen, & Casey, 2002).

The PP Heuristics were constructed to enable designers to think more systematically about the gameplay and didactic elements they would encapsulate in their instructional game design. The heuristics were categorized under the four game attributes, 'Captivation of Interest', 'Meeting Learning Needs', 'Building Confidence' and 'Self-Assessment' as identified in the GDE Model (for more details on the game attributes, refer to Chapter 3, Section 3.3.1, p. 47). To detect playability issues, the GameFlow Model by Sweetser and Wyeth (2005) was constructed from the literature based on the elements of flow and the evidence of flow experiences in games. The GameFlow criteria provides a concrete understanding of what constitutes good design and player enjoyment in Sweetser and Wyeth's study on games. The criteria, concentration, challenge, control, clear goals, feedback and immersion, were integrated into the PP Heuristics as they share common and relevant elements and connotations with the game attributes of the GDE Model. For example, the criterion

‘concentration’ which refers to the ability of the game to provide stimuli that would grab players’ attention, is similar to the property of the game attribute ‘Captivation of Interest’. To ensure usability issues were addressed, relevant Nielsen’s (1994b) heuristics were chosen to be incorporated in the PP Heuristics as they underwent extensive testing and were widely used for usability evaluation of many application systems (for example, Bekker et al., 2008; Pinelle et al., 2008).

The final list of 25 heuristics formulated as questions were then synthesized from the instructional principles of ARCS Model (Keller, 2010) and Events of Instruction (Gagné et al., 2005), playability principles of GameFlow Model (Sweetser & Wyeth, 2005) and Nielsen’s usability heuristics (Nielsen, 1994b). The PP Heuristics were adopted in evaluating design issues of the game prototype in the early phase of design process.

Table 4.1 illustrates the PP Heuristics categorized under the four attributes and how they are associated with Gagné’s instructional events, Keller’s model, GameFlow model and Nielsen’s heuristics.

Table 4.1
Pedagogical Playability Heuristics

Attribute	Events of Instruction	ARCS Model	PP Heuristics	Source
Captivation of Interest	1. Gain attention	1.Attention	1. Does the storyline relate to your life experiences and grab your interest?	Immersion (Sweetser & Wyeth, 2005)
			2. Are the visuals, animation and music able to capture your interest?	
			3. Are there variations that are able to maintain your attention?	
			4. Does the game stimulate your curiosity and make you want to explore?	
			5. Do you have total concentration while playing the game?	Concentration (Sweetser & Wyeth, 2005)
Meeting Learning Needs	2. Inform learners of objectives	2.Relevance	6. Are the learning objectives and goals of the game clear to you?	Clear Goals (Sweetser & Wyeth, 2005)
	3. Stimulate recall of prior learning		7. Does the game help you to associate new knowledge and skills with your prior knowledge and skills?	
			8. Do you associate the contents presented in the game with your problems?	Match between system and the real world (Nielsen, 1994b)
	4. Present the content		9. Do you learn new concepts and skills?	
			10. Do you understand the instructions given?	

Table 4.1
Pedagogical Playability Heuristics (continued)

Attribute	Gagné's Events of Instruction	ARCS Model	PP Heuristics	Source
Building Confidence	5. Provide "learning guidance"	3. Confidence	11. Does the game provide a challenge at an appropriate difficulty level?	Challenge (Sweetser & Wyeth, 2005) Help and Documentation (Nielsen, 1994b) Error prevention (Nielsen, 1994b)
			12. When playing the game, did you experience the level of challenge that matches your skill level?	
			13. Do you feel confident playing the game even if you have only the online help as a reference?	
			14. Can you easily get help during your gameplay and find this "help" useful for you to achieve the goals and learning objectives?	
	6. Elicit performance		15. Do you encounter errors?	
			16. Do you achieve the learning objectives and goals?	
			17. Do you feel a sense of control of the playing actions you take and the strategies that you use?	Control (Sweetser & Wyeth, 2005) User control and feedback (Nielsen, 1994b)
			18. Do you find the game controls and on-screen interface features simple and easy to navigate in the game environment?	Flexibility and efficiency of use (Nielsen, 1994b)
Self-Assessment	7. Provide feedback	4. Satisfaction	19. Do you find consistency in the game i.e. commands and words are consistent?	Consistency and standards (Nielsen, 1994b)
			20. When playing the game, do you receive immediate feedback on your actions?	Feedback (Sweetser & Wyeth, 2005)
	21. Can you gauge your overall progress at each stage of your game?		Visibility of system status (Nielsen, 1994b)	
	8. Assess performance 9. Enhance retention and transfer of skills		22. Does the game reward you appropriately for your effort and skill development?	
			23. Do you experience satisfaction and success after playing the game?	
24. Does the game allow you to do reflection on your learning?				
		25. Does the feedback and online help reinforce your understanding?		

4.3 Design of Study I

From the literature research undertaken, it was decided that instead of using a particular method in isolation, the study should take a focus on the complementary role that heuristic evaluation by users and participatory design methods can play. The study employed these two methods to enable a richer collection of data and offset any limitations that are usually inherent in the adoption of one method.

The methodology consisted of three stages: Stage 1-Exploratory Play-Testing, Stage 2-Participatory Heuristic Evaluation and Stage 3-Participatory Design (Figure 4.1). Specifically, the children played the roles of users, testers, informants and design partners in the three stages (Druin, 2002).

In Stage 1, the children, in the roles of users and testers, play-tested the game. An initial game prototype, described in Chapter 3, was constructed for this purpose. In Stage 2, participatory heuristic evaluation advocated by Muller (1998) involved getting the users instead of the domain experts to inspect the prototype against a set of guidelines or heuristics, was undertaken. Playing the role of informants, the children were empowered to give their opinions and viewpoints on usability and playability issues. For this purpose, the Pedagogical Playability (PP) Heuristics discussed in the previous section were employed. In Stage 3, participatory design sessions took place with the same group of children. They became active participants as designers in the evaluation process, expressing their perspectives and ideas directly through their designs, thereby furnishing the design team with a richer appreciation of their experiences with the application (Ross, Ramage, & Rogers, 1995).

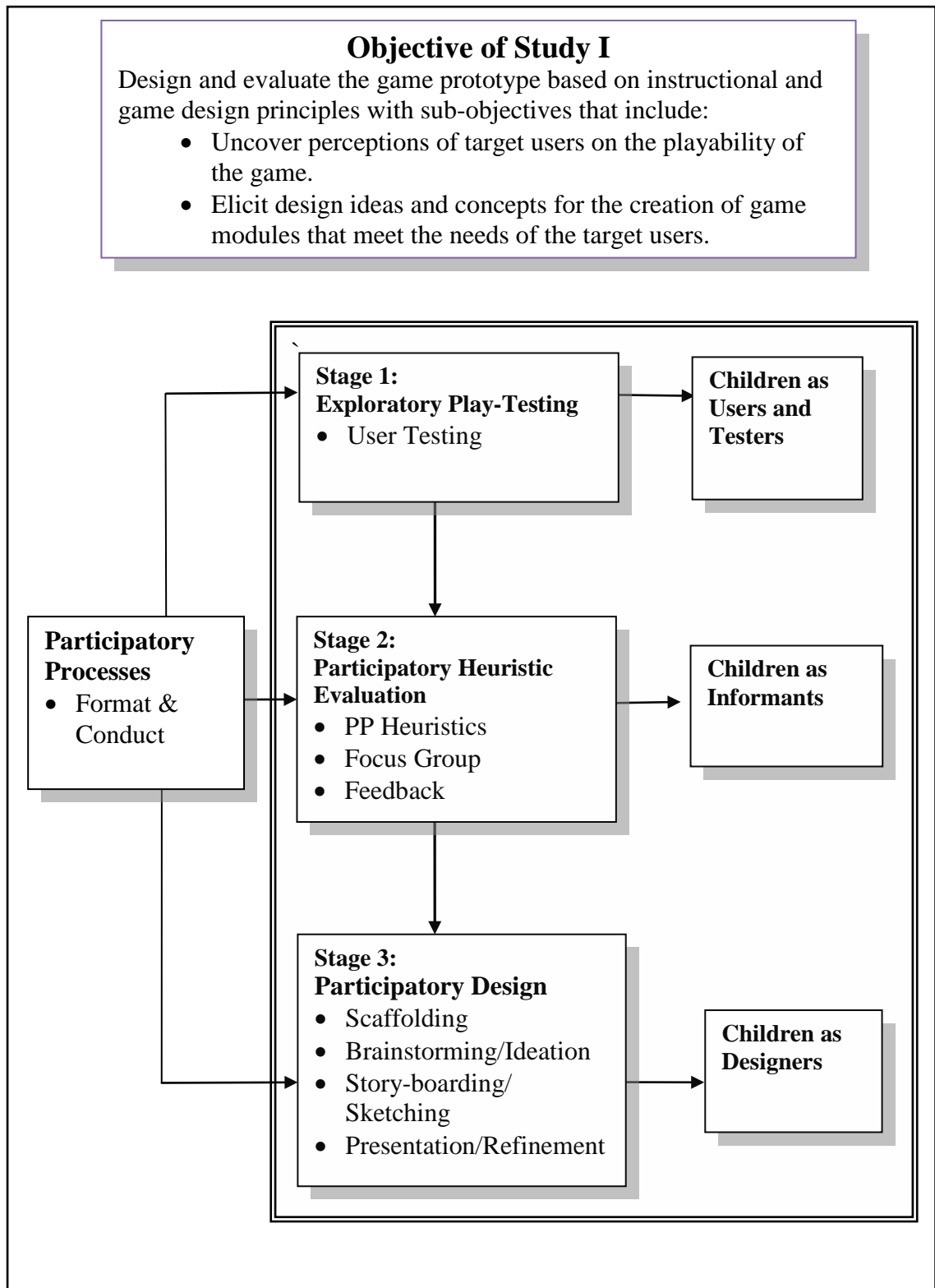


Figure 4.1. Stages in the formative evaluation

4.4 Conduct of Study

Altogether there were five 3-hour sessions that spanned over a one-month period. Each session was conducted in the afternoon after school hours. The locations of the study were at the computer laboratory and library function room. These venues were selected as they would be familiar environment for the children and conducive for learning.

A pre-questionnaire was administered to the children at the start of Study I respectively. It covered information on the children's demographic data on age, gender, computer usage and gameplaying (Appendix A).

The design team, consisted of the researcher (also the author) and four game designers, acted as facilitators throughout the five sessions. Two of the game designers were engaged as project officers, one playing the role of a game artist-cum-designer and the other as a game programmer, to design and develop the game. The other two game designers were engaged for the purpose of the study. All of them have the necessary education requirements, skills and experience in game design.

4.4.1 Participants

The participants should ideally be as similar to the system's future users (Ruland et al., 2008). The intended users of *Socialdrome*® are primary school-going students of age group from 9 to 12 years. For this study, twelve 10-year-old children of a local elementary school, representing the target user group, volunteered to be participants, with parental consent. The age of the six boys and six girls was in accordance with the predefined target audience age. Children at this age should have the confidence in articulating their experiences and preferences in both vocal and written expressions and graphic representations.

The sample size of twelve was considered as adequate as most studies had indicated that five to ten subjects should be able to detect most of the usability problems (Jacko & Sears, 2003). Nielsen and Molich (1990) drew conclusion from their studies that ideally there should at least be three to five evaluators to conduct the heuristic evaluation. Zurita, Nussbaum, and Shaples (2003) involved a sample size of 11 children in their usability analysis study and assessed that 11 children was a sufficiently large sample size as they observed repetition of many usability problems.

From the findings of the pre-questionnaire, the mean age of the six boys and six girls was 10.4 years. They reported they had computers with Internet access at home and have used the computer for more than 3 years. Six said that they knew a lot about computers, two children said they knew something about computers and four children said that they knew a little. Seven children reported that they normally spent less than five hours per week on the computer, four children normally spent about 6 to 10 hours per week on the computer and one reported that he spent more than 10 hours per week on the computer. They used the computers for playing games, blogging, internet chatting, doing school assignments, social networking, emailing and browsing the Internet for fun. The boys played games for an average of 9.0 hours per week compared to 3.7 hours for the girls. This finding that males tend to dedicate more time to gameplaying than girls is consistent with other studies such as the one by Bonanno and Kommers (2005). Most of the children played games almost every day, preferring online and portable handheld device games (e.g. Gameboy and PSP). Based on the data collected from the pre-questionnaire, inference could be made that the children were adept at using computer and spent significant time playing computer games. So there was no doubt that they were knowledgeable about computer games and were suitable to play-test the game prototype in Stage 1.

4.4.2 Stage 1: Exploratory Play-testing

In Stage 1, exploratory play-testing, the children assumed the role of users and testers (Druin, 2002; Ruland et al., 2008). The purpose was to provide the children with the gameplay experience, allow them to interact with the game features and understand the learning contents in the game. At the start, the children attended an orientation session during which the researcher explained the goal, purpose and plan of the study and helped them understand the purpose and context of the game (Figure 4.2). The researcher gave an overview of the main features and mechanics of the game. The children were given time to familiarize themselves with the game environment.

During the gameplay, the twelve children were seated at a personal computer each and interacted with the game individually (Figure 4.3). The children accessed the game website using the Web browser, logged in with given usernames and passwords. They selected their own avatar according to their gender type and entered the first game module, Mission 1, which had four quests. They were required to read the instructions, interact with the game using either the mouse or keyboard, type and submit responses. Before completing the game, the children were required to reflect on the skills learned and submit a reflection journal which is inbuilt in the game.

Throughout the interventions, the design team provided procedural and technical help. Data were collected from recording by a video camera and screen captures of the children's interaction with the game using the software, CamStudio.



Figure 4.2. Orientation session



Figure 4.3. Play-testing the game

4.4.3 Stage 2: Participatory Heuristic Evaluation

It was envisaged that interweaving evaluation and design in the study was necessary as the design process could only emerge from an understanding of what the game seeks to achieve and what the would-be game should look, which was only possible through playing the game. Interviewing is a technique usually used in user requirements analysis phase (Moser, Fuchsberger, & Tscheligi, 2011). However the young participants might feel awkward in verbalizing their experiences and expressing annotations on their interactions individually with an unfamiliar adult. Hence the focus group discussion approach was considered as more appropriate. The peer support in focus group setting redresses the power imbalance of the adult-child relationship presents in one-to-one interview and facilitates a greater involvement of the children (Hennessy & Heary, 2005).

The children were divided into three groups to participate in the focus group discussions after play-testing. In this stage, the children assumed the role of informants (Danielsson & Wiberg, 2006; Druin, 2002). The purpose of the session was to garner the children's opinion on the usability and playability issues of the prototype based on the PP Heuristics. The design team participated as facilitators throughout the sessions. Questions were posed by the facilitators in simple and unambiguous language for the

children's ease of understanding (Refer to Section 4.2 Table 4.1). It was important that the design team established a good rapport with the young participants so that they would feel at ease during the focus group discussion sessions and therefore able to speak their minds (Kam et al., 2006). For instance, opportunities were given for the children to exchange experiences playing their favorite games as usually they would like to share their previous gaming activities. If there was fear or even hostility toward the design team, the children might provide accounts during the sessions that they thought were appropriate rather than genuine accounts of their experiences, which might contribute to inconsistencies in the data collected.

4.4.4 Stage 3: Participatory Design

In Stage 3, the same twelve children that participated in Stage 1 and Stage 2 assumed the role of designers in the Participatory Design workshops (Druin, 2002; Nousiainen, 2009). The workshops took place in the school library function room. The researcher explained the purpose of the workshops which was to build low-fidelity prototypes of the game consisting of three game modules, Mission 2, Mission 3 and Mission 4. Storyboarding, recommended by Truong, Hayes, and Abowd (2006) was the technique adopted for this stage (Figure 4.4). Low-tech profiling tools used by Druin (2002) such as storyboard templates, drawing boards, paper, crayons, pencil colors and markers were provided for the children to represent the fundamental concepts and designs (Figure 4.5).



Figure 4.4. Developing a storyboard



Figure 4.5. A team working together

Given the fact that the game is intended for both genders, the children were divided into three teams of two boys and two girls each, to prevent potential gender bias when designing the game. Having teams of mixed gender composition is to allow ideas from the both genders to be captured, as it is well-documented that there are distinct gender differences in the preference for game characteristics and concepts (Inal & Cagiltay, 2007).

During the workshop sessions, the design team acted as mentors to provide guidance and suggestions, recommended by Good and Robertson (2006). They facilitated the brainstorming of issues and ideas and discussed possible designs. Ideas generated during the sessions were transferred onto paper (Figure 4.6). The design team prepared some examples of comic-type storyboards and Microsoft Powerpoint slides with graphic designs to stimulate the ideation process. These can be viewed as scaffolding supports for the children to use as a lead-in to their story-boarding process and to help accelerate the storyboard creation (Cilella, Berman, & Rheinfrank, 2010). Figure 4.8 illustrates a comic strip of a scenario of a boy pushing his friend into a mud-hole. The teams then came together to present their ideas and elaborate on one another's designs (Figure 4.7).



Figure 4.6. Brainstorming



Figure 4.7. Presentation

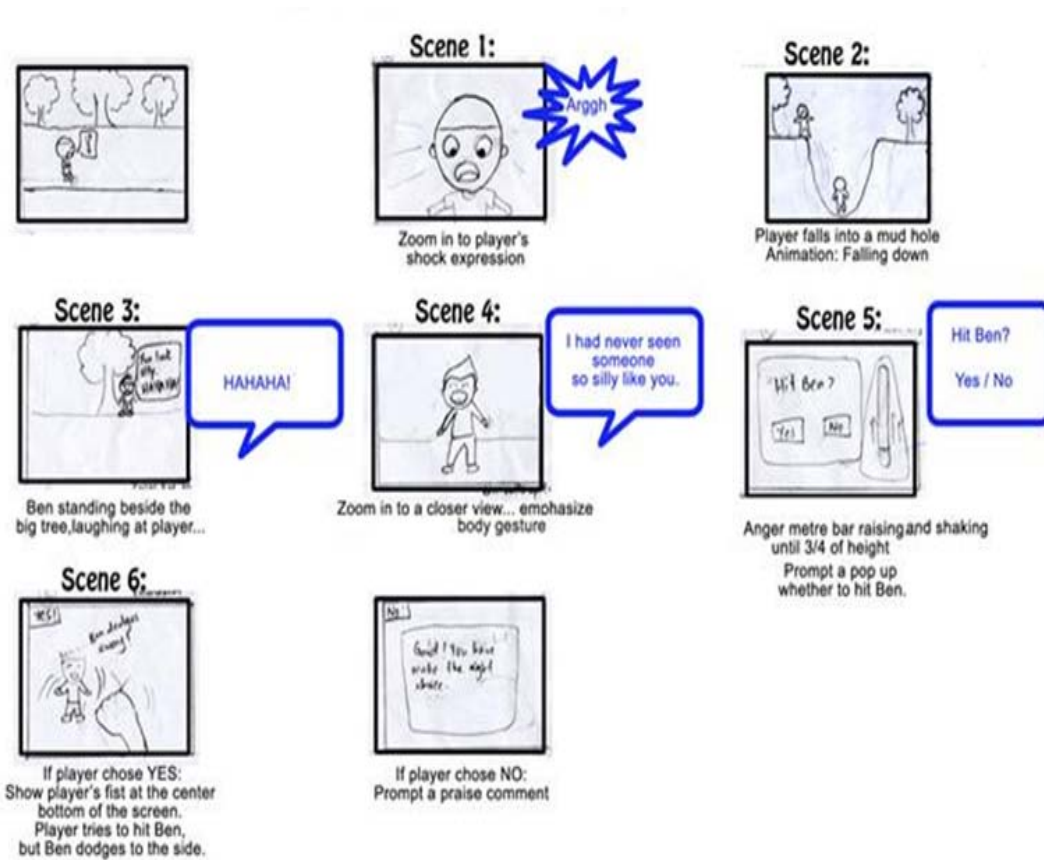


Figure 4.8. Comic-typed storyboard as a scaffolding support

4.5 Findings and Analyses

This section discusses the key findings and analyses garnered from the collaboration with the children during the three stages, Exploratory Play-Testing, Participatory Heuristic Evaluation and Participatory Design. The critical data

collection for the study was from Stage 2 –Participatory Heuristic Evaluation and Stage 3 – Participatory Design. The data collected from Stage 1 using video recording and screen captures of gameplay, though limited, served to supplement the qualitative data collected in Stage 2 and Stage 3. The video recording was carried out by a game designer who moved around the children seated in two rows, facing the computer screens.

4.5.1 Findings and Analyses of Stage 1

From the screen captures of gameplay, data were collected to compare the on-task time, that is the time when the children logged into the game prototype. Generally the boys took a shorter time to complete the game with a mean of 17.6 minutes (SD = 5.6), compared to girls who completed the game with a mean of 27.9 minutes (SD = 8.1).

Table 4.2
Participants' On-Task Time

Boys	Time Taken (min)	Girls	Time Taken (min)
B1	15.4	G7	25.7
B2	14.1	G8	25.7
B3	17.3	G9	19.7
B4	14.3	G10	23.5
B5	28.8	G11	43.1
B6	15.9	G12	29.8
Mean	17.6	Mean	27.9
Standard Deviation	5.6	Standard Deviation	8.1

Observations were carried out by a mobile video camera shooting close-up footage of users. The game designer who handled the camera, moved around the children seated in two rows, facing the computer screens. Due to this limitation of recording by only one video-camera, it was not possible to record the behavior or facial expressions of every child.

When the children were instructed to key in the usernames and passwords, there were looks of excitement on their faces. They were observed to be engaged and persistent in tackling the game. They did not interact or talk to their peers and any queries that they had were directed to the design team. Evidently there was absence of social talk though the children were seated closely to each other.

Another significant observation was that some boys did not seek help from *PetTeach* but used trial and error if they were unsure on how to move to the next step. Most children sought help from the design team if they had difficulty.

The players used the arrow keys on the keyboard to manoeuvre the movement of the avatar. Some of the children were seen as more skilled and could control the avatar effectively to move within the path boundary. Others were observed to be less skilled in controlling the keyboard and clicked the mouse randomly to move the avatar around. These children took a longer time to complete a quest. The girls were observed to be more meticulously in exploring the gameworld and were more careful in operating the mouse and keyboard. Most boys tried to move on the next part of the game by clicking the mouse repeatedly and multiple times each time. The design team had to keep reminding the children to not to click the mouse too quickly and slow down the gameplay. The children were prompted to spend more time writing their reflections. It was observed that boys write shorter reflection notes and completed the game earlier.

4.5.2 Findings and Analyses of Stage 2

The findings and analyses were conducted based on the four game attributes: ‘Captivation of Interest’, ‘Meeting Learning Needs’, ‘Building Confidence’ and ‘Self-Assessment’ of GDE model and the theoretical principles, Keller's (2010) ARCS Model for Motivation and Gagné’s (2005) Events of Instruction, Sweetser and Wyeth’s (2005) GameFlow Model and Nielsen’s (1994b) heuristics, that underpinned the development of the PP Heuristics.

To maintain confidentiality, pseudonyms B1, B2, B3, B3, B4, B5 and B6 were assigned to the six boys and pseudonyms G7, G8, G9, G10, G11 and G12 were assigned to the six girls in the report of the findings.

Captivation of Interest. The PP Heuristics on ‘Captivation of Interest’ are found at Section 4.2 Table 4.1. The children were able to relate to the storyline presented in the introduction movie which grabbed their attention. Remarks made by the children included the following:

- [B5] *“Yes, I like the story. I can relate to the story, for e.g, my friends’ parents are usually arguing and quarreling and this affects him.”*
- [G8] *“I have friends that are always angry. I also feel angry when people disturb me especially when I want to finish my assignment.”*

While most girls found *“the visuals attractive”* [G11, G12], the boys were more critical as they remarked *“the background and graphics were too plain and simple ”* [B2, B6]. They would like to have more avatars and more graphics in the background to increase the appeal of the game. The boys also wanted more action and animation to add thrill and excitement to the game.

A remark by [B4] *“Music was monotonous as the same piece of music was played throughout”* indicated that there should be more variation in the music and

sound effects. The children were found not to favor reading large blocks of static texts on instructions and explanations as indicated by [B1]’s remark: *“When there was too much text or many words, I would just click the mouse and move to the next screen.”* [B5] made a recommendation that *“the screen designs should have less text but have more graphics or icons to represent instructions.”* These findings emphasize that the game as a learning tool should have video, audio effects, graphics and animation that appeal to players. The four quests in the game module, Mission 1, have a different subgame or task for each quest. This added variability to the entire game prototype.

Getting attention of children is not enough as the real challenge is to sustain their attention (Keller, 2010). In this case, the children [B3, G11] commented that the storyline presented in the introduction movie aroused their curiosity, which is an element in Gagné’s (2005) model to stimulate learning. This strategy is recommended by Dickey (2006) as a plot hook to excite and intrigue players as it keeps them guessing. Their curiosity on how the narrative progressed and what would happen to their avatars was clear when they repeatedly begged for more missions. Remarks made include the following:

- [G9] *“I like the story. I want to know what happens next.”*
- [B4] *“I do not have enough. Can I play the next mission now?”*
- [G7] *“The game was fun and interesting. I got excited with each change of activity.”*
- [B2] *“I was totally immersed as I wanted to finish the game quickly.”*
- [B5] *“I was focused as the game was interesting.”*

The above remarks indicated that the children’s attention was completely absorbed by the gameplaying, which implies that concentration and immersion, two of GameFlow heuristics (Sweetser & Wyeth, 2005), were present. This is also in

accordance with the data from the video recordings of the children's facial expressions and verbal utterances that revealed their engrossment in the game. Grabbing their interest in the game is important for learning to take place so that the learning points can be unfolded in stages as according to Keller (2010), attention is the prerequisite for learning.

Meeting Learning Needs. The PP Heuristics on 'Meeting Learning Needs' are found at Section 4.2 Table 4.1. When questioned on the learning objectives of Mission 1, [G10] said "*I didn't see the learning objective. Is it to be kind to others?*" Some of the children were unsure and not able to give the right answers. This indicates that clear learning objectives and goals should be presented at appropriate times so as to keep players motivated (Laitinen, 2008; Sweetser & Wyeth, 2005) and helped them stay on target (Gagné et al., 2005). This is also a key component of relevance in the ARCS model and as players would be more motivated if they perceived that the skills delivered by the game is beneficial to them.

Nielsen's heuristic of "match between the system and the real world" is in alignment with Gagné's event 3 "stimulate recall of prior learning". Some children reported that they felt more comfortable if they could associate what they saw on the game with their prior experiences. They could put themselves in the protagonist's shoes as they were confronted with anger issues in their daily interactions with their peers. The narrative made the game meaningful to the children as it related to their life problems. Here familiarity with the narrative can be seen as relevant and help to impart abstract concepts to the learners. Comments made by the children were:

- [B5] "*I experienced the same type of problems.*"
- [G8] "*My past experience helped me come up with answers for some parts of the game.*"

Clearly, the children drew from their prior experiences and relevant knowledge to help them understand the situations presented in the game. Given the opportunity to assume the role of the avatar, they found the learning of social skills relevant and meaningful. To test whether the children understood the instructions, they were asked on what they learn. The comments made were

- [B3] *“I learned new words on feelings.”*
- [G11] *“I learned more about emotion.”*
- [G12] *“I learned improving body language is important.”*
- [G7] *“I can just click on PetTeach to get help.”*

Comments that they received help from *PetTeach* indicate they had no problem understanding the instructions.

Building Confidence. The PP Heuristics on ‘Building Confidence’ are found in Section 4.2 Table 4.1. In this attribute, the children, especially the boys who frequently played games, felt some quests did not match their skill levels while others felt some parts of the game were too fast for them to respond. Comments made include the following:

- [B1] *“Not challenging enough.”*
- [B2] *“The words on feelings in Quest 1 were too easy.”*
- [G10] *“Quite challenging. The bears in the bear game came out too fast. This made me excited.”*

Game designers should be mindful that as the game is catered for children with different gaming experiences, gameplay should either be sufficiently challenging or should provide new challenges at an appropriate pace (Sweetser & Wyeth, 2005).

The children felt “confident most of the time” [B3, G8] playing the game as they were assisted by the online guidance in the form of *PetTeach* which they found

helpful when they were stuck in the game or needed clarification. Evidently, the support, help and scaffolds created in the game increased children's confidence. However, there were children that thought otherwise and did not seek help from *PetTeach*.

- [B1] *"No, it spoils the surprise. I rather use trial and error."*
- [B6] *"Sometimes there were no instructions when I clicked on PetTeach. So I didn't click on it all the time."*

The children were able to achieve the learning objectives and goals of the game. They did not encounter any errors in the gameplay and had no problem recovering from errors. Redundant actions causing inefficiency in the interaction were surfaced for improvement, for example, redundant clicks to read texts or perform an action.

The element "control" is found in both the Nielsen's and GameFlow heuristics. The former refers to control of the interface and the latter refers to the control over players' actions in the game. The children felt they were in control of the user interface as it was simple and intuitive to use. The simplicity of the design interface reduced the cognitive load of the players and did not hamper their interaction with the game elements. In term of player control, generally they found it relatively easy to navigate in the game environment. The children also made the following remarks that indicated they would like more control over the game characters and their movements in the gameworld:

- [B6] *"I wish I could move my avatar anywhere I like."*
- [G10] *"The controls did not allow me to go in any direction."*
- [G9] *"At times when I pressed the arrow keys, nothing happened! It was frustrating."*

The children found the user interface consistent in control, commands and

dialog design. However, most of them encountered problems in Quest 3, for example, they made the following comments:

- [G9] *“Instructions were not clear for Quest 3. My avatar went the wrong direction.”*
- [G11] *“Many times I took the wrong paths at Quest 3.”*
- [B4] *“No, it didn’t tell us that we went to the wrong way.”*

This indicated there were inadequate navigational posts which caused the children to struggle to find the right path.

Self-Assessment. The PP Heuristics on ‘Self-Assessment’ are found in Section 4.2 Table 4.1. Playing the game assisted the children to make self-assessments that the desired learning has occurred (Gagné et al., 2005). When asked whether the game provided them with feedback, remarks made by the children included the following:

- [B4] *“Yes, it provided feedback for wrong or right actions. The feedback was 100% useful.”*
- [G9] *“Yes, there was feedback provided, e.g. in the bear game, if I got it correct, a tick was shown but if I got it wrong, there was be a cross.”*

The children were presented with continuous content and performance feedback on their actions and input. Identifying their scores and status as they progressed toward their goals increased their enjoyment levels which is consistent with the GameFlow Model (Sweetser & Wyeth, 2005). They were notified by the scores earned in the form of mints when they accomplished the goals throughout their gameplaying. They felt rewarded with the mints they received and were immersed in trying to obtain more mints. The children made the following remarks:

- [B6] *“Oh, I was so happy that I collected so many mints.”*
- [B4] *“I was not satisfied with the number of mints I received. I wanted more.”*

This confidence-building strategy of receiving feedback throughout the game proved to be effective in providing a sense of accomplishment. For example, they received affirmations in the form of “ticks” when they identify the appropriate emotions and obtained more scores when they completed tasks or made decisions successfully.

The children also suggested that imposing penalties on making errors like deducting scores is a desirable strategy. According to the children, with this added feature, achieving high scores or obtaining solution to the problem created will provide a more satisfying sense of accomplishment. The following strategies were suggested:

- [G8] *“If a player cannot solve the quest, the mints should decrease.”*
- [B1] *“There should be penalties for making an error or taking too long to play.”*
- [B5] *“I think we should have a time bar from Quest 1 to Quest 2. If the player takes his own sweet time, he loses a life or mints.”*

Self-reflection provided the meaningful context for the children to retain and transfer the skills learned (Gagné et al., 2005). When asked whether they find writing their reflection useful, the children made the following remarks:

- [B1] *“It helped me to recall the mission I just learned.”*
- [B2] *“No, it was inconvenient. Anyway, we already know our own feelings. I want my privacy.”*
- [G8] *“Yes, because I could recap on what I did during the game.”*
- [G12] *“Yes, I could share my reflection and this increased my understanding.”*
- [B4] *“Yes, it helped me to understand more. But I don’t like to type.”*

It was observed that the downside of the reward scoring strategy is that the children spent less time on reflection as gathering the mints became their top priority. They might mindlessly collect the mints without focusing on the pedagogic elements

of the game. A boy shared the following comment:

- [B6] *“When asked to relate a story on an angry situation, I typed one sentence only. I wanted to collect lots of mints, so I didn’t bother to waste time writing a better story.”*

The following remarks were made when the children were asked whether they felt that the online help, *PetTeach*, reinforced their understanding.

- [B3] *“Yes, it helped when I did not understand some parts.”*
- [G7] *“Yes, it helped to reinforce my understanding.”*
- [B1] *“No, PetTeach was very annoying. I could use trial and error.”*
- [B2] *“Some instructions were not necessary. I could use my common sense.”*

Though the children felt that the online help reinforced their understanding, there were some that found *PetTeach* annoying as it disrupted their gameplay.

4.5.2 Findings and Analyses of Stage 3

Each of the three teams designed a wealth of creative storyboards for the three modules. For each module, the children developed designs for a pre-quest, four quests and a post-quest, and detailed designs of the non-player characters and background. There were altogether 20 storyboards, 4 mini-games, 16 sketches on non-player characters and 10 sketches of background graphics and screens design. Consequently, the design team selected the ideas, designs and concepts that are in alignment with the GDE model for inclusion in the game. Four storyboards incorporated into the game are illustrated in detail below.

Accepted Storyboard 1: Find angry faces. The storyboard is about the avatar arriving at a farm of potatoes (Figure 4.9). Three potatoes with different feelings, happy, shocked and angry, block his way and want him to help make their angry

potato friends happy. In the game, the potatoes pop out of the holes and the player has to touch only those that are mildly angry (e.g., irritated), moderately angry (e.g., frustrated) and extremely angry (e.g., mad) with the Magic Wand. Players have to identify different intensities of anger feelings by making fast responses through tapping the “angry” potatoes with the magic wand. This storyboard was found to be suitable as it can help players identify the different intensities of anger feelings.



Figure 4.9. Storyboard on identifying feelings

Accepted Storyboard 2: Deep breathing. The storyboard is about the avatar trying to cross the river to collect bricks at the other side of the river (Figure 4.10). However, the bridge has collapsed. Suddenly, Frog Jumpy jumps out of the water and offers to help only if he practices the deep breathing technique. After performing the

breathing technique and playing a memory swapping game, he crosses the river by stepping on Jumpy's back, which was considered as a novel idea by the design team. This storyboard was selected as players will get to "learn by doing" the relaxation technique of deep breathing.

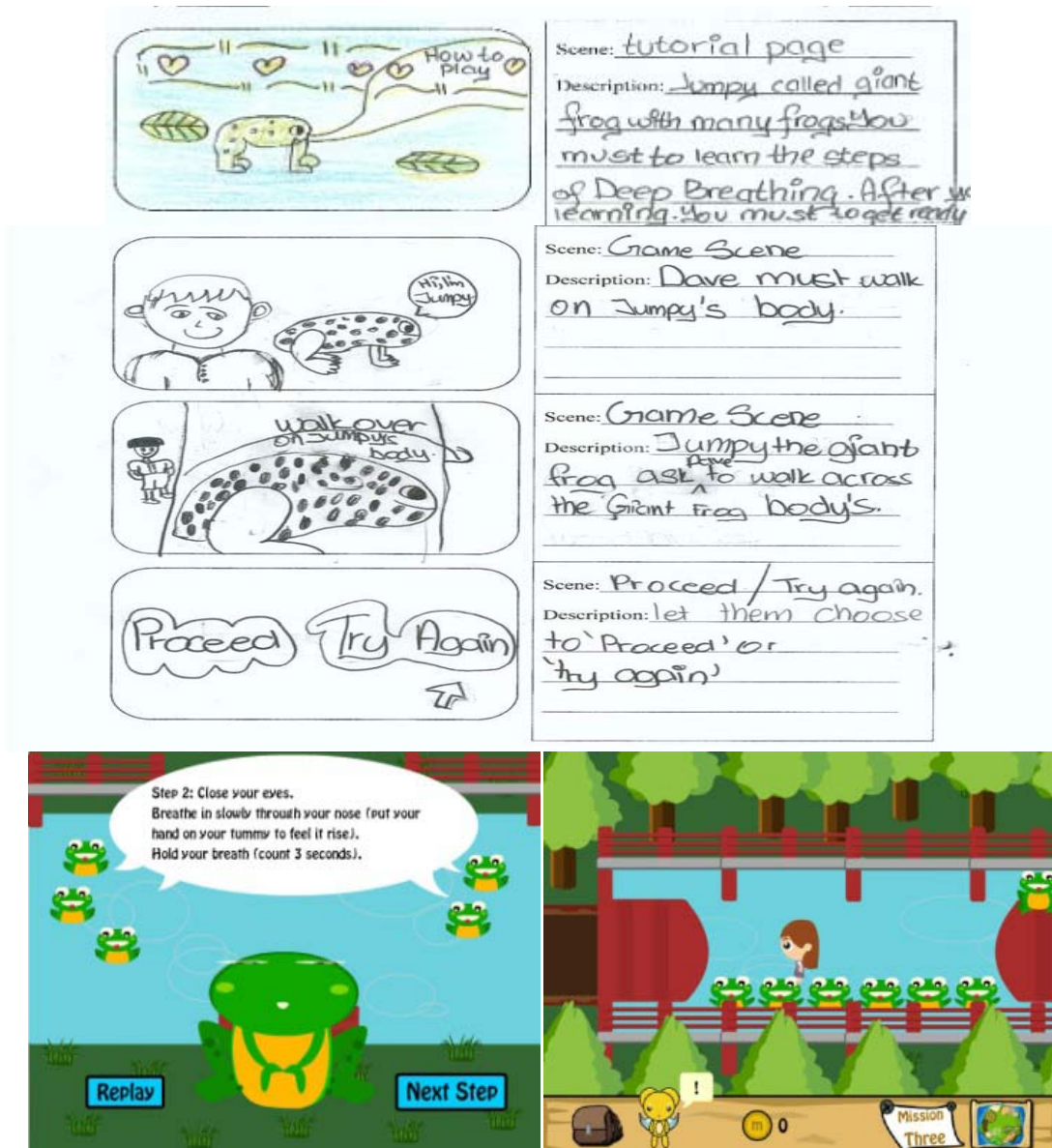


Figure 4.10. Storyboard on a relaxation technique

Accepted Storyboard 3: Positive versus negative self talk. The storyboard is about the avatar approaching a stream and discovering that the only way to get across

the stream is by boat (Figure 4.11). Before he can get on the boat, he is required to divide the sacks of flour lying on the shore, carry sacks of flour with positive self-talk statements to the boat and throw the sacks of flour with statements that reflect negative self-talk into a dustbin. The storyboard helps players to cope with anger by using the thinking tool, positive self-talk.

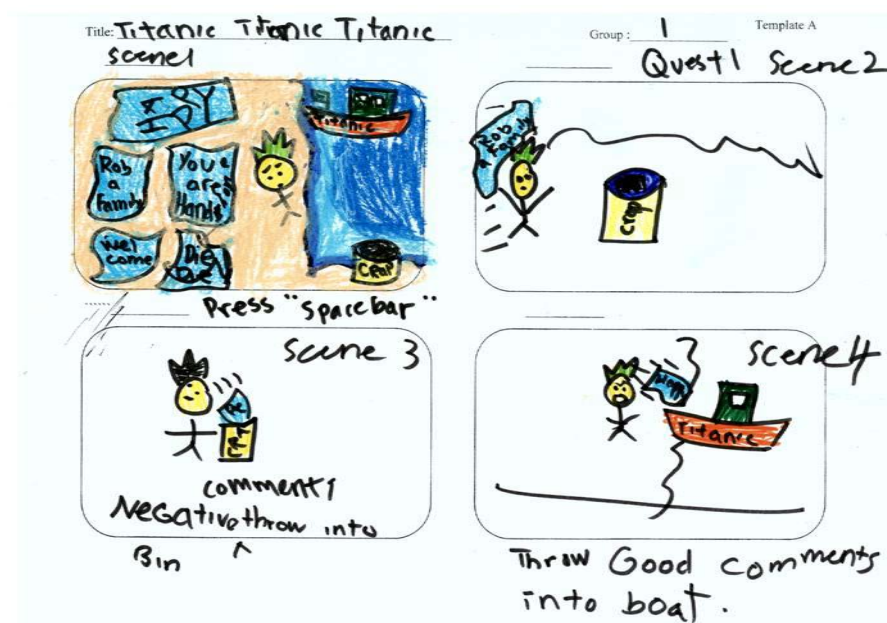


Figure 4.11. Storyboard on positive self-talk

Accepted Storyboard 4: Leisure activities. The storyboard (Figure 4.12) is about the avatar's encounter with a woodcutter who is chopping wood. The avatar has to collect only those pieces of "good" wood that represent useful leisure activities. The

design team considered the ideas of being able to choose the cutting tools and time bar to make the game more challenging as creative. This game teaches players to cope with their anger by engaging in meaningful recreational activities.

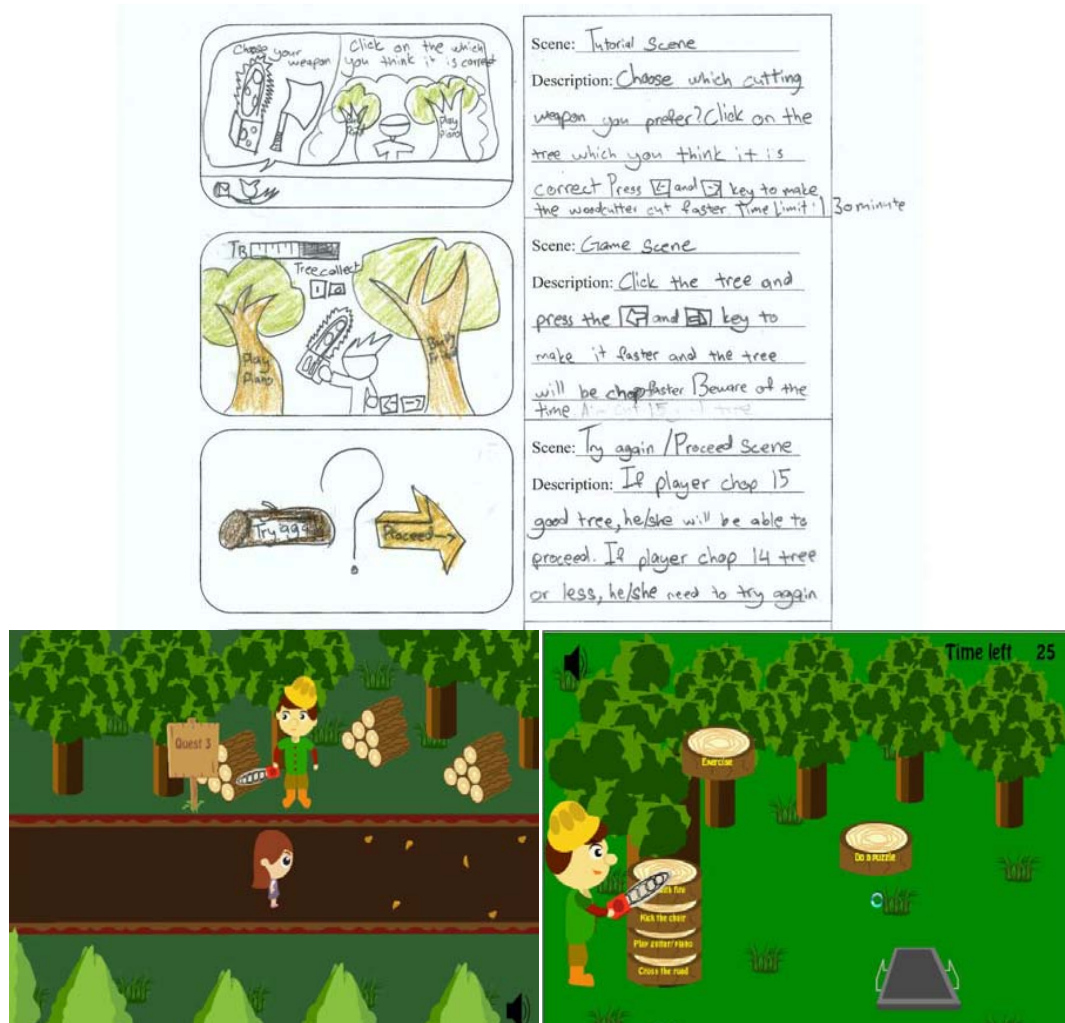


Figure 4.12. Storyboard on leisure activities

Analyses of the artifacts created. To enhance game attribute ‘Captivation of Interest’ of the GDE model, the children made recommendations that the designs should rely less on textual modality, but include more multi-modal features so as to appeal to their senses. They drew visual cues in the form of pictorial images and graphical icons, such as stars, to represent auditory cues of sound effects. They

considered that these effects would capture the attention of the users. A feature that was strongly recommended by the children to increase the appeal of the game was the opportunity to “learn by doing”. In the storyboard ‘Deep Breathing’, players have to perform the relaxation technique, deep breathing, while playing the game. When the players are actively participating in the learning process, they can ‘learn by doing’ through concretizing abstract concepts and get to enjoy the game without getting bored (Çankaya & Karamete, 2009).

To achieve the attribute ‘Meeting Learning Needs’, the children drew characters that they could and would like to associate with, for example, non-player characters such as sheep, farmer and pirate. In the storyboard ‘Leisure Activities’, players have to reflect on their prior knowledge and experience before they can make responses (Kirschner, Sweller, & Clark, 2006). This would bring about the internalization of abstract concepts and connection with the learning objectives of the mission.

To be in line with the strategy of the game attribute, ‘Building Confidence’ of the GDE Model, the children worked on story lines that incorporated interactivity in the game as they felt this component was an essential consideration to increase their confidence. They included activities and tasks that players must provide responses to. In the quest ‘Positive versus Negative Self Talk’, players should respond by selecting appropriate sacks of flour. The children surmised that the opportunity to think and respond would help in the internalization of concepts and skills, thereby increasing their confidence level.

Included in the ‘Find Angry Faces’ storyboard are commentaries and points to reward players for their success. The children understood that this feature would enhance the attribute ‘Self-Assessment’ of the GDE Model. The children felt that

writing down their thoughts and reflections would be beneficial in the retention of skills learned, a game event of the GDE Model. So they included this technique in some of their storyboards. The endorsement of this reflective process of writing was unexpected as some of them during the previous stage, heuristic evaluation, indicated that they did not like to type their reflections as this interrupted the flow of the gameplay.

The design team did not accept ideas that ran against the pedagogical aims of the game. Ideas rejected included violent quests on fighting and shooting using weapons, which contradict the learning objectives of the game modules. Figure 4.13 illustrates a rejected storyboard drawn by a boy on shooting grenades and cannonballs. The storyboard is about a ship encountering rocks with positive and negative comments. Players have to use the arrow keys or mouse to aim at the rocks with the grenades. If players shoot the wrong rocks, the grenades will reflect and hit the ship.



Figure 4.13. Rejected storyboard on cannonballs and grenades

4.6 Discussion

This section presents a discussion of the analyses obtained from the study. It highlights the four game attributes identified in the GDE Model as critical for learning: ‘Captivation of Interest’, ‘Meeting Learning Needs’, ‘Building Confidence’ and ‘Self-Assessment’. The section also discusses the different preferences of the two genders that influenced the type of designs created by them.

First, on the game attribute ‘Captivation of Interest’, different images, graphics and sounds represent different degrees of multimodality for the children (Patel, 2007). Problematic issues in these areas were readily identified by the children during the study. Beyond this, it can be argued that it may be difficult for the designers to pinpoint exactly what makes children curious as their interests vary. It is the art of the designers to acquire the skills of capturing the interest of children. Ideally it would be beneficial that designers seek the prospective users’ affirmation throughout the development process. Unless children are consulted, it is difficult to foresee their opinions on the entertainment aspects that appeal to them (Danielsson & Wiberg, 2006). This emphasizes the well-documented importance of giving the prospective users a voice in the evaluation process without the mediating influence of adults (Druin, 2002; Pardo et al., 2005). The feedback elicited from the children provided the design team with specific detailed data which led to significant changes to the design. For example, more varied background environments for other missions, such as a meadow, tropical rainforest and dark tunnel, were designed to grab the attention of the children. Further more challenging gameplay, more appealing sound effects and rich storylines to meet expectations of the user group were incorporated.

The second attribute ‘Meeting of Learning Needs’ informs learners of objectives and goals so that they are able to identify the relevance of the learning

materials. However during the focus group discussion, the children were not able to articulate the right learning objectives of the game. To keep the children motivated, they should be provided with both short-term and long-term goals as they progress along the game (Laitinen, 2008). Interweaving the learning contents and objectives seamlessly with the entertainment elements would likely reinforce learning objectives (Hirumi & Stapleton, 2009).

The children role-played as the protagonist to help them associate the problems encountered in the game with their own life problems. In acting out the assumed roles, they participated in the gameworld took control over the actions of the characters in the game, reflected on ways of helping the protagonist's friend, Roger, to acquire social skills. Opportunities should be given to the users to assume the roles created in the game as role-playing is a highly effective mechanism for the learners to understand the interplay of personalities and situations and become intellectually and emotionally immersed in the characters (Oblinger, 2004). Through the process, they acquired knowledge and skills built in the virtual characters, objects and environments (Oblinger, 2006). The players would then acquire knowledge and skills built in the narrative. A possible example is to let the player assume the role of a counselor which will help them practice their own empathy skills when he/she tries out counseling with other characters in the game. This is also in accordance with Gagné's and Keller's instructional principles that practice increases the confidence of the learners (Gagné et al., 2005; Keller, 2010).

On the game attribute "Building Confidence", the findings suggested that as instructional support increases the confidence level of children, the game, essentially, should provide discourse, guiding questions and feedback about the quality of the children's selection of responses and explorations to scaffold their cognitive load

(Aulls, 2002). Throughout the game, discourse in the form of conversation between the avatar, the representation of the children, and the non-player characters, is presented as dialogic instruction to increase successful accomplishment of the activity and learning outcomes (Aulls, 2002).

However the children felt that too much help was intrusive and slowed down the gameplay. This was evident when they were instructed to click on the online help system, *PetTeach* for assistance, most did not. This finding is consistent with previous research that suggested that children preferred finding their own solutions when they were stuck in the gameplay (Kinzie & Joseph, 2008). However this play strategy of trial and error may result in them missing the learning contents embedded in *PetTeach*. This trial and error strategy is also a predominant tactic preferred by the children in a study by Dempsey, Haynes, Lucassen, and Case (2002). As such, the game, *Socialdrome*®, should be designed such that important educational contents must not be embedded in *PetTeach*, but in the narrative. The gameplay should be designed such that the children are compelled to acquire the newly learned contents before they can proceed to the next part or higher level of the game (Gunter et al., 2008). Making learning seamless will encourage stealth learning, where one could play a game and learn something without even being aware of it (American Society for Training and Development, 2008; Annetta, 2010).

On the fourth game attribute 'Self-assessment', the findings demonstrated that giving opportunities to assess the children's achievement made them feel good about being able to judge the success of their accomplishments (Keller, 2010). The data from the video recording and screen captures of the children's interaction with the game brought to light that girls paid attention to the details of the game and explored the gameworld more meticulously. On the other hand, boys were competitive and were

inclined to complete the game faster than the girls. The boys were observed to spend less time writing in the reflection journal. This finding is consistent with work done by previous researchers, for example, Kinzie and Joseph (2008) found that boys favor active play, quick responses and trial and error strategies while girls prefer exploration and discovering new things in the game playing field.

A main concern here is whether the process of reflection will take place in players adopting fast-paced actions. Kiili (2007) argued that since the outcome of critical reflection is the personal synthesis of knowledge in the player's private worlds, whether a person learns effectively from the gaming experience will depend on his/her ability to reflect. As reflection is a contributing factor for learning, the game would be structured such that the players have to take time to reflect on the new knowledge acquired, the choices and strategies made. Unless the learning tasks encourage reflection, deeper levels of learning may not happen (Rieber & Noah, 2008). Future work should look at what type of game elements could facilitate the reflective thinking process and how to make learners be aware that reflection is beneficial for learning.

It can be said that the storyboards created are windows into the children's sense-making and preferences. From the ideas expressed, the design team gleaned insights into the children's preferences which helped them in creating a game that could accommodate to gender-based differences. It is noteworthy that substantial gender differences exist in the preference of storylines in the games. Interestingly, the boys conformed to the masculine stereotype as they admitted that they liked more character action and interaction, placing value on games that are challenging, complex and highly competitive in nature. On the other hand, the girls reported a stronger preference for adventure and exploration games. With this apparent divide in their preferences, clearly the game has to be designed by incorporating different types of

genres so that it will appeal to both genders. This is consistent with previous work that indicated distinct differences of the two genders in gameplay styles, genre choice, game contents and design preferences (Ibrahim, Wills, & Gilbert, 2010). Findings of this study would hopefully persuade game designers to adopt a gender-sensitive approach as a gender-neutral game will present equal learning opportunities for both males and females (Steiner, Kickmeier-Rust, & Albert, 2009).

4.7 Summary

Study I was conducted to glean insights into the likes and dislikes of children and to assess whether the features of *Socialdrome*® pose playability and usability issues to the young users. A child-centered approach that emphasizes the active involvement of users at the early part of the design process, was advocated. The children play-tested the game prototype and participated in focus group discussions. The Pedagogical Playability Heuristics based on usability and playability factors that are aligned to instructional design and game design principles, were used to solicit children's experiences and opinions. Storyboarding, a low fidelity prototyping technique, was adopted to involve children in development of design concepts and ideas for the development of the game missions.

The feedback and design artifacts provided by the children would be used by the design team to develop the final game prototype which would be discussed in Chapter 5. The findings indicated that involving children in the formative evaluation is a valuable and worthwhile practice to analyze the opportunities and challenges in engaging children as users, testers, informants and design partners.

CHAPTER 5 DEVELOPING THE FINAL GAME PROTOTYPE

This chapter presents Phase 4, the development of the final game prototype, *Socialdrome*®, to further address the first research objective of designing and evaluating the game based on instructional and game design principles. After Study I, the design team analyzed the children's input and incorporated suitable design ideas into the game modules. The design team then conducted at least two rounds of testing and evaluation iteratively with the students and the trained school counselors for each of the seven game missions. This chapter describes the refinement to the game backstory, the components and contents of the game missions built for the implementation of Study II.

5.1 Gender-Neutral Features

Findings from Study I pointed to the fact that there were gender differences in game preferences so *Socialdrome*® should not favour a specific gender or a specific gender should not be disadvantaged if the game is brought into the classroom. The game developed should have gender-neutral features so as to maintain a high level of gender-inclusiveness.

For each game mission, efforts were made to incorporate both male and female characters as well as gender-neutral non-player characters. The graphics, music/sound and storyline should be appropriate for both genders.

5.2 Improved Game Backstory

As a result of data collected from Study 1, the storyline was enhanced so that it provided an environment in which players can identify. The players are to take the role

of the main game character based on their gender type. The name “Dave” is used as the default protagonist in the description of the seven missions in this chapter.

The Introduction Movie (Figure 5.1) has improved graphics and begins by portraying the game character’s best friend, Roger, as a very hot-tempered, impatient boy who usually bullies his classmates (Figure 5.2). As a result, his classmates dislike him and avoid him. Dave is troubled by his best friend, Roger’s antisocial behavior and rejection from his peers. He wants to find a way to help Roger. One day, he finds an ancient book “Secrets of Magic Potions” on Grandpa’s bookshelf. The book is a treasury of wisdom and advice. The book mentions a magic potion that can help in the acquisition of social skills. It also reveals that the ingredients to form the power formula for the potion can be obtained from the Island of Cascara. Dave accidentally rubs on the edge of the book. Time then stops completely and the book slips from his fingers. Suddenly he finds himself teleported to the Island of Cascara (Figure 5.3).

Dave meets the chief, Karn, once he reaches the island. Karn gives Dave more information about the ingredients and how to collect them. The ingredients are sacred treasures in each of the seven villages. In order to get them, he must help the villagers or other living things by solving their problems. Karn also gives his pet, *PetTeach* to Dave. *PetTeach* is raised by Karn and knows every nook of the island. It will help Dave when he encounters any problems during his mission. *PetTeach* functions as the online help. Based on the feedback from the participants of Study I that they were not sure when *PetTeach* was giving instruction, it is now animated and appears awake when it has instructions and advice, and asleep when there is no instruction (Figure 5.4).

In the last part of the movie, Karn tells Dave to be careful of a “monster” that came to the island one million years ago. However, for some reason it is hiding somewhere. Dave proceeds with his adventure, together with *PetTeach*.



Figure 5.1. Introduction Movie



Figure 5.2. Screenshot of Roger as a bully



Figure 5.3. Map of the Island of Cascara



Figure 5.4. *PetTeach*, the Online Help System

5.3 Game Missions

The following section describes the seven missions that the players have to navigate in the game. Within each mission, the players have to complete the tasks assigned in the quests.

Mission 1. Table 5.1 presents the learning objectives of Mission 1 and the four quests.

Table 5.1

Learning Objectives of Mission 1

Mission 1	Quest	Learning Objectives
Identification of Feelings	Quest 1: Types of feelings.	1. To gain self-awareness
	Quest 2: Identifying feelings	2. To identify a wide range of human emotions in yourself and others
	Quest 3: Pleasant and unpleasant feelings	
	Quest 4: Sharing your feelings	

The learning objectives and goals are also presented on the first screen of each mission so that the target users are fully aware of the desired outcome (Gagné et al., 2005). The intention of Mission 1 is to help the children focus on the identification of a wide range of emotions that human beings are capable of. The children will learn that most people show their feelings through their faces. However, they can use other clues such as words, tone of voice, body language and situation to help them identify people's feelings. They also learn that pleasant feelings (e.g. joy, hopeful, satisfied) make them feel good while unpleasant feelings (e.g. rejected, scared, envy) make them feel sad.

In Quest 1 and Quest 2, the protagonist, Dave travels to a bear village where he helps the children of a middle-aged lady identify the different types of feelings and helps a child complete her homework by identifying people's feelings using clues such as words, tone of voice, body language and situation. The child informs Dave that Uncle Tom who rears bears may have the ingredient that Dave is looking for. In Quest 3, before giving the Anger Meter to Dave, Uncle Tom requests that Dave helps him separate his bears into two groups using words that describe pleasant and unpleasant feelings (Figure 5.5). The choice of vocabulary for the two quests has been revised to include more challenging terms and complex feelings that are appropriate for the 10-

year old target users, for example, the feeling “sad” is replaced with “miserable”.

These two quests also serve to increase the children’s vocabulary and understanding of feelings-words.

Uncle Tom extends his thanks to Dave for his help and decides to give the Anger Meter to him as a present. The Anger Meter is designed as a metaphorical object to help the children understand the benefits of constantly checking and regulating their anger feelings. Uncle Tom cannot find the meter and realizes that the meter may be “stolen” by a naughty bear. Dave goes to look for the bear. The lonely bear is overjoyed when Dave recounts some personal situations of his feelings. In Quest 4, the player has to share about a time when he feels happy or angry. Using the secret reflection journal, he is required to reflect on his prior experiences (Figure 5.6). This process will help to stimulate recall of prior learning and help him connect with the learning objectives of the mission, the third game event of the GDE Model (Gagné et al., 2005). Finally, Dave collects the Anger Meter, puts it in his backpack, and proceeds to Mission 2.



Figure 5.5. Screenshot of Mission 1

Figure 5.6. Secret reflection journal

Mission 2. Table 5.2 presents the learning objectives of Mission 2 and the four quests.

Table 5.2

Learning Objectives of Mission 2

Mission 2	Quest	Learning Objectives
Exploring Anger Feelings	Quest 1: Find Angry Faces	1. To understand the different intensity of anger feelings
	Quest 2: Intensity of Feelings	2. To identify anger signals
	Quest 3: Anger Signals	3. To differentiate between feelings and behavior
	Quest 4: Difference between Feelings and Behavior and Consequences of Anger	4. To understand the consequences of anger

In Mission 2, the children will learn that feelings can be in different levels of intensity ranging from mild, to moderate and severe. They learn that anger feelings can range from mildly angry (e.g., irritated), to moderately angry (e.g., frustrated), and to extremely angry (e.g., mad). The mission also helps the children recognize their anger by understanding the various physical signals (e.g. flushed face), thought signals (e.g. “I hate him”) and action signals (e.g. kick). The focus is to bring awareness the distinction between feelings and behavior and that feelings influence, but do not dictate their behavior. Scenarios on consequences of acceptable behavior (e.g. talking it over calmly) and unacceptable behavior (e.g. using violence to resolve the conflict) are presented for the children’s self-reflection. In the SIP model, children are usually faced with a behavioral decision-making task before enacting their responses (Crick & Dodge, 1994). They evaluate possible responses to social situations by considering the content of the generated response and the type of outcomes likely to ensue.

In Quests 1 and 2, Dave travels to a farm full of potatoes. A curious snail meets and rewards him with a Magic Wand when he is able to define the term “anger”. Dave uses the Magic Wand, which has the magical power to remove anger feelings from any living things, to make the angry potatoes happy. The player has to share

three situations to wake the potatoes up. In Quest 3, he meets an angry scarecrow and identifies the angry signals: thought, body language and action signals. In the last quest, a boy named Ben pushes Dave into a mud hole (Figure 5.7). Dave has to decide how to handle the situation by distinguishing between feelings and behavior and weighing the consequences of his actions (Figure 5.8). Eventually, he collects some angry badges, put them in the backpack, and proceeds to Mission 3.

In playing this quest, the children have to anticipate the consequences of different solutions, judge and compare them before deciding on the best solution (Kim, Park, & Baek, 2009). According to Crick and Dodge (1994), a person's anger feelings might serve as an impetus for retaliatory goals. It is conceivable that the reason behind why children engage in impulsive, retaliatory acts against their peers is due to their lack of success in their interpersonal relationships. Presenting hypothetical situations allows the children to reflect on the possible courses of action in actual problematic situations (Crick & Dodge, 1994).



Figure 5.7. Screenshot of Mission 2



Figure 5.8. Screenshot of Mission 2

Mission 3. Table 5.3 presents the learning objective of Mission 3 and the four quests.

Table 5.3

Learning Objective of Mission 3

Mission 3	Quest	Learning Objective
Anger	Quest 1: Deep Breathing	To learn ways of managing anger by using Thinking Tools, Social Tools and Assertive Tools
Coping	Quest 2: Visualization Quest	
Techniques I	Quest 3: Leisure Activities	
	Quest 4: Muscle Relaxation	

In Mission 3, the children learn a relaxation technique, deep breathing, an easy and quick method to calm themselves down when they are angry or nervous. They can engage in a visualization technique which will help them to cope in emotionally stressful situations. Visualizing an imaginary scene or a special place for relaxation can help to get rid of angry thoughts and replace them with calm and relaxing thoughts. The children also learn the appropriate way of doing muscle relaxation exercises to relax their bodies. To help them cope effectively with anger or frustration, they can also engage in positive leisure activities, for example, listening to their favorite music. In Quest 1, Dave arrives at a beautiful lush forest and meets an old man, Hiro, who is homeless. Dave decides to help him gather materials to build a house. To collect the bricks, Dave has to cross the river but alas, the bridge has collapsed. All of a sudden, Frog Jumpy jumps out of the water and will help him if he learns the deep breathing technique from it. In the next quest that follows, Dave learns a visualization technique from a girl named Linda by playing a crossword puzzle game. In Quest 3, he meets a woodcutter and learns that engaging in positive leisure activities can help him cope effectively with anger or frustration. In the final quest, a lady informs him of a magic mirror nearby. Kimono, a spirit in the mirror, appears and teaches Dave a muscle relaxation technique to calm himself down (Figure 5.9). After collecting all the necessary materials for the house, bricks, blueprint and wood, Dave goes to look for

Hiro. To show his gratitude, Hiro rewards Dave with half a heart, the third mission ingredient. Dave collects the ingredient, put it in his backpack, and proceeds to Mission 4.

The experiences the players go through can be described as a “learning by doing” strategy which is favored as more effective than learning by telling or being told (Schank, Berman, & Macpherson, 1999). The players are provided with rich experiences, for example, learning the steps of the deep breathing or muscle relaxation techniques. Skills practiced in the game environment should closely relate to how children will use them outside the learning environment. For example, in Mission 3, the anger coping techniques can be used to calm children down when they encounter problematic situations. Consistent with Kolb’s Experiential Learning model, people who preferred to be involved in “hands-on” experience, learn best when they are given action-oriented tasks (Kolb, Boyatzis, & Mainemelis, 2009). Children, who are doers and work best carrying out authentic and practical tasks through active experimentation, as depicted in Stage 4 of the GDE Model, will take advantage of these experiential situations.

Mission 4. Table 5.4 presents the learning objective of Mission 4 and the four quests.

Table 5.4

Learning Objective of Mission 4

Mission 4	Quest	Learning Objective
Anger Coping Techniques II	Quest 1: Positive Vs Negative Self Talk	To learn ways of coping with anger by using relaxation techniques and engaging in a variety of recreational activities
	Quest 2: Positive Self Talk	
	Quest 3: Social Tools	
	Quest 4: Assertiveness	

The children learn to manage their anger using the Thinking Tool, positive self-talk. Positive self-talk is a statement that the children can say to themselves to

calm themselves down, or help them cope with anger or other unpleasant feelings. It also shows that they have self-control over their feelings and behavior. Assertive techniques help them to make requests and refusals assertively and calmly, not passively or aggressively. Being assertive means that a person has to stand up for himself or herself, without breaking the three anger rules, without getting back at someone else and without acting obnoxiously or distastefully. Some assertiveness techniques to help the children express themselves in angry situations are: use “I” statements while stating your feelings and needs, for example, “I am not happy that you shouted at me. Please ask nicely.”, be polite and respectful by using words such as “please” and “thank you” and avoid using bad language, speak in appropriate volume, not too soft or too loudly, maintain a normal facial expression, and maintain eye-contact by looking at the person while talking to him or her. When the children encounter a problematic or angry situation that they cannot solve on their own, they can use the Social Tool, asking someone (e.g. parents, siblings, teacher) for help.

In Quest 1, Dave proceeds to a meadow called Woolly Meadow. On his way to help a sheep find its owner, he uses the Thinking Tool to identify positive statements from negative statements. He learns that positive self-talk allows him to react more calmly to an angry person or situation. It also allows him to have self-control over his own feelings and behavior. Dave has to help café manager, Sandy, make hay burgers for her customers, in exchange for food. In this quest, Dave is provided with help on other positive self-talk statements to help him in angry situations (Figure 5.10). Along the journey toward Quest 3, Dave meets Daniel and finds out that he has problems with his neighbor, Jack, who enjoys playing nasty tricks on him, for example, fooling him that the wolves are coming to eat his sheep, calling him names and throwing stones at the sheep. Dave teaches Daniel to resolve the situation using Social Tools

and use the appropriate Social Tools depending on the seriousness of the situation. In the last quest, he carries on the journey and meets another shepherd, Jacob. Jacob is frustrated because his thoughtless friend, Tom, often takes his sheep without his permission. Dave helps Jacob solve this problem using the assertiveness technique. Feeling grateful, Jacob passes Dave the other half of the heart, the fourth mission ingredient, as a reward. Dave collects the other half of the heart, puts it in his backpack, and proceeds to Mission 5.

As explained in the GDE Model, experiential learning takes place as the players draw upon their previous knowledge-base to form new schema (Kolb et al., 2009). At their cognitive development level, the 10-year old target users should be able to activate their schema to make sense of the context of the positive statements presented, for example, “I’m going to try to learn how to manage my anger”. It is only through playing the game that they are able to connect their prior knowledge with the abstract concepts presented in the game which leads to acquisition of new knowledge.



Figure 5.9. Screenshot of Mission 3



Figure 5.10. Screenshot of Mission 4

Mission 5. Table 5.5 presents the learning objective of Mission 5 and the four quests.

Table 5.5
Learning Objective of Mission 5

Mission 5	Quest	Learning Objective
Empathy Skills	Quest 1: Understanding other people's feelings	To learn about empathy skills and how these skills can help in understanding the feelings of others
	Quest 2: Demonstrating empathy skills at the classroom	
	Quest 3: Understanding empathy	
	Quest 4: Demonstrating empathy skills at home	

In Mission 5, the children learn that empathy is the ability to understand and recognize others' feelings. To be able to empathize requires an understanding of the mental state of another individual (Beauchamp & Anderson, 2010). Having empathy is important for the children to understand how they can sometimes unknowingly hurt others through their behavior. Opportunities are provided for children to help them understand others' feelings. In the different situations presented, the children should question themselves whether who may be affected, how might the affected person feel, what are the consequences and what can be done to make the person feel better.

In the mission, the children will play the role of a counselor. According to Oblinger (2004), role-playing is a highly effective mechanism for the learners to understand the interplay of personalities and situations by becoming intellectually and emotionally immersed in the characters. In Quest 1, the avatar Dave arrives at a town named "Town of Magic" and enters Quartyso School. He meets the school principal who mistakes him for the new counselor (Figure 5.11). He is instructed to counsel four students who are facing personal problems such as rejection from classmates, unfair treatment by mother, grieving the passing of a loved one and performing badly in

examinations. Each of the students gives the avatar a little smiley face as a token of appreciation, after the counseling.

The children have to understand the students' feelings before they are able to think of what advice to give (Figure 5.12). The children learn the difficult concept of empathy by putting themselves in the shoes of the children with problems. Playing the role as a counselor helps them practice their own empathy skills. This is in accordance with Gagné's and Keller's instructional principles that practice increases the confidence of the learners, a game attribute of the GDE Model (Gagné et al., 2005; Keller, 2010).



Figure 5.11. Screenshot of Mission 5

Figure 5.12. Screenshot of Mission 5

Dave is then tasked to monitor a recalcitrant student, Kelvin, in Quest 2. Dave follows Kelvin from school to his house and witnesses his bad habit of littering the school ground and making his bedroom a mess. Questions are posed on how Kelvin's behavior could hurt those close to him, the consequences of the behavior and what he could do to make the person feel better. Through reflections on the situations, the children build their empathy skills and learn to understand feelings of other people. In this particular context, the GDE Model supports the learning that occurs from the reflection stage toward abstract conceptualization and active experimentation (Kolb, 1984). At the end of the mission, the principal rewards Dave with a number of smiley

badges, the fifth mission ingredient. Dave collects the smiley badges, puts it in his backpack, and proceeds to Mission 6.

Mission 6. Table 5.6 presents the learning objective of Mission 6 and the five quests.

Table 5.6
Learning Objective of Mission 6

Mission 6	Quest	Learning Objective
Problem-solving skills	Quest 1: Anger Plan	To learn the 5-step problem-solving Anger Plan to resolve problems systematically
	Quest 2: Practice using the Anger Plan	
	Quest 3: Apply the Anger Plan steps on situation 1	
	Quest 4: Apply the Anger Plan steps on situation 2	
	Quest 5: Share a situation using the Anger Plan	

In Mission 6, the children start the quest by learning the Anger Plan which is a 5-step plan problem-solving strategy for resolving problems systematically. The children are to ponder on the following statements/questions for the five steps:

1. Feeling Angry? Are you feeling angry? How can you tell? What is my body telling me?
2. Do Not React first. Stop and do not react toward the problematic situation,
3. Generate Solutions. What can I do to make myself less angry? Draw on the skills learned,
4. Evaluate Solutions. What might happen if I choose the first solution? What might happen if I choose the second solution? Which is the best solution?
5. Reflect and Reward. If the solution works, I can reward myself. If the solution does not work, I can go back to Step 4 and choose another solution.

Next, Dave arrives at another part of the island for the next quest. The wizard, Prospero, recounts that an evil spell has been cast on Lucinda, a witch. This spell has

caused her to go around casting bad spells on naughty children in the forest. Prospero teaches Dave the Anger Plan to enable him to collect the five magic crystals to destroy the spell on Lucinda before it gets out of hand. Using the magic broom from Prospero, Dave continues his journey and sees Lucinda floating in the sky. He gives chase and at the same time collects the five crystals but unfortunately, he loses sight of her as the broom runs out of energy (Figure 5.13). In Quests 3 and 4 on his search for the witch, he meets Donald, Henry and Danny. The witch has cast them with bad spells due to their bad behavior. Dave teaches them the Anger Plan to help them cope with their anger feelings. At the rocky mountain, Dave meets Bashaa, a dwarf and relates to him a situation when he was feeling angry and how the Anger Plan can be applied. Bashaa helps Dave to repair the broom. Dave then flies to search for the witch and sees her from afar. The determined Dave catches up with the witch by avoiding the lava and fireballs. He quickly uses the five magic crystals he has collected and breaks the wicked spell. It works and witch Lucinda is transformed into a kind-hearted witch. Lucinda thanks Dave and passes him a medieval glass bottle containing fireballs. Dave proceeds to Mission 7.

In Mission 6, the players will not be able to proceed to Quest 2 if they have not mastered the Anger Plan embedded at the start of quest. The game event of the GDE Model of enhancing retention of skills is employed as a key learning strategy here. This is highly recommended by Gunter (2008) who posited that embedding pedagogic contents in the game rules will reinforce learning as the learners would have to synthesize the new knowledge first before they could proceed to the next level in the game

The mission presents problem-solving strategies which are adapted from the SIP model. Crick and Dodge (1994) proposed that children, like the target users,

would encounter social situations with a set of limited biological capabilities and a memory store of past experience. The five quests in the mission allow the players to transfer their new knowledge to different situations, thereby reinforcing the problem-solving strategies that will guide them in their decision-making in challenging social situations (Daunic et al., 2006).

Mission 7. Table 5.7 presents the learning objective of Mission 7 and the four quests.

Table 5.7
Learning Objective of Mission 7

Mission 7	Quest	Learning Objective
Integrative Session	Quest 1: Recapitulation of skills learned.	To recapitulate the skills and techniques learned in the previous missions

Mission 7, the last mission, serves as a review session for the children to recapitulate the skills that they have learned in the previous missions on anger coping techniques, social-cognitive skills and social problem-solving skills.

In Mission 7, Dave finally makes his way to the castle. He sees an enormous monster, Wonky, standing forlornly along the corridor. Wonky has been trying for years in vain to prepare the magic potion. Each time, it tries to create the secret potion, it explodes in its face. Wonky wants Dave to help him and takes him to the laboratory where the potion-making machine sits. Dave starts to explore the machine and figure out how to form the right formula, mindful that a wrong formula will trigger an explosion. Dave has to recapitulate what he has learned from the previous missions as each ingredient represents the objective of each mission. He applies the knowledge he learned in order to differentiate the ingredients associated with positive or negative behaviors, putting the ingredients associated with positive behavior into the green vessel and putting the ingredients associated with negative behavior into the red vessel

(Figure 5.14). He has to lower the scale of the Anger Meter to the bottom and triggers the button to activate the potion-making process. The last part is challenging and requires reflection on their acquired knowledge as there is no clue or hint given. The players have to draw the connection between keeping their anger level low and adjusting the Anger Meter to the lowest level is more likely to help them succeed in their mission.

The GDE Model can be used to support learning through gameplay in the last mission which is conceived to engage children in a cyclical transition from concrete experience, reflective observation, abstract conceptualization to active experimentation (Kolb, 1984). The children get ‘concrete experiences’ from playing the previous missions. As the end of each mission, they reflect on these experiences using the secret reflection journal. These reflections are assimilated and lead to the formation of new abstract concepts. In Mission 7, the children receive an opportunity to experiment actively with the concepts distilled through problem-solving and finally find the solution to create the magic potion.

Concluding Movie. The gameplay is brought to a close by wrapping up the story with a concluding movie when the player completes the game (Adams, 2010). The Concluding Movie relates how Dave returns home with the magic potion and his secret reflection journal and gives them to Roger. Roger is happy to see his friend and drinks the potion. He reads the journal and practices the anger-coping strategies he learned (Figure 5.15). The movie portrays several successful social situations Roger has with his classmates (Figure 5.16). Roger eventually acquires the necessary social skills to manage his daily social interactions. His classmates find him a likeable person and do not reject him anymore.



Figure 5.13. Screenshot of Mission 6



Figure 5.14. Screenshot of Mission 7

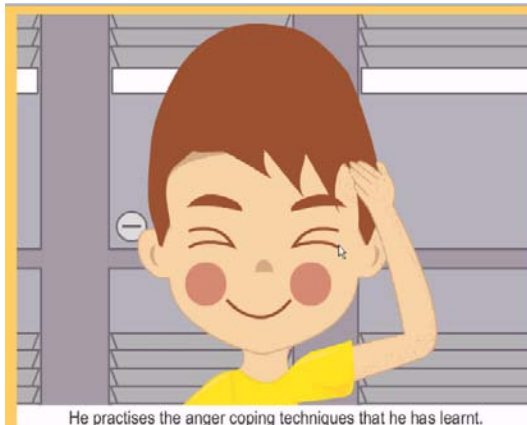


Figure 5.15. Concluding Movie



Figure 5.16. Concluding Movie

5.3 System Requirements

The game is designed as a Web-based single-player environment on the Adobe Flash development platform using the Actionscript scripting language. This supports platform independence, so that Web browsers only need to be Flash-compatible, for example, Microsoft Internet Explorer and Mozilla Firefox. As the game does not require any other program to be installed in the computer, this facilitates its independent use by students anywhere, anytime.

The system specifications required to run the game are a computer with an Internet connection and a Flash-compatible Web browser. The minimum hardware

requirements are an Intel Pentium III 1.0 GHz computer, 512 MB RAM, a sound card, a video card and a network card.

5.4 Summary

Based on the theoretical underpinnings of the GDE Model and data analyses gathered from Study I, a Web-based game called *Socialdrome*® was built. The game presents an intrinsically motivating environment for the learners to make sense of how the exploration, experimentation and discovery enacted in the gameworld may take on relevance with issues in their real world (de Freitas, 2006). The learners have to reflect on the knowledge, skills and concepts presented in the game and at the same time acquire knowledge and skills through active participation and active observation in the gameplay. From the social information processing aspect, learners go through mental operations by selecting the appropriate social cues presented in the game, making causal attributions of intents, generating goals, constructing and deciding on responses, and enacting behavior. This experiential learning reinforces positive prosocial behavior among the learners. The challenge was for the design team to embed narrative elements, graphics, animation, sound effects, and learning tasks into *Socialdrome*® to entice the target users, make the game meaningful to them, and at the same time achieve the instructional goals.

CHAPTER 6 STUDY II - SUMMATIVE EVALUATION

This chapter presents Phase 5 to address the second research objective of investigating the learning outcomes and user acceptance that the children derive from the game-based learning environment. The sub-objectives are:

- Determine the extent of increase of children's social skills knowledge through participation in the game-based learning environment.
- Examine whether user differences affect the learning gains of children that participate in the game-based learning environment.
- Investigate the interrelationships among the two factors, playability and playfulness, that affect user acceptance of the game-based learning environment among children.
- Examine whether user differences affect acceptance of the game-based learning environment among children.

At the end of the game development, *Socialdrome*® underwent summative evaluation in Study II which was conducted to assess its learning effectiveness and user acceptance among the children. The chapter describes the research design, sample and setting, instruments, intervention procedures, data collection protocol, results and discussion of the findings.

6.1 Introduction

As a basis for constructing a pedagogical summative evaluation methodology for *Socialdrome*®, Study II conducted two different approaches of evaluation to assess the learning efficacy and user acceptance that the children obtained from their engagement with the game-based learning environment.

The first approach studied learning efficacy, addressing whether *Socialdrome*® would be able to create positive learning outcomes. As with any other educational intervention, this game-based learning environment, which is seen as a fast growing new genre that has the potential to bring about cognitive and affective changes in learners, should be evaluated on whether it is educationally beneficial for children.

The second approach focused on user acceptance. To optimize game-based learning, this approach drew from IS literature review, as described in Chapter 3, by identifying the underlying factors that affect the learners' behavioral intention to use the game which is important in the evaluation of any new technology. Many studies have overwhelmingly supported that behavioral intention brings about actual usage (Castañeda et al., 2007). In particular, the second approach investigates whether perceptions of the four game attributes are prerequisites of perceived playfulness among children and whether intention to use is a function of perceived playfulness and user differences.

By combining these two approaches, it is hoped that this would yield persuasive evidence about the educational efficacy and impact of the game as well as provide a better understanding of the users' profiles, experiences and behavioral intention to use the game. The constructs of this study were adapted from prior work on user acceptance with modifications to fit the specific context of this game-based social skills learning environment.

6.2 Hypotheses Development

This section derives the research hypotheses postulated for Study II based on the literature review carried out.

6.2.1 Approach 1: Learning Efficacy

Social Skills Knowledge. To assess the learning effectiveness of the game, it was important to investigate whether the game would affect the learning outcomes of the children who received the game-based learning social skills training compared to those who did not receive the treatment. The measure of knowledge in social skills is used as the construct of learning outcomes of children undergoing the social skills training (Pfiffner & McBurnett, 1997). The difference in the performance of children's pre-test and post-test performance in content knowledge was investigated to find out whether the magnitude of change is significant. The effectiveness of the game design is thus determined by the following hypothesis:

***H 1:** Children exposed to the game-based learning environment will achieve higher social skills knowledge from pre-intervention to post-intervention compared to those in the control condition who did not participate in the intervention.*

Gaming experience. Gaming experience has been used as an independent variable and has produced mixed results in learning outcomes (Richardson, Powers, & Bousquet, 2011). Miller, Chang, Wang, Beier, and Klich's (2011) study found that prior gaming experience was not a significant predictor of post-test content knowledge performance. In contrast, a study conducted by Orvis, Horn, and Belanich (2008) found that gaming experience significantly influenced the learning outcomes in the game-based instructional environments.

Clark et al. (2011) cautioned against creating games that are productive only for players with considerable gaming experience. Game designers should include scaffolds to minimise the frustration for less experienced players. Thus it is beneficial to evaluate whether the design of *Socialdrome*® has enough support structure for both

experienced as well as less experienced game players. The next hypothesis thus explores how individual differences in gaming experience affect the learning of social skills knowledge.

***H 2:** Prior gaming experience has significant effects on the acquisition of social skills knowledge over and above pre-test levels.*

Gender. The next hypothesis explores how individual differences of gender affect the learning of social skills knowledge. Empirical data have indicated that boys spend significantly more time playing games than girls and this may be attributed to the fact that boys are more experienced in gameplaying and find the games more conducive to their natural cognitive processing (Bonanno & Kommers, 2005). On the other hand, there are studies (e.g. Ogletree & Drake, 2007) that showed that learning through games was beneficial for both genders. Data collected by Clark et al. (2011) during implementation of game-based learning in Taiwan and the United States with students revealed that gameplay did not result in notable difference in learning gains for both genders. In spite of the cultural differences of students from these two countries, there were similarities in terms of learning and engagement, suggesting the potential benefits for both boys and girls. Clearly, examining the variables on individual differences would help in understanding the attraction of games and their impact on learning. Therefore it is hypothesized that:

***H 3:** Gender difference has significant effects on the acquisition of social skills knowledge over and above pre-test levels.*

6.2.2 Approach 2: User Acceptance

Perceived playability and perceived playfulness. The perceptions of the users on the four game attributes, 'Captivation of Interest', 'Meeting Learning Needs', 'Building Confidence' and 'Self-Assessment' are collectively defined as perceived playability. In game design, playability has been regarded to be a decisive issue affecting gameplay experience (Järvinen et al., 2002). While usability focuses on the effectiveness and efficiency of a system, playability of a game describes the user experience of achieving enjoyment and entertainment (Sánchez et al., 2009b). Games with good perceived playability are considered as enjoyable.

To better understand user experiences in the use of the game, perceived playability was investigated on whether it has positive impact on perceived playfulness. Numerous studies such as those conducted by Moon and Kim (2001) and Terzis and Economides (2011) suggested that perceived ease of use has significant effect on perceived playfulness. The attributes of playability is similar conceptually to those that exist in usability but have different meanings in the video game context (Sánchez et al., 2009a). Arguably, it can be said that as perceived playability or perceived game usability is conceptually positioned as similar to perceived ease of use, therefore it is reasonable to predict that perceived playability should influence perceived playfulness. Games with good playability are considered to induce a higher level of playfulness of the learners. Evaluating player playfulness will indicate the extent of quality of playability and whether the game has the capability to provide fun over an extended period of time (Kücklich, 2004). Analyzing whether perceived playability plays a dominant role in influencing a user's experience of playfulness would provide understanding on making the game more playable and appealing. Therefore the following hypothesis is posited as:

H 4: Perceived playability has a positive effect on perceived playfulness among children.

Intention to use. Next, the study investigated the effects of perceived playfulness on the behavioral intention to use *Socialdrome*®. This approach was identified to better capture the essence of games as tools to provide pleasure. Studies have identified that the construct, perceived playfulness or perceived enjoyment plays an important role in users' intention toward, and acceptance of a game (Lee & Tsai, 2010). Zhao and Fang (2009) contended that in a gaming context, perceived usefulness is no longer applicable and explored, so using the term, perceived enjoyment, which is similar to perceived playfulness, as an alternative, could better explain user acceptance.

Gaming can be viewed as having a hedonic attribute in which users experience fun when using the system (Fang et al., 2005; van der Heijden, 2004). As games are obviously the entertainment-oriented usage of information technology, existing literature has supported the replacement of perceived usefulness with perceived playfulness for studying games (e.g., Hsu & Lu, 2007; Liang & Yeh, 2009; Liang & Yeh, 2011; Wang & Wang, 2008). Based on the above premise, it is posited that perceived playfulness will have a positive effect on the behavioral intention.

H 5: Perceived playfulness influences the behavioral intention to use the game-based learning environment among children.

Gender differences. Research in gender and games has revealed distinct preferences of male and female players in terms of game design, game genre and play environment (Ibrahim et al., 2010). Empirically-based research has demonstrated that males claimed more competence and greater feelings of confidence compared to

females (Bonanno & Kommers, 2008). While males show a positive attitude toward gaming, females tend to demonstrate a less positive or neutral attitude toward gaming. Further, research has shown that there are clear gender differences in the salience of factors affecting individuals in their technology adoption decisions (Venkatesh, Morris, & Ackerman, 2000). With different socially cognitive structures, both groups adopt different decision-making processes in evaluating systems which affect their intention to use the systems.

With the above in mind, the study sought to investigate whether *Socialdrome*® was gender-specific or whether the means to ensure gender-inclusivity in the game design proves to be effective. Thus, Hypothesis 6 is posited as:

H 6: Gender difference influences the behavioral intention to use the game-based learning environment among children.

Gaming experience. Previous research has associated the concept of experience with an individual's familiarity and knowledge about the system of interest (Sun & Zhang, 2006). Individuals with more knowledge gained through prior experience would accumulate more knowledge sources when using the new system and hence perceive positively the ease of use. Prior research has also acknowledged that players with gaming experience are more familiar and skilful at using the games (Bourgonjon, Valcke, Soetaert, & Schellens, 2009). These players tend to favor the use of the games when they are brought into the classrooms than those who seldom engage in playing games. On the other hand, Brown, Dennis, and Venkatesh (2010) found that experience did not have effect on effort expectancy or perceived ease of use. Usually, users start off with dissatisfaction when they first use a new system. As their experience grows with increased use, they exhibit improved performance as they

overcome the initial hurdles of usage (Dennis & Garfield, 2003). It is, therefore, reasonable to investigate the following hypothesis:

***H 7:** Gaming experience influences the behavioral intention to use the game-based learning environment among children.*

Gaming self-efficacy. In the domain of user acceptance of information technology, the concept of self-efficacy has been included in the study of behavioral intention. Recent user acceptance studies have focused on judgments of computer self-efficacy as key antecedents of ease of use associated with technology usage (Agarwal, Sambamurthy, & Stair, 2000). Computer self-efficacy is defined as “a judgment of one's capability to use a computer” (Compeau & Higgins, 1995, p. 192). Agarwal, Sambamurthy, and Stair (2000) argued that application-specific self-efficacy is a more powerful predictor than general computer self-efficacy in the study of individual behavior toward different target technologies. They advocated that the construct for self-efficacy should be adapted to the target technology. The effects of application-specific self-efficacy on system use were also examined by Yi and Hwang (2003). So in the context of this study, it is hypothesized that gaming self-efficacy influences behavioral intention.

***H 8:** Gaming self-efficacy influences the behavioral intention to use the game-based learning environment among children.*

In sum, Figure 6.1 illustrates the inter-relationships between perceived playability, perceived playfulness, gender, gaming experience, gaming self-efficacy and behavioral intention to use the game that were being investigated in the second approach.

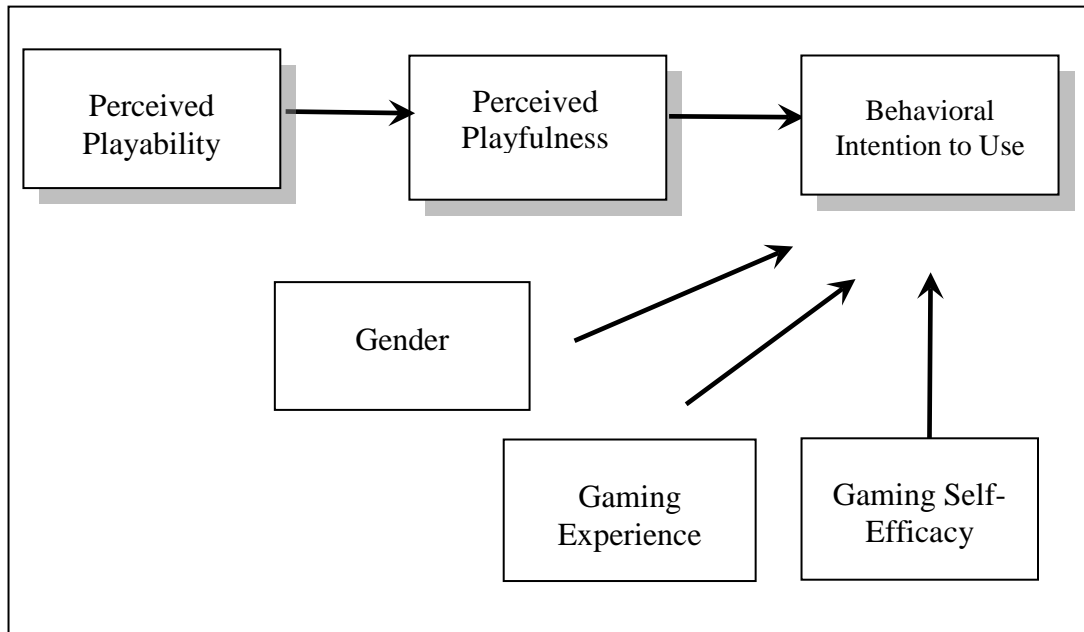


Figure 6.1. Approach 2: Inter-relationships between constructs

6.3 Research Design

The study involved the adoption of a quasi-experimental pre-test post-test control group design approach. True-experimental design was not possible in the study as randomization of participants to groups was impractical in a classroom setting. Quantitative data collection was adopted in a formal school setting as this approach would allow the examination of the effect of the treatment on a large number of students and therefore reaching a stronger conclusion with less error (Cairns & Cox, 2008).

First, the study sought to measure the difference in acquisition of social skills knowledge for students who received the game-based social skills training compared to those who did not. Second, the study explored whether perceived playability had a positive effect on perceived playfulness among students. Last but not least, this study explored the relationships between behavioral intention to use the game-based learning environment, perceived playfulness and differences among students in terms of gender, gaming experience, gaming self-efficacy. Quantitative measures such as pre- and post-

test achievement of social skills knowledge scores and scores of constructs from close-ended surveys, served as major sources of data.

6.3.1 Research Population and Setting

Study II adopted a convenience sampling approach which is usually recommended for studies conducted in educational settings (Gay, Mills, & Airasian, 2009). A random assignment by intact classes to group treatment was conducted because in a school setting it was not possible to assign the individual participants to groups randomly but to keep the existing classes intact. The study took place in a government primary school which has a population that is broadly representative of the population of Singapore children. The students came mainly from middle to low social economic status background.

The participants of the study were 10-year old students of moderate ability. Two classes were assigned to the experimental group and another two assigned to the control group. Of the 157 students in the four classes, 148 individuals participated in the study. One boy from the experimental group was excluded from the study as his parent did not give consent; three girls from the experimental group withdrew from the study as they were unable to attend all the sessions. Data from five students from the control group were incomplete and were thus excluded. The resulting sample size of 148 participants consisted of 72 students in the experimental group and another 76 assigned to the control group. There were 93 males (experimental $n = 52$; control $n = 41$) and 55 females (experimental $n = 20$; control $n = 35$) engaged in the study.

6.3.2 Scope

This research sought to investigate the effectiveness on the game-based social skills training based on whether the experimental group acquire the necessary knowledge on social skills knowledge and not whether the treatment brought about the transfer of social skills learning in naturalistic settings. Knowledge of social skills entails learning and cognitive reasoning whereas performance of social skills refers to directly observable behaviors and the ability to exert behavioral control in the service of achieving one's interpersonal aims (Goldstein, Miklowitz, & Mullen, 2006). This study focused on providing the participants with knowledge of what to do in social situations. Evaluation of individual child's level of knowledge of social skills would be considered as a pertinent first step in designing social skills training (Combs & Lahey, 1981; Matson & Wilkins, 2007). Participants who receive social skills training would be more knowledgeable about anger management and social problem-solving strategies and more likely to achieve social, emotional and behavioral gains than those who do not acquire this knowledge (DeRosier & Gilliom, 2007). This is concurred by Hennessey (2007) that students in classrooms that teach prosocial behaviours showed increases in prosocial behaviors and decreases in problem behaviors.

6.3.3 Instrumentation

Three instruments were developed to gather quantitative data to test the hypotheses of Study II: (1) Social Skills Knowledge Test, (2) Demographic Questionnaire and (3) Game Evaluation Survey, which are presented in Appendix B, Appendix C and Appendix D respectively. Both the experimental and control groups completed the Social Skills Knowledge Test and the Demographic Questionnaire so as to provide measures for comparison. The Game Evaluation Survey tracks the

perceptions of the experimental group of their experiences with the game-based learning environment. The instruments are described below.

The contents of the Social Skills Knowledge Test were evaluated for content and face validity. Face validity addresses whether a test looks valid or appears to measure a certain criterion or variable. Content validity measures whether the test covers all the content that was taught in the instruction, that is, how well the content of the Social Skills Knowledge Test matches the instructional contents in the game. In the development of the items for the Social Skills Knowledge Test, the training manual and a workbook on social skills training written by Ang and Ooi (2003a; 2003b), which is considered as a reliable, published source, were consulted to increase higher content relevance and adequate content coverage of the test instrument. Typically, validity evidence is obtained from expert judgments by content specialists or subject-matter experts on the extent of the relationship between the contents of the test and the constructs it is intended to measure (Jackson, 2011). In this case, as part of test validation, three content experts were invited for evaluating content validity. Lawshe (2006) purported that “If the subject matter experts are perceived as true experts, it is therefore unlikely that there is a higher authority to challenge the purported content validity” (p. 565). One of the selected content experts holds a PhD in School Psychology, the second has Master of Science in Counselling and the third is a trained school counselor. All three have expert knowledge in development of social skills of primary school children. They provided detailed feedback on the appropriateness and the readability of the test items for the 10-year old students. The revised instrument was trial tested with five students to assess item difficulty, clarity of items and whether the vocabulary used was appropriate. The students obtained scores of between 6 to 8, which indicates that the test was neither too easy nor too

difficult. While this approach of pretesting with a small number of users and experts is typically conducted to improve and modify the instruments by researchers in the information systems field (Chung & Tan, 2004; Lee & Tsai, 2010; Liao, To, Liu, Kuo, & Chuang, 2011; Wang & Wang, 2008), this is a limitation nonetheless. Future work should consider pretesting with a larger group of users and experts to improve generalizability.

For the Game Evaluation Survey, three scales, Perceived Playability Scale, Perceived Playfulness Scale and Behavioral Intention Scale were developed. The Perceived Playability Scale was developed to assess the perceived playability of the game. To generate the items for the scale, the Pedagogical Playability Heuristics developed for Study I was refined. The heuristics took reference from instructional principles of ARCS Model (Keller, 2010) and Events of Instruction (Gagné et al., 2005), game design principles of GameFlow Model (Sweetser & Wyeth, 2005) and Nielsen's usability heuristics (Nielsen, 1994b). These heuristics were modified and customized to form a scale consisting of a pool of items to better suit the purpose of the survey for capturing perceived playability of the game. Based upon insights gathered from Study I, modifications were made to improve item clarity and consistency of phrasing and style. The vocabulary of the items was pitched at the level that was considered appropriate for the age of the children. Overlapping and unsuitable items were eliminated so that the scale was of a reasonable length with 20 items. This would minimize time for the children to complete and allow them to stay engaged throughout the process of answering the survey.

The items for the Perceived Playfulness Scale were adapted with modifications from the scale constructed by Moon and Kim (2001) which was based on Csikszentmihalyi's (1991) flow theory and Ryan and Deci's (2000) intrinsic

motivation theory. The original scale consisted of a total of nine items. As the participants of this study were 10-year-old children, the items were either simplified or removed. For example, the item on “When interacting with _____, I do not realize the time elapsed” was removed as the children would not understand the related question. The scale was reduced to six items as too many items would contribute to fatigue in the children.

The items used for the Behavioral Intention Scale were adapted from Venkatesh, Morris, Davis, and Davis (2003) with minor changes on the context of use. Content validity of the Game Evaluation Survey was assured through content-expert review by an expert in the area of information systems. Pre-testing of the instrument was carried out with five students. Based on the input and comments given by the expert and students, the instrument was revised.

Social Skills Knowledge Test. The Social Skills Knowledge Test, which was administered individually to the children, assessed their level of knowledge and understanding of social skills pertaining to the three domains: understanding of emotions, anger coping techniques and social-cognitive skills. A pool of 15 items was developed with five items for each domain. Each item followed a multiple choice format with four possible choices of which there was only one single best answer and three distractors. Each correct item was given a score of one. The number of correct responses to these items was summed to create a total score. The highest possible score was 15 and the lowest possible score was zero, with higher scores reflecting higher knowledge of social skills.

An example item of the Social Skills Knowledge Test is: “Joshua’s classmate, Richard often called him names. One day, when Joshua was by himself, Richard walked up to him and called him “Cry Baby”. Joshua got very angry and started

hitting Richard. Choose the best answer to describe your understanding of the situation. (A) Joshua's anger feelings caused him to hit Richard and this is not Joshua's fault, (B) Joshua has the right to hit Richard just to teach him a lesson because he is angry, (C) Joshua's anger feelings can influence the way he behaves but it is Joshua who decided to react violently when he is angry, (D) Joshua should hit Richard to stop him from calling him names. (Answer = C)."

The dependent variable, social skills knowledge test scores, was measured before the onset of the experiment (pre-experimental measures) to establish the baseline of the children's knowledge of social skills. At the end of the experiment (post-experimental measures) for the purpose of pre-test and post-test comparisons, both experimental and control participants completed a post-treatment assessment. The questions in the instrument were identical for both the pre-assessment and post-assessment.

Demographic Questionnaire. The Demographic Questionnaire was developed to extract the children's demographic information on class, date of birth, gender, computer experience, gaming experience and gaming self-efficacy. The demographic questionnaire was administered at the start of the children's involvement of the study.

Computer experience was rated by the children as the number of years they had used computers. For gaming experience, the children were categorized into five groups, novice, light user, occasional user, regular user and frequent user depending on how rate themselves in the frequency of the gameplay, that is "never", "not very often", "several times a month", "several times a week" and "almost every day" respectively. Gaming self-efficacy was defined as the self-perception of the children's knowledge about computer games and could be rated by the children on whether they "don't

know anything”, “know a little”, “know something”, “know a lot” and “know everything” about computer games.

Game Evaluation Survey. The Game Evaluation Survey, comprising the Perceived Playability Scale, the Perceived Playfulness Scale and the Behavioral Intention Scale, was designed to measure users’ interaction and experiences. The details of the three constructs, perceived playability, perceived playfulness and behavioral intention, and the number of corresponding items on the instrument are presented in Table 6.1. The survey was administered at the conclusion of the treatment, after the children completed playing all the seven game modules.

Table 6.1






Scale Constructs Pertaining to the Perceptions of the Participants

Scale Construct	Number of Items
Perceived Playability	20
Perceived Playfulness	7
Behavioral Intention	3

Five-point Likert-type scales were adopted for the measurement of aforementioned constructs with 5 being the positive end of the scale and 1 being the negative end of the scale (Table 6.2). “Smiley” or “frowny” faces of the Smileyometer used by Read (2006) were incorporated to the scales with corresponding phrases, “a great extent”, “a big extent”, “to some extent”, “a little” to “not at all”, to help children produce more reliable responses (Harrison, Zappen, & Watson, 2009).

Table 6.2

Five-Point Scale

				
A Great Extent	To A Big Extent	To A Moderate Extent	A Little	Not at all
5	4	3	2	1

Perceived Playability Scale. The Perceived Playability scale, comprising 20 statements, measures the perception of the children on the four game attributes, ‘Captivation of Interest’, ‘Meeting Learning Needs’, ‘Building Confidence’ and ‘Self-Assessment’. The composite score, Perceived Playability score, forms an overall measure of children’s perceived perception of the playability of the game. It is determined by averaging all of the items on the scale. Each item had a minimum score of one, indicating low perceived playability and a maximum score of five, indicating high perceived playability. Higher Perceived Playability scores indicate the children perceive the game to offer higher playability. The children were asked to rate their level of perception on the playability of the game. An example item from the game attribute ‘Self-Assessment’ is “When playing the game, I received immediate feedback on my actions.”

Perceived Playfulness Scale. The Perceived Playfulness Scale, comprising seven statements, measures the extent to which the children are experiencing fun, enjoyment and immersion in the game while playing it. The scores of the seven items were averaged to form an overall measure of children’s playfulness. Scores range from 1 to 5 with higher scores indicating high levels of children’s perceived playfulness level. Example of an item from this scale is “I want to play more of the game because the game was fun”

Behavioral Intention Scale. The Behavioral Intention Scale, comprising three statements, was an index measuring user acceptance of the game-based learning environment, *Socialdrome*®. The scores of the three items were averaged to form an overall measure of children’s behavioral intention to use the game. Higher scores reflect the greater the intention to use the game in future. An example item from this scale is “I intend to play the game in the future”.

6.4 Procedure

6.4.1 Ethical Considerations

Ethical principles were addressed in three dimensions, namely informed consent, privacy, confidentiality and anonymity (Boeije, 2010; Walker, 2010). Approval was sought from the Ministry of Education and Principal of the school to conduct Study II and collect data. There were no anticipated risks and harm to the children participating in the study. They were informed of the purpose and the potential benefits of the study. They were invited to participate in the study and given informed consent forms. These forms signed by parents or guardians of all participating children were collected before their participation in the study. The children were also assured that privacy, confidentiality and anonymity would be strictly maintained and no individuals' names and other unique identifiers would be disclosed in the analysis and report of the data collected.

6.4.2 Intervention Procedure

The experiment treatments took place three weeks before the end of the final term in the school year. The study was conducted as part of the school after-examination activity during the regular school hours. The study was presented as a Step-Up Social Problem-Solving Program to the children. The children in the experimental group, consisting of two classes, participated in the study for seven sessions each. The total number of 14 sessions were completed within two consecutive weeks, thus minimizing attrition and lapses in the study protocol (Hopkins et al., 2011). Each session took about one and a half hours in duration.

During the intervention period, the children in the control group received no treatment but participated in the school's regular academic program where they

received assistance in their academic subjects, for example, English, Mathematics and Science. This procedure was taken to control for the effects of time and attention. The lessons conducted with this group were useful for the children but the contents of these lessons were not associated with the learning objectives of the game-based social skills training. Gay et al. (2009) cautioned that the control group should not “sit in a closet” while the study is conducted.

All the sessions for the two classes were conducted by two lead facilitators: the school counselor and the researcher. The school counselor, who played a key role in providing guidance and counselling services in the school, is experienced and skilful in delivering social skills to children. The researcher is a senior education officer and is experienced in working with school children. Another three research assistants facilitated the sessions by providing help in navigating the game interface during gameplay. A Computer Technician was present to provide technical help, if needed.

The interventions were carried out in one of the school computer laboratories. It has 42 networked PCs with 2.8 GHz Pentium Core 2 Duo processors, running Windows XP, equipped with accelerated 3D graphics support and audio output with stereo headphones and installed with Internet Explorer browser. For all the sessions, the children were assigned a PC each according to their class register number, which is a unique identifier. They were to use the same PC for the entire study. During the first session, the lead facilitators delivered a half-an-hour orientation session during which the children were informed of the purpose and objectives of the study.

Using Microsoft PowerPoint slides, the lead facilitators gave an overview of the new skills learned for each session and explained the rationale for the skills trained (Refer to a sample of the slides in Appendix E). They helped to familiarize the children with the game environment by giving instructions on how to navigate and

interact in the game interface. The children had to access *Socialdrome*® through the given URL. The actual gameplaying session began when the children logged in with their unique user IDs and passwords. The gameplaying was conducted under the supervision of the five facilitators. For each session, the children were instructed to play a specified mission which consisted of four to five quests. The game was programmed and sequenced in such a way that prevented the players from playing other missions.

During the gameplay, the children were instructed to click on the online help system, *PetTeach* for help and instructions. Whenever a task or quest was successfully completed, the children earned scores in the form of mints. Additionally before the children exited each session, they had to write their reflections on the secret reflection journal in *Socialdrome*®. The reflection process allowed the children to check their understanding throughout the playing of the seven modules. They were informed that their journals would only be read by the school counselor and the researcher, for the purpose of monitoring their progress in social skills acquisition. Their peers would not read their journals unless permission was granted. The children's interaction with the game, for example their reflections and textual answers to open-ended questions, was stored in the game server.

6.4.3 Treatment Fidelity

To ensure that the intervention was being administered in a standardized manner, strategies were devised to monitor and enhance the consistency of the intervention (Bullis et al., 2001; Jones et al., 1993). The facilitators followed the session outlines detailing the sequence of the training. The sessions were scripted to

promote treatment fidelity with the inclusion of the presentation slides for use by the lead facilitators for every session (Refer to a sample of the slides in Appendix E).

The researcher met with the facilitators before and after each session to review the implementation protocol and processes. There were no apparent substantial deviations from the session outlines. As session fidelity was consistently fostered, it would then be possible to judge the true effects of the intervention.

6.4.4 Threats to Validity

Where possible, steps were taken to nullify the threats to validity. A possible extraneous variable is the academic performance of students as studies have reported there is a link between academic performance and social skills, for example, poor academic performance and social behavior problems frequently co-occur (Hennessey, 2007). To minimize this threat, the participants from both the experimental and control groups were from moderate ability classes.

A potential threat to validity is pre-test sensitization which is a threat of improved performance on a post-test due to the effects of the pre-test. The testing threat is more likely to occur if factual information is measured. To minimise this threat, the instrument, the Social Skills Knowledge Test, tested less on recall information but more on higher-order skills of application and analysis. With 15 multiple-choice questions of four choices each, it would be unlikely that the children were able to recall the questions after the pre-test. Another precaution was that the children were not informed of the correct answers to the multiple-choice questions after the pre-test. Gay, Mills, and Airasian (2009) cautioned against having two different tests as it may pose a potential threat to internal validity if the two tests are

not of equal difficulty. A difficult post-test would mask the improvement and a simple post-test would indicate an improvement that was not present.

Another possible threat that was reduced was the novelty effect, especially in this study where an emerging technology was used. It was expected that the children would have increased interest, motivation and engagement simply because games were rarely used as a mode of instruction. As recommended by Gay et al. (2009) a way to counteract this effect is to increase the number of sessions. In this study, seven sessions of four to five quests were considered long enough for the novelty effect to wear off.

6.5 Data Collection Protocol

The two instruments, Social Skills Knowledge Test and Demographic Questionnaire, were administered to both the treatment and control groups on the Friday of the week before the study. To help prevent anxiety on the part of the children, the Social Skills Knowledge Test was administered to them as a quiz. The children were given 30 minutes to complete the two instruments.

To ensure consistency, the instruments were administered by the form teachers of the four classes. They administered the two instruments individually to each participant in their classrooms at approximately the same time. To maintain the integrity and standardization of the instruments, the teachers were provided with written instructions on the proper way to administer the instruments. The teachers read out the instructions to the children. They were assured that their identities would be kept confidential and anonymous. They were informed that the data collected would be reported in an aggregate manner without identification of anyone as individuals. They were informed that each question contains four possible answers of which there

is only one single best answer. They should read the questions carefully and decide which option from the list is the single best answer.

To decrease internal threats to validity, the teachers were instructed to ensure that the children did not share their answers with each other and silence should be maintained throughout the session and they should not be left unattended. The researcher walked around the four classrooms which were situated next to each other to provide assistance and ensure experimental fidelity was abided.

At the end of the intervention, the same instrument, the Social Skills Knowledge Test, was administered to obtain post-assessment data from both the treatment and control groups. Besides this instrument, the children in the treatment group rated their own perception on the Game Evaluation Survey. The facilitator gave instructions for completing the survey. To ensure that all children understood the meaning of the test instrument, the facilitator read aloud each item, explained the meaning of more difficult words and attended to any clarifications raised. The children were instructed to place a tick below the 'smiley' or 'frowny' face that best indicates their level of agreement. The children were reminded to check that they rated all items in the surveys as the surveys would be considered as invalid if there were missing responses. The procedure lasted approximately 30 minutes for both groups. On completion of the survey, the children were each given a token of appreciation.

6.6 Results

This section describes the findings on data on profile of the sample, learning outcomes attained and perceptions of users corresponding to the constructs to address Research Objective 2. It presents the results of statistical analyses which included the

tests of internal consistency reliability, descriptive statistics, chi-square, repeated one-way ANOVA and multiple regression.

6.6.1 Descriptive Statistics of the Sample

The experimental group consisted of 52 (72.2%) boys and 20 (27.8%) girls and the control group consisted of 41 (53.9%) boys and 35 (46.1%) girls (refer to Table 6.3). In the experimental group, there were 8 (11.1%) children with 1 year of computer experience, 11 (15.3%) children with at least 2 years of computer experience, 14 (19.4%) children with at least 3 years of computer experience, 39 (54.2%) children with 4 or more years of computer experience (refer to Table 6.4). In the control group, there were 7 (9.2%) children with one year of computer experience, 12 (15.8%) children with at least 2 years of computer experience, 16 (21.1%) children with at least 3 years of computer experience, 41 (53.9%) children with 4 or more years of computer experience. A chi-square test, $\chi^2(1, N=148) = 0.186, p = .980$ revealed that there was no significant difference by computer experience between the experimental and the control groups.

Table 6.3
Descriptive Statistics of Gender of Sample Profile

Group	Category	Frequency	Percent
Experimental	Male	52	72.2
	Female	20	27.8
Control	Male	41	53.9
	Female	35	46.1

Table 6.4
Descriptive Statistics of Computer Experience of Sample Profile

Group	Category	Frequency	Percent
Experimental	> 1year	8	11.1
	> 2year	11	15.3
	> 3year	14	19.4
	> 4year	39	54.2
Control	> 1year	7	9.2
	> 2year	12	15.8
	> 3year	16	21.1
	> 4year	41	53.9

For gaming experience, in the experimental group, there were 21 (14.2%) light users who did not play games very often, 6 (4.1%) occasional users who played games several times a month, 28 (18.9%) regular users who played games several times a week, and 17 (11.5%) frequent users who played games almost every day. In the control group, there were 2 (1.4%) novices who never played games, 17 (11.5%) light users who did not play games very often, 11 (7.4%) occasional users who played games several times a month, 26 (17.6%) regular users who played games several times a week and 20 (13.5%) frequent users who played games almost every day (refer to Table 6.5). Chi-square findings, $\chi^2(1, N=148) = 4.104, p = .39$ revealed that there was no significant difference by gaming experience between the two groups.

Table 6.5
Descriptive Statistics of Gaming Experience of Sample Profile

Group	Category	Frequency	Percent
Experimental	Novice	0	0.0
	Light User	21	14.2
	Occasional user	6	4.1
	Regular User	28	18.9
	Frequent User	17	11.5
Control	Novice	2	1.4
	Light User	17	11.5
	Occasional user	11	7.4
	Regular User	26	17.6
	Frequent User	20	13.5

The datasets revealed that most of the children were not lacking in computer experience and had some prior knowledge about computer gaming. There were no significant differences between the groups in terms of computer experience and gaming experience. (refer to Table 6.6). Put simply, the children in the two groups were similar in terms of computer experience and gaming experience.

Table 6.6

Analyses of Computer Experience and Gaming Experience

Variable	χ^2	df	<i>p</i>
Computer Experience	0.186	148	.980
Gaming Experience	4.104	148	.392

6.6.2 Descriptive Data of Variables

Generally, it can be deduced that users responded positively in their perceptions of user experiences as the averages were all greater than 4 out of a scale of 5. Table 6.7 presents the means and standard deviations of the constructs.

Table 6.7

Means and Standard Deviations of Constructs

Construct	Mean	Standard Deviation
Perceived Playability	4.11	0.63
Perceived Playfulness	4.14	0.84
Behavioral Intention	4.01	1.10

6.6.3 Reliability and Validity

Exploratory Factor Analysis using principal components analysis (PCA) extraction method was employed to determine the construct validity of the Perceived Playability Scale, the Perceived Playfulness Scale and the Behavioral Intention Scale. The dataset was examined to determine whether the sample size was adequate for factor analysis. The “Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy”

statistic, a criterion to determine the degree of correlation between the variables, was employed (Pallant, 2010). The minimum KMO value for a good factor analysis is .6 (Tabachnick & Fidell, 2007). For the three scales, all the KMO values were higher than .6, indicating that common factors exist. The KMO values of perceived playability scale, perceived playfulness scale and behavioral intention scale were .841, .842 and .693 respectively exceeding the recommended value of .6 (Kaiser, 1970, 1974).

Bartlett's (1954) Test of Sphericity was conducted to find out whether there was a high degree of correlation between variables and to measure the multivariate normality of the distribution of the data. As the test was highly significant at .001 level for the three scales (perceived playability scale: $\chi (190, N=72) = 702.059, p < .0001$, perceived playfulness: $\chi (21, N=72) = 244.022, p < .0001$, behavioral intention: $\chi (3, N=72) = 87.402, p < .0001$), the factorability of the correlation matrix is supported (Pallant, 2010).

Reliability analyses were also conducted to examine the composite reliability or internal consistency of the three scales. According to Green and Salkind (2011), Cronbach's alpha values should be at least .70 for the test to be considered reliable. The Cronbach's alphas or correlation coefficients of the Perceived Playability Scale, the Perceived Playfulness Scale and the Behavioral Intention Scale were .918, .877 and .835 surpassing the recommended threshold of .70 (Tabachnick & Fidell, 2007). This indicated that the items for each construct were highly inter-related, reflecting adequate and good internal consistency for this data. The three scales were considered robust and meaningful as the reliability estimates were acceptable. Table 6.8 presents the summary table of the reliability and validity analyses.

Table 6.8
Summary Table of Reliability and Validity Analysis.

Dimension	KMO value	Bartlett	Eigen value	Percent of variance	Composite Reliability
Perceived Playability	0.841	702.059	8.003	40.014	.918
Perceived Playfulness	0.842	244.022	4.140	59.142	.877
Behavioral Intention	0.693	87.402	2.258	75.278	.835

6.6.4 Hypotheses Testing

Inferential statistics, specifically ANOVA and multiple regression analyses, were employed to test the hypotheses using the data from the social skills knowledge scores attained by the experimental group and the control group and the surveys on the perception of the children in the experimental group toward the game-based learning environment. One-way repeated-measures ANOVA were used to determine whether the use of *Socialdrome*® produced a significant increase in learning outcomes. To be consistent with studies on user acceptance such as those by Chung, Park, Wang, Fulk, and McLaughlin (2010), Moon and Kim (2001) and Yang (2005), the hypothesized relationships were tested using multiple regression analyses.

H 1: Children exposed to the game-based learning environment are expected to achieve higher social skills knowledge from pre-intervention to post-intervention compared to those in the control condition who did not participate in the intervention.

The hypothesis was analysed using a one-way repeated-measures ANOVA design, with one between-groups factor (group: experimental versus control) and one within-groups factor (time: pre-treatment and post-treatment). The dependent variable was social skills knowledge scores. The independent variable was the treatment, game-based learning environment used for instruction of social skills. The quantitative data

were analysed for any significant pre-post gains in the treatment group compared to the control group.

Table 6.9 shows that there was a significant difference between the two measures at Time 1 and Time 2, $F(1,146) = 68.05, p < .05$. The effect size or partial eta squared, η^2 of .32 indicated that 32% of the variance in the dependent variable was due to within-subject differences between the two measures. According to Cohen (1988), the value of the effect size reflected that the effect of the treatment was very large (.01 = small, .06 = moderate, .14 = large effect). The table also shows a significant time by group interaction effect on the test scores (Time*Group, $F = 40.66, df = 1, Sig. = .000$). Here, 22% of the variance in test scores was accounted for by the interaction of Time and Group.

Table 6.9

Summary Table for One-Way Repeated-Measures ANOVA

Source	Sum of Squares	df	Mean Square	F	Partial Eta Squared
Between-Subjects					
Intercept	18664.72	1	18664.72	2707.14**	.95
Group	403.10	1	403.099	58.47**	.29
Error	1006.62	146	6.895		
Within Subjects					
Time	223.63	1	223.63	68.05**	.32
Time * Group	133.63	1	133.63	40.66**	.22
Error (Time)	479.83	146	3.286		

* $p < .05$, ** $p < .01$

Table 6.10 presents the means and standard deviations of the pre-test and post-test scores of the experimental and control group at Time 1 (pre-intervention) and Time 2 (post-intervention). The experimental group achieved the higher mean (mean = 10.65, SD = 2.24) compared to the control group (mean = 6.97, SD = 2.43).

Table 6.10

<i>Descriptive Statistics of Mean Scores on Social Skills Knowledge</i>				
Time Period	Group	Mean	Standard Deviation	N
Time 1 (Pre-Test Scores)	Experimental Group	7.57	2.155	72
	Control Group	6.58	2.180	76
	Total	7.06	2.217	148
Time 2 (Post-Test Scores)	Exp Group	10.65	2.240	72
	Control Group	6.97	2.433	76
	Total	8.76	2.975	148

Figure 6.2 displays two line graphs that provide graphical evidence that mean scores on social skills knowledge were significantly higher from Time 1 (pre-intervention) to Time 2 (post-intervention) for the experimental group compared to the control group.

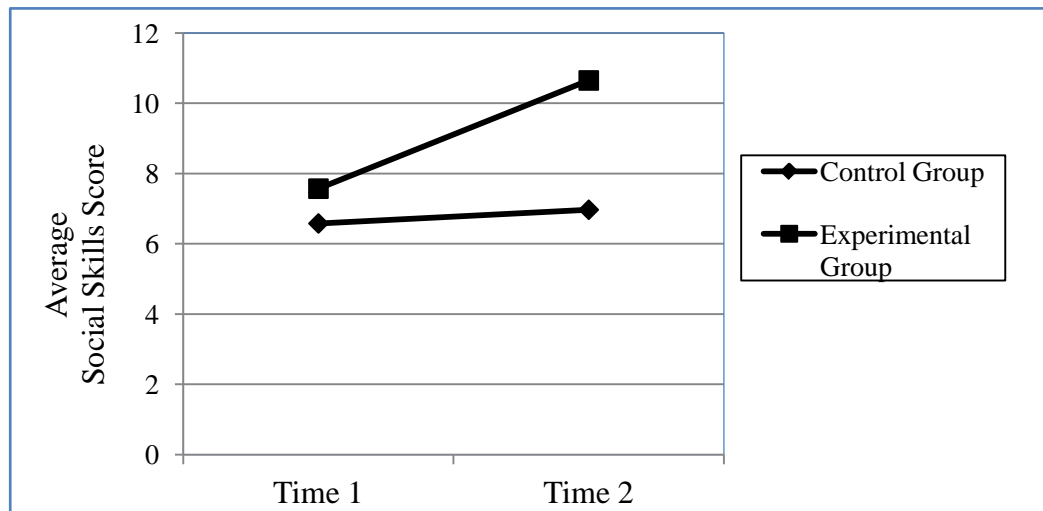


Figure 6.2. Average social skills scores as a function of group and time

The findings demonstrated that there was a statistically significant difference between the intervention group taught in the game-based learning environment and the control group that did not participate in the experiment. Thus Hypothesis 1 was supported. The first group acquired social skills knowledge far superior than the

second group. This indicated that the gaming approach was effective in promoting children's acquisition of social skills knowledge.

H2: *Prior gaming experience has significant effects on the acquisition of social skills knowledge over and above pre-test levels.*

H3: *Gender difference has significant effects on the acquisition of social skills knowledge over and above pre-test levels.*

Hierarchical regression analysis was conducted to determine whether prior gaming experience and gender have significant effects on the acquisition of social skills knowledge over and above pre-test levels. Pre-test scores were entered first into a hierarchical multiple regression equation, followed by the demographics block, comprising prior gaming experience and gender. The predictor variables were gender and gaming experience. The pre-test scores were used as covariates to control the effect of the children's variance.

The results of multiple regression analysis (Table 6.11) revealed that the model accounted for 18% of the variance in the acquisition of social skills knowledge, $R = .43$, $R^2 = .18$, $F(3,144) = 10.8$, $p < .01$. The R square change was not statistically significant ($\Delta R^2 = .014$, n.s.). The analysis suggested that gaming experience and gender were not significant predictors as there was no significant effect of gaming experience and gender on the acquisition of social skills knowledge over and above pre-test levels. Hypotheses 2 and 3 were thus not supported.

Table 6.11
Regression Analysis of Post-Test Scores

Model		Beta	t	Sig.	R	R ²	F
1	(Constant)		6.504	.000			
	Pre-test	.411	5.443	.000	.411 ^a	.169	29.623**
2	(Constant)		4.571	.000			
	Pre-test	.435	5.647	.000	.428 ^b	.183	10.756**
	Gaming Experience	-.072	-.948	.345			
	Gender	.106	1.373	.172			

*p < .05, **p < .01

a. Predictors: (Constant), Pre-test

b. Predictors: (Constant), Pre-test, Gaming Experience, Gender

c. Dependent Variable: Post-test

H 4: *Perceived playability has a positive effect on perceived playfulness among children.*

The user perceptions on the four game attributes were used collectively as a single measure of overall perceived playability. As perceived playability influences users differently, it becomes important to understand how the construct contributes to explaining the variance seen in perceived playfulness among children.

A regression analysis was conducted by adding perceived playability as the predictor variable and perceived playfulness as the outcome variable. The regression model for perceived playfulness had a good fit and provided 70% variance for the prediction of perceived playability among children, $R^2 = .70$, $F = 165.699$, $p < .001$. The beta weight ($\beta = .838$), representing the unique contribution of the variable, suggested that perceived playability was statistically significant ($p < .05$) in predicting perceived playfulness. Therefore, Hypothesis 4 was supported. Table 6.12 presents the results of the linear regression model for perceived playfulness.

Table 6.12
Linear Regression Model for Perceived Playfulness

Predictor Variable	B	SE(B)	β	t	Sig(p)
Perceived Playability	1.111	0.86	.838	12.872**	.000
R^2	.703				
F	165.699**				

* $p < .05$, ** $p < .01$

H 5: *Perceived playfulness predicts behavioral intention to use the game-based learning environment among children.*

H 6: *Gender predicts behavioral intention to use the game-based learning environment among children.*

H 7: *Gaming experience predicts behavioral intention to use the game-based learning environment among children.*

H 8: *Gaming self-efficacy predicts behavioral intention to use the game-based learning environment among children.*

The intent of the testing of the above hypotheses was to investigate the relationships between behavioral intention to use the game-based learning environment and perceived playfulness, gender differences, gaming experience and gaming self-efficacy.

For the linear regression model for behavioral intention, the outcome variable was behavioral intention and the predictor variables were perceived playfulness, gender, gaming experience and gaming self-efficacy. The results of the regression analysis revealed that the model had a good fit and accounted for 49% of the variance in the intention to use, $R^2 = .49$, $F = 15.977$, $p < .001$. The regression coefficient or beta weight of perceived playfulness ($\beta = .650$) was statistically significant ($p < .05$) in

predicting in predicting the behavioral intention to use, providing support for Hypothesis 5.

However the effects of the three predictors, gender, gaming experience and gaming self-efficacy, were not significant. Therefore, Hypotheses 6, 7 and 8 were not supported. The results are displayed in Table 6.13.

Table 6.13
Linear Regression Model for Behavioral Intention

Predictor Variable	B	SE(B)	β	t	Sig(p)
Perceived Playfulness	.851	.121	.650	7.019**	.000
Gender	-.072	.224	-.030	-.321	.749
Game Experience	-.152	.091	-.159	-1.665	.101
Gaming Self-Efficacy	.008	.108	.007	.077	.939
R ²	.488				
F	15.977**				

* $p < .05$, ** $p < .01$

In summary, the results of the hypotheses are illustrated in Table 6.14.

Table 6.14
Results of Hypotheses

Hypothesis	Dependent Variable/ Outcome Variable	Independent Variable/ Predictor Variable	Result
H1	Post Test Scores	Intervention	Supported
H2	Post Test Scores	Gaming Experience	Not Supported
H3	Post Test Scores	Gender	Not Supported
H4	Perceived Playfulness	Perceived Playability	Supported
H5	Behavioral Intention	Perceived Playfulness	Supported
H6	Behavioral Intention	Gender	Not Supported
H7	Behavioral Intention	Gaming Experience	Not Supported
H8	Behavioral Intention	Gaming Self-Efficacy	Not Supported

6.7 Discussion

6.7.1 Learning Efficacy

In assessing the learning effectiveness of the game, the experimental group performed statistically better compared to the control group in terms of social skills scores, thus providing support for Hypothesis 1. In particular, the children in the experimental group achieved an average of 10.65 which was significantly higher than the average score of 6.97 attained by the control group. The findings suggested that *Socialdrome*® had achieved its objective of being an effective game-based learning environment in terms of the learning outcome. Thus the game could be utilized in formal learning environment to support the acquisition of social skills knowledge. Put differently, this empirical study adds to a growing body of evidence for the efficacy of social skills in social skills literature.

The positive outcome of this research is in agreement with other recent work that suggested students benefited from the motivating and fun learning environment of games (Liu & Chu, 2010; Miller et al., 2011). A game with increased appeal to the senses, increased interactivity and increased challenge would offer continuous motivation and arouse students' interest toward continued learning (Yip & Kwan, 2006). In fact, in a motivating game environment, disengaged students with poor academic performance achieved greater learning gains compared to students with good and moderate academic performance as they appeared to be very satisfied and interested in the educational contents of the game (Virvou et al., 2005).

It is noteworthy to mention that though the acquisition of social skills knowledge could bring about exhibition of prosocial behaviors in children, any standalone school-based social skills intervention implemented in isolation would not promote a large effect for developing a repertoire of sophisticated complex social

skills (Wilson, Gottfredson, & Najaka, 2001). Typically, only interventions that spanned over a year were able to provide some amount of modest support, and interventions that lasted over several years have been found to have the greatest impact (Hennessey, 2007). In fact, researchers have called for schools to adopt a greater ecological focus on social skills intervention (Bierman et al., 2010). Social skills programs should not be confined only to the training settings but should expand to different ecological settings with teachers, other school personnel and parents (Jones et al., 1993). It is recommended that students should be offered the opportunities to utilize the new social skills learned in reinforcing environments so that the skills learned can be sustained (Hennessey, 2007). It is therefore hoped that the increase of social skills knowledge will translate into an improvement of social skills and drop in problem behaviors in children if attention is paid to generalization of skills in ecological settings with teachers, other school personnel and parents (Jones et al., 1993). This will then reinforce the efforts of the game-based social skills training.

6.7.2 User Acceptance

The high mean of perceived playability of 4.11 out of 5.00, with a standard deviation of 0.63, indicates that the children had a positive perception of the playability of the game. This suggests that the children perceived the game attributes in a favourable light and encountered positive experiences while playing it.

The first regression model demonstrates that the construct, playability, has significant high explanatory power with a R^2 of 70%, indicating that the model is able to account for 70% of the variance in playfulness. The analysis determined that the construct, perceived playability, has significant influence on perceived playfulness among children and is a prerequisite of perceived playfulness. So it could be

postulated that a high level of perceived playability would lead to a high state of users' playfulness. Prior empirical studies demonstrated that the relationship between perceived ease of use and perceived playfulness is strong which purports that playfulness can be increased by providing ease of use (Moon & Kim, 2001; Terzis & Economides, 2011). The attributes of playability is similar conceptually to those that exist in the ease of use of a system (Sánchez et al., 2009b), therefore, it is reasonable to imply the relationship between playability and playfulness in Study II demonstrates concurrence with other empirical studies. This suggests that the playability of the game attributes ought to be enhanced as they have impact on perceived playfulness.

The second regression model demonstrates satisfactory predictive power with a R^2 of 49%. The regression coefficient or beta weight of perceived playfulness ($\beta = .650$) was statistically associated with behavioral intention. This finding corroborates with previous empirical findings that playfulness had a significant positive effect on behavioral intention to use the game (Ahn et al., 2007; Fang et al., 2005; Lin et al., 2005; Moon & Kim, 2001; Wang & Wang, 2008). This indicates that the children are more likely to play the game when they feel more playful, which in turn is predicted by the playability of the game. On the other hand, if the children perceive that the game would not give them enjoyment and pleasure, they would not likely consider playing it in the near future. A significant implication is that the features of the game associated with making users experience enjoyment such that they are in a playful state, are critical for the acceptance of the game.

With the positive user experience in gameplaying, the possibility of adopting and playing the game repeatedly is heightened (Rieber & Noah, 2008). The increased interaction with the game would further facilitate the learners to elicit desirable behaviors based on emotional or cognitive reactions (Pivec & Dziabenko, 2004). This

in turn would bring about effective learning of social skills, more practice of social problem-solving skills and generalisation of social skills to naturalistic settings (More, 2008), for example, the playground and the school canteen. Consequently, the learning of the social skills would build children's self-esteem, improve their interpersonal behavior and help them cope with any psychological distress and social isolation (Beauchamp & Anderson, 2010; Canney & Byrne, 2006).

6.7.3 Demographic Relationships

Another primary interest of this research involved investigation of the dynamics of the demographic relationships with learning outcomes and user acceptance. In exploring the potential effect of gender differences in the learning effectiveness of the game, it was reflected in the finding that the difference between the gains in knowledge of the two genders was not statistically significant. This implies that both boys and girls displayed similar achievement of learning gains through the use of a computer game, which is in compliance with findings by Papastergiou (2009). A meta-analysis conducted by Vogel et al (2006) indicated that reported statistics comparing males and females found no significant differences in cognitive gains using games and simulations.

No significant effect of gender differences on the learning outcomes also suggests that the game satisfies the criterion of being gender-neutral. The way *Socialdrome*® was designed was a response to criticisms that games are usually more male-oriented, competitive style in interaction and inclined to gender stereo-typing of female characters (Boyle & Connolly, 2009). So for *Socialdrome*® to be considered as an effective educational tool, it should be able to facilitate learning without disadvantaging one gender over the other. Simply put, game designers should be

cognizant that games for learning should aim to be gender-inclusive and not alienate the female students in the learning process.

Previous work has demonstrated a strong male preference for computer games which impacts user acceptance. The frequency of gameplaying among males is much higher compared to females, which suggests that gameplaying is very much a male domain (Bonanno & Kommers, 2005; Green & McNeese, 2008; Quaiser-Pohl et al., 2006). The high availability of violent gender stereotyped content and competitive nature in games contribute to the male preference for games (Boyle & Connolly, 2009). However, over the years, the number of female players has increased as both boys and girls today have the same exposure to computers, therefore reducing the gender gap (Wu, 2009).

In a typical government primary school in Singapore, the student to computer ratio is 6.6:1 (Lim, 2007). With the high number of computers, it can be inferred that both male and female participants in the study were given equal access to the computers in the school. Beside this, free browser games are easily available on the Internet which attract large player communities (Klimmt, Schmid, & Orthmann, 2009). More girls have greater access to games available on popular social networking sites such as Facebook, and thus, this suggests that the gender gap in game uptake among the two genders is slowly diminishing. This opportunity increases girls' gaming skills and gaming experience and brings about confidence and perceptions of self-efficacy in game- playing. This might have attributed to the findings that gender differences had no effect on behavioral intention.

This study indicates that game experience had no significant impact on learning outcomes and behavioral intention. In a study conducted by Frey, Hartig, Ketzler, Zinkernagel, and Moosbrugger (2007), it was not feasible to totally level out

the differences between participants with different gaming experiences in just one session of training. However in this study, the number of playing sessions was seven and the findings indicated that a priori differences between the children of different levels of experience were decreased by seven sessions of training. Orvis, Horn, and Belanich (2008) contended that prior videogame experience is a malleable characteristic that could be compensated easily through training. It is plausible to establish that the simple game navigation features and the opportunities for practice presented in the game allow the children to acquire social skills knowledge even if they have no gaming experience. It is reasonable to argue that *Socialdrome*® provided opportunities for the inexperienced players to distinctly improve their navigation performance and pick up the necessary game skills during the training. Hence prior game experience is not a determinant of user acceptance.

Self-efficacy, as a construct, did not make any contributions to behavioral intention to use the game indicating it did not have any impact toward use. This finding is supportive of decision by Venkatesh et al.(2003) to drop the construct as it did not have any influence on user acceptance. Venkatesh (2000) argued that self-efficacy is one of the constructs that shapes the perceived ease of use about a new system, especially during the early phase of user experience. However after users gain experience through the training sessions, self-efficacy of the children improves and accordingly do not influence user acceptance.

6.8 Summary

Study II established that Hypotheses H1, H4 and H5 were supported and Hypotheses H2, H3, H6, H7 and H8 were rejected. This implies that *Socialdrome*® is effective in promoting social skills knowledge acquisition as the children made

significant learning gains by participating in the game-based learning environment. The study also suggested that differences in gender and gaming experience do not contribute significant roles in the achievement of social skills scores.

The study evaluated user acceptance in the game by exploring the two constructs, perceived playability and perceived playfulness. It demonstrated that increasing playability is the key to success of increasing playfulness and excitement in gameplaying. High level of playability brings about the feelings of being joyful and playful in the users. This study also demonstrated the importance of playfulness in shaping behavioral intention to use the game. In other words, a positive perceived playability had a significant effect on perceived playfulness. Perceived playfulness in turn, had a significant influence on user acceptance. Three variables, gender, gaming experience and gaming self-efficacy, introduced in the study, had no effect on behavioral intention. Thus, game design practitioners and researchers must take playability and playfulness into consideration when designing gaming tasks. More discussion on implications of the game design and implementation based on the findings of Study II will be dealt with in Chapter 7.

CHAPTER 7 CONCLUSION

This chapter concludes by bringing the entire research together with a deliberation on related work, design implications, contributions, limitations and future work. Toward this end, the chapter is organized into five sections. The first compares this research with other related research and the second discusses the design implications derived from the work to address the two research objectives. The third section explicates the contributions for research as well as contributions to practice. Next, the limitations of the research are presented as no research is complete without acknowledging the limitations due to the methodology selected. Finally the chapter brings the research to a close by recommending possible future work.

7.1 Introduction

The purpose of this research is to design and analyze how educational games for social skills training affect learning outcomes and user acceptance. A Web-based game, *Socialdrome*®, was developed as a specific instantiation of game-based social skills learning environments. The game aims to entertain and instruct students to identify and manage feelings, exercise self-control, solve social problems and negotiate conflict situations. The research sought to address the following two research objectives:

RO 1: Design and evaluate the game prototype based on instructional and game design principles with sub-objectives that include:

- Uncover perceptions of target users on the playability of the game.
- Elicit design ideas and concepts for the creation of game modules that meet the needs of the target users.

RO 2: Investigate the learning outcomes and user acceptance that the children derive from the game-based learning environment with sub-objectives that include:

- Determine the extent of increase of children's social skills knowledge through participation in the game-based learning social skills training.
- Examine whether user differences affect the learning gains of children that participate in the game-based learning environment.
- Investigate the interrelationships among the two factors, playability and playfulness, that affect user acceptance of the game-based learning environment among children.
- Examine whether user differences affect acceptance of the game-based learning environment among children.

To achieve the two objectives, *Socialdrome*® was designed as a captivating and functional educational game which integrates central principles of user-centered interaction design, instructional and game design principles so as to bring about productive learning outcomes and playful learning in children (Markopoulos & Bekker, 2003a; Price et al., 2003). *Socialdrome*® was built based on the theoretical underpinnings of the GDE Model, which formed the evaluative framework against which the data and outcomes of the entire research were interrogated.

Study I was conducted to address the first research objective and Study II was conducted to address the second research objective. The research objectives, methods and deliverables of the work executed in Study I and Study II are shown in Figure 7.1. While Study I was undertaken to formally evaluate the initial game prototype and ensure that the game attributes were successfully embodied in the final game prototype,

Study II was designed to evaluate the learning effectiveness and the user acceptance of *Socialdrome*®.

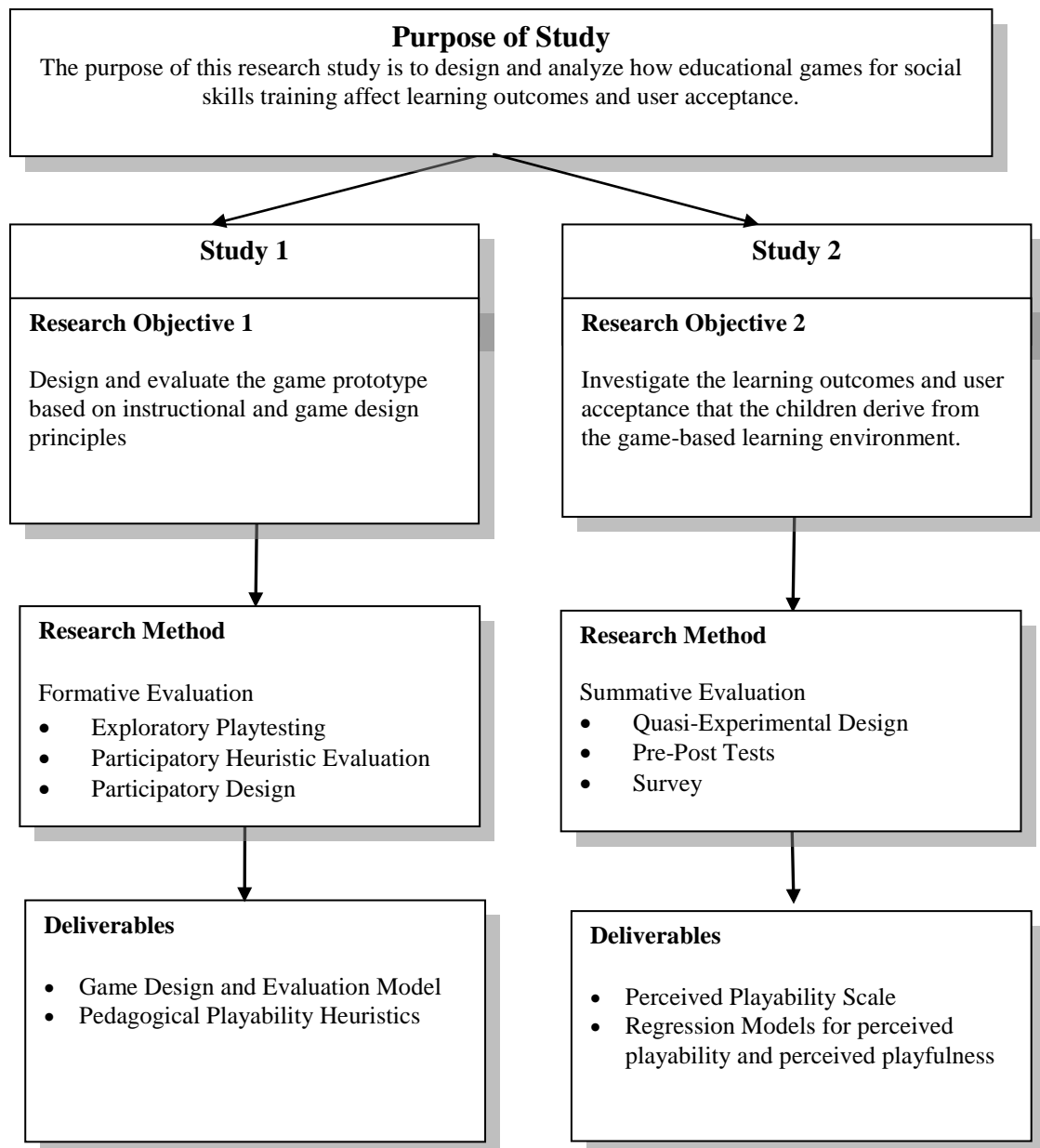


Figure 7.1. Overview of research objectives, methods and deliverables

7.2 Comparison with Related Work

This section deliberates on the strands that are related to this research and on how this research sought to offer unique and original contribution to scholarship and the identified fields mentioned in Chapter 3.

Firstly, for the participatory design approach, the activities organized could be categorized into three main types of session activities: educational activities to improve the children's knowledge and skills, evaluation activities to generate suggestions for improvement of existing prototype and brainstorming activities for idea generation. These are identical to activities conducted in the KidStory project by Taxén, Druin, Fast, and Kjellin (2010) who found the activities led to elaboration of new ideas, impacted the design of existing software application and creation of interesting designs.

Secondly, the approach taken has similar benefits as other collaborative techniques of gathering user requirements from children, for example, the KidReporter method and Cooperative Inquiry approach, have been explored (Bekker et al., 2003; Druin, 2002). However in this study, several novel techniques were introduced at the sessions which include the use of comic-typed storyboards. These idea representations, acted as scaffolds to support creative processes in individuals and groups, were found to be effective in providing structure to capture ideas (Coughlan & Johnson, 2006). A variety of activities such as physical games and bits of inspiration delivered in the form of YouTube video clips on role of a designer and design works by other game designers were included to not only stimulate creativity but to keep the children's attention.

Thirdly, the research also provided opportunities for the children to weave storylines and narratives in game design so as to offer engaging educational

experiences to them. Bruner (cited in Lyle, 2000) regarded narrative as a universal way used by all cultures to make meaning through organizing experiences into narrative forms, as human beings have the innate predisposition to narrative organization. Through creating stories, the children got to create a story and detail ideas, features and flow of experience (Cilella et al., 2010) and develop their own narrative skills such as plot planning. Narratives were depicted graphically in the form of storyboards, a common technique used in HCI and the film and television industries (Truong et al., 2006).

Research on evaluation of educational games for children usually focuses on usability and fun aspects and not on pedagogical aspects. For example, the Structured Expert Evaluation developed by Bekker, Baauw and Barendregt (2008) was based on Malone's concepts of fun and Norman's theory of action model which applies to the interaction between human and any system. The PP Heuristics, developed by placing priority on instructional design principles and bringing the concepts of usability and playability together, were different from the heuristics developed for commercial games. Researchers have proposed different attributes to characterise playability for commercial games, namely: satisfaction, learnability, effectiveness, immersion, motivation, emotion and socialization (Sánchez et al., 2009b); gameplay, game mechanics, entertainment and engagement issues (Desurvire et al., 2004; Korhonen & Koivisto, 2007); and gameplay/game story, virtual interface and device-and application-specific heuristics (Koeffel et al., 2010). The PP Heuristics are unique as they focus on criteria that emphasize (1) features that captivate the interest of the learners, (2) features that meet the personal and learning needs of the learners, (3) features that build learners' confidence and help them believe that they will succeed

and control their success and (4) features that allow self-assessment for creating feelings of good experiences and desire to continue learning.

It is also noteworthy to mention that there were prior empirical studies on social skills training that investigated the gains in social skills per se using psychometric instruments. The two most widely researched instruments to assess general behavioral social skills are Social Skills Rating System (Gresham & Elliot, 1990) and Matson Evaluation of Social Skills with Youngsters (Matson, Rotatori, & Helsel, 1983). These instruments depend on assessments using teacher ratings, student ratings and parent ratings which may have their limitations as response bias may affect the accuracy of teacher, student and parent judgements of social skills (Fraser et al., 2005). The reasons are the teachers, students and parents may not be blind to the intervention conditions and may provide overly positive self-evaluation (Bierman et al., 2010; Hennessey, 2007; Laugeson et al., 2009).

User acceptance in the realm of educational games is not well-studied. Typically evaluation of educational games carried out thus far, investigated whether there was improvement in skills, knowledge and attitudes (Wilson et al., 2009). This research moved a step ahead and investigated the user experiences of the children as the success of the game could be influenced by the extent to which it was able to promote a high-quality interaction experience in the users, as propounded by Law and Van Schaik (2010).

7.3 Implications for Design and Implementation of *Socialdrome*®

7.3.1 Study I

For Study I, a game prototype was first designed based on the GDE Model. Adopting a user-centered approach, the prospective users play-tested and evaluated the

game prototype using the Pedagogical Playability Heuristics. During the design workshops, the children developed design concepts and ideas using storyboarding, a low-fidelity prototyping technique, which were then selected for the development of the game modules of the game, *Socialdrome*®. Drawing from the findings of Study I, games attributes, ‘Captivation of Interest’, ‘Meeting Learning Needs’, ‘Building Confidence’ and ‘Self-Assessment’, that would bring about stimulation, connecting instructions to goals, appropriate challenge and influencing goal achievement respectively were integrated into the game design (Gagné et al., 2005; Keller, 2010).

From the findings of Study I conducted, it is clear that *Socialdrome*® as a learning tool should have more pictorial images, animated graphical icons and sound effects and less text. This is consistent with the work of Fabricatore, Nussbaum, and Rosas (2002) which suggested that explicit representations could be integrated in games when dealing with possibilities or consequences of interactions by the players.

Though the inclusion of multimedia elements such as meaningful auditory and visual input would increase player enjoyment, multimodality of the game may interfere with the learning process. A game that is high in modality may result in less active cognitive reflection as too much congestion of the visual and auditory channels may also decrease the intrapersonal communication within oneself (Annetta, 2010). Children may be absorbed in the modalities just for pleasure without learning (Tüzün, 2007).

Helping children identify the relevance of the learning materials facilitates the learning experiences of children. Real-life examples on social problems experienced by children in their everyday interaction should be anchored in the experiential game-based environment. The concept of learning through experiencing “learning by doing”

occurs best if children are provided with rich experiences in authentic or real life situations.

Further, to build the learners' confidence, the finding pointed to the fact that the children generally prefer to be able to take action and have control over their decision-making. While it is well accepted that children learn best when they are given opportunities to discover knowledge and skills with minimal guidance (Papert, 1980), researchers like Kirschner et al.(2006), Klahr and Nigam (2004) and Mayer (2004) argued that some form of instructional guidance and structure is necessary to support the cognitive processing of novice learners. Unlike expert learners who can draw from the extensive experience stored in their long-term memory, children with their limited experiences are unable to skillfully apply the best procedures for solving problems.

The essence of giving opportunities for children to assess their achievement is based on the premise that people feel good about being able to judge the success of their accomplishments (Keller, 2010). Garris et al. (2002) suggested that performance feedback in the form of gathering credit points and score keeping, would allow children to track progress toward desired goals. However Rieber and Noah (2008) argued that though this would increase the level of satisfaction and enjoyment of children, it might distract their learning away from the instructional goals. The participants of Study I, especially the boys were observed to march through the game, chalking up their mints as quickly as possible. Essentially, teachers should be present to facilitate the gameplaying process and constantly remind students of the benefits of taking time to assimilate new knowledge and skills.

The attribute 'Self-Assessment' emphasizes that reflection enhances the retention and transfer of skills, which in turn helps children feel good about their experience and desire to continue learning (Gagné et al., 2005).To ensure that the

children carry out reflection, the secret reflection journal was incorporated as a key feature in every mission of *Socialdrome*®. The intent of reflective thinking is to improve understanding, to provide a means for evaluating and altering the children's thinking and to serve as reinforcement in the acquisition and maintenance of the behavioral repertoire. From the feedback gathered during the heuristic evaluation that the children did not like to type their reflections as this interrupted the flow of the gameplay, the design team sought to find other means of reinforcing learning. Unexpectedly, during the workshops, the children endorsed the reflective process and included it in some of their storyboards. A reason for this is that though they disliked writing out their thoughts, they felt that this reflective thinking would be beneficial for other children too. An obvious conclusion is that instructional games should promote cognitive reflection so the gaming experience is meaningful from an educational viewpoint (Rieber & Noah, 2008).

The participatory design sessions stretched children's creativity and critical thinking on game design and enhanced children's cognitive understanding of social knowledge, evident from the design artifacts produced. The outcomes of the study pointed to the value of child-centered collaborative approaches and call for further exploration into creative ways of involving children to support researchers in their endeavors to balance the educational and entertainment value of games they design.

7.3.2 Study II

In Study II, summative evaluation using a quasi-experimental design with a pre-post test format was conducted to evaluate the impact of the game on learning outcomes. This study hypothesized that children who received the game-based social skills training would improve on social skills knowledge compared with control-group

children. The measure of social skills knowledge was used to assess children's knowledge about the specific social skills taught during the training which is consistent with Pfiffner and McBurnett (1997).

The study evaluated the learning effectiveness of *Socialdrome*® targeted for the acquisition of social skills knowledge. The learning outcome obtained after children were exposed to seven sessions of game indicates that it is reasonable to imply that the game-based learning environment contributes to effective learning. Simulated tasks inbuilt into the game, for example the deep breathing exercise, which are desirable for fostering experiential learning, improved the effectiveness of gameplaying and extended the impact of the learning materials (Yip & Kwan, 2006). These findings are consistent with other research that suggests that gameplaying can bring about engaged and meaningful learning made possible with the design of the game environment (Barab, Thomas, Dodge, Carteaux, & Tuzun, 2005). The findings illustrated that *Socialdrome*® presents potential benefits as an instructional tool to foster social skills knowledge acquisition in classroom settings.

Next, studying whether perceived playability was able to have impact on perceived playfulness among children would bring better understanding on user behavior in game-based learning. Arguably, understanding what makes children enjoy a game is a key issue to successful game design because if children do not enjoy the game, they will not play it (Jegers, 2007; Sweetser & Wyeth, 2005). The study brought to light that the children are more likely to play the game if they are in a more playful state. When children are involved in an activity for enjoyment, they are intrinsically motivated which causes them to stay longer on the activity (Chiang & Lin, 2010). The intrinsic motive developed should increase the likelihood of them desiring to repeat the activity again (Lin et al., 2005). The findings also indicated that the children

perceived the game as an entertainment-oriented technology and considered enjoyment as an important priority.

The analyses revealed that the proposed regression models could serve as a robust framework for Web-based game studies in the future. The high predictive power suggests perceived playability with its relatively higher variance, has a significant positive effect on perceived playfulness. The findings implied that perceived playfulness is an important determinant with direct effects that facilitate the children's behavioral intention to use the game. The findings underscored the fact that if the users do not perceive playfulness in the game, they are unlikely to play it. Playing a well-designed game may bring about high concentration, curiosity and enjoyment in the children as they enter into a playful state, However van der Heijden (2004) cautioned that these higher levels of playfulness or enjoyment derived from the game-based learning environment do not imply that it will help an individual to become more effective. So it is reasonable to infer that the hedonic quality of game will entice the children to come back to play but may not necessarily indicate that the children will acquire the necessary learning outcomes. Along these lines, it is therefore essential that instructional designers ensure that appropriate game attributes necessary for effective instruction, for example, 'Captivation of Interest', 'Meeting Learning Needs', 'Building Confidence' and 'Self-Assessment', should be incorporated into games.

By creating a fun, intrinsically, motivating environment to explore the boundaries of game technology, the game-based training offered by *Socialdrome*® would instill a heightened state of playfulness among users and still maintain meaningful instructional contents for learning. A game created for use in classrooms should have the offering of a technology-enhanced playful learning environment and

yet able to present a variety of learning opportunities to the students. De Freitas and Oliver (2006) echoed the concern that a lack of the element of playfulness in educational games tends to demotivate students from learning and impede the uptake of games in formal educational settings. Hence, a pertinent design implication drawn from the findings is that instructional designers should design games that affirm that both play and learning take place, bringing about the desired outcomes valued in formal education (de Freitas & Oliver, 2006; Hong et al., 2009).

Findings from Study II revealed that all the demographic attributes, such as differences in gender, gaming experience and gaming efficacy, investigated were irrelevant in predicting game acceptance. This affirms the fact that *Socialdrome*® was designed such that it appeals to both genders. Prior studies have reported gender differences favoring males in spatial tasks (Richardson et al., 2011) and males declaring that they have more video game experience than females (Castelli, Latini, & Geminiani, 2008). However with the permeation of computer games into the lives of both genders, it is conceivable that the habit of playing games may change rapidly (Quaiser-Pohl et al., 2006). Furthermore with more girls playing games (Entertainment Software Association, 2011), it can be assumed that the female players are catching up in terms of gaming experience and efficacy. With the gender gap in game adoption seemingly abating, a clear design implication is a need to develop multi-faceted games that cater to a varied range of interests of both genders (Paraskeva, Mysirlaki, & Papagianni, 2010). Alternatively, different features, components and characteristics could be arranged into a single game that could fit learners of the two genders (Steiner et al., 2009).

Findings by Kebritchi, Hirumi and Bai (2010) revealed that individual differences in experience were significant at the start of using the games but gradually

tapered off as the students gained the required skills and experience and skills to negotiate the gameworld (Kebritchi et al., 2010). They also went on to suggest that a teacher plays a vital role in supporting a group of students with individual differences in experience, skills and knowledge. In the context of *Socialdrome*®, the game is designed that online help and feedback are presented at every stage of the gameplaying to assist the learners so that the ones lacking in gaming experience would develop the skills and experience necessary for effective gameplay. With the gain in experience, the children derived feelings of self-efficacy or positive perception of their capabilities to execute the courses of action required to deal with prospective situations. This is consistent with prior works that indicate with the appropriate experience through providing sessions of training, users strengthen their confidence, thus fostering their feelings of self-efficacy (Fusilier, Durlabhji, & Cucchi, 2008; Lau & Woods, 2009). Perceptions of the users' of self-efficacy are likely to change as the users gain experience in using the system. So a design implication gleaned from the analysis is for instructional designers to incorporate features that allow novices with low experience to practice, increase their familiarity and gain confidence in order to enjoy playing the game and achieve the desired learning outcomes.

The research generates insights for instructional game designers for developing a game that is able to impart the learning of social skills knowledge and at the same time able to achieve the approbation of the users. The research also provides a theoretical understanding of the factors contributing to the playability of games that have an influential effect on the state of playfulness of the users, which in turn shapes the user acceptance to play games

7.4 Contributions

7.4.1 Contributions to Research

This work makes several important contributions to research. A key contribution is the approach to incorporate multiple fields and disciplines such as educational psychology, instructional principles, game design principles, human-computer interaction and information systems into the research. More specifically, the learning tasks in the game, *Socialdrome*®, were based on educational psychology from Kolb (1984) and Crick and Dodge (1994) and the game attributes were aligned to the instructional principles of ARCS Model (Keller, 2010) and Events of Instruction (Gagné et al., 2005), game design principles of GameFlow Model (Sweetser & Wyeth, 2005). A user-centered viewpoint, which took reference from the literature of human-computer interaction was adopted (Shneiderman & Plaisant, 2010). The information systems literature provided perspectives on the user acceptance of *Socialdrome*® as a learning tool for social skills acquisition. For example, the Behavioral Intention Scale used in the research to measure user acceptance, were adapted from Venkatesh, Morris, Davis, and Davis (2003).

The second area of contribution is the GDE Model which is developed based on Gagné's Events of Instruction (Gagné et al., 2005), ARCS Motivation Model (Keller, 2010), Experiential Learning Theory (Kolb, 1984) and Social Information-Processing Model (Crick & Dodge, 1994). This eclectic integration of dimensions is able to provide a frame of reference for game design and exploration of the playability, efficacy and acceptance of instructional games as tools for learning and entertainment. It serves as a theoretical structure for understanding how experiential learning in an intrinsic motivating gameworld influences the acquisition of social skills knowledge. Developed on the postulate that learning is a constructive process, the model anchors

the game in an experiential environment with real-life examples and social problems usually experienced by children in their everyday interactions. The model provides researchers with a good understanding for designing learning tasks and concepts, making design choices, developing redesign directions and maximizing the learning opportunities of students.

The third area of contribution is the Pedagogical Playability (PP) Heuristics, which was created in tandem with the conceptual GDE model to inspect and evaluate the game. The PP Heuristics comprising four attributes, 'Captivation of Interest', 'Meeting Learning Needs', 'Building Confidence' and 'Self-Assessment', were designed to be aligned to instructional, HCI and game design principles and to be able to uncover significant usability and playability factors in the game. The PP Heuristics serve as a pragmatic tool to help researchers and designers of educational games to think through the need for considering instructional strategy development for effective design outcomes. Careful application of instructional system design and game design principles ensures that games designed for educational settings should enable players to experience knowledge gain and skill improvement and at the same time have fun.

The fourth contribution is the Perceived Playability Scale with its acceptable reliability estimates, is reusable in other contexts. The scale contributes to the HCI research community as it is the first tool developed for the evaluation of perceived playability of instructional games in large scale empirical studies. It is hoped that this would generate more work on developing instruments that yield reliable and valid scores for assessing the characteristics of instructional games.

Contributions to research included the three publications 'Child-Centered Interaction in the Design of a Game for Social Skills Intervention', 'Usability and Playability Heuristics for Evaluation of an Instructional Game' and 'Participatory

Evaluation of an Educational Game for Social Skills Acquisition' (refer to Appendix F).

7.4.2 Contributions to Practice

The first contribution to practice is that the investigation of the game-based social skills training is beneficial for the targeted learner population. This study is motivated by the beliefs that social problem-solving skills training forms a vital part of a child's social and emotional development and education, and game technology holds potential promise in ameliorating social skills deficits of children in school settings. Against this backdrop, *Socialdrome*®, was designed such that it could be embedded in the school curriculum to educate children to be more socially skilled. The game modules synthesize the domains of self-control, management of emotions, victim empathy and interpersonal problem-solving strategies to promote social and emotional competence. Social skills training designed to be implemented in the regular school curriculum for all students, regardless of their risk status, is regarded as positive and proactive in enhancing students' resilience and well-being (Bullis et al., 2001). Unlike small pull-out group interventions, training in classrooms minimizes the potential of stigmatizing participants and labeling of at-risk and already anti-social children (Greenberg, Domitrovich, & Bumbarger, 2000). Thus this game-based social skills program will present an opportunity for teachers, counselors and school leaders to implement school-wide social skills training programs to a large group as they are less resource intensiveness compared to traditional social skills training.

The second contribution is that the evidence-based findings from this study, though preliminary, will add to the social skills training literature in the Asian context which can be compared with other social skills research from the western communities.

The samples of the two studies conducted were drawn from two Singapore local schools with a multi-ethnic Asian population. The learning materials in *Socialdrome*® were adapted from a training manual and a workbook on social skills training by Ang and Ooi (2003a; 2003b) based on research in Asian settings (Ang, 2003; Ooi et al., 2007). They catered to the interests of students in Singapore, for example, real-life and authentic examples that happen in a typical Singapore school day, were incorporated to add relevance to the game so as to give the young users meaningful experiences and at the same time enable them to fulfill the learning objectives of the game.

The third contribution is the development of a prototype for game-based learning of social skills could be used by schools as a starting point for exploration of games for social skills learning to complement traditional methods of delivering didactic materials. The findings of the research will be of interest to policy makers, educators and mental health practitioners as the lessons learned can inform and stimulate the further implementation of this genre of games in schools, counseling centers or hospitals.

7.5 Limitations

It is acknowledged there exist a number of potential limitations in the present research which give rise to possible new directions for future research. A limitation of Study I is that a single iteration of formative research was applied to the game prototype. More iterations will increase validity of the evaluation method, which Markopoulos and Bekker (2003b) argued would bring one closer to the “truth” of uncovering the “real” problems that impact the effectiveness of the applications. Despite this limitation, Study I which spanned over five 3-hour sessions, drew substantive feedback and insights for the game design practitioners in conceptualizing

designs that appeal to the prospective users. Further involving representative users as participants in the formative evaluation process enables the design of the game to better reflect students' existing schema, prior experiences and views and expectations (Danielsson & Wiberg, 2006; DiPietro, Ferdig, Boyer, & Black, 2007).

On the other hand, only involving the prospective users has its limitations as they may not have a good grasp of logical design and insights of the educational goals of the application (Ruland et al., 2008). Nonetheless, it can be argued that to obtain a more credible evaluation, the findings should be triangulated with pedagogical expert reviews, namely the teachers who are well-versed in teaching social skills. In any case, the teachers are the ones with the expert knowledge and able to judge the suitability of the application for its intended educational purposes (Squires & Preece, 1999). Hence, experts, for example teachers and school counselors, involved in the research study will present other perspectives on improving the game design.

Next, participants of Study II came from one school which might be less representative of the target population. This raises the generalization problem of any single study although it should be noted that the same limitation was also commonly reported in other studies. For example, a meta-analysis of 101 articles published in information systems journals done by Lee, Kozar, and Larsen (2003) reported that many studies usually examined only one information system with a homogeneous group of participants which might possibly bias findings.

Another possible limitation in Study II is that perceptions of user experiences are subjective and vary between individuals due to different personal standards, between standards and over time. According to Hassenzahl (2005), the psychological complexity of user experiences cannot be underestimated. Though the children played games during their leisure, instructional games were rarely used in the curriculum.

Possibly, high ratings of perceived playability, perceived playfulness and behavioral intention of the children could be attributed to novelty effects which commonly exist in users of new information systems (for e.g., Africano et al., 2004).

7.6 Future Research

Three areas of important future work that emerged from the findings of this work are focused on enhancing game design, game effectiveness and aspects that influence user acceptance.

First to enhance the game design, a major extension to the research is to run formative evaluation iteratively throughout the different stages in the game development. To test for robustness, additional iterations could be repeated with different groups of children as design partners to determine whether they provide the same perspectives. These iterations allow learning points and findings obtained from one round to be incorporated into the next one. Further iterations with students as designers will emphasize a more constructive and creative role for students, leading to more opportunities for designing their own stories, rules, goals, objectives, identities and assignments (Huizenga, Admiraal, Akkerman, & Dam, 2009).

Another possible area of research is to investigate other measures of learning effectiveness of the game. The current research used social skills knowledge as a measure for the efficacy of the game and did not examine whether the participants applied this knowledge in real-life contexts. Future work should look at other measures that are able to detect whether the users actually acquire, display and transfer the social skills learned from the intervention to their daily lives at school, play and home and follow-up discussions with parents and teachers. Previous empirical studies on traditional social skills training have used teacher-, parent- and self-reported data

(Oord et al., 2005), peer-ratings (Choi & Heckenlaible-Gotto, 1998) and observations of students in free play situations (Combs & Lahey, 1981). Longer-term follow-up data suggested by Beaumont and Sofronoff (2008) should be collected to investigate whether the enduring treatment gains are sustained in the long run. To further increase convergence and corroboration of results, qualitative data should be collected for Study II so as to aim to achieve coherence, integrity and synergy between qualitative and quantitative methods (Creswell, 2009). Triangulating qualitative data with the quantitative approach will expand understanding and better clarify and inform the potential results from the quantitative method (Johnson & Onwuegbuzie, 2004). Qualitative measures including data from game logs and recordings of screen activities could be employed to provide a richer quality of findings on the effectiveness of the game.

The third opportunity of future work should extend the research to bring about further generalization on acceptance of the game. A large scale empirical study should be conducted using a bigger random sample size from schools with geographically different locations to validate the results of this research, for example validating the Social Skills Knowledge Test, and further test the acceptance of the game. With a bigger sample size, additional constructs, for example, antecedents of perceived playability, and moderating factors should be investigated empirically to achieve greater variance in the model. Essentially this will deepen understanding on identifying the game characteristics or features that instructional designers should be cognizant of. The research should go beyond collecting self-reported data on independent and dependent constructs that impact perceived playability, perceived playfulness and students' intention to use the game but should include other objective data such as individual variables on learning styles, actual gameplaying habits and

other constructs to explain users' hedonic behaviors. Collecting longitudinal data at different points in time, for example, one month after implementation and three months after implementation, would be ideal to test the stability of these findings.

7.7 Concluding Remarks

From the findings, it can be inferred that the students viewed the games very much as a hedonic system though the game was designed for the pragmatic reasons of helping them acquire social skills knowledge. Rieber and Noah (2008) argued that educational game designers should be cognizant that while it is important that the game should foster enjoyment for students, it should not distract the learning away from the intended instructional goals. Undoubtedly, games with an educational focus should have, as advocated by the literature, contents that are meaningful and worthwhile for learning, unlike commercial entertainment games where learning may be incidental (Foster, 2008). With a well-planned instructional design, it could be possible for students to adapt to the process of learning and attain entertainment in an environment under which they acquired new skills or knowledge (Gunter et al., 2006).

The Web-based game, *Socialdrome*®, developed as a specific instantiation of game-based social skills learning environments, was able to improve the learning efficacy of social skills knowledge in the children. The research has focused on playability from both educational and HCI perspectives and established that increasing playability is the key to success of increasing playfulness and excitement in gameplaying. Game design practitioners and researchers should place high priority on the two success factors, playability and playfulness, when designing gaming tasks. This research has demonstrated the importance of reflecting playfulness as an intrinsic factor in shaping individual's acceptance of a game.

REFERENCES

- Adams, E. (2010). *Fundamentals of game design* (2nd ed.). Berkeley, CA: New Riders.
- Africano, D., Berg, S., Lindbergh, K., Lundholm, P., Nilbrink, F., & Persson, A. (2004). Designing tangible interfaces for children's collaboration. *Proceedings of the CHI '04 extended abstracts on Human Factors in Computing Systems*, Vienna, Austria. New York, NY: ACM Press.
- Agarwal, R., Sambamurthy, V., & Stair, R. M. (2000). Research report: The evolving relationship between general and specific computer self-efficacy - An empirical assessment. *Information Systems Research*, *11*, 418-430.
- Ahn, T., Ryu, S., & Han, I. (2007). The impact of Web quality and playfulness on user acceptance of online retailing. *Information & Management*, *44*, 263-275.
- American Society for Training and Development. (2008). *Train the trainer volume 2: Instructional design & implementation*. Alexandria, VA: ASTD Press.
- Ang, C. S., Avni, E., & Zaphiris, P. (2008). Linking pedagogical theory of computer games to their usability. *International Journal on E-Learning*, *7*, 533-558.
- Ang, R. P. (2003). Social problem-solving skills training: Does it really work? *Child Care in Practice*, *9*, 5-17.
- Ang, R. P., & Ooi, Y. P. (2003a). *Helping angry children and youth: Strategies that work. Activity Workbook*. Singapore: Armour Publishing.
- Ang, R. P., & Ooi, Y. P. (2003b). *Helping angry children and youth: Strategies that work. Training Manual*. Singapore: Armour Publishing.
- Annetta, L., Mangrum, J., Holmes, S., Collazo, K., & Cheng, M. T. (2009). Bridging reality to virtual reality: Investigating gender effect and student engagement on learning through video game play in an elementary school classroom. *International Journal of Science Education*, *31*, 1091-1113.
- Annetta, L. A. (2008). Video games in education: Why they should be used and how they are being used. *Theory Into Practice*, *47*, 229-239.
- Annetta, L. A. (2010). The "I's" have it: A framework for serious educational game design. *Review of General Psychology*, *14*, 105-112.
- Antle, A. N. (2006). Child-personas: fact or fiction? *Proceedings of the 6th Conference on Designing Interactive Systems*, University Park, PA. New York, NY: ACM Press.
- Arnold, M. E., & Hughes, J. N. (1999). First do no harm: Adverse effects of grouping deviant youth for skills training. *Journal of School Psychology*, *37*, 99-115.

- Arsenio, W. F., & Lemerise, E. A. (2004). Aggression and moral development: Integrating social information processing and moral domain models. *Child Development, 75*, 987-1002.
- Aulls, M. W. (2002). The contributions of co-occurring forms of classroom discourse and academic activities to curriculum events and instruction. *Journal of Educational Psychology, 94*, 520-538.
- Baauw, E., Bekker, M. M., & Barendregt, W. (2005). A structured expert evaluation method for the evaluation of children's computer games. In M. F. Costabile & F. Paternò (Eds.), *Human-Computer Interaction - INTERACT 2005* (Vol. 3585, pp. 457-469). Berlin & Heidelberg: Springer.
- Baek, J.-S., & Lee, K.-P. (2008). A participatory design approach to information architecture design for children. *CoDesign, 4*, 173-191.
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*, 191-215.
- Bandura, A. (2006). Guide for constructing self-efficacy scales. In F. Pajares & T. C. Urdan (Eds.), *Self-efficacy beliefs of adolescents* (pp. 307-338). Charlotte, NC: Information Age Publishing.
- Barab, S., Thomas, M., Dodge, T., Carteaux, R., & Tuzun, H. (2005). Making learning fun: Quest Atlantis, a game without guns. *Educational Technology Research and Development, 53*, 86-107.
- Barakova, E., Gillessen, J. A. N., & Feijs, L. O. E. (2009). Social training of autistic children with interactive intelligent agents. *Journal of Integrative Neuroscience, 8*, 23-34.
- Baranowski, T., Buday, R., Thompson, D. I., & Baranowski, J. (2008). Playing for real: Video games and stories for health-related behavior change. *American Journal of Preventive Medicine, 34*, 74-82.e10.
- Barendregt, W., & Bekker, M. M. (2004). Towards a framework for design guidelines for young children's computer games. In M. Rauterberg (Ed.), *Entertainment Computing-ICEC 2004, LNCS* (Vol. 3166/2004, pp. 365-376). Berlin & Heidelberg: Springer
- Barendregt, W., Bekker, M. M., Bouwhuis, D. G., & Baauw, E. (2006). Identifying usability and fun problems in a computer game during first use and after some practice. *International Journal of Human-Computer Studies, 64*, 830-846.
- Bartlett, M. S. (1954). A note on the multiplying factors for various χ^2 approximations. *Journal of the Royal Statistical Society. Series B (Methodological), 16*, 296-298.
- Bastien, J. (2010). Usability testing: A review of some methodological and technical aspects of the method. *International Journal of Medical Informatics, 79*, e18-e23.

- Bates, M., Brown, D., Cranton, W., & Lewis, J. (2007). Carving a new approach to learning. In D. Remenyi (Ed.), *The European Conference on Games Based Learning* (pp. 19-26). Reading, UK: Academic Conference Ltd.
- Battin-Pearson, S., Newcomb, M. D., Abbott, R. D., Hill, K. G., Catalano, R. F., & Hawkins, J. D. (2000). Predictors of early high school dropout: A test of five theories. *Journal of Educational Psychology, 92*, 568-582.
- Beauchamp, M. H., & Anderson, V. (2010). SOCIAL: An integrative framework for the development of social skills. *Psychological Bulletin, 136*, 39-64.
- Beaumont, R., & Sofronoff, K. (2008). A multi-component social skills intervention for children with Asperger Syndrome: The Junior Detective Training Program. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 49*, 743-753.
- Becker, K. (2007). Digital game-based learning once removed: Teaching teachers. *British Journal of Educational Technology, 38*, 478-488.
- Begg, M. (2008). Leveraging game-informed healthcare education. *Medical Teacher, 30*, 155-158.
- Bekker, M., Baauw, E., & Barendregt, W. (2008). A comparison of two analytical evaluation methods for educational computer games for young children. *Cognition, Technology & Work, 10*, 129-140.
- Bekker, M., Beusmans, J., Keyson, D., & Lloyd, P. (2003). KidReporter: A user requirements gathering technique for designing with children. *Interacting with Computers, 15*, 187-202.
- Berk, L. E. (2009). *Child development* (8th ed.). Boston, MA: Pearson/Allyn & Bacon.
- Bernard-Opitz, V., Sriram, N., & Nakhoda-Sapuan, S. (2001). Enhancing social problem solving in children with autism and normal children through computer-assisted instruction. *Journal of Autism and Developmental Disorders, 31*, 377-384.
- Bierman, K. L., Coie, J. D., Dodge, K. A., Greenberg, M. T., Lochman, J. E., McMahon, R. J., & Pinderhughes, E. (2010). The effects of a multiyear universal social-emotional learning program: The role of student and school characteristics. *Journal of Consulting and Clinical Psychology, 78*, 156-168.
- Blumberg, F. C., Rosenthal, S. F., & Randall, J. D. (2008). Impasse-driven learning in the context of video games. *Computers in Human Behavior, 24*, 1530-1541.
- Boeije, H. (2010). *Analysis in qualitative research*. Los Angeles, CA: SAGE.
- Bonanno, P., & Kommers, P. A. M. (2005). Gender differences and styles in the use of digital games. *Educational Psychology: An International Journal of Experimental Educational Psychology, 25*, 13-41.

- Bonanno, P., & Kommers, P. A. M. (2008). Exploring the influence of gender and gaming competence on attitudes towards using instructional games. *British Journal of Educational Technology*, 39, 97-109.
- Bongers, I., Koot, H., Van der Ende, J., & Verhulst, F. (2008). Predicting young adult social functioning from developmental trajectories of externalizing behaviour. *Psychological Medicine*, 38, 989-1000.
- Borgers, N., de Leeuw, E., & Hox, J. (2000). Children as respondents in survey research: Cognitive development and response quality. *Bulletin de Méthodologie Sociologique*, 66, 60-75.
- Boulos, M. N. K., Hetherington, L., & Wheeler, S. (2007). Second Life: An overview of the potential of 3-D virtual worlds in medical and health education. *Health Information & Libraries Journal*, 24, 233-245.
- Bourgonjon, J., Valcke, M., Soetaert, R., de Wever, B., & Schellens, T. (2011). Parental acceptance of digital game-based learning. *Computers & Education*, 57, 1434-1444.
- Bourgonjon, J., Valcke, M., Soetaert, R., & Schellens, T. (2009). Exploring the acceptance of video games in the classroom by secondary school students. *Proceedings of the 17th International Conference on Computers in Education [CDROM]*, Hong Kong, Taiwan: Asia-Pacific Society for Computers in Education.
- Bourgonjon, J., Valcke, M., Soetaert, R., & Schellens, T. (2010). Students' perceptions about the use of video games in the classroom. *Computers & Education*, 54, 1145-1156.
- Boyle, E. A., & Connolly, T. (2009). Games for learning: Does gender make a difference? In T. Connolly, M. Stansfield & L. Boyle (Eds.), *Games-based learning advancements for multi-sensory human computer interfaces: Techniques and effective practices* (pp. 288-303). Hershey, PA: IGI Global.
- Brederode, B., Markopoulos, P., Gielen, M., Vermeeren, A., & Ridder, H. d. (2005). pOwerball: The design of a novel mixed-reality game for children with mixed abilities. *Proceedings of the 2005 Conference on Interaction Design and Children*, Boulder, Colorado. New York, NY: ACM Press.
- Brezinka, V. (2008). Treasure Hunt - A serious game to support psychotherapeutic treatment of children. *Studies in Health Technology & Informatics*, 136, 71-76.
- Brill, O., & Knauss, E. (2011). Structured and unobtrusive observation of anonymous users and their context for requirements elicitation. *Proceedings of the IEEE 19th International Requirements Engineering Conference*, Trento, Italy.
- Brown, S. A., Dennis, A. R., & Venkatesh, V. (2010). Predicting collaboration technology use: Integrating technology adoption and collaboration research. *Journal of Management Information Systems*, 27, 9-54.

- Bruckman, A., & Bandlow, A. (2003). Human-computer interaction for kids. In J. A. Jacko & A. Sears (Eds.), *The human-computer interaction handbook: Fundamentals, evolving technologies and emerging applications* (pp. 428-440). Hillsdale, NJ: Lawrence Erlbaum.
- Bullis, M., Walker, H. M., & Sprague, J. R. (2001). A promise unfulfilled: Social skills training with at-risk and antisocial children and youth. *Exceptionality*, 9, 67-90.
- Burgess, K. B., Wojslawowicz, J. C., Rubin, K. H., Rose-Krasnor, L., & Booth-LaForce, C. (2006). Social information processing and coping strategies of shy/withdrawn and aggressive children: Does friendship matter? *Child Development*, 77, 371-383.
- Cairns, P., & Cox, A. L. (Eds.). (2008). *Research methods for human-computer interaction*. Cambridge, UK: Cambridge University Press.
- Calleja, G. (2010). Digital games and escapism. *Games and Culture*, 5, 335-353.
- Callicott, B. (2002). Library web site user testing. *College & Undergraduate Libraries*, 9, 1-17.
- Çankaya, S., & Karamete, A. (2009). The effects of educational computer games on students' attitudes towards mathematics course and educational computer games. *Procedia - Social and Behavioral Sciences*, 1, 145-149.
- Canney, C., & Byrne, A. (2006). Evaluating Circle Time as a support to social skills development - Reflections on a journey in school-based research. *British Journal of Special Education*, 33, 19-24.
- Castañeda, J. A., Muñoz-Leiva, F., & Luque, T. (2007). Web Acceptance Model (WAM): Moderating effects of user experience. *Information & Management*, 44, 384-396.
- Castelli, L., Latini, C. L., & Geminiani, G. C. (2008). Spatial navigation in large-scale virtual environments: Gender differences in survey tasks. *Computers in Human Behavior*, 24, 1643-1667.
- Çelik, H. (2011). Influence of social norms, perceived playfulness and online shopping anxiety on customers' adoption of online retail shopping: An empirical study in the Turkish context. *International Journal of Retail & Distribution Management*, 39, 390-413.
- Chang, B.-H., Lee, S.-E., & Kim, B.-S. (2006). Exploring factors affecting the adoption and continuance of online games among college students in South Korea. *New Media & Society*, 8, 295-319.
- Chee, Y. S. (2007). Embodiment, embeddedness, and experience: Game-based learning and the construction of identity. *Research and Practice in Technology Enhanced Learning*, 2, 3-30.

- Chen, K., Chen, J. V., & Yen, D. C. (2011). Dimensions of self-efficacy in the study of smart phone acceptance. *Computer Standards & Interfaces*, 33, 422-431.
- Cherney, I. D., & Rendell, J. A. (2010). Sex differences in effects of testing medium and response format on a visuospatial task. *Perceptual and Motor Skills*, 110, 809-824.
- Chiang, Y. T., & Lin, S. S. S. J. (2010). Early adolescent players' playfulness and psychological needs in online games. *Social Behavior and Personality: An International Journal*, 38, 627-636.
- Choi, H. S., & Heckenlaible-Gotto, M. J. (1998). Classroom-based social skills training: Impact on peer acceptance of first-grade students. *Journal of Educational Research*, 91, 209-214.
- Christensen, T. K., & Osguthorpe, R. T. (2004). How do instructional-design practitioners make instructional-strategy decisions? *Performance Improvement Quarterly*, 17, 45-65.
- Chumbley, J., & Griffiths, M. (2006). Affect and the computer game player: The effect of gender, personality, and game reinforcement structure on affective responses to computer game-play. *CyberPsychology & Behavior*, 9, 308-316.
- Chung, J., & Tan, F. B. (2004). Antecedents of perceived playfulness: An exploratory study on user acceptance of general information-searching websites. *Information & Management*, 41, 869-881.
- Chung, J. E., Park, N., Wang, H., Fulk, J., & McLaughlin, M. (2010). Age differences in perceptions of online community participation among non-users: An extension of the Technology Acceptance Model. *Computers in Human Behavior*, 26, 1674-1684.
- Cilella, S., Berman, C., & Rheinfrank, J. (2010). Experience definition through storyboarding. *Proceedings of the Fourth International Conference on Tangible, Embedded, and Embodied Interaction*, Cambridge, Massachusetts. New York, NY: ACM Press.
- Clark, D. B., Nelson, B. C., Chang, H. Y., Martinez-Garza, M., Slack, K., & D'Angelo, C. M. (2011). Exploring Newtonian mechanics in a conceptually-integrated digital game: Comparison of learning and affective outcomes for students in Taiwan and the United States. *Computers & Education*, 57, 2178-2195.
- Cohen, J. (1988). *Statistical power analysis for the Behavioral Sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Combs, M. L., & Lahey, B. B. (1981). A cognitive social skills training program: Evaluation with young children. *Behavior Modification*, 5, 39-60.
- Compeau, D. R., & Higgins, C. A. (1995). Computer self-efficacy: Development of a measure and initial test. *MIS Quarterly*, 19, 189-211.

- Connolly, T., & Stansfield, M. (2006). Using games-based elearning technologies in overcoming difficulties in teaching information systems. *Journal of Information Technology Education, 5*, 459-476.
- Connolly, T. M., Stansfield, M., & Hainey, T. (2009). Towards the development of a games-based learning evaluation framework. In T. M. Connolly, M. Stansfield & E. Boyle (Eds.), *Games-based learning advancements for multi-sensory human-computer interfaces: Techniques and effective practices*. Hershey, PA: IGI Global.
- Cory, L., Dattilo, J., & Williams, R. (2006). Effects of a leisure education program on social knowledge and skills of youth with cognitive disabilities. *Therapeutic Recreation Journal, 40*, 144-164.
- Coughlan, T., & Johnson, P. (2006). Interaction in creative tasks: Ideation, representation and evaluation in composition. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, Montreal. New York, NY: ACM Press.
- Cowen, E. L., Pederson, A., Babigian, H., Izzo, L. D., & Trost, M. A. (1973). Long-term follow-up of early detected vulnerable children. *Journal of Consulting and Clinical Psychology, 41*, 438-446.
- Coyle, D., Matthews, M., Sharry, J., Nisbet, A., & Doherty, G. (2005). Personal Investigator: A therapeutic 3D game for adolescent psychotherapy. *Interactive Technology and Smart Education, 2*, 73-88.
- Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches* (3rd ed.). Thousand Oaks, CA: Sage Publications.
- Crick, N. R., & Dodge, K. A. (1994). A review and reformulation of social information-processing mechanisms in children's social adjustment. *Psychological Bulletin, 115*, 74-101.
- Csikszentmihalyi, M. (1991). *Flow: The psychology of optimal experience*. New York, NY: Harper Perennial.
- Cunningham, D., & Duffy, T. (1996). Constructivism: Implications for the design and delivery of instruction. In D. Jonassen (Ed.), *Handbook of research for educational communications and technology* (pp. 170-198). New York, NY: Simon & Schuster, Macmillan.
- Danielsson, K., & Wiberg, C. (2006). Participatory design of learning media: Designing educational computer games with and for teenagers. *Interactive Technology and Smart Education, 3*, 275-291.
- Daunic, A. P., Smith, S. W., Brank, E. M., & Penfield, R. D. (2006). Classroom-based cognitive-behavioral intervention to prevent aggression: Efficacy and social validity. *Journal of School Psychology, 44*, 123-139.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of Information Technology. *MIS Quarterly, 13*, 319-340.

- de Aguilera, M., & Mendiz, A. (2003). Video games and education: (Education in the Face of a "Parallel School"). *Computers in Entertainment, 1*, 1-14.
- de Freitas, S. (2006). *Learning in immersive worlds: A review of game-based learning*. Retrieved September 22, 2011, from the Joint Information Systems Committee website:
http://www.jisc.ac.uk/media/documents/programmes/elearninginnovation/gamingreport_v3.pdf
- de Freitas, S., & Oliver, M. (2006). How can exploratory learning with games and simulations within the curriculum be most effectively evaluated? *Computers & Education, 46*, 249-264.
- Delclos, V. R., & Kulewicz, S. J. (1986). Improving computer-based problem solving training: The role of the teacher as mediator. *Computers in Human Behavior, 2*, 135-146.
- DeLeeuw, K. E., & Mayer, R. E. (2011). Cognitive consequences of making computer-based learning activities more game-like. *Computers in Human Behavior, 27*, 2011–2016.
- Delice, K. E., & Gungor, Z. (2009). The usability analysis with heuristic evaluation and analytic hierarchy process. *International Journal of Industrial Ergonomics, 39*, 934-939.
- Dempsey, J. V., Haynes, L. L., Lucassen, B. A., & Casey, M. S. (2002). Forty simple computer games and what they could mean to educators. *Simulation & Gaming, 33*, 157-168.
- Dempsey, J. V., & Johnson, R. B. (1998). The development of an ARCS gaming scale. *Journal of Instructional Psychology, 25*, 215-221.
- Dennis, A. R., & Garfield, M. J. (2003). The adoption and use of GSS in project teams: Toward more participative processes and outcomes. *MIS Quarterly, 27*, 289-323.
- DeRosier, M., & Gilliom, M. (2007). Effectiveness of a parent training program for improving children's social behavior. *Journal of Child and Family Studies, 16*, 660-670.
- Desurvire, H., Caplan, M., & Toth, J. A. (2004). Using heuristics to evaluate the playability of games. *Proceedings of the CHI '04 extended abstracts on Human Factors in Computing Systems*, Vienna, Austria. New York, NY: ACM Press.
- Desurvire, H., & Wiberg, C. (2010). User experience design for inexperienced gamers: GAP - Game Approachability Principles. *Evaluating user experience in games* (pp. 131-147). London: Springer.
- Dickey, M. (2006). Game design narrative for learning: Appropriating adventure game design narrative devices and techniques for the design of interactive learning environments. *Educational Technology Research and Development, 54*, 245-263.

- Dickey, M. D. (2005). Engaging by design: How engagement strategies in popular computer and video games can inform instructional design. *Educational Technology Research & Development, 53*, 67-83.
- Dickey, M. D. (2007). Game design and learning: A conjectural analysis of how massively multiple online role-playing games (MMORPGs) foster intrinsic motivation. *Educational Technology Research & Development, 55*, 253–273.
- DiPietro, M., Ferdig, R. E., Boyer, J., & Black, E. W. (2007). Towards a framework for understanding electronic educational gaming. *Journal of Educational Multimedia and Hypermedia, 16*, 225-248.
- Dodge, K. A., & Crick, N. R. (1990). Social information-processing bases of aggressive behavior in children. *Personality and Social Psychology Bulletin, 16*, 8-22.
- Dodge, K. A., & Pettit, G. S. (2003). A biopsychosocial model of the development of chronic conduct problems in adolescence. *Developmental Psychology, 39*, 349-371.
- Dodge, K. A., & Rabiner, D. L. (2004). Returning to roots: On social information processing and moral development. *Child Development, 75*, 1003-1008.
- Dondi, C., & Moretti, M. (2007). A methodological proposal for learning games selection and quality assessment. *British Journal of Educational Technology, 38*, 502-512.
- Driscoll, M. P. (2005). *Psychology of learning for instruction*. Boston, MA: Pearson Allyn and Bacon.
- Druin, A. (2002). The role of children in the design of new technology. *Behaviour & Information Technology, 21*, 1-25.
- Druin, A., & Fast, C. (2002). The child as learner, critic, inventor, and technology design partner: An analysis of three years of Swedish student journals. *International Journal of Technology and Design Education, 12*, 189-213.
- Ducheneaut, N., & Moore, R. J. (2005). More than just 'XP': Learning social skills in massively multiplayer online games. *Interactive Technology and Smart Education, 2*, 89-100.
- Ducheneaut, N., Yee, N., Nickell, E., & Moore, R. J. (2006). Alone together?: Exploring the social dynamics of massively multiplayer online games. *Proceedings of the 2006 Annual Special Interest Group on Computer-Human Interaction at the Conference on Human Factors in Computing Systems (SIGCHI)*, Montréal, Québec. New York, NY: ACM Press.
- Echeverría, A., García-Campo, C., Nussbaum, M., Gil, F., Villalta, M., Améstica, M., & Echeverría, S. (2011). A framework for the design and integration of collaborative classroom games. *Computers & Education, 57*, 1127-1136.

- Egenfeldt-Nielsen, S. (2007). Third generation educational use of computer games. *Journal of Educational Multimedia and Hypermedia* 16, 263-281.
- Elias, M. J., Gara, M. A., Schuyler, T. F., Branden-Muller, L. R., & Sayette, M. A. (1991). The promotion of social competence: Longitudinal study of a preventive school-based program. *American Journal of Orthopsychiatry*, 61, 409-417.
- Elliott, S. N., & Gresham, F. M. (1993). Social skills interventions for children. *Behavior Modification*, 17, 287-313.
- Entertainment Software Association. (2011). *Essential facts about the computer and video game industry* Retrieved October 3, 2011, from http://www.theesa.com/facts/pdfs/ESA_EF_2011.pdf
- Erdley, C. A., & Asher, S. R. (1999). A social goals perspective on children's social competence. *Journal of Emotional & Behavioral Disorders*, 7, 156-167.
- Erdley, C. A., Loomis, C. C., Cain, K. M., & Dumas-Hines, F. (1997). Relations among children's social goals, implicit personality theories, and responses to social failure. *Developmental Psychology*, 33, 263-272.
- Ermi, L., & Mäyrä, F. (2007). Fundamental components of the gameplay experience: Analysing immersion. In S. D. Castell & J. Jenson (Eds.), *Worlds in play: International perspectives on digital games research* (pp. 37-53). New York, NY: Peter Lang Publishing, Inc.
- Evans, S. W., Axelrod, J. L., & Sapia, J. K. (2000). Effective school-based mental health interventions: Advancing the social skills training paradigm. *Journal of School Health*, 70, 191-194.
- Fabricatore, C., Nussbaum, M., & Rosas, R. (2002). Playability in action videogames: A qualitative design model. *Human-Computer Interaction*, 17, 311-368.
- Facer, K., Joiner, R., Stanton, D., Reid, J., Hull, R., & Kirk, D. (2004). Savannah: Mobile gaming and learning? *Journal of Computer Assisted Learning*, 20, 399-409.
- Fang, X., Chan, S., Brzezinski, J., & Xu, S. (2005). Moderating effects of task type on wireless technology acceptance. *Journal of Management Information Systems*, 22, 123-157.
- Federoff, M. (2002). *Heuristics and usability guidelines for the creation and evaluation of fun in video games*. (Master Thesis, Indiana University, 2002). Retrieved from <http://citeseerx.ist.psu.edu/index>.
- Fenstermacher, K., Olympia, D., & Sheridan, S. M. (2006). Effectiveness of a computer-facilitated interactive social skills training program for boys with attention deficit hyperactivity disorder. *School Psychology Quarterly*, 21, 197-224.

- Fenwick, T. J. (2001). *Experiential learning: A theoretical critique from five perspectives. Information Series No. 385*. Columbus, OH: Publications, Center on Education and Training for Employment.
- Fernandez, A. (2008). Fun experience with digital games: A model proposition. In O. Leino, H. Wirman & A. Fernandez (Eds.), *Extending experiences: Structure, analysis and design of computer game player experience* (pp. 181-190). Rovaniemi, Finland: Lapland University Press.
- Flannery, D. J., Vazsonyi, A. T., Liau, A. K., Guo, S., Powell, K. E., Atha, H., . . . Embry, D. (2003). Initial behavior outcomes for the PeaceBuilders universal school-based violence prevention program. *Developmental Psychology, 39*, 292-308.
- Foster, A. (2008). Games and motivation to learn science: Personal identity, applicability, relevance and meaningfulness. *Journal of Interactive Learning Research, 19*, 597-614.
- Fraser, M. W., Galinsky, M. J., Smokowski, P. R., Day, S. H., Terzian, M. A., Rose, R. A., & Guo, S. (2005). Social information-processing skills training to promote social competence and prevent aggressive behavior in the third grades. *Journal of Consulting and Clinical Psychology, 73*, 1045-1055.
- Frey, A., Hartig, J., Ketzler, A., Zinkernagel, A., & Moosbrugger, H. (2007). The use of virtual environments based on a modification of the computer game Quake III Arena® in psychological experimenting. *Computers in Human Behavior, 23*, 2026-2039.
- Fu, D., Jensen, R., & Hinkelman, E. (2008). Evaluating game technologies for training. *Proceedings of the Aerospace Conference 2008, IEEE*.
- Fusilier, M., Durlabhji, S., & Cucchi, A. (2008). An investigation of the integrated model of user technology acceptance: Internet user samples in four countries. *Journal of Educational Computing Research, 38*, 155-182.
- Gagné, R. M., Wager, W. W., Golas, K. C., Keller, J. M., & Russell, J. D. (2005). *Principles of instructional design* (5th ed.). Belmont, CA: Wadsworth.
- Garris, R., Ahlers, R., & Driskell, J. E. (2002). Games, motivation, and learning: A research and practice model. *Simulation & Gaming, 33*, 441-467.
- Garzotto, F. (2008). Broadening children's involvement as design partners: From technology to "experience". *Proceedings of the 7th International Conference on Interaction Design and Children*, Chicago, Illinois. New York, NY: ACM Press.
- Gay, L. R., Mills, G., & Airasian, P. (2009). *Educational research: Competencies for analysis and applications* (9th ed.). London, England: Pearson Education International.
- Gee, J. P. (2007). *What video games have to teach us about learning and literacy* (Rev. and updated ed.). New York, NY: Palgrave Macmillan.

- Gentile, D. (2009). Pathological video-game use among youth ages 8 to 18: A national study. *Psychological Science, 20*, 594-602.
- Gentry, M. (2006). No child left behind: Neglecting excellence. *Roeper Review, 29*, 24-27.
- Gifford-Smith, M. E., & Brownell, C. A. (2003). Childhood peer relationships: Social acceptance, friendships, and peer networks. *Journal of School Psychology, 41*, 235-284.
- Goh, D. H., Ang, R. P., & Tan, H. C. (2008). Strategies for designing effective psychotherapeutic gaming interventions for children and adolescents. *Computers in Human Behavior, 24*, 2217-2235.
- Goldstein, T. R., Miklowitz, D. J., & Mullen, K. L. (2006). Social skills knowledge and performance among adolescents with bipolar disorder. *Bipolar Disorders, 8*, 350-361.
- Good, J., & Robertson, J. (2006). CARSS: A framework for learner-centred design with children. *International Journal of Artificial Intelligence in Education, 16*, 381-413.
- Gotze, E., Prange, C., & Uhrovská, I. (2009). Children's impact on innovation decision making: A diary study. *European Journal of Marketing, 43*, 1, 264-295.
- Gratch, J., & Kelly, J. (2009). MMOGs: Beyond the wildest imagination. *Journal of Interactive Learning Research, 20*, 175-187.
- Green, M., & Piel, J. A. (2002). *Theories of human development: A comparative approach*. Boston, MA: Allyn and Bacon.
- Green, M. E., & McNeese, M. N. (2008). Factors that predict digital game play. *Howard Journal of Communications, 19*, 258-272.
- Green, S. B., & Salkind, N. J. (2011). *Using SPSS for Windows and Macintosh: Analyzing and understanding data*. (6th ed.). Boston, MA: Prentice Hall.
- Greenberg, M. T., Domitrovich, C., & Bumbarger, B. (2000). *Preventing mental disorders in school-age children: A review of the effectiveness of prevention programs*. Retrieved September 12, 2010, from Prevention Research Center for the Promotion of Human Development, Pennsylvania State University website: <http://prevention.psu.edu/>
- Greeno, J. G., Collins, A. M., & Resnick, L. B. (1996). Cognition and learning. In D. C. Berliner & R. C. Calfee (Eds.), *The handbook of educational psychology* (pp. 15-46). New York, NY: Simon & Schuster, MacMillan.
- Gresham, F. M. (1988). Social skills: Conceptual and applied aspects of assessment, training, and social validation. In J. C. Witt, S. N. Elliott & F. M. Gresham (Eds.), *Handbook of behavior therapy*. New York, NY: Plenum Press.

- Gresham, F. M. (2001). Assessment of social skills in children and adolescents. *Handbook of psychoeducational assessment* (pp. 325-355). San Diego, CA: Academic Press.
- Gresham, F. M., & Elliot, S. N. (1990). *Social skills rating system manual*. Circle Pines, MN: American Guidance Service.
- Gresham, F. M., Sugai, G., & Horner, R. H. (2001). Interpreting outcomes of social skills training for students with high-incidence disabilities. *Exceptional Children, 67*, 331-344.
- Griffiths, M. (2002). The educational benefits of videogames. *Education and Health, 20*, 47-51.
- Griffiths, M. (2004). Can videogames be good for your health? *Journal of Health Psychology, 9*, 339-344.
- Griffiths, M. D., Davies, M. N. O., & Chappell, D. (2004). Demographic factors and playing variables in online computer gaming. *Cyberpsychology & Behavior, 7*, 479-487.
- Gros, B. (2007). Digital games in education: The design of games-based learning environments. *Journal of Research on Technology in Education, 40*, 23-38.
- Gul, S. O., & Vuran, S. (2010). An analysis of studies conducted video modeling in teaching social skills. *Educational Sciences: Theory and Practice, 10*, 249-274.
- Gulliksen, J., Harker, S., & Steger, J. (2001). The ISO approach to the development of ergonomics standards for accessibility. In Nicolle C & A. J (Eds.), *Inclusive design guidelines for HCI* (pp. 151-164). New York, NY: Taylor & Francis.
- Gunter, G., Kenny, R., & Vick, E. (2008). Taking educational games seriously: Using the RETAIN model to design endogenous fantasy into standalone educational games. *Educational Technology Research and Development, 56*, 511-537.
- Gunter, G., Kenny, R. F., & Vick, E. H. (2006). A case for a formal design paradigm for serious games. *The Journal of the International Digital Media and Arts Association, 3*, 93-105.
- Guo, Y., Savoy, A., Byrd, K., & Salvendy, G. (2009). Development and validation of an instrument to evaluate the content effectiveness of video games: A pilot study. *Theoretical Issues in Ergonomics Science, 10*, 107-133.
- Ha, I., Yoon, Y., & Choi, M. (2007). Determinants of adoption of mobile games under mobile broadband wireless access environment. *Information & Management, 44*, 276-286.
- Hanna, L., Neapolitan, D., & Ridsen, K. (2004). Evaluating computer game concepts with children. *Proceedings of the 2004 Conference on Interaction Design and Children: Building a Community*, Maryland. New York, NY: ACM Press.

- Harrison, T. M., Zappen, J. P., & Watson, D. (2009). Children's use of government information systems: Design and usability. *Proceedings of the 10th Annual International Conference on Digital Government Research: Social Networks: Making Connections between Citizens, Data and Government*, Puebla, Mexico. New York, NY: ACM Press.
- Hartmann, T., & Klimmt, C. (2006). Gender and computer games: Exploring females' dislikes. *Journal of Computer-Mediated Communication*, *11*, 910-931.
- Hassenzahl, M. (2005). The thing and I: Understanding the relationship between user and product funology. In M. Blythe, K. Overbeeke, A. Monk & P. Wright (Eds.), *Funology: From usability to enjoyment. Human-Computer Interaction Series* (Vol. 3, pp. 31-42). Netherlands: Springer
- Hayashi, Y., Bourdeau, J., & Mizoguchi, R. (2006). Ontological support for a theory-eclectic approach to instructional and learning design. In W. Nejdl & K. Tochtermann (Eds.), *Innovative Approaches for Learning and Knowledge Sharing* (Vol. 4227, pp. 155-169). Berlin & Heidelberg: Springer
- Healey, M., & Jenkins, A. (2000). Kolb's experiential learning theory and its application in geography in higher education. *Journal of Geography*, *99*, 185-195.
- Hebert-Myers, H., Guttentag, C. L., Swank, P. R., Smith, K. E., & Landry, S. H. (2006). The importance of language, social, and behavioral skills across early and later childhood as predictors of social competence with peers. *Applied Developmental Science*, *10*, 174-187.
- Hefner, D., Klimmt, C., & Vorderer, P. (2007). Identification with the player character as determinant of video game enjoyment. In L. Ma, M. Rauterberg & R. Nakatsu (Eds.), *Entertainment Computing – ICEC 2007* (Vol. 4740, pp. 39-48). Berlin & Heidelberg: Springer.
- Hennessey, B. A. (2007). Promoting social competence in school-aged children: The effects of the open circle program. *Journal of School Psychology*, *45*, 349-360.
- Hennessey, E., & Heary, C. (2005). Researching children's experiences: Approaches and methods. In S. M. Greene & D. M. Hogan (Eds.), *Exploring children's views through focus groups*. (pp. 236–252). London: Sage.
- Hirumi, A., & Stapleton, C. (2009). Applying pedagogy during game development to enhance game-based learning. In C. T. Miller (Ed.), *Games: Purpose and potential in education* (pp. 127-162). New York, NY: Springer.
- Hobbs, J., & Yan, Z. (2008). Cracking the walnut: Using a computer game to impact cognition, emotion, and behavior of highly aggressive fifth grade students. *Computers in Human Behavior*, *24*, 421-438.
- Hong, J.-C., Hwang, M.-Y., Lu, C.-H., Cheng, C.-L., Lee, Y.-C., & Lin, C.-L. (2009). Playfulness-based design in educational games: A perspective on an evolutionary contest game. *Interactive Learning Environments*, *17*, 15-35.

- Hopkins, I., Gower, M., Perez, T., Smith, D., Amthor, F., Wimsatt, C., & Biasini, F. (2011). Avatar assistant: Improving social skills in students with an ASD through a computer-based intervention. *Journal of Autism and Developmental Disorders, 41*, 1543-1555.
- Houghton, S., Milner, N., West, J., Douglas, G., Lawrence, V., Whiting, K., . . . Durkin, K. (2004). Motor control and sequencing of boys with Attention-Deficit/Hyperactivity Disorder (ADHD) during computer game play. *British Journal of Educational Technology, 35*, 21-34.
- Höysniemi, J., Hämäläinen, P., & Turkki, L. (2003). Using peer tutoring in evaluating the usability of a physically interactive computer game with children. *Interacting with Computers, 15*, 203-225.
- Hsu, C.-L., & Lu, H.-P. (2007). Consumer behavior in online game communities: A motivational factor perspective. *Computers in Human Behavior, 23*, 1642-1659.
- Huang, W.-H., Huang, W.-Y., & Tschopp, J. (2010). Sustaining iterative game playing processes in DGBL: The relationship between motivational processing and outcome processing. *Computers & Education, 55*, 789-797.
- Huizenga, J., Admiraal, W., Akkerman, S., & Dam, G. t. (2009). Mobile game-based learning in secondary education: Engagement, motivation and learning in a mobile city game. *Journal of Computer Assisted Learning, 25*, 332-344.
- Hung, D. (2001). Theories of learning and computer-mediated instructional technologies. *Educational Media International, 38*, 281-287.
- Iarocci, G., Yager, J., & Elfers, T. (2007). What gene-environment interactions can tell us about social competence in typical and atypical populations. *Brain and Cognition, 65*, 112-127.
- Ibbitson, K. (2005). *The use of complex digital games and simulations in the classroom to enhance engagement and learning*. Retrieved September 9, 2009, from <http://homepage.mac.com/markdouglaswagner/.Public/Ibbitson.doc>
- Ibrahim, R., Wills, G., & Gilbert, L. (2010). Degendering games: Towards a gender-inclusive framework for games. *Proceedings of the IADIS International Conference: Games and Entertainment Technologies part of the IADIS Multiconference on Computer Science & Information Systems (MCCSIS 2010)*, Freiburg, Germany.
- Inal, Y., & Cagiltay, K. (2007). Flow experiences of children in an interactive social game environment. *British Journal of Educational Technology, 38*, 455-464.
- Jacko, J. A., & Sears, A. (2003). *The human-computer interaction handbook: Fundamentals, evolving technologies, and emerging applications*. Mahwah, N.J.: Lawrence Erlbaum Associates.
- Järvinen, A., Heliö, S., & Mäyrä, F. (2002). *Communication and community in digital entertainment services. Prestudy Research Report*. Tampere, Finland: University of Tampere Hypermedia Lab.

- Jegers, K. (2007). Pervasive game flow: Understanding player enjoyment in pervasive gaming. *Computers in Entertainment*, 5, 1-11.
- Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, 33, 14-26.
- Johnson, T. E., & Huang, W. D. (2008). Complex skills development for today's workforce: Using games as a strategy for engineering model-centered learning environments. In D. Ifenthaler, P. Pirnay-Dummer & J. M. Spector (Eds.), *Understanding models for learning and instruction* (pp. 305-325). New York, NY: Springer.
- Jones, A., Scanlon, E., Tosunoglu, C., Morris, E., Ross, S., Butcher, P., & Greenberg, J. (1999). Contexts for evaluating educational software. *Interacting with Computers*, 11, 499-516.
- Jones, R. N., Sheridan, S. M., & Binns, W. R. (1993). Schoolwide social skills training: Providing preventive services to students at-risk. *School Psychology Quarterly*, 8, 57-80.
- Joseph, G. E., & Strain, P. S. (2003). Comprehensive evidence-based social-emotional curricula for young children: An analysis of efficacious adoption potential. *Topics in Early Childhood Special Education*, 23, 65-76.
- Kafai, Y. B. (2006). Playing and making games for learning. *Games and Culture*, 1, 36-40.
- Kaiser, H. F. (1970). A second generation Little Jiffy*. *Psychometrika*, 35, 401-415.
- Kaiser, H. F. (1974). An index of factorial simplicity*. *Psychometrika*, 39, 31-36.
- Kam, M., Ramachandran, D., Raghavan, A., Chiu, J., Sahni, U., & Canny, J. (2006). Practical considerations for participatory design with rural school children in underdeveloped regions: Early reflections from the field. *Proceedings of the 2006 Conference on Interaction Design and Children*, Tampere, Finland. New York, NY: ACM Press.
- Kass, A., Burke, R., Blevins, E., & Williamson, M. (1993). Constructing learning environments for complex social skills. *Journal of the Learning Sciences*, 3, 387-427.
- Kazdin, A. E., Bass, D., Siegel, T., & Thomas, C. (1989). Cognitive-behavioral therapy and relationship therapy in the treatment of children referred for antisocial behavior. *Journal of Consulting and Clinical Psychology*, 57, 522-535.
- Kazdin, A. E., Esveldt-Dawson, K., French, N. H., & Unis, A. S. (1987). Problem-solving skills training and relationship therapy in the treatment of antisocial child behavior. *Journal of Consulting and Clinical Psychology*, 55, 76-85.
- Ke, F. (2008). A case study of computer gaming for Math: Engaged learning from gameplay? *Computers & Education*, 51, 1609-1620.

- Ke, F., & Grabowski, B. (2007). Gameplaying for Maths learning: Cooperative or not? *British Journal of Educational Technology*, 38, 249-259.
- Kebritchi, M., & Hirumi, A. (2008). Examining the pedagogical foundations of modern educational computer games. *Computers & Education*, 51, 1729-1743.
- Kebritchi, M., Hirumi, A., & Bai, H. (2010). The effects of modern Mathematics computer games on Mathematics achievement and class motivation. *Computers & Education*, 55, 427-443.
- Keller, J. M. (2010). *Motivational design for learning and performance: The ARCS Model approach*. New York, NY: Springer.
- Kennewell, S., & Beauchamp, G. (2003). The influence of a technology-rich classroom environment on elementary teachers' pedagogy and children's learning. *Proceedings of the International Federation for Information Processing Working Group 3.5 Open Conference on Young Children and Learning Technologies*, Sydney, Australia. Darlinghurst, Australia: Australian Computer Society Inc.
- Kiili, K. (2007). Foundation for problem-based gaming. *British Journal of Educational Technology*, 38, 394-404.
- Kim, B., Park, H., & Baek, Y. (2009). Not just fun, but serious strategies: Using meta-cognitive strategies in game-based learning. *Computers & Education*, 52, 800-810.
- Kinzie, M. B., & Joseph, D. R. D. (2008). Gender differences in game activity preferences of middle school children: Implications for educational game design. *Educational Technology Research and Development*, 56, 643-663.
- Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. *Educational Psychologist*, 41, 75-86.
- Klahr, D., & Nigam, M. (2004). The equivalence of learning paths in early Science instruction. *Psychological Science*, 15, 661-667.
- Klimmt, C., Schmid, H., & Orthmann, J. (2009). Exploring the enjoyment of playing browser games. *CyberPsychology & Behavior*, 12, 231-234.
- Kline, S., Dyer-Witthford, N., & Peuter, G. D. (2003). *Digital play: The interaction of technology, culture, and marketing*. Quebec City, Quebec: McGill-Queen's University Press.
- Koeffel, C., Hochleitner, W., Leitner, J., Haller, M., Geven, A., & Tscheligi, M. (2010). Using heuristics to evaluate the overall user experience of video games and advanced interaction games. In R. Bernhaupt (Ed.), *Evaluating user experience in games concepts and methods* (pp. 233-256). London: Springer.

- Kolb, A. Y., & Kolb, D. A. (2009). The learning way meta-cognitive aspects of experiential learning. *Simulation & Gaming, 40*, 297-327.
- Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Englewood Cliffs, N.J.: Prentice-Hall.
- Kolb, D. A., Boyatzis, R. E., & Mainemelis, C. (2009). Experiential learning theory: Previous research and new directions. In R. J. Sternberg & L. F. Zhang (Eds.), *Perspectives on thinking, learning, and cognitive styles* (pp. 193-210.). Mahwah, NJ: L. Erlbaum Associates.
- Korhonen, H., & Koivisto, E. M. (2006). Playability heuristics for mobile games. *Proceedings of the Mobile HCI 2006*, Helsinki, Finland. New York, NY: ACM Press.
- Korhonen, H., & Koivisto, E. M. I. (2007). Playability heuristics for mobile multi-player games. *Proceedings of the 2nd International Conference on Digital Interactive Media in Entertainment and Arts*, New York, NY: ACM Press.
- Kücklich, J. (2004). *Play and playability as key concepts in new media studies*
Retrieved October 13, 2010, from <http://www.playability.de/Play.pdf>
- Ladd, G. W. (1999). Peer relationships and social competence during early and middle childhood. *Annual Review of Psychology, 50*, 333-359.
- Lai, C. H., Yang, J. C., Chen, F. C., Ho, C. W., San Liang, J., & Chan, T. W. (2005). Improving experiential learning with mobile technologies. *Proceedings of the IEEE International Workshop on Wireless and Mobile Technologies in Education*, Tokushima, Japan.
- Laitinen, S. (2006). Do usability expert evaluation and testing provide novel and useful data for game development? *Journal of Usability Studies, 1*, 64-75.
- Laitinen, S. (2008). Usability and playability expert evaluation. In K. Isbister & N. Schaffer (Eds.), *Game usability* (pp. 91-111). Boston: Morgan Kaufmann.
- Landry, S. H., Smith, K. E., & Swank, P. R. (2009). New directions in evaluating social problem solving in childhood: Early precursors and links to adolescent social competence. *New Directions for Child & Adolescent Development, 2009*, 51-68.
- Lane, K. L. (1999). Young students at risk for antisocial behavior: The utility of academic and social skills interventions. *Journal of Emotional & Behavioral Disorders, 7*, 211-223.
- Lane, K. L., Menzies, H. M., Barton-Arwood, S. M., Doukas, G. L., & Munton, S. M. (2005). Designing, implementing, and evaluating social skills interventions for elementary students: Step-by-step procedures based on actual school-based investigations. *Preventing School Failure, 49*, 18-26.
- Lankoski, P. (2011). Player character engagement in computer games. *Games and Culture, 6*, 291-311.

- Lau, S.-H., & Woods, P. C. (2009). Understanding learner acceptance of learning objects: The roles of learning object characteristics and individual differences. *British Journal of Educational Technology*, *40*, 1059-1075.
- Laugeson, E., Frankel, F., Mogil, C., & Dillon, A. (2009). Parent-assisted social skills training to improve friendships in teens with Autism Spectrum Disorders. *Journal of Autism and Developmental Disorders*, *39*, 596-606.
- Law, E., Kickmeier-Rust, M., Albert, D., & Holzinger, A. (2008). Challenges in the development and evaluation of immersive digital educational games. In A. Holzinger (Ed.), *HCI and usability for education and work* (Vol. 5298, pp. 19-30). Berlin & Heidelberg: Springer
- Law, E. L. C., & Van Schaik, P. (2010). Editorial: Modelling user experience - An agenda for research and practice. *Interacting with Computers*, *22*, 313-322.
- Lawshe, C. H. (2006). A quantitative approach to content validity. *Personnel Psychology*, *28*, 563-575.
- Lee, J. J. (2006). Design factors for players' perceived playability in massively multiplayer role play games. *Proceedings of the World Conference on Educational Multimedia, Hypermedia and Telecommunications*, Chesapeake, VA: AACE.
- Lee, M.-C., & Tsai, T.-R. (2010). What drives people to continue to play online games? An extension of technology model and Theory of Planned Behavior. *International Journal of Human-Computer Interaction*, *26*, 601 - 620.
- Lee, M. K. O., Cheung, C. M. K., & Chen, Z. (2005). Acceptance of internet-based learning medium: The role of extrinsic and intrinsic motivation. *Information & Management*, *42*, 1095-1104.
- Lee, Y., Kozar, K. A., & Larsen, K. R. T. (2003). The Technology Acceptance Model: Past, present, and future. *Communications of the Association for Information Systems*, *12*, 752-780.
- Leffert, J. S., Brady, M. E., & Siperstein, G. N. (2009). A "tools for teachers" approach for infusing social skills instruction into daily teaching activities. *Teaching Exceptional Children Plus*, *6*, 2-25.
- Li, L., & Campbell, J. (2010). Emotion modeling and interaction of NPCs in virtual simulation and games. *The International Journal of Virtual Reality*, *9*, 1-6.
- Liang, T. P., & Yeh, Y. H. (2009). Situational effects on the usage intention of mobile games. In C. Weinhardt, S. Luckner & J. Stöber (Eds.), *Designing E-Business Systems. Markets, Services, and Networks. Lecture Notes in Business Information Processing* (Vol. 22, pp. 51-59). Berlin & Heidelberg: Springer Verlag.
- Liang, T. P., & Yeh, Y. H. (2011). Effect of use contexts on the continuous use of mobile services: The case of mobile games. *Personal and Ubiquitous Computing*, *15*, 187-196.

- Liao, C., To, P. L., Liu, C. C., Kuo, P. Y., & Chuang, S. H. (2011). Factors influencing the intended use of web portals. *Online Information Review, 35*, 237-254.
- Lim, C. P. (2007). Effective integration of ICT in Singapore Schools: Pedagogical and policy implications. *Educational Technology Research and Development, 55*, 83-116.
- Lin, C. S., Wu, S., & Tsai, R. J. (2005). Integrating perceived playfulness into expectation-confirmation model for web portal context. *Information & Management, 42*, 683-693.
- Liu, T.-Y., & Chu, Y.-L. (2010). Using ubiquitous games in an English listening and speaking course: Impact on learning outcomes and motivation. *Computers & Education, 55*, 630-643.
- Lösel, F., & Beelmann, A. (2003). Effects of child skills training in preventing antisocial behavior: A systematic review of randomized evaluations. *Annals of the American Academy of Political and Social Science, 587*, 84-109.
- Lucas, K., & Sherry, J. L. (2004). Sex differences in video game play: A communication-based explanation. *Communication Research, 31*, 499-523.
- Lyle, S. (2000). Narrative understanding: Developing a theoretical context for understanding how children make meaning in classroom settings. *Journal of Curriculum Studies, 32* 45-63.
- Malecki, C. K., & Elliot, S. N. (2002). Children's social behaviors as predictors of academic achievement: A longitudinal analysis. *School Psychology Quarterly, 17*, 1-23.
- Malone, T. W., & Lepper, M. R. (1987). Making learning fun: A taxonomy of intrinsic motivation for learning. In R. E. Snow & M. J. Farr (Eds.), *Aptitude learning and instruction III: Conative and affective process analyses*. Hillsdale, NJ: Erlbaum.
- Marakas, G. M., Yi, M. Y., & Johnson, R. D. (1998). The multilevel and multifaceted character of computer self-efficacy: Toward clarification of the construct and an integrative framework for research. *Information Systems Research, 9*, 126-163.
- Markopoulos, P., & Bekker, M. (2003a). Interaction design and children. *Interacting with Computers, 15*, 141-149.
- Markopoulos, P., & Bekker, M. (2003b). On the assessment of usability testing methods for children. *Interacting with Computers, 15*, 227-243.
- Marks, I. M., Cavanagh, K., & Gega, L. (2007). *Hands-On Help: Computer-Aided Psychotherapy*. New York, NY: Psychology Press.
- Mathieson, K., Peacock, E., & Chin, W. W. (2001). Extending the technology acceptance model: The influence of perceived user resources. *ACM SIGMIS Database, 32*, 86-112.

- Matson, J. L., Rotatori, A. F., & Helsel, W. J. (1983). Development of a rating scale to measure social skills in children: The Matson Evaluation of Social Skills with Youngsters (MESSY). *Behaviour Research and Therapy*, *21*, 335-340.
- Matson, J. L., & Wilkins, J. (2007). A critical review of assessment targets and methods for social skills excesses and deficits for children with autism spectrum disorders. *Research in Autism Spectrum Disorders*, *1*, 28-37.
- Mayer, R. E. (2004). Should there be a three-strikes rule against pure discovery learning? The case for guided methods of instruction. *American Psychologist*, *59*, 14-19.
- Mayer, R. E. (2011). Multimedia learning and games. In S. Tobias & J. D. Fletcher (Eds.), *Computer games and instruction* (pp. 281–305). Greenwich, CT: Information Age Publishing.
- Mayes, T., & De Freitas, S. (2001). *JISC e-Learning Models Desk Study*. Retrieved April 19, 2010, from the Joint Information Systems Committee website: <http://www.macs.hw.ac.uk/~rjr/dolweb/docs/>
- McFarland, D. J., & Hamilton, D. (2006). Adding contextual specificity to the technology acceptance model. *Computers in Human Behavior*, *22*, 427-447.
- McLeod, G. (2003). Learning theory and instructional design. *Learning Matters*, *2*, 35-43.
- Meadan, H., & Monda-Amaya, L. (2008). Collaboration to promote social competence for students with mild disabilities in the general classroom: A structure for providing social support. *Intervention in School & Clinic*, *43*, 158-167.
- Miller, L. M., Chang, C.-I., Wang, S., Beier, M. E., & Klisch, Y. (2011). Learning and motivational impacts of a multimedia Science game. *Computers & Education*, *57*, 1425-1433.
- Mioduser, D., Tur-Kaspa, H., & Leitner, I. (2000). The learning value of computer-based instruction of early reading skills. *Journal of Computer Assisted Learning*, *16*, 54-63.
- Moon, J.-W., & Kim, Y.-G. (2001). Extending the TAM for a World-Wide-Web context. *Information & Management*, *38*, 217-230.
- More, C. (2008). Digital stories targeting social skills for children with disabilities: Multidimensional learning. *Intervention in School & Clinic*, *43*, 168-177.
- Moreno-Ger, P., Burgos, D., Martínez-Ortiz, I., Sierra, J. L., & Fernández-Manjón, B. (2008). Educational game design for online education. *Computers in Human Behavior*, *24*, 2530-2540.
- Moser, C., Fuchsberger, V., & Tscheligi, M. (2011). Using probes to create child personas for games. *Proceedings of the 8th International Conference on Advances in Computer Entertainment Technology*, Lisbon, Portugal. New York, NY: ACM.

- Nangle, D. W., Erdley, C., Carpenter, E. M., & Newman, J. E. (2002). Social skills training as a treatment for aggressive children and adolescents: A developmental-clinical integration. *Aggression and Violent Behavior, 7*, 169-199.
- Nielsen, J. (1994a). Enhancing the explanatory power of usability heuristics. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems: Celebrating Interdependence*, Boston, MA. New York, NY: ACM Press.
- Nielsen, J. (1994b). Heuristic evaluation. In J. Nielsen & R. L. Mack (Eds.), *Usability inspection methods* (pp. 25–64). New York: John Wiley & Sons.
- Nielsen, J., & Molich, R. (1990). Heuristic evaluation of user interfaces. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems: Empowering People*, Seattle, Washington. New York, NY: ACM Press.
- Nokelainen, P. (2006). An empirical assessment of pedagogical usability criteria for digital learning material with elementary school students. *Educational Technology & Society, 9*, 178-197.
- Nousiainen, T. (2009). Children's involvement in the design of game-based learning environments. In M. Kankaanranta & P. Neittaanmäki (Eds.), *Design and use of serious games* (pp. 49-66). New York: Springer Science.
- Nousiainen, T., & Kankaanranta, M. (2008). Exploring children's requirements for game-based learning environments. *Advances in Human-Computer Interaction, 2008*, 1-7.
- Nworie, J., & Haughton, N. (2008). The unintended consequences of the application of technology in teaching and learning environments. *TechTrends, 52*, 52-58.
- O'Neil, H. F., Wainess, R., & Baker, E. L. (2005). Classification of learning outcomes: Evidence from the computer games literature. *Curriculum Journal, 16*, 455-474.
- Oblinger, D. (2004). The next generation of educational engagement. *Journal of Interactive Media in Education, 8*, 1-18. from <http://www-jime.open.ac.uk/2004/8/oblinger-2004-8.pdf>
- Oblinger, D. (2006). Games and learning. *EDUCAUSE Quarterly, 29*, 5-7.
- Ogletree, S., & Drake, R. (2007). College students' video game participation and perceptions: Gender differences and implications. *Sex Roles, 56*, 537-542.
- Ong, C.-S., & Lai, J.-Y. (2006). Gender differences in perceptions and relationships among dominants of e-learning acceptance. *Computers in Human Behavior, 22*, 816-829.
- Ooi, Y. P., Ang, R. P., Fung, D., Wong, G., & Cai, Y. (2007). Effects of CBT on children with disruptive behaviour disorders: Findings from a Singapore study. *ASEAN Journal of Psychiatry, 8*, 71-81.

- Oord, S., van der , Meulen, E. M., van der , Prins, P. J. M., Oosterlaan, J., Buitelaar, J. K., & Emmelkamp, P. M. G. (2005). A psychometric evaluation of the social skills rating system in children with attention deficit hyperactivity disorder. *Behaviour Research and Therapy*, *43*, 733-746.
- Oosterholt, R., Kusano, M., & Vries, G. d. (1996). Interaction design and human factors support in the development of a personal communicator for children. *Proceedings of the CHI 96*, Vancouver. New York, NY: ACM Press.
- Orvis, K. A., Horn, D. B., & Belanich, J. (2008). The roles of task difficulty and prior videogame experience on performance and motivation in instructional videogames. *Computers in Human Behavior*, *24*, 2415-2433.
- Pagulayan, R., Keeker, K., Wixon, D., Romero, R., & Fuller, T. (2003). User-centered design in games. In J. A. Jacko & A. Sears (Eds.), *The human-computer interaction handbook: Fundamentals, evolving technologies and emerging applications* (pp. 883-905). Mahwah, NJ: Lawrence Erlbaum Associates.
- Pallant, J. (2010). *SPSS survival manual: A step by step guide to data analysis using SPSS* (4th ed.). Maidenhead, Berkshire: Open University Press/McGraw-Hill.
- Papastergiou, M. (2009). Digital game-based learning in high school Computer Science education: Impact on educational effectiveness and student motivation. *Computers & Education*, *52*, 1-12.
- Papert, S. (1980). *Mindstorms: Children, computers, and powerful ideas*. Brighton, Sussex: Harvester Press.
- Paraskeva, F., Mysirlaki, S., & Papagianni, A. (2010). Multiplayer online games as educational tools: Facing new challenges in learning. *Computers & Education*, *54*, 498-505.
- Pardo, S., Howard, S., & Vetere, F. (2008). Child-centered evaluation: Broadening the child/designer dyad. *Advances in Human-Computer Interaction*, *2008*, 1-9.
- Pardo, S., Vetere, F., & Howard, S. (2005). Broadening stakeholder involvement in UCD: Designers' perspectives on child-centred design. *Proceedings of the 17th Australia Conference on Computer-Human Interaction: Citizens Online: Considerations for Today and the Future*, Canberra, Australia. Canberra: Computer-Human Interaction Special Interest Group of Australia.
- Parker, J. G., & Asher, S. R. (1987). Peer relations and later personal adjustment: Are low-accepted children at risk? *Psychological Bulletin*, *102*, 357-389.
- Parker, J. G., & Asher, S. R. (1993). Friendship and friendship quality in middle childhood: Links with peer group acceptance and feelings of loneliness and social dissatisfaction. *Developmental Psychology*, *29*, 611-621.
- Parsons, S., Leonard, A., & Mitchell, P. (2006). Virtual environments for social skills training: Comments from two adolescents with autistic spectrum disorder. *Computers & Education*, *47*, 186-206.

- Parsons, S., & Mitchell, P. (2002). The potential of virtual reality in social skills training for people with autistic spectrum disorders. *Journal of Intellectual Disability Research, 46*, 430-443.
- Patel, B. (2007). Designing children's multimedia. In S. Kurniawan & P. Zaphiris (Eds.), *Advances in universal web design and evaluation: Research, trends and opportunities* (pp. 43-72). London: University of Cambridge.
- Pfiffner, L. J., & McBurnett, K. (1997). Social skills training with parent generalization: Treatment effects for children with attention deficit disorder. *Journal of Consulting and Clinical Psychology, 65*, 749-757.
- Piaget, J., & Bärbel, I. (2000). *The Psychology Of The Child* (H. Weaver, Trans.). NY: Basic Books, Inc.
- Pinelle, D., Wong, N., & Stach, T. (2008). Heuristic evaluation for games: usability principles for video game design. *Proceedings of the CHI 2008*, Florence, Italy. New York: ACM Press.
- Pivec, M., & Dziabenko, O. (2004). Game-based learning in universities and lifelong learning: "UniGame: Social Skills and Knowledge Training" game concept. *Journal of Universal Computer Science, 10*, 14-26.
- Prensky, M. (2007). *Digital game-based learning*. New York, NY: McGraw-Hill.
- Prensky, M. (2010). *Teaching digital natives: Partnering for real learning*. Thousand Oaks, CA: Corwin Press.
- Price, S., Rogers, Y., Scaife, M., Stanton, D., & Neale, H. (2003). Using 'tangibles' to promote novel forms of playful learning. *Interacting with Computers, 15*, 169-185.
- Qin, H., Rau, P.-L. P., & Salvendy, G. (2010). Effects of different scenarios of game difficulty on player immersion. *Interacting with Computers, 22*, 230-239.
- Quaiser-Pohl, C., Geiser, C., & Lehmann, W. (2006). The relationship between computer-game preference, gender, and mental-rotation ability. *Personality and Individual Differences, 40*, 609-619.
- Quinn, M. M., Kavale, K. A., Mathur, S. R., Rutherford, J. R. B., & Forness, S. R. (1999). A meta-analysis of social skill interventions for students with emotional or behavioral disorders. *Journal of Emotional & Behavioral Disorders, 7*, 54-64.
- Read, J., Gregory, P., MacFarlane, S., McManus, B., Gray, P., & Patel, R. (2002). An investigation of participatory design with children - informant, balanced and facilitated design. *Proceedings of the Interaction Design and Children International Workshop*, Herzogenrath, Germany: Shaker Publishing.
- Read, J. C., & MacFarlane, S. (2006). Using the fun toolkit and other survey methods to gather opinions in child computer interaction. *Proceedings of the 2006*

Conference on Interaction Design and Children, Tampere, Finland. New York: ACM Press.

- Rezaiyan, A., Mohammadi, E., & Fallah, P. A. (2007). Effect of computer game intervention on the attention capacity of mentally retarded children. *International Journal of Nursing Practice*, 13, 284-288.
- Richardson, A. E., Powers, M. E., & Bousquet, L. G. (2011). Video game experience predicts virtual, but not real navigation performance. *Computers in Human Behavior*, 27, 552-560.
- Rieber, L., & Noah, D. (2008). Games, simulations, and visual metaphors in education: Antagonism between enjoyment and learning. *Educational Media International*, 45, 77-92.
- Rieh, S. Y., Kim, Y. M., Yang, J. Y., & St Jean, B. (2010). A diary study of credibility assessment in everyday life information activities on the Web: Preliminary findings. *Proceedings of the American Society for Information Science and Technology*, 47, 1-10.
- Roda, C. (2004). Participatory system design as a tool for learning. *Proceedings of the IADIS International Conference CELDA (Cognition and Exploratory Learning in Digital Age)*, 15-17 Dec 2004, Lisbon, Portugal.
- Ross, S., Ramage, M., & Rogers, Y. (1995). PETRA: Participatory evaluation through redesign and analysis. *Interacting with Computers*, 7, 335-360.
- Rotheram-Borus, M. J., Bickford, B., & Milburn, N. G. (2001). Implementing a classroom-based social skills training program in middle childhood. *Journal of Educational and Psychological Consultation*, 12, 91-111.
- Rubin, K. H., & Rose-Krasnor, L. (1992). Interpersonal problem solving and social competence in children. In V. B. Van Hasselt & M. Hersen (Eds.), *Handbook of social development: A lifespan perspective. Perspectives in developmental psychology* (pp. 283–323). New York: Plenum.
- Ruland, C. M., Starren, J., & Vatne, T. M. (2008). Participatory design with children in the development of a support system for patient-centered care in pediatric oncology. *Journal of Biomedical Informatics*, 41, 624-635.
- Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55, 68-78.
- Sánchez, J. L. G., Zea, N. P., & Gutiérrez, F. L. (2009a). From usability to playability: Introduction to player-centred video game development process. In M. Kurosu (Ed.), *Human Centered Design* (Vol. 5619, pp. 65-74). Berlin & Heidelberg: Springer
- Sánchez, J. L. G., Zea, N. P., & Gutiérrez, F. L. (2009b). Playability: How to identify the player experience in a video game. In T. Gross, J. Gulliksen, P. Kotzé, L. Oestreicher, P. Palanque, R. Prates & M. Winckler (Eds.), *Human-Computer*

- Interaction – INTERACT 2009* (Vol. 5726, pp. 356-359). Berlin & Heidelberg: Springer.
- Sarason, I. G., & Sarason, B. R. (1981). Teaching cognitive and social skills to high school students. *Journal of Consulting and Clinical Psychology, 49*, 908-918.
- Scaife, M., & Rogers, Y. (1998). Kids as informants: Telling us what we didn't know or confirming what we knew already? *The design of children's technology* (pp. 27-50). San Francisco, CA: Morgan Kaufmann
- Scattone, D. (2007). Social skills interventions for children with autism. *Psychology in the Schools, 44*, 717-726.
- Schank, R. C., Berman, T. R., & Macpherson, K. A. (1999). Learning by doing. In C. M. Reigeluth (Ed.), *Instructional-design theories and models: A new paradigm of instructional theory* (pp. 633–651). Mahwah, NJ: Lawrence Erlbaum Associates.
- Schott, G., & Hodgetts, D. (2006). Health and digital gaming: The benefits of a community of practice. *Journal of Health Psychology, 11*, 309–316.
- Schrader, P. G., & McCreery, M. (2008). The acquisition of skill and expertise in massively multiplayer online games. *Educational Technology Research & Development, 56*, 557–574.
- Segrin, C. (2000). Social skills deficits associated with depression. *Clinical Psychology Review, 20*, 379-403.
- Semple, A. (2000). Learning theories and their influence on the development and use of educational technologies. *Australian Science Teachers Journal, 46*, 21-28.
- Shackel, B. (2009). Usability - Context, framework, definition, design and evaluation. *Interacting with Computers, 21*, 339–346.
- Shaffer, D. W., Squire, K., Halverson, R., & Gee, J. P. (2005). Video games and the future of learning. *The Phi Delta Kappan, 87*, 104-111.
- Sharry, J., McDermott, M., & Condron, J. (2003). 'Relax To Win' - Treating children with anxiety problems with a biofeedback video game. *EISTEACH 2*, 22-26.
- Sheppard, B. H., Jon, H., & Warshaw, P. R. (1988). The Theory of Reasoned Action: A meta-analysis of past research with recommendations for modifications and future research. *Journal of Consumer Research, 15*, 325-343.
- Shin, D.-H. (2009). An empirical investigation of a modified technology acceptance model of IPTV. *Behaviour and Information Technology, 28*, 361-372.
- Shin, D.-H. (2010). The dynamic user activities in massive multiplayer online role-playing games. *International Journal of Human-Computer Interaction, 26*, 317-344.

- Shiratuiddin, N., & Landoni, M. (2002). Evaluation of content activities in children's educational software. *Evaluation and Program Planning*, 25, 175-182.
- Shneiderman, B., & Plaisant, C. (2010). *Designing the user interface: Strategies for effective human-computer interaction* (5th ed.). Boston, MA: Addison-Wesley.
- Smeets, E. (2005). Does ICT contribute to powerful learning environments in primary education? *Computers & Education*, 44, 343-355.
- Spector, J. M. (2001). Philosophical implications for the design of instruction. *Instructional Science*, 29, 381-402.
- Spence, S. H. (2003). Social skills training with children and young people: Theory, evidence and practice. *Child & Adolescent Mental Health*, 8, 84-96.
- Spence, S. H., & Donovan, C. (2000). The treatment of childhood social phobia: The effectiveness of a social skills training-based, cognitive-behavioural intervention, with and without parental involvement. *Journal of Child Psychology & Psychiatry & Allied Disciplines*, 41, 713-726.
- Squire, K. D. (2008). Video game-based learning: An emerging paradigm for instruction. *Performance Improvement Quarterly*, 21, 7-36.
- Squire, K. R., & Jenkins, H. (2003). Harnessing the power of games in education. *Insight*, 3, 5-33.
- Squires, D., & Preece, J. (1999). Predicting quality in educational software: Evaluating for learning, usability and the synergy between them. *Interacting with Computers*, 11, 467-483.
- Steiner, C. M., Kickmeier-Rust, M. D., & Albert, D. (2009). Little big difference: Gender aspects and gender-based adaptation in educational games. In M. Chang, R. Kuo, Kinshuk, G.-D. Chen & M. Hirose (Eds.), *Learning by Playing. Game-based Education System Design and Development. Lecture Notes in Computer Science* (Vol. 5670, pp. 150–161). Berlin & Heidelberg: Springer Verlag
- Sun, H., & Zhang, P. (2006). The role of moderating factors in user technology acceptance. *International Journal of Human-Computer Studies*, 64, 53-78.
- Sweetser, P., & Johnson, D. (2004). Player-centered game environments: Assessing player opinions, experiences, and issues. In M. Rauterberg (Ed.), *Entertainment Computing - ICEC 2004. Lecture Notes in Computer Science* (Vol. 3166, pp. 305-336). Berlin & Heidelberg: Springer
- Sweetser, P., & Wyeth, P. (2005). GameFlow: A model for evaluating player enjoyment in games. *Computers in Entertainment*, 3, 1-24.
- Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Boston: Allyn and Bacon.

- Tan, J. L., Goh, D. H.-L., Ang, R. P., & Huan, V. S. (2011). Child-centered interaction in the design of a game for social skills intervention. *Computers in Entertainment, 9*, 1-17.
- Taxén, G., Druin, A., Fast, C., & Kjellin, M. (2010). KidStory: A technology design partnership with children. *Behaviour & Information Technology, 20*, 119-125.
- Terlecki, M., Brown, J., Harner-Steciw, L., Irvin-Hannum, J., Marchetto-Ryan, N., Ruhl, L., & Wiggins, J. (2011). Sex differences and similarities in video game experience, preferences, and self-efficacy: Implications for the gaming industry. *Current Psychology, 30*, 22-33.
- Terzis, V., & Economides, A. (2011). The acceptance and use of computer based assessment. *Computers & Education, 56*, 1032-1044.
- Thatcher, D. C. (1990). Promoting learning through games and simulations. *Simulation & Gaming, 21*, 262-273.
- Trentacosta, C. J., & Shaw, D. S. (2012). Preventing Early Conduct Problems and Later Delinquency. In E. L. Grigorenko (Ed.), *Handbook of Juvenile Forensic Psychology and Psychiatry* (pp. 309-322). New York, NY: Springer.
- Trepte, S., & Reinecke, L. (2010). Avatar creation and video game enjoyment: Effects of life-satisfaction, game competitiveness, and identification with the avatar. *Journal of Media Psychology: Theories, Methods, and Applications, 22*, 171-184.
- Triantafyllakos, G., Palaigeorgiou, G., & Tsoukalas, I. A. (2006). We!Design: A student-centred participatory methodology for the design of educational applications. *British Journal of Educational Technology, 39*, 125-139.
- Triantafyllakos, G., Palaigeorgiou, G., & Tsoukalas, I. A. (2010). Fictional characters in participatory design sessions: Introducing the “design alter egos” technique. *Interacting with Computers, 22*, 165-175.
- Truong, K. N., Hayes, G. R., & Abowd, G. D. (2006). Storyboarding: An empirical determination of best practices and effective guidelines. *Proceedings of the 6th Conference on Designing Interactive Systems*, University Park, PA. New York: ACM Press.
- Tsiatsos, T., Andreas, K., & Pomportsis, A. (2010). Evaluation framework for collaborative educational virtual environments. *Educational Technology & Society, 13*, 65-77.
- Tüzün, H. (2007). Blending video games with learning: Issues and challenges with classroom implementations in the Turkish context. *British Journal of Educational Technology, 38*, 465-477.
- Tüzün, H., Yilmaz-Soylu, M., Karakus, T., Inal, Y., & Kizilkaya, G. (2009). The effects of computer games on primary school students' achievement and motivation in Geography learning. *Computers & Education, 52*, 68-77.

- van der Heijden, H. (2004). User acceptance of hedonic information systems. *MIS Quarterly*, 28, 695-704
- Vaucelle, C., Africano, D., Davenport, G., Wiberg, M., & Fjellstrom, O. (2005). Moving pictures: Looking out/looking in. *Proceedings of the ACM SIGGRAPH 2005 Educators Program*, Los Angeles, California. New York: ACM Press.
- Venkatesh, V. (2000). Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the Technology Acceptance Model. *Information Systems Research*, 11, 342-365.
- Venkatesh, V., Morris, M. G., & Ackerman, P. L. (2000). A longitudinal field investigation of gender differences in individual technology adoption decision-making processes. *Organizational Behavior and Human Decision Processes*, 83, 33-60.
- Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27, 425-478.
- Venkatesh, V., Speier, C., & Morris, M. G. (2002). User acceptance enablers in individual decision making about technology: Toward an integrated model. *Decision Sciences*, 33, 297-316.
- Virvou, M., & Katsionis, G. (2008). On the usability and likeability of virtual reality games for education: The case of VR-ENGAGE. *Computers & Education*, 50, 154-178.
- Virvou, M., Katsionis, G., & Manos, K. (2005). Combining software games with education: Evaluation of its educational effectiveness. *Educational Technology and Society*, 8, 54-65.
- Vogel, J. J., Vogel, D. S., Cannon-Bowers, J. A. N., Bowers, C. A., Muse, K., & Wright, M. (2006). Computer gaming and interactive simulations for learning: A meta-analysis. *Journal of Educational Computing Research*, 34, 229-243.
- Vorderer, P., & Bryant, J. (2006). *Playing video games motives, responses, and consequences*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Walker, I. (2010). *Research methods and statistics*. New York, NY: Palgrave Macmillan.
- Wang, H.-Y., & Wang, Y.-S. (2008). Gender differences in the perception and acceptance of online games. *British Journal of Educational Technology*, 39, 787-806.
- Watson, W. R., Mong, C. J., & Harris, C. A. (2011). A case study of the in-class use of a video game for teaching high school History. *Computers & Education*, 56, 466-474.
- Webster-Stratton, C., & Reid, M. J. (2004). Strengthening social and emotional competence in young children - The foundation for early school readiness and

- success: Incredible Years Classroom Social Skills and Problem-Solving Curriculum. *Infants & Young Children*, 17, 96-113.
- Welle Donker-Kuijjer, M., de Jong, M., & Lentz, L. (2010). Usable guidelines for usable websites? An analysis of five e-government heuristics. *Government Information Quarterly*, 27, 254-263.
- Welsh, M., Parke, R. D., Widaman, K., & O'Neil, R. (2006). Linkages between children's social and academic competence: A longitudinal analysis. *Journal of School Psychology*, 39, 463-482.
- Whippey, C. (2011). Community in world of warcraft: The fulfilment of social needs. *Totem: The University of Western Ontario Journal of Anthropology*, 18, 49-59.
- Wilkinson, N., Ang, R. P., & Goh, D. H. (2008). Online video game therapy for mental health concerns: A review. *International Journal of Social Psychiatry*, 54, 370-382.
- Wilson, D. B., Gottfredson, D. C., & Najaka, S. S. (2001). School-based prevention of problem behaviors: A meta-analysis. *Journal of Quantitative Criminology*, 17, 247-272.
- Wilson, K. A., Bedwell, W. L., Lazzara, E. H., Salas, E., Burke, C. S., Estock, J. L., . . . Conkey, C. (2009). Relationships between game attributes and learning outcomes. *Simulation & Gaming*, 40, 217-266.
- Winters, N., & Mor, Y. (2008). IDR: A participatory methodology for interdisciplinary design in technology enhanced learning. *Computers & Education*, 50, 579-600.
- Woszczynski, A. B., Roth, P. L., & Segars, A. H. (2002). Exploring the theoretical foundations of playfulness in computer interactions. *Computers in Human Behavior*, 18, 369-388.
- Wu, Z. (2009). *Computing interests of early adolescents: Gender, attitudes, self-efficacy, and outcome expectations*. (Doctoral dissertation, University of Virginia, 2009). Retrieved from Proquest Digital Dissertations. (AAT 3447228).
- Yanchar, S., South, J., Williams, D., Allen, S., & Wilson, B. (2010). Struggling with theory? A qualitative investigation of conceptual tool use in instructional design. *Educational Technology Research and Development*, 58, 39-60.
- Yang, K. C. C. (2005). Exploring factors affecting the adoption of mobile commerce in Singapore. *Telematics and Informatics*, 22, 257-277.
- Yannakakis, G. N., & Hallam, J. (2007). Towards optimizing entertainment in computer game. *Applied Artificial Intelligence*, 21, 933-971.
- Yi, M. Y., & Hwang, Y. (2003). Predicting the use of web-based information systems: Self-efficacy, enjoyment, learning goal orientation, and the technology acceptance model. *International Journal of Human-Computer Studies*, 59, 431-449.

- Yip, F., & Kwan, A. (2006). Online vocabulary games as a tool for teaching and learning English vocabulary. *Educational Media International*, 43, 233-249.
- Zaphiris, P., & Constantinou, P. (2007). Using participatory design in the development of a language learning tool. *Interactive Technology and Smart Education*, 4, 79-90.
- Zerfass, A., & Hartmann, B. (2005). The usability factor: Improving the quality of e-content. In P. A. Bruck, Z. Karssen, A. Buchholz & A. Zerfass (Eds.), *E-Content* (pp. 165-182). Berlin & Heidelberg: Springer.
- Zhao, F., & Fang, X. (2009). Factors affecting online game players' loyalty. In N. Aykin (Ed.), *Internationalization, Design and Global Development* (Vol. 5623, pp. 197-206). Berlin & Heidelberg: Springer.
- Zurita, G., Nussbaum, M., & Shaples, M. (2003). Encouraging face-to-face collaborative learning through the use of handheld computers in the classroom. In L. Chittaro (Ed.), *Human-Computer Interaction with Mobile Devices and Services* (Vol. 2795, pp. 193-208). Berlin & Heidelberg: Springer.

APPENDICES

Appendix A: Pre-Questionnaire (Study I)

Please complete the following questionnaire by ticking the appropriate boxes. For each question, tick one box except for question 4, you may tick more than 1 box. Your answers will form part of a statistical study and will not identify you as an individual

Name : _____ Class : _____
Sex : Male/Female* Birthday: __ (date)/ __ (month)/ ____ year)

1. I have used the computer for ____ years.

less than 1
1 to 2

3 to 4
more than 4

2. I think I _____ about computers.

know a lot
know a little

know something
don't know anything

3. I normally spend _____ hours per week on the computer.

zero
less than 5

6-10
more than 10

4. I use the computer for _____. (You may tick more than 1 box.)

playing games
blogging
chatting (e.g. MSN)
(don't use at all)
others, please specify _____

doing school work (assignments, projects)
sending and receiving e-mails
social networking (Facebook, Twitter)
browsing the Internet for fun

5. I have a computer at home

Yes

No

6. I have Internet connection at home.

Yes

No

7. How often do you play the following types of video games? Tick only one box per row.

Types of Games	Almost every day	At least once a week	At least once a month	Seldom	Never
Stand alone PC games					
Online PC games					
Arcade games					
Mobile phone games					
Console games (e.g Xbox, Play Station)					
Portable handheld device games (e.g. Gameboy, PSP)					

8. How many hours per week do you spend on playing games? _____ hours

Appendix B: Social Skills Knowledge Test (Study II)

There are 15 questions. This is not a test, so do not worry if you do not know the answer. By answering these questions, you are helping us improve the school programme.

- Each question contains four possible answers of which there is only **one single best answer**.
- You should decide which option from the list is the single best answer.
- When you are satisfied with your decision, circle your answer on the answer sheet.

1. Sometimes we experience pleasant feelings and that makes us feel good. Sometimes we also experience unpleasant feelings and that makes us feel bad. Select the correct grouping of pleasant and unpleasant feelings.

	Pleasant Feelings	Unpleasant Feelings
A	Cheerful, Jealous	Irritated, Guilty
B	Helpful, Joyful	Suspicious , Irritated
C	Satisfied, Guilty	Scared, Depressed
D	Confident, Loved	Disappointed, Hopeful

2. Most people show their feelings through their faces. The look on a person's face (i.e., facial expression) is an important clue to tell us about his feelings. However, there are other clues that tell us about how people feel. Select the clue that will **NOT** help us know how a person is feeling.

- A Words
- B Tone of voice
- C Thoughts
- D Body language

3. Anger is **NOT** _____.

- A A normal, healthy feeling
- B Something experienced by everyone
- C A powerful feeling, but you can learn to manage with practice.
- D A behavior

4. Tim got very angry when he was teased by some of his classmates. Choose one of the following that is **NOT** an anger signal.

- A Body Response-Flushed Face
- B Thought Signal- "I hate him"
- C Action Signal- Clenched Fist
- D Indifferent Attitude – Walk away

5. Joshua's classmate, Richard often called him names. One day, when Joshua was by himself, Richard walked up to him and called him "Sissy". Joshua got very angry and started hitting Richard. Choose the best answer to describe your understanding of the situation.
- A Joshua's anger feelings caused him to hit Richard and this is Richard's fault.
 - B Joshua has the right to hit Richard just to teach him a lesson.
 - C Joshua's anger feelings can influence the way he behaves but it is Joshua who decided to react violently when he is angry.
 - D Joshua should hit Richard to stop him from calling him names
6. Wei Ming got very angry because of a foul committed during a soccer match. He was given a warning by the referee before for his aggressive behavior. What advice should you **NOT** give to Wei Ming?
- A Breathe in and out quickly through your nose
 - B Tense and relax your shoulders
 - C Visualise a relaxing scene
 - D Count 1 to10
7. Teck Ho has angry or negative thoughts because he is upset that his classmate, Chun Ming broke his favourite badminton racket. Teck Ho threw Chun Ming's bag into the dustbin. You should advise him to practise self-talk. Identify one statement to help him.
- A This is too much! I must get even.
 - B Everyone thinks I am an angry person.
 - C I'm never going to learn how to manage my anger.
 - D I am going to keep my cool and not get into further trouble.
8. Ahmad was angry after finding out that his friend, Edmund, had taken his coloured pencils without telling him. Edmund played with them and broke all the pencils. What do you think Ahmad could say or do?
- A Use assertiveness technique to tell Edmund not to do this again.
 - B Walk away and think of how to get back at Edmund.
 - C Inform your teacher immediately.
 - D Not to use "I" statements while stating his feelings to Edmund.
9. Jenny's classmates laughed at her and called her "Lousy Player" when she accidentally threw the basketball outside the court, instead of into the net. As this is **NOT** a serious matter, what should Jenny do?
- A Jenny can get her brother to deal with her classmates as soon as possible.
 - B Deal with the situation herself so as to show them that she is not weak or cowardly.
 - C Tell the teacher quickly.
 - D Stand up for herself by telling them not to do it again.
10. Weng Chong's classmate threw stones at him while he was playing catching during recess. As the situation is serious, _____,
- A Weng Chong should inform the teacher immediately.
 - B Weng Chong should deal with the situation himself quickly.

- C Wait till his teacher is free, then inform him.
D Ignore the situation and walk away.

11. What is empathy?

- A The ability to feel sorry for another person.
B The ability to understand and recognise others' feelings.
C The ability to be kind to another person.
D The ability to not be troubled when we hurt another person

12. Kassim talks loudly in class when his teacher is teaching. You are his friend and want to teach Kassim empathy skills? Which should you **NOT** do?

- A Tell him to be considerate, keep quiet and not to make any more noise
B Tell him that Miss Lim is upset over his inconsiderate behavior.
C Ask him "How might the teacher feel?"
D Tell him to think of the consequences of his actions.

13. Lee Hui did not clean up the room. Her mother is very busy as she has to prepare dinner and take care of Lee Hui's younger baby brother. In order to practise empathy skills, what should she **NOT** do?

- A She should ask herself, "How might her mother feel?"
B She should ask herself, "How can she make her mother feel better?"
C She should reason that her mother should know that she is busy
D She should ask herself this question, "What are the consequences of her action?"

14. Rearrange the steps below so that they are in an appropriate order for handling anger.

Step	Action
T	Reflect and Reward
P	Generate solutions
S	Evaluate solutions
R	Do Not React first
Q	Feeling Angry?

- A S, T, R, P, Q
B Q, R, P, S, T
C R, Q, S, T, P
D Q, T, R, R, P

15. During swimming lesson, Gopal was disturbed by another boy, Ravi who is from the same class. Ravi pushed Gopal. Gopal got really angry and wanted to kick him back.

What is the solution that Gopal should **NOT** generate?

- A Do deep breathing.
B Use visualization strategy and think of a calm and peaceful picture or place
C Tense and relax his arms.
D Do his homework.

Thank you for your co-operation.

Appendix C: Demographic Questionnaire (Study II)

Please complete the following questionnaire by circling your answer on the answer sheet. For each question, select only one answer.

Your answers will form part of a statistical study and will not identify you as an individual.

Name : _____ Class : _____

Register Number: _____ Sex : Male/Female*

Date of Birth: _____ (date)/ _____(month)/ _____(year)

1. I have used the computer for _____ years.

- A 0
- B 1
- C 2
- D 3
- E 4 and more

2. How often do you play computer games?






- A never
- B not very often
- C several times a month
- D several times a week
- E almost every day

3 I think I _____ about computer games.






- A don't know anything
- B know a little
- C know something
- D know a lot
- E know everything

Appendix D: Game Evaluation Survey (Study II)






Perceived Playability Scale.

Please answer the following questions in relation to your experience in the Step Up Problem-Solving Programme you have just completed. There are no right or wrong answers. Place a tick below the face that best tells how much you agree with the sentence.						
		A Great Extent	To A Big Extent	To A Moderate Extent	A Little	Not at all
1.	I found the storyline in the game relates well to the things I do in my life.					
2.	The visuals, animation and music were able to capture my interest.					
3.	The variety of mini-games was able to maintain my attention.					
4.	The materials presented in the game were eye-catching.					
5.	The learning objectives and goals of the game were clear to me when I played the game.					
6.	The game helped me link new knowledge and skills with what I have learned before.					
7.	I found the contents of the game relevant to the things I do in my life.					
8.	I learned new concepts and skills from the game.					
9.	I understood the instructions and the contents of the game.					
10.	The game provided a challenge at an appropriate difficulty level.					
11.	I felt confident playing the game with the instructions and the online help (PetTeach).					
12.	When playing the game, I experienced the level of challenge that matched my skill level.					
13.	I was able to achieve the learning objectives and goal of the game.					
14.	I always felt in control of the game.					
15.	I found the game easy to navigate.					
16.	When playing the game, I received immediate feedback on my actions.					
17.	The game rewarded me appropriately for my effort in playing the game.					
18.	I found the self-reflection in the game useful for my learning.					
19.	The feedback helped in the reinforcement of skills learned.					
20.	The online help (PetTeach) help me in the reinforcement of skills learned.					

Perceived Playfulness Scale.

Please answer the following questions in relation to your experience in the Step Up Problem-Solving Programme you have just completed. There are no right or wrong answers. Place a tick below the face that best tells how much you agree with the sentence.						
		A Great Extent	To A Big Extent	To A Moderate Extent	A Little	Not at all
21.	I felt so immersed in the game because I was interested in seeing what would happen next.					
22.	I felt so immersed in the game because I wanted to increase my scores or 'mints'.					
23.	I felt so immersed in the game that I was unaware of what was happening in my surroundings					
24.	I felt so immersed the game because it stimulated my curiosity.					
25.	I enjoyed the game so much because I felt satisfied with my performance in the game					
26.	I enjoyed the game so much because there are skills I learned that I might use in my life.					
27.	I want to play more of the game because the game was fun.					

Behavioral Intention Scale

Please answer the following questions in relation to your experience in the Step Up Problem-Solving Programme you have just completed. There are no right or wrong answers. Place a tick below the face that best tells how much you agree with the sentence.						
		A Great Extent	To A Big Extent	To A Moderate Extent	A Little	Not at all
28.	I intend to play the game in the future.					
29.	I predict I will play the game in the future.					
30.	I plan to play the game in the future because I want to improve my social skills.					

Appendix E: Sample of Slides

Below are the Microsoft PowerPoint slides used by the lead facilitators during the first session of Study II. The facilitators gave an overview of the new skills learned for the session and explained the rationale for the skills covered. They helped to familiarize the children in the experimental group with the game environment by giving instructions on how to navigate and interact in the game interface.



Figure E1. Introduce Step-Up Problem Solving Program



Figure E2. Explain the importance of social skills



Figure E3. Log in screen



Figure E4. Present Introduction Movie

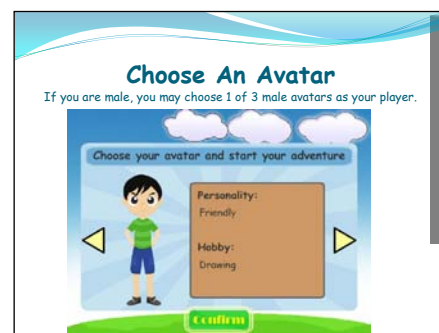


Figure E5. Choose a male avatar

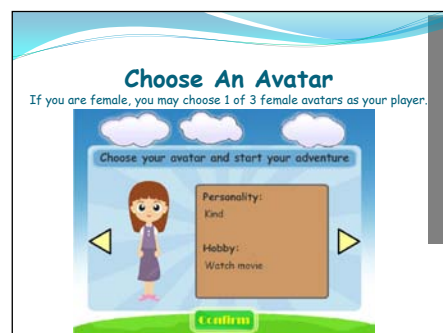


Figure E6. Choose a female avatar



Figure E7. Location of adventure

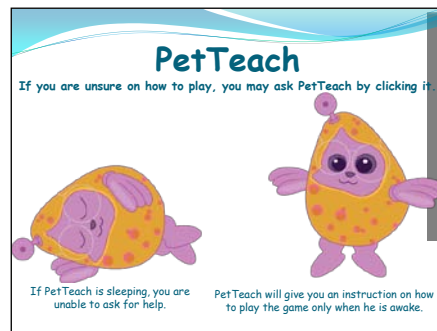


Figure E8. The online guide

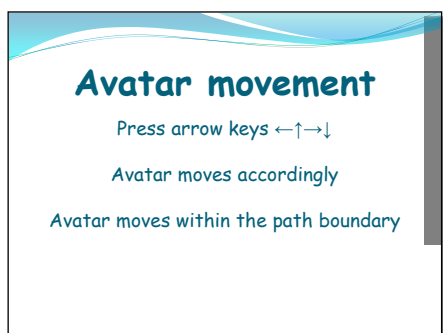


Figure E9. How to navigate the avatar



Figure E10. Introduce Mission 1



Figure E11. Objectives of Mission 1

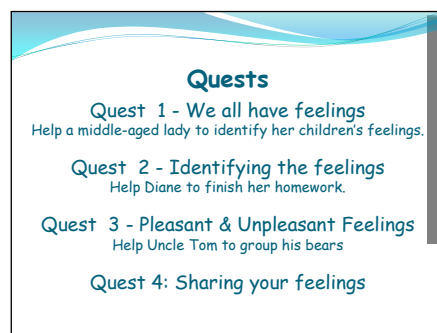


Figure E12. Introduce the 4 quests

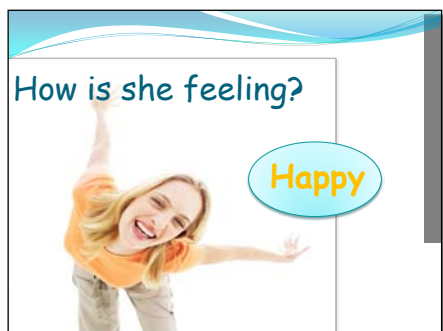


Figure E13. Example of a feeling



Figure E14. Secret reflection journal

Appendix F: Published Papers

Tan, J. L., Goh, D. H. L., Ang, R. P., & Huan, V. S. (2011). Child-centered interaction in the design of a game for social skills intervention. *Computers in Entertainment, 9*, 1-17.

Tan, J. L., Goh, D. H. L., Ang, R. P. & Huan, V. S. (2010). Usability and playability heuristics for evaluation of an instructional game. In J. Sanchez & K. Zhang (Eds.), *Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2010*. Chesapeake, VA: AACE.

Tan, J. L., Goh, D. H. L., Ang, R. P., & Huan, V. S. (2013). Participatory evaluation of an educational game for social skills acquisition. *Computers & Education, 64*, 70-80.