

The Role of Game-based Learning in Newcomer Children's Cultural Adjustment

by

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Abstract

The purpose of this thesis is to investigate the role of educational computer games as a tool to help newcomer children adjust socially. Newcomer children face tense conditions when trying to adjust in a new culture, one of which is experiencing difficulties in understanding the right behaviour in the new place of living. While there are traditional approaches of education and support used to help these children realize their new environment and adjust to it, there is a lack of research on the use of new digital interactive technologies in this regard.

We have developed an educational game called *New Beginning* that sought to help newcomer tweens (age 9-12 years) learn more about a few selected behavioural issues. The game includes social behaviour advice with a focus on bullying and how to respond to it. The participating children were assigned randomly to do one of the following activities: 1) playing a computer game that contains behavioural advice about social interaction in the context of a space fantasy story, 2) reading a brochure taken from Canadian school material related to the same topics.

Analyzing the pre and post questionnaires for both digital game group and brochure group showed that the children's knowledge of social adjustment in both groups has improved with a significant increase in the numbers of correct answers. The game group showed even stronger results. While the brochure found to be easy to read, children found the digital game more useful and enjoyable in comparison to the brochure. As such, the study confirmed the potential value of educational games in enhancing newcomer children's social adjustment compared to more conventional methods.

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CHAPTER 1. INTRODUCTION

1.1 BACKGROUND AND MOTIVATION

Canada is known internationally as a country that prides itself on following the principle of multiculturalism. According to Statistics Canada, in 2016, Canada had 1,212,075 new immigrants who stayed in Canada permanently from 2011 to 2016 (Statistics Canada, 2017). These new immigrants represented 3.5% of Canada's total population in 2016. Asia has the first rank, Africa is the second, and Europe is the third. According to the 2016 Census, almost 2.2 million children under the age of fifteen years old were born outside Canada or had at least one foreign-born parent representing 37.5% of all Canadian children. This percentage was 34.6 in 2011 (Statistics Canada, 2017). The increasing number of refugees due to various international crises and the Canadian willingness to support those in need has increased the number of newcomers to Canada.

The "newcomers" are persons who have travelled to a new host country from their motherland within the last two years, including immigrant and refugees (Brown, 2014). Their achievements are socially and economically beneficial for all Canadians. Their work has always been an essential factor in Canadian society that is built on the immigrant population, and their supports are indispensable to its future (Brown, 2014).

Many resources have been developed to help newcomers adjust to their new living conditions, interact with other members of society from different cultural backgrounds, and contribute positively to society. However, despite many efforts to help newcomers, not enough resources exist to help newcomer children develop the necessary intercultural skills

to thrive in a highly multicultural society and integrate into their new homes and to provide them with social/emotional support they need (Social Planning Council of Ottawa, 2010).

In a multicultural society, such as Canada, newcomers are able to integrate, retaining cherished values of their home country while adding the language and customs of the new land (Berry, 1997). However, it is often difficult for children to navigate home and host cultural worlds and claim their cultural identities. In addition to the challenges of adjusting to a foreign environment, they frequently experience role reversal as they often acquire language skills faster than their parents and need to help adults in the family deal with daily tasks. This further increases the children's challenges of constructing their own identities (Zhou, 2001). If children do not receive adequate support, they assimilate into "oppositional culture of marginalized peers" (Gibson, 2001; McBrien, 2005), and fail to integrate and contribute positively to society (McBrien, 2005). The failure to develop a strong sense of identity with healthy connection to family and the new environment may result in various mental health issues (Fazel et al., 2012), isolation from family and/or society, potentially leading to frustrations (SPCO, 2010), and in more severe cases criminal activity (Suárez et al., 2009) and political radicalization (Ganor, 2011). These issues are particularly severe in the case of refugees who are less prepared for the challenges they face (Fazel et al., 2012) and experience higher acculturation stress (Berry et al., 1987). Many refugees come to the country after traumatic experiences and may suffer from physiological and psychological challenges hindering adjustment (McBrien, 2005).

Canadian society respects the differences in culture and appreciates what ethnic and linguistic diversity add to the community (Chiu et al., 2014). However, those differences can be a significant reason for misunderstanding between the newcomers and the

Canadian-born population. For example, the newcomer students may face bullying and discrimination in their new schools, in a way that is different from their native countries. This misbehaving towards the newcomers may occur in schools where students have not received proper education on how to respect diversity. It is a big challenge for new students to rebuild their school environment, which is essential to their educational success. The new environment requires them to learn a new language, make new friends who would accept such diversity, understand the new culture, and interact with new people and in potentially new ways. To ensure that the new student will be able to create such an environment, proper education, teacher support, and learning material are important factors to encourage the students and increase their ability to integrate quickly in the society (Chiu et al., 2014).

There is a need for better methods used by educators to improve the newcomer children's knowledge of the society around them and help them adjust socially. The interactive digital media can play a potentially significant role in this regard that is not well investigated.

1.2 PROBLEM STATEMENT AND SIGNIFICANCE

Proper cultural education of the newcomer children is crucial in making sure they will become happy and functional members of their new society. While digital media technologies have caused a significant growth in computer games and electronic educational content for children (Prensky, 2001), there is little understanding regarding how they can support newcomer children to better adjust and interact with their social environment.

Advances in computer game technologies and the popularity and availability of these games have made them strong candidates for educational purposes (Prensky, 2004). A growing body of research shows that Game-Based Learning (GBL) can be used effectively in various scenarios. Despite these technical and research advances, as we will see in the next chapter, there is almost no study investigating the effectiveness of digital media and particularly GBL for newcomer children.

Considering the importance of social adjustment for newcomer children, the need for better tools, and potential value of game-based learning, this research aims at investigating the role of computer games as an educational tool to help newcomer children adjust to their new environment. A very important aspect of adapting is to understand the correct behaviour. All children face difficulties in understanding the right behaviour in the new environments, but this is particularly problematic for newcomer children due to extreme differences in the environment and expectations (CMAS, 2015). They have the behaviour that they used to do while they are in their previous country, which was acceptable according to their culture. Now in their new country, those behaviours will cause a misunderstanding of their surroundings. Figuring out which behaviour is appropriate and which one is unacceptable will take time and needs guidance.

With the diverse set of issues related to social adjustment and varying needs of children in different age group, this research focuses on tweens (children aged 9-12 years old) and a small set of behavioural subjects related to social interaction at school such as responding to bullying. This age group was chosen because the main researcher had both experiences working with them and access to sample population through the Ottawa Chinese Community Service Centre (OCCSC). This community centre is providing several

services to the newcomers and part of those newcomers are Middle Eastern, especially those who need to learn English language or are searching for specific help. OCCSC has committed itself to a process of modernization to streamline its programs and services in order to better manage the growth and development to meet emerging community needs. We discussed our study plan with this organization, and they were more than happy to provide the required participants and computers to facilitate our study. The target behaviours and related issues for the newcomer children were identified by advisors in our community partner, OCCSC.

1.3 CONTRIBUTIONS

The main contributions of this thesis are:

1. Investigating the use of GBL as a helpful tool for newcomer tween's social adjustment. There are not many projects which talk specifically about GBL for newcomer tweens. We showed that GBL has potential to be an effective tool in this regard.
2. Developing a prototype game for social and behavioural adjustment. We called the game: "*New Beginning*". It focuses on particular behavioural advice suggested by multicultural liaison officers who had dealt with newcomer children.
3. Providing design suggestions on game-based learning for newcomer children. Universal themes, variety of characters, better user interface, and the use of more attractive technologies such as Augmented and Virtual Reality are among these suggestions..

Our research findings are submitted to the International Conference on Education, Research, and Innovation (ICERI-2019).

1.4 RESEARCH APPROACH

With the goal of investigating the role of game-based learning in the social adjustment of newcomer children, and after doing a literature review, we defined the following research questions:

- Can technology help newcomer children adapt quicker to Canadian culture?
- Is game-based learning a better way to educate newcomer children about social adjustment than more traditional methods? (more general)
- Will game-based learning assist the newcomer tweens in improving their behavioural adaptation? (more specific)
- What are the design considerations in successful game-based learning for newcomer children and particularly tweens?

We based our research on the hypothesis that games provide a better educational medium than traditional reading material (brochures), and following standard evaluation methods in Human-Computer Interaction (HCI), we used a set of subjective criteria (ease of use, enjoyment, and perceived usefulness) and objective ones (comparative learning) for evaluating these two educational methods.

For this research, we followed an approach with the following elements:

- 1) Creating a prototype game based on specific design principles. We used multimedia learning principles, which are explained explicitly in chapter 3.
- 2) Involving newcomer tweens and their parents. We described the study in details in section 5.1.
- 3) Using objective and subjective quantitative metrics. The objective quantitative analysis was demonstrated in section 5.3.1, and the subjective quantitative analysis was demonstrated in section 5.3.2
- 4) Including qualitative questions for general feedback. In section 5.3.3, we mentioned the qualitative tweens' answers, and in section 5.3.4, we revealed the qualitative parent's answers.

1.5 THESIS STRUCTURE

Chapter 2 reviews the related work and research literature on the subjects of newcomer children and game-based learning. We start by describing the situation and some problems which are facing the newcomers in general and then the tweens in particular. Then, we mention the traditional methods which are found for helping the newcomer children. After that, we talk about digital game-based learning (GBL) and review some of those games and how do they may relate to the newcomer children. At the end of this chapter, we present a gap analysis and list our research questions.

Chapter 3 contains an overview of our proposed system. The chapter talks about the multimedia design approach, which we followed, and the instructional design model. After that, we introduce the designed game and mention the learning objectives of this

game. We end this chapter by the reflection of how our study follows the multimedia learning principals and the instructional design model.

Chapter 4 elaborates more on the game development and mentions some details about the assets and controllers and level design, which the players will experience when they are playing the game.

Chapter 5 presents the design and results of our user study. We explain our data collection process and show the statistical data analysis together with the qualitative feedback and some discussions.

Chapter 6 provides some concluding remarks.

CHAPTER 2. RELATED WORK

2.1 THE SITUATION AND PROBLEMS FACING NEWCOMER CHILDREN

Approximately 34% of all newcomers to Canada are under age 25 (AMSSA, 2016). Newcomer children face a significant life variation when moving to a new country, at a crucial period of their lives (Shenfield, 2017; Beiser et al., 2015). Unlike adults, children are still in the process of forming their identities and getting caught between cultures can cause significant conflicts for them (Shenfield, 2017). The immigrants' socialization is considered main concern, especially when the new arrival is not able to assimilate without difficulty. Many challenges are associated with the process of integration; one of the core challenges is bullying. Bullying is one of the serious matters that distress the health of many school children. This social problem among school-aged children is considered having problematic significances in children's lives, and that is stretched to their future (Ahmed, 2019).

Their struggles are too often not detected by others, even parents, who can be more focused on academic performance as opposed to general well-being. Feeling accepted, behaving appropriately, maintaining identity and self-esteem, and establishing relationships are among common problems faced by newcomer children (Shenfield, 2017; Beiser et al., 2015). "Immigrant children not only face a higher risk of outright bullying than non-immigrant children, they often deal with frequent micro-aggressions related to their choice of food, clothing, religion, manners, and other customs" (Shenfield, 2017). In the last decade or so, there has been significant research regarding the issues the newcomer

youth are facing in their settlement and integration (OCIN, 2011), mostly due to the increase in the number of newcomer youth.

The rules and norms of behaviour, reaction to certain emotions or stimuli, differ from one culture to another, also from one country to another (Nardon et al., 2011). For example, in some Asian countries, individuals tend to express their disagreement with silence, but on the other hand, some Westerners may express it by shouting. If the supervisor praises their employees, in North America, it would be considered motivational. In Russia, that would be viewed as extraordinary, but in France, it may be a sign of the supervisor being surprised that the employee can do such a thing, so would be considered offensive (Nardon et al., 2011).

The Affiliation of Multicultural Societies and Service Agencies (AMSSA) has mentioned that there are programs which enable the youth to share their culture with the broader community to ensure that they will adopt the new culture. Such programs will produce a positive impact on the youth and tween and improve their adaptation in the new culture (AMSSA, 2016).

2.2 SPECIFIC PROBLEMS WHICH NEWCOMER TWEENS ARE FACING

Even though immigrating to Canada is a valued step toward the future of the family, the process cannot be achieved without having challenges and problems which would face the whole family during their first years in the new country. Newcomer children may feel overwhelmed by the massive change in their lives because of immigration. The tweens, in particular, may face a critical period, because they are forming their identities. Tweens may face an internal conflict which will reflect on their personality and social life when being

transformed from a culture to another (Shenfield, 2017; Chuang, 2010; The Ministry of Children and Youth Services, 2017).

Being the time when their thinking skills, emotional stability, and personality are forming, tweens may find themselves in a situation of risky pressure and anxiety (CMAS, 2015).

The difficulties and problems which the newcomer children and particularly tweens are facing can be categorized into cultural, behavioural, and educational groups (Shenfield, 2017; CMAS, 2015; Chuang, 2010; The Ministry of Children and Youth Services, 2017).

2.2.1 Cultural

Learning about the Canadian way of life is a necessary process which all the newcomers should face. Children in general and tweens, in particular, may find this stressful and challenging process. They will be facing many traditions and standards which are different from their native culture. Thus, they find it difficult to adjust. If the children did not adapt quickly to the new culture, this might result in a cultural shock for the newcomer child (Chuang, 2010). The child's confidence would also be affected by culture shock. This step may reduce their self-confidence to discover and improve their skills (CMAS, 2015). Culture has a significant influence on a child's psychological, emotional, social, and cognitive development. Besides, newcomer children are less likely to receive the mental health services they need (The Ministry of Children and Youth Services, 2017).

2.2.2 Behaviour

It is well-known that many children face difficulties to form a social network. It would be much more difficult to find friends when moving to another country (Chuang, 2010). Some children may struggle for a long time to find friends. This long-time may result in negative psychological outcomes for the child, such as anxiety, loneliness, and tension. After finding friends, those friends should accept newcomer children and should be ok if they encounter any behaviour which may be misunderstood due to cultural differences (Chuang, 2010). The newcomer tween may face some difficulty to play with others in the new culture, either in school or neighbourhood. This problem will make the child feels isolated and disinterested in playing with others. Even if they started to play with others, they might play for a short period (CMAS, 2015).

2.2.3 Education

Starting to live in the new country, children feel worried regarding their performance in the school and their ability to achieve high grades, especially when they are facing a new way of teaching and new curriculum, which they are not used to see in their previous country (Chuang, 2010).

Children develop competencies at their definition. Competence can be seen as subjectively based on culture, context, and personal experience. It is defined as the skill to do something successfully or competently. For example, children who are newcomers may have different viewpoints on the meaning of competence. These differences should be understood and supported accordingly (The Ministry of Children and Youth Services, 2017). Being at the tween's age, not being able to follow-up their classmates, newcomer

children will feel frustrated and stressed. They will feel isolated and feel lonely. The new language is also considered as a barrier which should be taken into consideration. The children may experience distress when they feel that they cannot realize what is happening around them (CMAS, 2015). Most of the time, the language they are using in school is a new language, and they are trying to learn this at the same time as they are adapting to a new culture. Middle years children face many obstacles in delivering complex thoughts and feelings verbally (The Ministry of Children and Youth Services, 2017).

2.3 TRADITIONAL METHODS FOR HELPING NEWCOMER CHILDREN

2.3.1 Non-Digital Games

A cross-cultural simulation game BARNGA was used to investigate the relationships between the behaviour of a player and the social skills of that player (Katagami et al., 2010). To depend on a good social skill scale, they used Kikuchi's Scale of Social Skills (KiSS-18). BARNGA is a card game which aims at realizing a virtual cross-cultural experience. The authors picked a new version of this game, which is an online one. To measure the success of this game, the authors depended on the behavioural logs. The results showed that the scale of social skills, KiSS-18, is thoroughly linked to the behaviour of players as in what way the players took their actions that considerably impacted others in the ordered condition and the cross-cultural condition (Katagami et al., 2010).

For the past three years, the Newcomer Youth Advancements Program has given over 2,750 newcomers ability to join the Boys and Girls Clubs facilities and programs (Gouinn et al., 2016). The facilities include swimming pool, playground, multimedia room, and

others. The programs differ from location to others, in general, they provide academic engagement, employment support, leadership development, skill development, cooking activities, art, and multimedia. This study mentioned that the outcome of the newcomer youth was positive, and they felt welcomed. Those kinds of activities made those youth feel a sense of belonging and arises their cultural awareness and social skills and made them engage more in the community (Gouinn et al., 2016).

A program supported by the National Hockey League (NHL) and players' association teaches the newcomer children the basics of the hokey games (Brady, 2017). That way is essential for children to adapt quickly to the surrounding community. NHL is not the only league doing that. For some of the children, this program is the first sports program they are attending an organized sports event. It seems that the kids are enjoying their time, which helps them to learn the game and understand better their society. A survey was given to the kids for study purposes (Brady, 2017).

The results from BARNGA game (Katagami et al., 2010), showed us the relation between the scale of social skills and the behaviour of the players. Also, the programs held in the facilities Boys and Girls Club highlight similar relation (Gouinn et al., 2016) by noticing how the newcomer children and youth improve their social skills after they are enrolled in different social activities in the facility. This kind of adaptation was clearly shown from the results of the survey, which was given to the participants for study purposes (Brady, 2017). The newcomer children have quickly improved their understanding of the new environment. However, this solution is not accessible for all the newcomers. Those clubs may be located far away from the newcomer's children resident. Also, it is not always available the whole time, the programs provided are held in a specific time, so the

newcomer child may not be able to attend if his parents are not free to accompany the child to such clubs.

2.3.2 Social Interaction

In her blog (Astrug, 2012), D. Astrug mentioned that the newcomers have the most valuable stories to tell. Moreover, sharing those stories will affect the other newcomers positively as they can learn from each other. The activity will give them the chance to heal through storytelling. This kind of activity has advantages for both the teller and the listener. Since this activity was successful, the program ran in schools and affected changing some ESL (English as Second Language) programs to suit the newcomers better. North York Community House was able to capture over 275 stories from such a program (Astrug, 2012). The idea is extraordinary since it gives a chance for the person to tell what they have faced and for the listener to learn from the experience of the others so that they will not repeat their mistakes. The writer should have shared some results from the study and inform the readers how many participants were involved in this study.

The purpose of the After-School Program is to support newcomer children and youth to integrate into their new culture in Canada (MIRSSA, 2016). Some of the activities include homework club, arts, and crafts, computer classes, cooking, field trips. The motivation behind the organizers is to provide the newcomer children and youth the opportunities to develop their personality and set goals for their future. Those activities are provided in different community centers like Boys and Girls. Most of the activities are free and registering in those centers are free too. So, it would be accessible to newcomer children and youth and help them to adapt quickly to the new culture (MIRSSA, 2016).

Storytelling is considered a useful tool to help the newcomers to learn from the mistakes of the others (Astrug, 2012). It is also essential for the newcomer children and youth to share their tradition and cultural practices with the others in the same community (AMSSA, 2016) in order for the newcomer youth to become more self-confidence and educate the others in the community about their background culture. The after-school program (MIRSSA, 2016) is also available for helping the newcomer children to adapt quicker in the Canadian culture.

2.3.3 Behaviour Guidance

The behaviour support plans were an important step to be taken to modify the behaviour of some students in the class (Reinke et al., 2014). The teachers were meeting with coaches to create this plane and the activities which accompany it. The coaches taught the teachers the appropriate way to apply this plan, and the teachers always had feedback to be discussed with the coaches. This kind of collaboration resulted in a shift of performances of the students receiving behavioural support when compared with another group who are not receiving such support. This study had 25 participants from students with disruptive behaviour. As a result, the teachers had noticed a considerable improvement in disruptive behaviour, and the same notice was given from the direct observation. This training proves that teachers with support can improve the student's behaviour, along with improving their knowledge (Reinke et al., 2014). This study had a small number of participants, so it cannot be generalized to be used in another place. However, it would be useful when the teachers are well trained to handle such support.

It inspects the associations between students' behaviours and the cultural effects (Katagami et al., 2010). Some teachers work directly with students who are having behavioural disorders. We have many cultures which differ from each other. The students going from one culture to another might face some problems if they were not well introduced to the rules. In China, the misbehaved student will be singled out in public. In this way, the student will work harder next time to avoid this punishment. While in America, the positive reinforcement which leads to higher behaviour compliance is more suitable and helpful for the future of the student.

On the other hand, the classroom size in China is large, and the education system is teacher-centred with much homework given to the students. Whereas in the United States, it is the opposite where the students are encouraging for self-learning and asking questions to depend on themselves to improve their personality. Not only in the classroom, there are differences but also in the student's raising actions at home which also goes back to the cultural behaviour in each country (Katagami et al., 2010).

There was a focus on the misbehaviour of the students in the classroom (Sun et al., 2012). Not only those misbehaviour disturb the teacher, but also it disturbs the students as well. The students and teachers agreed that those misbehaviour are violating the rules of the classroom and disrespecting the teacher and their fellow friends. The misbehaviour will either repeat and increase the times he is misbehaving or decrease it according to the reaction that the teacher will act after the disrespectful action from the student. Also, the teacher should understand the reason behind this act because it may be a misunderstanding or unintentional action. The teacher should also be aware of the cultural differences between the students. A student asking so many questions in China is considered trouble

making, but in other countries would seem reasonable and the student would be considered eager to know more. The study had only 18 students from the same school as participants, which does not seem to be a good point base to build the study upon (Sun et al., 2012). It is beneficial to establish such a project and to summarize and categorize the misbehaviours in the classroom. The study would have been more helpful if they found a solution to those problems and overcome the limitation so that the other teachers would take advantage of these solutions.

The researchers should know more about the culture of the immigrant and refugee families they are screening (Chow et al., 2007). They should use a cross-cultural lens when deducing the outcomes of transmission and evaluation tools; this can decrease the number of children who need special attention. In the second section of this study, the authors focused on the cross-cultural approach of those families. They named some principles which the researchers must follow in order not to disrespect the families. Taking into consideration the diversity of perspectives within each family they are interviewing. The research results may become misleading when the researchers are not considering the principles. In this guidebook, the authors had well understood the culture of some immigrant and refugee families, leading them to understand their homeland culture. This kind of understanding made them recognize the behaviour of the newcomer children in school and neighbourhood and how such behaviour can be misunderstood when it is done in a different culture. Depending on that knowledge, they built their rules of communication and resulted in understanding (Chow et al., 2007). This guidebook is essential to learn from but is not enough. It does not cover all the information about the

entire sides of the culture for each group family. The researcher should know more about the family culture before doing the field-based study.

The effect of the behaviour support plan was apparent on the students (Reinke et al., 2014), there is an improvement in the behaviour of the students after the one-to-one tutoring from their teachers. The teachers trained the students on how to behave better. Also, some of the students may have behavioural disorders (Katagami et al., 2010). Those students may improve if a teacher trained him/her. There is a chance that this disorder was made because of cultural differences. The misbehaving of a student, especially when they come from a different culture (Sun et al., 2012), disturb not only the teacher but also the students from the same class. If the teacher had good experience in such cases, she/he would provide the necessary help.

2.4 CHILDREN AND TECHNOLOGY

Scientific and technologic development is moving in a fast paste; children are raised with technologies dipped in their daily life (Brito et al.,2017). While listening to a 6-year-old or younger, for sure one of the following words will be included in his talk: “computer,” “Internet,” “console,” “iPad,” “mobile phone,” or “YouTube.” Since they always use their devices daily to play or spend time watching online videos. In the last era, many types of research mentioned that children are accessing the web daily. In Sweden, in 2011, half the 3-year-olds accessed the web, and in 2013 that age decreased to 2-year-old. In the United Kingdom, in 2013, the number of children between 5 and seven that access the web increased by 68% when compared to 2007 (Brito et al.,2017).

The objective of their study (Wang, 2012) is to listen to how do the children define the technology by themselves in a formal and informal definition. To do so, the authors listened to the definition then let the children record their friend's while they are saying their definition. The participants were middle school students from Hungary and India. They questioned six focus groups and asked twenty-six children to produce video self-documentaries. Interviewing twenty-six children in two countries is a good idea because they will get the information from children from two different cultures. On the other hand, they did not mention the ages of the participants. Also, they should have taken into consideration that the children who use the technology through the day, has a different point of view from those who do not use it in daily bases (Wang, 2012).

The writer had named the students nowadays, "Digital Natives" (Veith et al., 2007). Simply because technology is improving fast and most of the students are following it and updating their information in technology more than most of their teachers. The writer had named the teachers who are not following up with technology "Digital immigrant." The technology which the teacher must follow is a new way of teaching their material. The creative way should include technology as a new language to capture the attention of the students who are eager to take new information. An essential approach to this creative way is to create educational games developed for teaching the students the required material (Veith et al., 2007).

Technology is the tendency of the future and children are exposed to technology from early ages (Brito et al.,2017) It is true that each child has his definition of technology and it would be useful to exchange this knowledge between the same age children (Wang, 2012). It would be wise to direct the children in early ages to the use of technology in

education. Teachers should include educational video games related to their curriculum to keep up with the “digital native” generation (Veith et al., 2007).

2.5 DIGITAL GAME-BASED LEARNING

The notion of playing games as a form of learning is not new and it has been argued that the “fun” in games comes from the positive effect that learning new skills and information causes in the brain (Koster, 2013). On the other hand, and considering the engaging and enjoyable nature of games, gamification (the use of game methods and concepts in non-entertainment application) and serious games (games with non-entertainment purposes) have been studied by researchers (McGonial, 2011; Nicholson, 2015, Nacke and Deterding, 2017). Game-Based Learning (GBL) is an educational approach derived from these ideas and powered by the new advanced in computer game technology (Prensky, 2001). It also has its roots in fundamental education and psychology theories such as Blooms Taxonomy that recognizes the affective aspects of education (Bloom, 1964) and Flow Theory that discusses the total engagement as a basis of improved performance (Csíkszentmihályi, 1996). Both these theories encourage a more emotionally supportive and engaging learning process that can be implemented using games.

We start this section with a review of related theoretical approaches: Bloom’s Taxonomy, Flow Theory, Gamification, and Game-Based-Learning. Then we talk about educational digital games for special school topics. After that, we mention several video games used in museums. Then we focus on the social and cultural games in general, then more specifically for youth and tweens. We conclude this section by talking about game-based learning for newcomer children.

2.5.1 Related Theories

2.5.1.1 Bloom's Taxonomy

Bloom's Taxonomy was formed in 1956 under the guidance of educational psychologist Benjamin Bloom to encourage advanced ways of thinking in education (Bloom, 1964). According to Bloom, learning can be divided into three domains: Cognitive, affective, and psychomotor.

The cognitive domain contains learning skills mostly connected to mental developments; those skills are built-in hierarchy order (Bloom et al., 1956). There are six stages of cognitive complexity: knowledge, comprehension, application, analysis, synthesis, evaluation. Bloom's taxonomy described levels of achievements rather than process skills. The categories can be considered as degrees of difficulties. That is, the first ones must usually be mastered before the next one can take place. (Bloom et al., 1956).

It is common to think of learning as only a cognitive process. However, one can also learn attitudes, behaviours, and physical skills which also affect the learning process (Bloom et al., 1964). The affective domain involves our feelings, values, motivations, emotions, and attitudes. This domain is categorized into five sub-domains, which include receiving, responding, valuing, organizing, and characterizing. This domain is arranged in a hierarchical structure and is organized from simpler feelings to those that are more complex (Bloom et al., 1964).

2.5.1.2 Flow Theory

Flow Theory (Csíkszentmihályi, 1996) describes a flow state (being in the zone) which involves total engagement with the task being performed and causes improved performance. The enjoyable elements applied in a serious game are crucial features in determining if a player will be involved in a play-learn process and able to accomplish the chosen learning outcomes. Flow theory can be implemented for determining user experience and evaluating the quality of serious game designs. Moreover, flow theory seems to have a positive influence on performance improvement, knowledge and engagement. The concept of flow is one of the most popular constructs used to describe the playing experience (Procci et al., 2012) Csikszentmihalyi introduced the flow state through the study of people involved in activities such as rock climbing, chess and dance.

The synchronized existence of elevated **concentration, interest, and enjoyment** summarizes the experience of flow; and all three are associated with learning. **Concentration**, which is essential to flow (Csikszentmihalyi, 1990), is related to meaningful learning, mental processing and academic performance. **Interest** guides attention, reproduces essential motivation, increase the desire to continue engagement in an activity, and is related to school accomplishment. **Enjoyment** is a positive feeling linked to the proficiencies, creative achievement, and school performance (Csikszentmihalyi et al., 1993). In this conceptualization, engagement in learning is highest when all three elements are concurrently encouraged.

2.5.1.3 Gamification and Game-Based Learning

The integration of technologies in education has progressed incredibly since the 21st century. For many teachers, this has become a challenging mission. The students would feel excited to be challenged, involved and motivated through a learning method, which connects them to creative learning practice. Two of these approaches are Gamification and Game-Based Learning (GBL). These approaches provided the students with the required tools to be engaged and motivated through their learning experience. The students nowadays are considered digital natives, and they should be approached by educational tools which suit the 21st century (Prensky, 2001).

According to Werbach and Hunter (Werbach et al., 2012), “Gamification is defined as the use of game elements and game design techniques in non-game contexts.” It is based on the achievement of the gaming industry, social media, and years of research in human psychology. The improved use of technologies in the knowledge society has a massive influence on the way people learn and do research. In education, Gamification has appeared, trying to accomplish the requirements of digital natives (Meschede et al., 2017). The goal of gamification is the increasing involvement of a player during an activity.

According to Perrotta Featherstone Aston and Houghton (Perrotta et al., 2013), GBL refers to the use of video games to support teaching and learning. It is a natural evolution from traditional methods of teaching, which include static, non-interactive elements, such as textbooks, chalkboards, and lecturing at students rather than exploring with students. It is a form of experiential involvement in which people learn by trial and error, by role-playing and by treating a specific topic not as “content” but as a set of rules, or a system of

choices and consequences. GBL could be considered the “big brother” of Gamification in Education.

2.5.2 Academic Digital Games for Special School Topics

It is known that video games can help in the player’s brain development (Cheng et al., 2017). Some of the games need the player to search, negotiate, plan, and try different approaches to get to the next level. Many recent games involve planning and problem-solving, creative self-expression, deep understanding of game rules and structure, and new ways of highlighting personalities and interests. Video games do not have to be labelled “educational” to help children learn to make decisions, use plans, anticipate consequences and express their personalities (Cheng et al., 2017).

LEIHOA is an educational application built on AR technology (Amaia et al., 2016). The paper presents AR as a relevant technology for early childhood education and introduces an AR-based system designed to assist young children to learn numbers which initiates reading and introduces English as a second language. The advantage of this application is that it increases motivation and learning autonomy. The learning system offers interactivity and uses visual, auditory and tactile stimuli and provides attractive opportunities for developing attention while learning new concepts. In this project, the author did not include any formal evaluation and analysis for the application which hides from the user the results of this application.

SEE ME ROAR is a mathematics AR-based social game platform for primary school students (Li et al., 2017). This paper describes the design and implementation process of the prototype of this game. Self-Determination Theory (SDT) and the Playful Experience

Framework (PLEX) are used to study the properties of different features in AR-based social learning games. In the co-design process, they worked with two primary school students, which were a very nice cooperating idea to improve the application design. However, the authors did not mention how many students test this application, nor how did they get the results of implementation (Li et al., 2017).

In the artificial world of the computer game, children must take responsibility for their learning (Kilgore, 2012). Though teachers and parents can guide and help from the real world, within the game, the student is in control of every action. The player should decide the goals and the right way to reach it, and after this decision, how are the movements achieved, then which way will the decision touch the environment.

Furthermore, computing power could soon offer unconceivable possibilities resulting in self-adaptive global structures that could connect lots of people into cooperative environments (Qiwen, 2017), where user performance could be evaluated in real-time. New technologies might offer formation of the user-tailored education process, where students might follow a personalized curriculum modified to their educational skills. So, the whole education familiarity could be changed entirely and provided in an ideal means (Qiwen, 2017).

Video games do not have to be labelled “educational” to help children learn (Cheng et al., 2017); some of it can help in the player’s brain development. Children are rising in a technological world, playing games is a daily activity for most of the students, and they enjoy it (Kalemis, 2011). Several games require the players to take decisions while playing, which helps improve the student’s personality (Kilgore, 2012). Many studies were made (Kalemis, 2011; Cheng et al., 2017; Amaia et al., 2016; Li et al., 2016), which recommended the

use of educational games to be a helpful tool in the classroom. Many successful educational games were tailored for a specific educational outcome.

2.5.3 Games in Museums

(Paliokas et al., 2016) reviewed forty-eight publications, each talking about museum applications. Being part of serious games, those kinds of application were made to increase the knowledge of the user in the cultural information especially related to the museum. The authors have found that there was an increase in the published papers mentioning the same topic from 2009 up to 2015. In general, the visitors enjoyed playing those applications and reflected their enjoyment of the collected questionnaire given to them before, during and after using the applications. Even though the visitors liked the idea of using the applications in their visit, but none of the papers provided a clear definition of the learning effect and if the applications had fulfilled their goal in teaching the visitors new information or just amusing them. There is a need for a quantitative measurement more than the qualitative one (Paliokas et al., 2016).

A study (Rehm et al., 2016) based on the development of an application for improving the involvement of children in the artwork museum was presented. The application introduces a digital buddy who helps the children in exploring more details about the artwork. To scale its success, they measured the student's subjective impression of fun, and their engagement in this activity, which also seeks to remember some details about the artworks. Fifty-seven children (age 6-12) participated in this activity, and they used tablets to play that application. In the results, it appeared that the digital agent had successfully engaged children in this cultural artifact. In the results, it appears that children whose age

was between 8-12 were more involved in this activity other than the younger ones (Rehm et al., 2016). Such activity should limit the age range to ensure more fun and engagement for the children.

The goal of the developer's work (Drosos et al., 2018) was to create an integrated application that would produce a 3D environment of the "El Greco's Travels and Artwork" and give the student freedom to navigate through it and understand the history and culture in the El Greco's period. After playing the game, the students were given a specific questionnaire to evaluate their experience. The outcome from the students was that in general, they liked the game and said it is an educational one. The results after the implantation were not so promising because the students are already used to play with more interesting animation 3D games (Drosos et al., 2018). The authors did not share with us the questionnaire nor the detailed results. They have tested the game on only five students, and usually, they need more participants to test the game.

In (Boididis et al., 2015), the author talks about the development of a tool which improves the exploration of the ancient Amphipolis. The application allows users to navigate into the olden places accompanied by a cartoonish philosopher. The participants were 21 students, 10-15 years old and ten teachers. After the evaluation, the authors were satisfied with the results, which reflects the understanding of the material which was provided in this application (Boididis et al., 2015). Creating such an application is useful for students to remember what they had enjoyably learned in history. However, it would be more enjoyable if it contains more gamification elements. Alternatively, even to include some challenge activities which the student can enjoy while playing this application.

A creative application (Thon et al., 2013) contains a unique idea of joining the drone with the augmented reality for presenting for the players the scenes of a traditional courtyard which is closed to the public. The developers gave the player the freedom to fly the drone to view this cultural place and understand more about the history behind it. Thirteen participants played this application. The authors were pleased with the results since they see that their objective was achieved. The authors came up with a new idea by joining the drone with the augmented reality to serve in teaching culture (Thon et al., 2013). The idea would have been more potent if they included more historical scenes in the same museum. Also, it would be astonishing if they included information as Augmented Reality to be displayed other than the target and shooting activity.

Another application (Christopoulos et al., 2011) was developed by implementing a virtual reality application used in the museum to describe the Thermopylae battle. The application shows the 3D soldiers and the player can see their cloth and what happened in this war. The developers wanted to show the visitors a 3D real-time game with documentary information so that this application would have a cultural heritage theme. Twelve visitors participated in this experiment. Their results were used to improve the application to better suits the visitors (Christopoulos et al., 2011). Such an application shows the user more information about a particular battle, but much time was spent to create such an application, and it would be more helpful for the visitor to view more battles in this time and not an only certain one. The authors did not share with the readers the results of the implementation to check if the application had fulfilled its goal.

Five games were designed for social networks to support the museum and the application (Bampatzia et al., 2016). Those games were made to present what the museum

has, also to have fun and collect memories. To develop such games, the authors depended on old successful games to build a similar one. All games are mini-games for single player. It was successful in creating such games, knowing that the player is familiar to it and would not spend time figuring it out (Bampatzia et al., 2016). To check the results, the authors should have done an implementation which reflects the user's opinion.

An AR application (Madsen et al., 2012) was created for the museum experience for children ages 8 to 12. Since the creation of that application, 54 users had played it. The application was called "memories of the walls." It displays AR figures overlapping particular walls. The children were given IPADS once they enter the museum, and they use the application. The results were encouraging, and the children enjoyed the application. One of the gaps is that the children are not interested in seeing the museum anymore; they enjoy playing the application. Another gap is the lengthy introduction, which is not interactive.

Museum applications are a vital tool to increase the knowledge of the visitor regarding cultural information (Drosos et al., 2018; Boididis et al., 2015; Thon et al., 2013; Mortara et al., 2014; Bampatzia et al., 2016). There is an increase in the published papers regarding the studies in this area from 2009. In (Paliokas et al., 2016) 48 publications talking about museum application were reviewed, most were reflecting the enjoyment of the visitors when using such applications and the improvement of the visitor's information regarding the given cultural information. A study (Rehm et al., 2016) mentioned the importance of including a character in the application, which makes it more enjoyable, having this digital agent made the children (8-12) get more engaged in the cultural artifact.

2.5.4 Social and Cultural Games

In their paper (Cheng et al., 2017), the authors have developed a VR game aiming to teach both the Japanese language and culture. Their goal was to make the learner feel immersed in the Japanese culture by teaching them some essential culture acts like how to bow and teaching them the language in a Japanese cultural house. The game was implemented by two types VR and Non-VR. This game was successful in delivering some basics in teaching language and cultural acts but had faced some disappointing feedback from the users (Cheng et al., 2017). Some participants were feeling dizziness from using the VR and others had difficulties in using the User Interface. Another problem that the developers had faced is that they could not teach the users the right angle of bowing. One more issue regarding this game is that the developers did not test the user's language learning outcomes.

Another social application is presented in (Dunwell et al., 2014), the authors introduced as a case study Mobile Assistance for Social Inclusion and Empowerment of Immigrants with Persuasive Learning Technologies and Social Networks (MASELTOV) project. They were studying the effect of such a game on the cultural learning advancement of the users. The story of the game takes the player through subjects including travel, job seeking, healthcare, and shopping, with difficulties met derived from a conversation with non-governmental organizations (NGOs) solving immigrants' issues daily. What is unique in this application is that it provides information to the immigrant, not only in a specific area of life but also deliver facts which the user can use in different regions of his new life (Dunwell et al., 2014). A restriction of this kind of games is that the users who had played

such a game are selected from the immigrants who are already engaged with NGOs. Thus, those who are not consulting such organizations will not know about this game. Better results will be obtained if the application reaches all immigrants to help them in integrating quicker in the new life.

An article (Gouveia et al., 2014) presents a serious game GLOBAL that raises the enhancement of interpersonal and intercultural competencies relevant to the SMEs internationalization. The authors found that creating such a game will provide a better resource to help the trainers focus on the specific design of games for the training process, which increases their motivation and engagement. This game provides six different scenarios which are independent. The players were students and managers. After implementation, the results were encouraging (Gouveia et al., 2014).

On the other hand, more details should be provided to about the game, including screenshots of different levels. Even though it is essential to know the player's opinion, but what is more important is to check if the goal of the application was achieved which is to improve the internationalization and language skills of SME managers. This result was not mentioned in this paper.

Joining different software to create a useful application was an important idea that came to the author's mind (Sagae et al., 2010). They have combined the SAIBA framework, with the Alelo products to improve the learning experience. Also, they added the Operational Language and Culture Training System in a 3D game environment (Sagae et al., 2010). This kind of application enables the learner to participate in spoken conversations in a second language so that they will practice speaking that language. The application is unique because they knew how to combine cultural skills with a well-

developed 3D serious game. On the other hand, the authors did not provide precise implementation results to prove that this application was useful and had achieved its goal.

ICURA is a cultural training serious game (Froschauer et al., 2010). It provides a chance to understand more about Japanese culture and etiquette. It is a 3D environment which joins the aspect of learning and having fun in a well-developed application. The developers included 12 questions which the player have to answer at the beginning of the game and will be repeated at the end, to evaluate the game. Twenty participants were involved in this user study. The evaluation of the given results was significant, and the goal of this application was achieved quantitatively (Froschauer et al., 2010). Gaining the results while the player is playing the game is a good idea because it will prove the effectiveness of the application. However, having 12 questions at the beginning of the game will confuse some of the players who will feel board before even playing. It would be better to spread such questions on each level before introducing the desired cultural information.

The authors describe in (Anastasovitis et al., 2009) the design and development of three 3D serious games which have a cultural heritage as a goal. Each focus on a particular case study. The first one is the Scladina cave in Belgium. The second one is Liverpool John Moores University in the United Kingdom. The third one is the Palace of Aigai in Greece. Each has a different theme, but all built using 3D technology (Anastasovitis et al., 2009). The paper describes how the development was and how to play the game. The developers put much effort to create such a historical location. On the other hand, those games were not implemented nor evaluated from participants.

It was a nice idea from the developers who decided to join the virtual humans with an intelligent tutoring system to teach social-cultural conventions (Lane et al., 2008). They

called this application BiLAT. Twenty-seven participants had used this application. After dividing them into three groups, the first group learned from video only, the second group learned without a coach, the third group learned from a virtual coach. The authors found that the third group had learned more concepts than the other groups (Lane et al., 2008). The authors created only one test which was used for pre-test and post-test. They should have created different versions. The authors also mentioned that they must improve the application to better suits the outcomes.

There was a clear explanation that not all video games should be described in the same way that it has a bad effect on the players (Saleem et al, 2012). Authors have made three studies in three countries for three age groups to prove that video games can have more than the fun effect on the player. They introduced the Prosocial serious games. They wanted to prove that those kinds of games have a short and long-term positive effect on the behaviour of the players. The players of prosocial games had a short-term improvement in their behaviour. They were more cooperative and helpful. The authors proved that once the players continue to play (on regular bases) such games, it will improve their social behaviour in the long term (Saleem et al, 2012).

The authors were providing a broad picture of the current idea of serious games in the cultural sector (Mortara et al., 2014), emphasizing the educational objectives of games in this area. Although they are helpful, these applications do not have a powerful tool to engage the large public into learning hoping the visitors would be motivated to create their way of culture understanding other than just receiving the information. In the cultural awareness games, the application concentrated on immaterial heritage, including the language, customs, traditions, folklore and rules of behaviour in a society. In the end, the

authors had mentioned recommendations that should be addressed by the developers to improve the quality of those applications and their benefits for users (Mortara et al., 2014).

2.5.5 Social and Cultural Games for Tweens and Youth

It was suggested that prosocial games might positively affect the behaviour of children between the ages of 9-14 (Prensky, 2001). After using a sample of that age, they have reached their destination by proving that playing video games with prosocial features will improve the helpful behaviour of the students and will also reduce their unkind behaviour.

It was discovered in (Alhumaidan et al., 2015) that the ethnic minority youth are an essential key to improve the adaptation of their population. By playing InfoMe, those teens were the tools to understand how digital devices and web applications are important to help in immigrant communities. Nevertheless, the youth also will be enrolled in the community and would be easier for them to face the challenges. They have found that the community will reach a critical level when the youth focus their attention and modify their path to reach a particular goal in a fun way, and they will enjoy it. The involved youth's age was between 16-18-year-old, divided into 4-5 groups. Each group had one supervisor (Alhumaidan et al., 2015). Even though the idea and implementation were unique, but still the results were not shared, and we do not know if the results were as expected and were helpful for the society as was aimed to be.

An application was developed and mentioned in (Hendriana et al., 2015), which encloses fundamentals of cultural information exclusively of Sasak culture as a tool to improve the cultural understanding so that children will adapt more quickly in this culture and will know the important rules which they have to recognize at that age. This game is

devoted to children aged between 7-11 years. The application is unique and creative because it succeeded to join the adventure side along with teaching the Sasak's cultural essentials. The authors provided a detail description of the application feature and game methodology (Hendriana et al., 2015). On the other hand, they mentioned that the children's cultural knowledge had improved after playing the application, yet they did not provide proof of how they concluded such a result. Neither did they tell us how many students were included in the implementation and their detailed feedback.

It was noticed in (Gentile, 2009) that the Turkish immigrants to Germany are facing some cultural problems in adapting into the German culture due to substantial cultural procedures. To solve this issue, (Gentile, 2009) proposed a new creative idea. They made a computer club which allows joining Turkish immigrant with German children to create a joined project to make newcomers feel more comforted in their new country. The projects had a particular goal for the integration purpose. The children were supposed to be accompanied by their parents. The authors found that the newcomer children were glad to do this activity and that their parents were unfamiliar with such technology. The idea of the computer club was extraordinary, which combines technology with cultural adaptation (Gentile, 2009). The results seem to be promising, but the authors did not make a quantitative approach to the obtained results.

Teaching culture and social fundamentals through applications and video games were proven to be effective, mainly when the application is specially designed to precise requirements and specific age group (Cheng et al., 2017; Dunwell et al., 2014; Gouveia et al., 2014; Alhumaidan et al., 2015; Hendriana et al., 2015; Sagae et al., 2010; Froschauer et al., 2010; Anastasovitis et al., 2018; Lane et al., 2008). Since not all the video games should

be described the same way (Saleem et al, 2012), researches were made on the cultural games to categorize the cultural sector and emphasize the educational objective of the games in this area(Mortara et al., 2014) It was proved that prosocial games increased helpful and decreased hurtful behaviour (Saleem et al, 2012).

2.5.6 GBL for Newcomers Children

There are not many projects which talk specifically about GBL for newcomer tweens. We found a paper (Maniar et al., 2007) which talks about a mobile application which helps the newcomers to reduce the cultural shock when they arrive in the new country. Even though this application is not dedicated to newcomer children, but the children may use it any, it may be considered a helpful tool for them. The paper describes the development of an application and talks about the ‘ABC’ theory of culture shock, which consists of Effects, Behaviour, and Cognitions. The application provides the newcomer with the basic information which they need in their daily life. Even though this application would be helpful for the newcomers, but there was no implementation for this application. The developers only used one mobile device, not taking into consideration the different sets of other devices. The lack of the result section will confuse the reader if the application is helpful or not.

2.6 GAP ANALYSIS

There is a wide range of services provided for the newcomer children to improve their understanding of the new environment (Gentile et al., 2009; MIRSSA, 2016; Brady, 2017) but they are done in centers not always reachable to the children. It was apparent that the

collaboration between the teachers and coaches (Reinke et al., 2014; Katagami et al., 2010; Sun et al., 2012) resulted in a shift of performances of the students receiving behavioural support from a one-to-one session with the teachers. However, such sessions are not always available and accessible to children. We learned from the literature review that some methods were found boring, either due to long introduction (Madsen et al., 2012) or the lack of challenging activities (Boididis et al., 2015). Also, the lack of limitation of the age range would decrease the fun and engagement for the children (Rehm et al., 2016). Some of the studies did not provide the results (Alhumaidan et al., 2015; Cheng et al., 2017; Amaia et al., 2016; Dunwell et al., 2014; Gouveia et al., 2014; Sagae et al., 2010; Christopoulos et al., 2011; Bampatzia et al., 2016; Anastasovitis et al., 2018) or they did not provide proof of how they concluded such a result (Li et al., 2017; Drosos et al., 2018; Hendriana & Ariyana, 2015; Gentile et al., 2009). The table in appendix 1 categorize some papers and mention the specific issues in them.

Even though there are several websites which gives information for the newcomers about the housing, health, employment, education and living (Settlement, 2018) it does not contain an informational section for the children so that they will also understand what they are expecting to face in the new environment. Even with the exerted efforts to support newcomers, not enough resources exist to help newcomer children develop the necessary intercultural skills to thrive in a highly multicultural society and integrate into their new homes. In the literature review, it is evident that there is a lack in the research which concentrates on the effect that technology can provide to help newcomer children integrate and contribute positively to society. Furthermore, there is an absence of research mentioning the newcomer tween social actions, and how would it affect them when they

are not educated well about the right behaviours before they arrive, and while they are in the first year at their new school.

The lack of research on game-based learning in the context of newcomer children's social adjustment is the central gap we identified and is the primary motivation for our research and the development of the *New Beginning* computer game. Also, we recognized few topics related to the social adjustment that we aim to teach in the game as it was mentioned from the previous researcher and through our discussion with multicultural liaison officers who are expert in dealing with newcomer children within selected schools in Ottawa area. These gaps guide our study by exploring the following research questions:

- Can technology help newcomer children adapt quicker to Canadian culture?
- Is game-based learning a better way to educate newcomer children about social adjustment than more traditional methods? (more general)
- Will game-based learning assist the newcomer tweens in improving their behavioural adaptation? (more specific)
- What are the design considerations in successful game-based learning for newcomer children and particularly tweens?

CHAPTER 3. GAME-BASED SOCIAL ADJUSTMENT

3.1 SYSTEM OVERVIEW

This research aims at investigating the role of game-based learning for social adjustment of newcomer tweens. Our hypothesis is that educational games offer a better experience than more traditional printed material with respects to objective and subjective evaluation criteria such as the level of learning and perceived usefulness, ease of use, and enjoyment. To verify this hypothesis, we have developed a computer game, *New Beginning*, to assist newcomer children (age 9-12) in better adjusting socially to their new way of living within Canada.

New Beginning focuses on particular behavioural advice suggested by multicultural liaison officers who had dealt with newcomer children. We considered the following guidelines in designing our evaluation game:

- Focusing on a specific behavioural issue to make it easier to evaluate the learning outcomes;
- Creating a fictional environment that avoids trauma and any negative side effects on participants;
- Using an attractive story-based game with simple advice and outcomes;
- Working with multicultural liaison officers, teachers, and parents.

New Beginning follows the multimedia learning principles (Mayer et al., 2008), which guided us in designing useful instructional material to engage learners in a creative play. Multimedia learning principles are defined in section 3.2. In order for us to show how does this mirrors on our game, we had added section 3.7. We also use the ADDIE model as an instructional design model which helped us in designing an effective educational game that facilitates learning. A description of the ADDIE model is presented in section 3.3, and a reflection on how does the game follow this model is mentioned in section 3.8.

While the player is playing the game, advice will pop up (but not all in the same time) that advice will be used to improve the behavioural adjustment of the player. They are for different case study scenarios, not only one. The newcomer children have specific needs, and we picked the tweens age range (9-12) to focus on it. We have chosen the newcomer tweens because of the problems they are facing, which we have mentioned in section 2.2.

New Beginning is a social game, not an academic one. We use the term academic in this context to mean related to school curriculum. Even though New Beginning contains realistic advice and situation that somehow resemble realistic physical world, it is not realistic in the sense that it depicts a fantasy world, not the school or city environment. This was decided so that the game cannot be hurtful by reminding children of any traumatic experience. The events and characters of the game are imaginary ones. The story of New Beginning was created only for the purpose of providing the required advice and adding more enjoyable elements to the game; that is why it is considered not realistic. The game contains the fundamentals of cultural information concentrating on students behaving in school and society. The players will hear the characters and will read the accessible text so they will practice listening and reading while playing this game. Learning about the new

culture will give the newcomer children self-confidence that will sure to help them in communicating with others. That will also help in building relationships with new friends and improving their social network. By playing this game, the newcomer tween will be solving most of the problems which they may face in the new culture which we had categorized as culture, behaviour, and education.

By playing this video game, the tweens will not only learn better behaviour but will also help their community to reach a better level. Such a computer game would be considered as a powerful tool for the newcomer tween to be engaged and motivated. This computer game is always accessible to the tweens to play and remind them about the correct behaviour. Those “Digital Natives” may feel more involved by using such a learning tool which is familiar to what they play on a daily bases. This activity may reduce the cultural shock for the tween because they would be learning more about the proper behaviour and increase their knowledge in this area which will improve their self-confidence and hopefully motivate them to do the right behaviour.

3.2 MULTIMEDIA LEARNING PRINCIPLES

Multimedia Learning is a form of learning supported by different sources of information like sound, text, and graphics. Those sources are handled jointly in order to understand and memorize a given content. In this section, we describe the multimedia learning principles applied to New Beginning’s design to increase the game’s instructional effectiveness. In their book, Clark and Mayer (Mayer et al., 2008) demonstrated multimedia learning principles that help in designing useful instructional material to engage learners in a creative play.

Mayer's theory is well braced by several types of research on cognitive load theory led by Sweller and his colleagues (Paas, Renkl, & Sweller, 2003; Sweller, 1994; Sweller, van Merriënboer, & Paas, 1998) (Fletcher, 2005). It matches the hypothesis (Tobias, 1976, 1982, 1989) that including graphics and pictures to the educational tool is helpful for students with poor information about the subject they are learning. Including text with graphics were raised from a long time ago, the interest in such an instructional enhancement increased its popularity from computer-based presentations (Fletcher, 1991, 2004). In such materials, graphics, animation, video, voice, music, and sound effects may accompany the text. Mayer (2001, p.3) defines multimedia learning as "learning from words and pictures," Mayer and his colleagues have spent 20 years researching the area of multimedia principals. Although the program is ongoing, Mayer (2001) potted many of its results in his book on multimedia learning. In sum, there are theories, well based on experimental psychology, that make us believe that the multimedia principle will improve learning (Mayer, 2005).

- **Coherence**

Adding elements that are irrelevant to the instructional goal interferes with learning. Mayer and his colleagues theorize that these distracting details can interfere with learning in different ways like diverting the learner's attention from key instructional points, disrupting the learner's organization of information, activating irrelevant prior knowledge.

- **Contiguity**

Which says that the effectiveness of multimedia instruction increases when words and pictures are presented contiguously in time or space. When corresponding portions of narration and animation are presented at the same time, the learner is more likely to be able to hold mental representations of both in working memory at the same time, and thus the learner is more likely to be able to build mental connections between verbal and visual representations. If the time between hearing a sentence and seeing the corresponding portion of animation is short, then the learner may still be able to build connections between words and pictures.

- **Segmenting**

People learn better when a narrated animation is presented in learner-paced segments rather than as a continuous presentation. So, the material given through multimedia learning would be better understood by the students when it is presented in separated parts.

- **Pre-training**

Players can learn better when they know the names and characteristics of the main concepts. This principle proposes that learners learn more deeply when they are made aware of what they are going to see in the game (Story, Controls, Obstacles, etc.) before they start playing the game itself.

- **Multimedia**

The use of multiple media types, such as images, text, and sound, are known as Multimedia. The student would understand the concept more effectively if it was presented in well-organized learning material. Usually, the students use the textbook, which would also contain pictures and text. However, if these learning components were presented in a multimedia way, such as joining sound with the text and image and improving it with attractive animation would create an active learning environment. This way will encourage the students to be more engaged during the learning experience

- **Personalization**

Users learn more deeply from multimedia lessons when learners experience heightened social presence, as when a conversational script or learning agents are used. It is an essential factor for guiding the learners throughout the instructional material.

3.3 INSTRUCTIONAL DESIGN MODEL

Instructional Design is an organized development of instructional conditions using learning and teaching models to guarantee the excellence of education. An instructional design model offers strategies to form suitable educational settings to influence instructional goals. Instructional design can be defined as the preparation of creating instructional methods to help facilitate learning most proficiently. It is the full understanding of analysis of educational needs and goals and the development of a delivery system to meet those requirements.

Making sure that teaching and assessment activities are associated with supporting students in doing so, it includes the development of instructional materials and activities; and tryout and evaluation of all instruction and learner activities. Instructional design models help instructional designers to make sense of abstract learning theory and enable the real-world application. The most common instructional design models are the ADDIE Model, Merrill's First Principles of Instruction, SAM Model.

➤ ADDIE Model

The ADDIE methodology was built on a linear model. ADDIE is an acronym whose letters stand for the five phases in its approach to design. These are:

- Analysis
- Design
- Development
- Implementation
- Evaluation

➤ Merrill's five principles are:

- Learning is developed when learners are involved in solving real-world problems
- Learning is upgraded when existing knowledge is activated as a basis for new information.
- Learning is advanced when new data is demonstrated to the learner
- Learning is forwarded when the learner applies new knowledge

- Learning is promoted when new data is integrated into the learner's world (Greenwood, 2017).

➤ SAM Model.

The Successive Approximation Model (SAM) is an agile development model. The import of “agile” in this situation is that several stages are evolved at the same time. The SAM process is iterative. Each development stage is cycled through at least three times, and each cycle should be closer to the ideal than the last one. SAM's repetitions during the development process allow evaluations and modifications to the project as required (Findcourses, 2019).

In our study, we picked the ADDIE Model. ADDIE Model is similar to the most used software process model, which is the waterfall model. As is easier to use a standard management model for the whole project, software processes based on the waterfall model are still commonly used. Since requirements are well understood and unlikely to change totally during system development. We have chosen the ADDIE model because it is straight forward. (Sommerville, 2011)

In his book, Hall mentioned that the ADDIE model is a form of easy to understand directions and can be linked to any learning strategies (Hall, 1997). In his paper (Jansak, 2001) Jansak explained that ADDIE model is a basic model, which has an organized approach to the procedure of designing education materials and provides a steady framework to guarantee that the educational products formed are efficient and effective (Jansak, 2001). According to Pribadi, one of the design models that shows stages of the

basic design to be simple and easy to learn is ADDIE. The five phases or stages of the ADDIE model need to be conducted systematically (Pribadi, 2011).

The ADDIE model is one of the most widely used ID models to produce a practical design. This design model used by many professional instructional designers for technology-based teaching. One cause it has been so successful is that it is deeply associated with acceptable quality design, with distinct learning objectives, wisely structured content, and strongly tied to desired learning outcomes. This model allows for the objectives or tasks to be defined clearly. Another strength is that this model is cost-effective

ADDIE stands for Analysis, Design, Development, Implementation, and Evaluation, which are the essential parts of producing the ID. Applying the ADDIE model processes can support in producing an effective learning design for any instructional material.

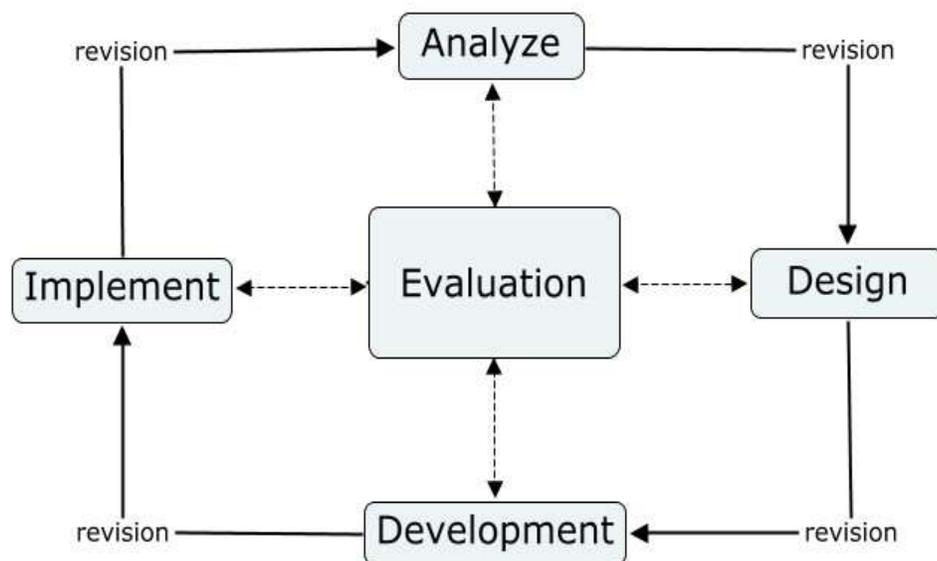


Figure 1. ADDIE Instructional Design Model (Source: Wikipedia, CC BY-SA 3.0)

- **Analysis**

Identify all the variables that need to be considered when designing the educational game, such as instructional problems and goals, learner characteristics and prior knowledge, resources available, delivery options and the timeline for the study, etc.

- **Design**

We hold what we learned from the Analysis phase and use it to make practical decisions. The goal of this stage is to create the structure of the learning material. In this step, we storyboarded our ideas and created a prototype of the educational material.

- **Development**

The development stage is where the storyboards, sketches, and detailed descriptions of various elements which were created during the design stage will come in handy. Each stage should be developed to match the design phase.

- **Implementation**

Implementation within the ADDIE model includes issuing of the educational material and proper training of the participants who are going to use this material. Finally, the material is shown and tested in terms of its usability.

- **Evaluation**

In the evaluation stage, it is vital to collect and evaluate the response provided by the participants who had played the educational material. The collection of more data would be crucial to obtain better results and would improve the quality of the educational material.

3.4 GAME DESIGN AND HIGHLIGHT

New Beginning is a Two-Dimensional (2D) educational and cultural behaviour video game. The game aims to help newcomer tween (age 9-12 years) to learn more about selected behaviour issues. The game comprises social behaviour advice which the player may not be aware of, and we anticipate that it will improve their understanding of how to deal with in each situation. Such advice is derived from real incidents which those tweens are facing in school's environment or the new hosed society. The stories were learned from multicultural liaisons officers. The themes of the three levels were inspired by the officer's experience and our literature review on the topic.

- **Theme One:** The officers informed us that once the newcomer student arrives at the new school, they will be assigned a friend from the same culture to help him/her to better adapt in the new school environment especially at first few days.
- **Theme Two:** Some newcomer children may face problems when they are trying to socialize with other students. Some of the students are helpful, and others may not be friendly to the newcomer student.

Sarah had to land her spaceship on a planet called planet C. Even though she tried to fix the spaceship, but she could not, and she has to stay and live in this new planet. In the beginning, she knew that she must adapt more quickly to the new environment in order to survive. To do so, she must follow the rules and avoid the obstacles and do her best to adjust to the new environment. The game is divided into **three Levels**. Those levels were inspired by the themes mentioned above.

i) Level 1: Sarah will meet Adam, who decided to support her to adapt to the new environment. Adam will provide Sarah with three pieces of advice, as follows:

- “Each planet has its own rules, and we have to respect those rules even if it is different from our planet.”



Figure 2. In level one: first advice was given to Sarah

- “Personal space is the area immediately surrounding your body. Personal space can even be different from culture to culture. Getting inside someone's personal space can make them uncomfortable.”
- “Do not fight back, even if someone wants to hurt you physically. Try to get away from him/her and tell an adult of what is happening to you”.

- ii) Level 2:** Sarah will face a dangerous situation. She will see someone who is holding a weapon, and she must move away from him and do as Adam had advised her to tell an adult about the situation.



Figure 3. In level two: Sarah saw the armed man and is going to tell the adult

- iii) Level 3:** Sarah will be introduced to two other living groups: Helpers and disturbance. The Helpers will support Sarah too by giving her two pieces of advice as follows, while the disturbance will discourage her.

- “Talk politely and pick your words carefully, make sure not to use expressions which may be understood differently in other cultures.”

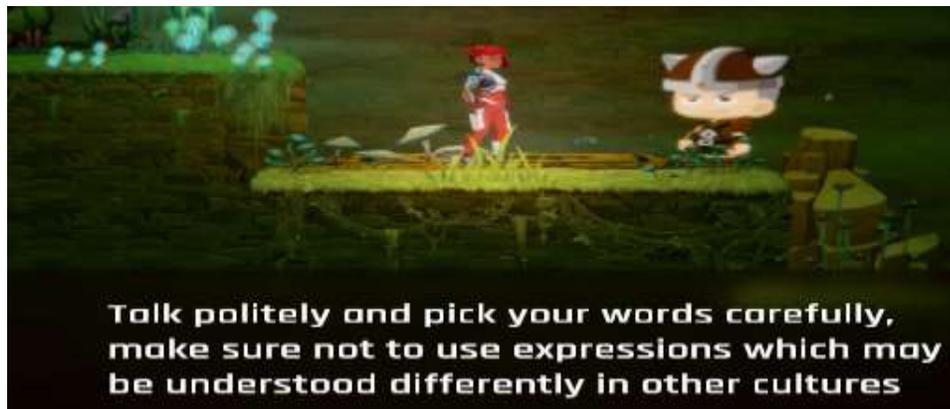


Figure 4. In level three: Sarah meets a helper and listens to his advice.

- “If you felt depressed and thought that nobody understands you. Try to tell your parents about your feeling and your concerns; also you can chat with your teachers.”

Sarah must gain three “Advice Keys” to help her open the “Advice Door.” At the end of each level, she will win a key. To collect the key, Sarah must pass through several challenges.

3.5 LEARNING OBJECTIVES

Learning Objectives	Study Activity	
	Brochure	Video Game
learning to respect the rules	-Reading some short paragraphs about how to deal with bullying while respecting rules.	During playing the game, the following advice will be shown to participant children: "Each planet has its own rules, and we have to respect those rules even if it is different from our planet."
what is Personal space?	-The kids will achieve the learning objectives by the following paragraphs: -Physical Bullying	During playing the game, the following advice will be shown:" Personal space is the area immediately surrounding your body. Personal space can even be different from culture to culture. Getting inside someone's personal space can make them uncomfortable".
Why is it important not to fight back?	-The kids will achieve the learning objectives by the following paragraphs: -Ways to deal with a bully	During playing the game, the following advice will be shown: "Don't fight back, even if someone wants to hurt you physically. Try to get away from him/her and tell an adult of what is happening to you".
Best way to talk	The kids will achieve the learning objectives by the following paragraphs: 1- Verbal bullying 2- Written Bullying	During playing the game, the following advice will be shown:" Talk politely and pick your words carefully, make sure not to use expressions which may be understood differently in other cultures".

Table 1 Learning Objective

3.6 THE IMPACT OF GIVEN ADVICES ON SARAH'S BEHAVIOUR

Advice One:

After landing her spaceship, Sarah was confused about the new planet and the way she should adopt in it. After Adam gave her the first advice, she understood that she must move on by jumping above the obstacles and trying not to hurt herself or others. She should follow the rules which will lead her to continue her survival in this new planet.

Advice Two:

On her planet, Sarah did not know that each person has his own space. After Adam told her this advice, she faced the Disturbance who had their own spaces. Sarah has to move away from them and give them their own space. She knows that if she did not do so, she might face heartbreak and she will not be happy about it.

Advice Three:

Adam gives Sarah the third advice, which she will remember in Level Three. At that level, she will find an Armed Man who is trying to get attention by holding a weapon and frightening the others. Sarah should not forget what Adam had told her, and she will get away from that man and tell an adult what happened to her. The adult in this situation will be the guard man who will be the most suitable person for this situation.

Advice Four:

The first Helper who will give Sarah the fourth advice will be Barbarian. Sarah is only used to greet in one particular way on her planet, but after this advice, she knew that she could not greet all people the same. She knew that politeness is the best way to greet and

ask for help. After that, Sarah felt lost, and then she met Guider. She asked him politely for directions, and he was helpful and guided her in the right way.

Advice Five:

Wizard would be the last Helper who gives this advice to Sarah. She has to keep it in mind and will not use it directly. Instead, she may face some problems later, which may remind her to use this advice for her benefit.



Figure 5. In level 3: Sarah meet another helper who gives her the last advice

3.7 REFLECTION ON HOW DOES THE STUDY GAME FOLLOW THE MULTIMEDIA LEARNING PRINCIPLES

3.7.1 Coherence

In “New Beginning,” concise advice are used, followed by a direct activity done by Sarah related to those advice. Knowing that the students grasp the advice better when it is

written in simple and clear language, we minimized the advice text and inserted it in the right activity to maintain coherence.

3.7.2 Contiguity

As a result of the above design decision, the advice was always given directly before each action which Sarah perform. In this way, the player will build a mental connection between verbal and visual representation.

3.7.3 Segmenting

Similarly, “New Beginning” is divided into three levels. Also, the advice is not given only in one level but spread through the levels so that the segmenting principle will apply to this game.

3.7.4 Pre-Training

At the beginning of the study, the participants will watch a short introductory video clip about the game. Knowing that would make them more comfortable to play the game and concentrate more on the given advice through the game.

3.7.5 Multimedia

New Beginning has combined sides of the multimedia by joining the text, sound, and image. While playing the game, the student will be given behavioural advice which will appear as text on the screen and will be narrated at the same time this is done in a 2D RPG game.

3.7.6 Personalization

The advice used in New Beginning are always used as a conversational style. Adam and the Helpers advice Sarah when she approaches them face to face. The voice used in the narration is a friendly voice depending on the speaker if he was a male, we will get a male voice, else a female voice. The picture of the speaker will appear next to the text which the speaker will be reading. So, the advice will appear to the player as a conversational style to improve learner's feeling of social presence and game engagement.

3.8 REFLECTION ON HOW DOES THE GAME FOLLOW ADDIE INSTRUCTIONAL DESIGN MODEL

3.8.1 Analysis

We started our analysis by defining the primary target audience, who are the newcomer tweens between the age of nine till 13. Then we concentrated on the learning goals. After doing our search, we picked the advice which we want to include in our game. After that, we set the physical and organizational constraints. Also, at this level, we decided that we are going to use the educational video game as our tool as an information delivery option.

3.8.2 Design

We determined the number of levels and the advice which should be given at each level. At this level, we have decided which kind of video game would be suitable in presenting the educational material. We designed the activity which Sarah would do after

each advice. At the end of this stage, we obtained a document which we used during the development stage, one that contained the answers to the most questions which we may have when developing the video game.

3.8.3 Development

The game assets were gathered, and the game was built and modified several times to ensure that all the requirements from the design document were met. We were always taking care of the timetable in order to deliver the material on time and according to our schedule. We made a habit of continually testing the game as it is being developed. Friends and their children aspect the game through the eyes of the end-user, noticing errors found in the game. A fresh look was always useful, and it helped to tell issues that may not be obvious to the developers. We used to correct those errors directly and prepare the game for the next testing.

3.8.4 Implementation

Before the day of the study, we installed the game on the required computers. The implementation day started by explaining the study to the participants. Then we divided the participants into two groups. The game group were given general information about the game, and the direction of how to use the controls of the game. Some of the children were not used to play advanced computer games, so they needed some advice regarding how to overcome some obstacles, so we provided such advice to make the game easier to enjoy and learn. Playing the game took around 10 minutes for most of the participants. Then the participants were given a questionnaire to collect the required data.

CHAPTER 4. GAME DEVELOPMENT AND SOFTWARE DETAILS

4.1 GAME DEVELOPMENT

New Beginning is an interactive educational and cultural video game. This video game is created, especially for the newcomer children age 9-12. It contains some daily life behavioural advice in a fun, educational way. The game has been developed in two stages: preproduction—developing the concepts and designs behind the game; and production – the actual asset collection and game development.

4.1.1 Preproduction

During the pre-production phase of development, the entire game was accurately designed. Every aspect, from character and environment, was discussed, and precise decisions were made at the early stages. At this stage, we organized the problems and advice which we had gathered from the liaison officers and the literature review into categories and divided it into three stages. This placed an excellent platform to allow the game in mind to be rapidly and efficiently developed and gave a clear and reliable picture of the final product. Of course, there were changes made regarding the presenting of the advice and the proper action taken after each advice to well represent that advice those

were discussed, and additional possibilities were explored, but the main concepts have stayed as planned and accepted by the officers.

4.1.2 Production

At that stage, we picked the gaming platform, which suits the requirements and helps us to establish the needs efficiently. We had picked Unity, which is a cross-platform game engine. Unity provides game creators with the necessary set of features to build games quickly and efficiently. The Unity version which we had used was “Unity 2017.4.17f1”. For coding, we have used Visual Studio 2017. We had selected a project called 2D Game Kit from Unity assets store. This game kit was picked because it is suitable for the age group we are targeting (tween) and it is easy to modify and add assets which would be helpful to customize the scenes and events according to our purpose. The shooting and unrelated features in this game kit so that the players would not feel unpleasant feelings during their play. We modified this project to reflect the given advice. We have used C# to add some codes to the assets. We have used assets from the Unity Asset Store to help us reach our goal. We made several modifications to the behaviour of some assets and customized most of the game to reach the requirements.

4.2 ASSETS

4.2.1 Characters

 <p>Sarah</p>	<p>She is the main character. She should learn from the advice given to her to adapt better to the new environment</p>	 <p>Adam</p>	<p>He only appears to advise on level one. He came from Sarah's planet before her.</p>
 <p>Disturbance</p>	<p>It moves automatically toward Sarah when he senses her coming. The disturbance will hurt her when he touches her.</p>	 <p>Barbarian</p>	<p>He is the first helper in level three. He cannot be controlled. He gives Sarah the fourth advice.</p>
 <p>Guider</p>	<p>Sarah will meet him after she feels lost. She asks for directions, and he would be the one who will guide her in the right way to go.</p>	 <p>Wizard</p>	<p>In level three, he will give Sarah 5th Advice. He cannot be controlled. Moreover, would not move from his place</p>
 <p>Security Guard</p>	<p>Sarah will meet the Police Helper in Level Two, and she will inform him that she had seen the Armed Man. Moreover, he knows what to do in this case.</p>	 <p>Armed Man</p>	<p>Sarah will meet the Armed Man in the Second Level. He will stay in his place while he is swinging his sword.</p>

Figure 6. Sarah and the other characters in New Beginning

4.2.2 Harming Obstacles

	<p>Acid Water: If Sarah fell in this water, it will result in heartbreak. She should jump above it and land safely on the other side.</p>		<p>Spikes: The Spikes would be either on the ground or on/under a moving Platform. Sarah should not touch nor let the spikes reach her in order not to break her heart.</p>
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Figure 7. Two obstacles which will hurt Sarah

4.2.3 Delaying obstacles

	<p>Destructible column: This column will block Sarah's way to continue her journey. Moreover, there would be no other way unless she breaks it with the breaking tool.</p>		<p>Door: This Door will stop Sarah from proceeding. She should search for the Switch to open the Door.</p>
	<p>Pass-Through Platform: If you were under it, jump by pressing Space. If you were above it press S+ Space.</p>		<p>Pushable Box: push the box to drop it and jump above it to continue moving.</p>
	<p>Teleporter: Enter through it to be transported to another place.</p>		

Figure 8. Obstacles which may not hurt Sarah but will hold her from proceeding in the game unless she knows what to do.

4.2.4 Tools

	<p>Pressure Pad: When Sarah steps on this Pad, a dialogue box will appear, and a voice will be played reading what is written in the dialogue box.</p>		<p>Health Pickup: If Sarah brocks one of her hearts, picking this box will restore one heart.</p>
	<p>Breaking Tool Pickup: This tool will be picked up only once, and Sarah will keep it with her through the journey. This tool will allow Sarah to break down the breakable columns.</p>		<p>Switch: When Sarah touches the switch, it will open the door, which will allow her to proceed on her journey.</p>
	<p>Advice Key: At the end of each level, Sarah has to collect a key which will let her go to the next level and collecting the three Advice Keys will help her open the 3rd level door.</p>		

Figure 9. Those tools help Sarah during her journey.

4.3 CONTROLLERS

4.3.1 Camera Controller

A dynamic camera was used which would follow the player while moving. To reach this, the camera was given its velocity that would accelerate when the player runs, and slow down when the player's movement slows down.

4.3.2 Player Controller

Sarah can be controlled using the following keyboard keys:

A: Turn/move left

D: Turn/move right

S: Crouch

K: Hit columns using the breaking tool

Space: Jump

Space+ S: Pass through the platform

4.4 LEVEL DESIGN AND PROGRESSION

4.4.1 Story

The main character in the game is called *Sarah*. *Sarah's* spaceship landed on C planet. Unfortunately, her spaceship is broken down, which made Sara surrender. Thus, she decided to start figuring out other alternatives by adapting to live in this new planet. She found herself lonely and need help and advice on how to start her new life in this

new location. While she was discovering her way on this planet, she met *Adam*. It happens that *Adam* is from *Sarah*'s planet who landed long before her, and now he knows the C planet very well. Through the first adaptation level, Adam will give Sarah three pieces of advice which will assist her to start adapting to the new environment. Then, *Sarah* will encounter other individuals who will either give her advice (*Helpers*) or will be mean to her (*Disturbance*). From the given advice, *Sarah* will learn how to adapt with the Disturbance and will be accustomed to the new environment. This game consists of three levels. In each level Sarah will have to pick a key at the end of the level. After she collects three keys, she will be able to open the last door. Which would make her glad that she understood the advice and started to adapt to the new planet. The game story stimulates some of the feeling, stress and loneliness that newcomers children face in their early days and weeks of arrival to their new way of living.

4.4.2 World

Planet C is an ancient and mysterious planet which contain hazards and obstacles within the ancient ruins. With the deadly crystal spikes and bubbling murky pools, it would be a unique adventure to discover what is hidden in the deep, long forgotten crypts of this large island with some seriously lush environments, containing classics and moving platforms, push able boxes, switches and magical glowing keys for the giant stone door. The planet is full of challenges and sometimes feel confusing even to figure from where the right way is to move on. This planet combines characters from different planets, most are helpful, and few are not.

4.4.3 Level One

The game will start with Sarah next to her spaceship. After taking a few steps, Sarah will meet Adam. At the same time, she will be stepping on a Pressure Pad which will show a dialogue box and a recorded voice containing the first advice from Adam to Sarah which is: ” *Each planet has its own rules, and we must follow those rules even if it is different from our planet.*”

After hearing the advice, Sarah will jump on a moving platform which will take her to a teleportal door. This door will take her to the other side, between those two sides, there is acid water. Then Sarah will continue jumping on moving and fixed platform to avoid the acid water until she meets Adam again. She will be stepping on a Pressure Pad which will activate a recorded voice, and a dialogue box contains the second advice which will be: “*Personal space is the area immediately surrounding your body. Personal space can even be different from culture to culture. Getting inside someone's personal space can make them uncomfortable*”. Then she will jump to pass through two platforms and goes upon moving up and down the platform. After she reaches the top, she jumps to the left where she will collect a hitting tool which only breaks the poles by pressing on the K key on the keyboard. Then she jumps down to collect health from the health box if she needed the health. Otherwise, she will not collect it. She must break another pole before she sees Adam for the third time. She will also be standing on a pressure pad when she will meet him. This will trigger the voice speech reading the dialogue box which contains the third advice:” *Do not fight back, even if someone wants to hurt you physically. Try to get away from him/her and tell an adult of what is happening to you*”.

After listening to the advice, Sarah will continue her journey at this level then she will meet the Disturbance who will to give Sarah a hard time by following her. She has to avoid them and continue her journey. In case the Disturbance succeeded to touch Sarah, she will be sad, and that will break her heart. Sarah has five hearts. If she breaks all her hearts then she has to restart that level from the beginning. After facing two Disturbances, Sarah will gain the first “Advice Key,” and the first level will be completed. Figure10 shows level1 map and Sarah’s hearts.



Figure 10. Level1 map and Sarah’s hearts

4.4.4 Level Two

In the Second Level, Sarah will face an Armed Man. He would be swinging his sword to hurt everyone who gets near him. He does not move from his place but will also hurt the one who comes behind him. Sarah will remember the advice which Adam had told her, and she would jump above the Armed Man to avoid him and not get near someone who wants to hurt her. Then she will meet a guard-man. Sarah will tell him what she had seen and expected him as an adult to know what to do in this situation. Figure11 shows Level 2 map.



Figure 11. Level 2 map

4.4.5 Level Three

The third level will be the final stage; it contains other challenges and obstacles. In this level, Sarah will meet the Helpers who will give her advice and again the Disturbances. This level starts with Sarah learning about the switch, which will open the first door. Through this level, she will search for other switches when she wants to open the doors. Then she must shove a Pushable Box and drop it in the acid water so that she can use it to jump to the other side. The Spikes are the new challenge which Sarah must face. The spikes are the dangerous obstacles, and if Sarah had touched it, she would be discouraged and have a heartbreak. She must avoid it by jumping on the moving platforms until she reaches the switch to open the door. She will descend until she meets the first Helper and she steps on the Pressure Pad. Voice advice will play, and the dialogue box will appear. Sarah will hear her fourth advice:” *Talk politely and pick your words carefully, make sure not to use expressions which may be understood differently in other cultures.*”

Then she meets a character (Guider) whom she asks politely about the directions to practice the advice. He will inform her about the correct direction. She will jump up through the Path through the platform and avoid touching the spikes. After reaching the top, she will push a pushable box and drop it down to reach the acid water. After she does so, the Disturbance will try to demotivate her by breaking her heart. Sarah must avoid it and continue her way. She will jump on a platform and search for a Switch to open the next door. Next, to the switch, she will find the “Wizard,” He will give her the Fifth advice: *“if you felt depressed and that nobody understands you. Try to tell your parents about your feeling and your concerns; also you can chat with your teachers.”*

A pushable box will be moving with her while she is on the moving platform, she has to stay on that platform after she opens the door so that the box will also be dropped in the acid water. The two boxes will create a path which will help her cross the acid water. After she reaches, she boxes and crosses the acid water; she will gain the third “Advice Key,” which will allow her to open the last door. Then the Game will be over. Figure12 shows Level 3 map.

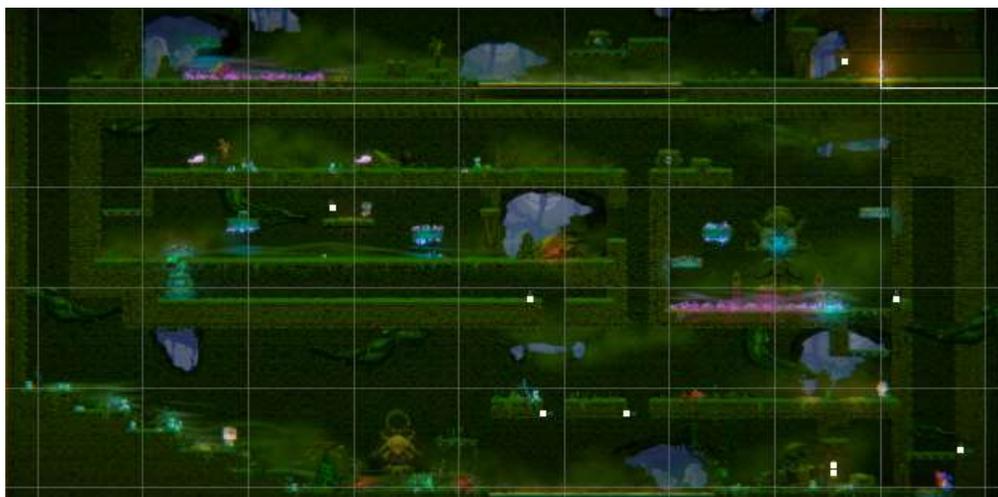


Figure 12. Level 3 map

CHAPTER 5. EVALUATION

5.1 USER STUDY

We identified that there is a lack of research on the use of game-based learning for newcomer children's social adjustment. The current study aims at investigating the potential of using game-based learning technology in assisting newcomer children (age 9-12) to better adjust socially to their new way of living within Canada.

More specifically, we are trying to capture children's feedback on using video games as a tool that helps them make social behaviour adjustment based on selected scenarios, comparing that to a more traditional method where a group of participating children will read an information brochure.

The study started by securing approval from the University Research Ethics Board (protocol #110087). Also, we received the approval from the Ottawa Chinese Community Service Centre (OCCSC) to conduct the study in their center. OCCSC actively supports many newcomers from a diverse set of ethnic backgrounds. We started by printing the poster, oral script, and invitation letters and sent it to the OCCSC to contact the participants. They were able to ensure the attendance of 30 participants. Before the study day, we printed 30 copies of the following documents: consent form, parent questionnaire, children questionnaire, children assent verbal form. Also, we printed 15 copies from the study brochure.

In the study day, we arrived early to prepare for the study. We installed the game on 15 computers found in the computer lab. We had two rooms reserved for this study: the

meeting room and the computer lab. All the participants were gathered in the meeting room; we informed them about the goal of the project and told them the procedure for this study. First, the parents signed the consent papers, and we asked the participant children for verbal assent. Second, we gave the children the pre-questionnaire to be filled. This questionnaire contains five questions with multiple choice answers. The participants were asked to answer those questions according to what they feel like the correct behaviour in the given situations in the questionnaire. After they filled that, we divided the children randomly into two groups, Group A who played the game and Group B who read the brochure. Each group included 15 participants.

Some of the participants from Group A finished playing quickly, and others took more time to complete the game. After they finished playing, they were given a post-questionnaire which consist of two pages; the first page was the same as the pre-questionnaire, the second page contains questions related to the game with a numerical scale from strongly agree (5) to strongly disagree (1). Also, the second page contains a space for any other comments which the participant would like to share with us after they played the game. After they read the brochure, Group B was also given a pre-questionnaire like a group A, but it was related to the brochure and were given the space to write for us their comments regarding the brochure.

At the end of the study, all the participants were gathered in the meeting room, and we thanked them all for their participation. The children were given a 10\$ gift card from Toys R US as an appreciation for their participation. After the participants had left, we digitalized the data found on the papers and destroyed the hardcopy of the results.

We focused on bullying and personal space as the main topics for the experiment. This was decided based on the advisors' feedback on common problems faced by newcomer children.

5.2 HYPOTHESIS AND METRICS

Our main hypothesis in this study was that game-based learning provides a superior learning experience for newcomer tweens trying to socially adjust to their new environment. To verify this hypothesis, and to use common Human-Computer Interaction (HCI) research approaches (MacKenzie, 2012), we used a series of objective and subjective measures:

- Level of learning as measured by the number of correct answers before and after the participation (objective)
- Perceived Ease of Use (subjective)
- Perceived Usefulness (subjective)
- Pleasantness (subjective)

The learning was measured by counting the number of correct answers, while the subjective metrics were measured using a 1-5 Likert scale. For the objective learning metrics, we hypothesized that:

- 1.1. Children will have better scores after reading the brochure compared to before the experience.
- 1.2. Children will have better scores after playing the game compared to before the experience.

1.3. The score after playing the game will be higher than the score after reading the brochure.

1.4. The score increase after playing the game will be higher than the score increase after reading the brochure

For the subjective part, we hypothesized that:

2.1. The game will have a higher rating for usefulness.

2.2. The game will have a higher rating for pleasantness.

2.3. The game will have a higher rating for ease of use.

We noticed that reading the brochure is probably easier than playing a game, but for the sake of similarity, we left the hypotheses in the same order. While ease of use is a valid metric in general, it is acceptable for a more pleasant and useful method to be harder to perform.

We also provide children and their parent the ability to enter open-ended comments describing their opinion and thoughts about the experience.

5.3 RESULTS

The participants in this study were 30 newcomer children from Middle Eastern background between the age of 9 and 12. The children were divided into two groups: Group A who played the game, and Group B, who read the brochure. A quantitative approach is used to test the difference in children's knowledge of the accepted behaviour in certain situations before and after using either the brochure or the game. The pre-questionnaire was one section of six questions (Appendix 2- Section 1) while the post-questionnaire had

two sections; the first section was the same pre-questionnaire six questions and the second section used Liker scale for subjective and open-ended qualitative questions (Appendix 2- Section 2 and 3). Those questions were discussed with the liaison officers, and we were told about the answer which would be considered the right behaviour in that situation. The correct answer for each question is marked in Appendix 2 Section.

5.3.1 Quantitative Objective Analysis

Following we are going to compare the results of the pre-questionnaire and post-questionnaire section one (Appendix 2- Section 1) for each group, then we are going to compare the post-questionnaire results between Group A and Group B (Appendix 2- Section 2 and 3).

5.3.1.1 Group B

- In question one (Q1), only 27% of the participants had answered this question correctly. After reading the brochure, 47% of the participants had answered this question correctly. This is an increase of 20% of the children answering correctly.
- In question two (Q2), only 13% of the participants had answered this question correctly before reading the brochure, interestingly this percentage even after reading the brochure. Which means there is no increase in the children answering correctly

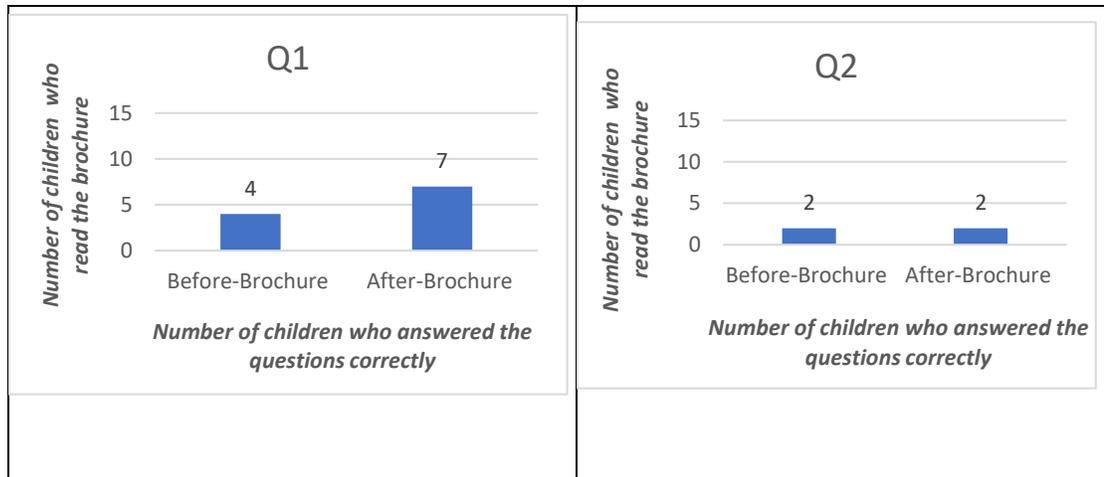


Figure 13. Comparison of the correct answers before reading the brochure and after reading the brochure in Question 1 & Question 2

- In question three (Q3), 80% of the participants had answered this question correctly. After reading the brochure, 93% of the participants had answered this question correctly, which is an increase of 13% of the children answering correctly.
- In question four (Q4), only 53% of the participants had answered this question correctly. After reading the brochure, also 53% of the participants had answered this question correctly.

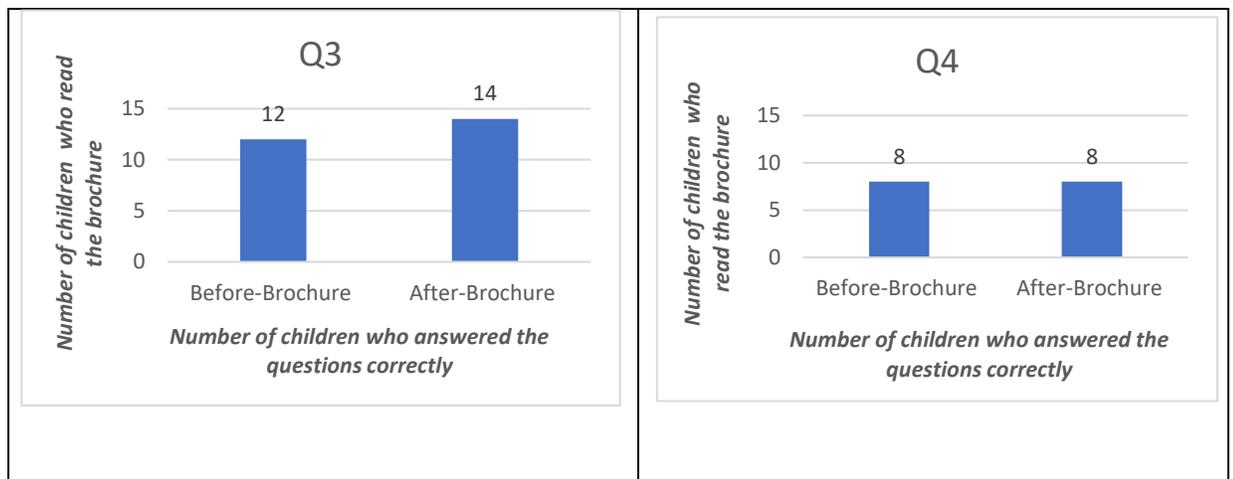


Figure 14. Comparison of the correct answers before reading the brochure and after reading the brochure in Question 3 & Question 4

- In question five (Q5), 67% of the participants had answered this question correctly. After reading the brochure, 73% of the participants had answered this question correctly, which is an increase of 6% of the children answering correctly.
- In question six (Q6), only 53% of the participants had answered this question correctly. After reading the brochure, also 53% of the participants had answered this question correctly. Which means there is no increase in the children answering correctly.

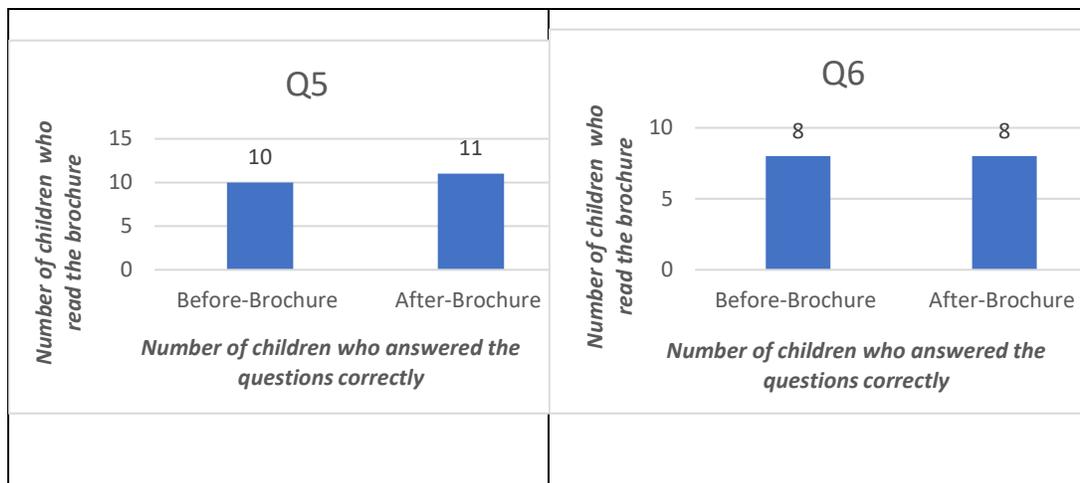


Figure 15. Comparison of the correct answers before reading the brochure and after reading the brochure in Question 5 & Question 6

Figure 16 shows the distribution of the participants' answers in each question before reading the Brochure. The high lighted cell is the correct answer to the question.

Before reading the Brochure					
	option 1	option 2	option 3	option 4	option 5
Q1	2	3	4	6	
Q2	2	2	1	10	
Q3	1	2		12	
Q4	1	2	4	8	
Q5	2	10	3		
Q6	1	8	3	3	

Figure 16. Answers before reading the Brochure

Figure 17 shows the distribution of the participants' answers in each question after reading the Brochure. The high lighted cell is the correct answer to the question.

After reading the Brochure					
	option 1	option 2	option 3	option 4	option 5
Q1		4	8	3	
Q2	2	2	1	10	
Q3		3	1	11	
Q4		6	2	7	
Q5	5	8	2		
Q6		9		6	

Figure 17. Answers after reading the Brochure

Figure 18 summarizes the before and after results of the participants answering the questionnaires correctly. We can notice that we have three questions which have no change in the correct answers before and after reading the brochure (Q2, Q4, Q6). In the other questions, there is an increase in Q5 of 6% and Q3 of 13% and Q1 of 20%. The increase in the correct answers for Group B does not reach above 20% in any question.

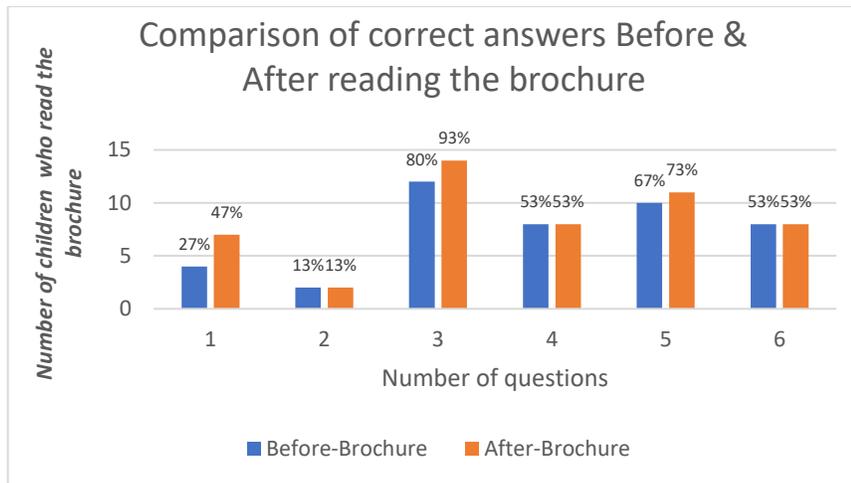


Figure 18. Children's correct answers before and after reading the brochure

To verify our hypothesis 1.1 (learning by brochure), we defined:

- H0 (null hypothesis): Brochure is not an effective way to teach the newcomer children the right behaviour.

-H1 (the alternate hypothesis): Brochure is an effective way to teach the newcomer children the right behaviour.

We ran a t-test to verify this. The p-value aims to provide more information about the test statistic with regards to the hypothesis test.

Using the data given in fig. 5, we used the one-tailed and paired t-test. The obtained p-value for the given data is $p= 0.00428$, (see Table 2) which is around $0.4 \% < 5\%$, meaning that the probability of obtaining that difference by chance is low, which means that we have sufficient evidence to support H1. So, the brochure is an effective way to teach the newcomer children the right behaviour.

	<i>Total Before</i>	<i>Total After</i>
Mean	2.933333	3.333333
Variance	4.780952	4.380952
Observations	15	15
Pearson Correlation	0.972861	
Hypothesized Mean Difference	0	
Df	14	
t Stat	-3.05505	
P(T<=t) one-tail	0.004282	
t Critical one-tail	1.76131	

Table 2. T-test for Brochure

5.3.1.2 Group A

- In question one (Q1), 53% of the participants had answered this question correctly. After playing the game, 80% of the participants had answered this question correctly. This is an increase of 27% of the children answering correctly.
- In question two (Q2), only 13% of the participants had answered this question correctly. After playing the game, also 13% of the participants had answered this question correctly. Which means there is no increase in the children answering correctly.

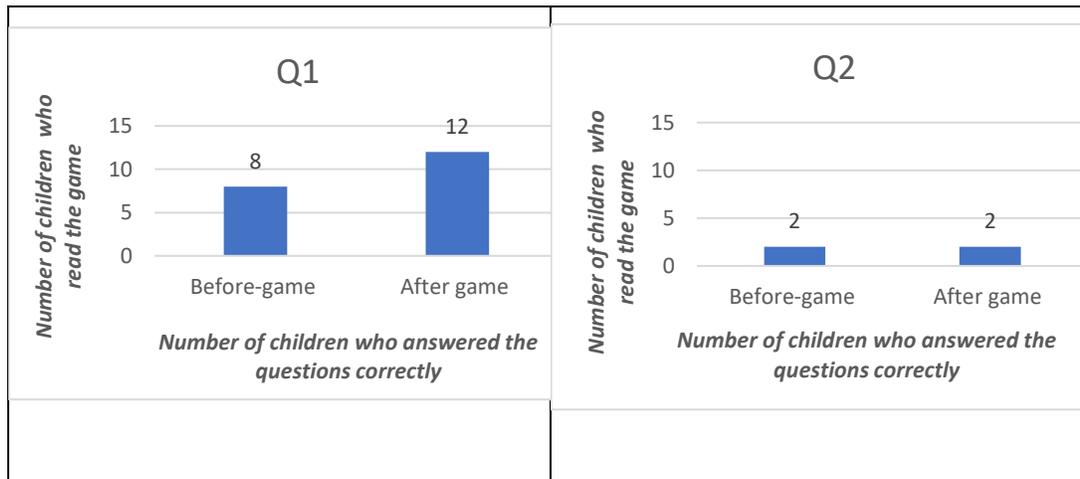


Figure 19. Comparison of the correct answers before playing the game and after playing the game in Question 1 & Question 2

- In question three (Q3), 73% of the participants had answered this question correctly. After playing the game, 100% of the participants had answered this question correctly; this is an increase of 27% of the children answering correctly.

- In question four (Q4), 47% of the participants had answered this question correctly. After playing the game, 60% of the participants had answered this question correctly; this is an increase of 13% of the children answering correctly.

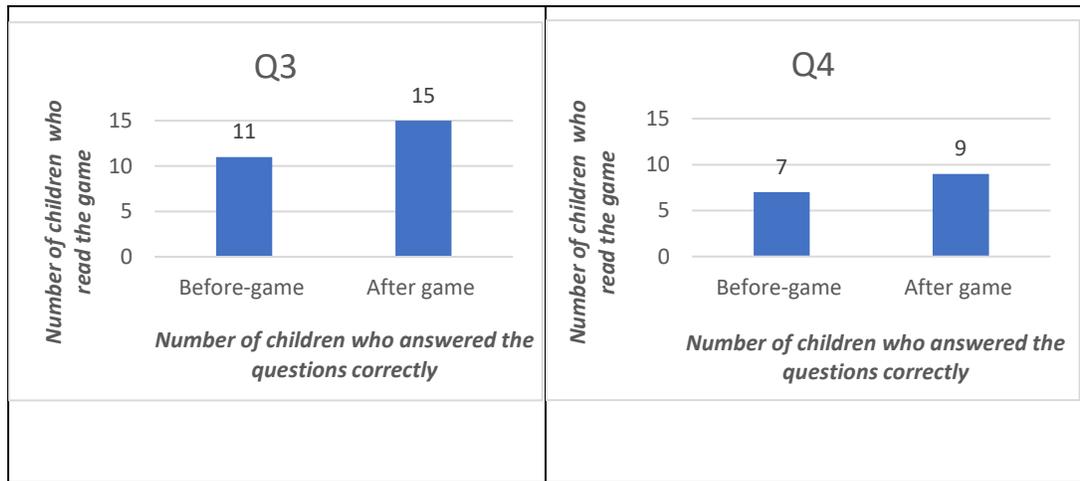


Figure 20. Comparison of the correct answers before playing the game and after playing the game in Question 3 & Question 4

- In question five (Q5), 53% of the participants had answered this question correctly. After playing the game, 67% of the participants had answered this question correctly; this is an increase of 14% of the children answering correctly.
- In question one (Q6), 60% of the participants had answered this question correctly. After playing the game, 67% of the participants had answered this question correctly; this is an increase of 7% of the children answering correctly

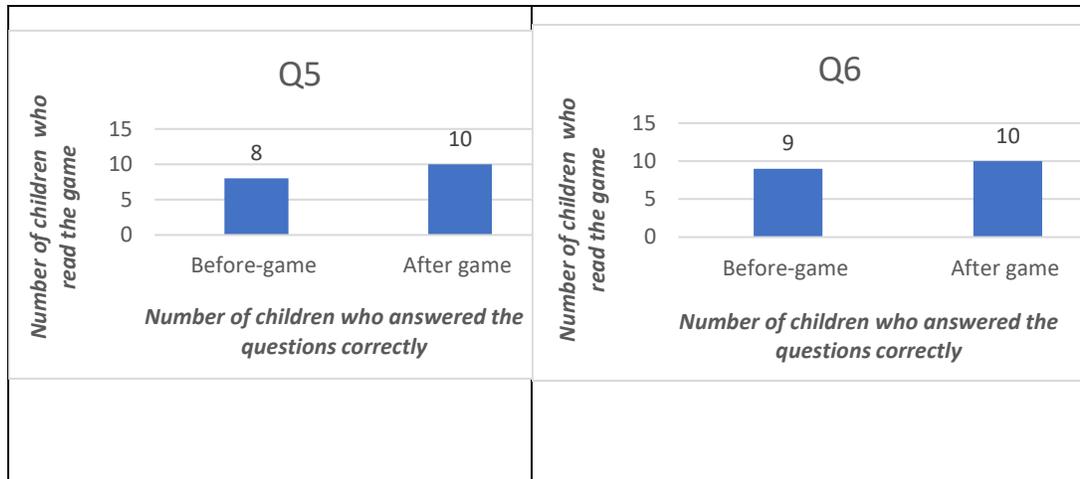


Figure 21. Comparison of the correct answers before playing the game and after playing the game in Question 5 & Question 6

Figure 21 shows the distribution of the participants' answers in each question before playing the game. The high lighted cell is the correct answer to the question.

Before playing the Game					
	option 1	option 2	option 3	option 4	option 5
Q1	1	3	8	3	
Q2	4	2	1	8	
Q3	2			11	2
Q4	2	3	3	7	
Q5	5	8	2		
Q6	2	9	1	3	

Figure 22. Answers before playing the Game

Figure 23 shows the distribution of the participants' answers in each question after reading the Brochure. The high lighted cell is the correct answer to the question.

After playing the Game					
	option 1	option 2	option 3	option 4	option 5
Q1		2	12	1	
Q2		2	1	12	
Q3				15	
Q4		4	2	9	
Q5	3	10	2		
Q6		10	2	3	

Figure 23. Answers after playing the Game

Figure 24 summarizes the before and after results of the participants answering the questionnaires correctly after playing the game. We can notice that we have one question which has no change in the correct answer (Q2). In the other questions, there is an increase in Q1 of 27% and Q3 of 27% and Q4 of 13% and Q5 of 14% and Q6 of 7%. The increase in the correct answers for Group A reaches 27% in two questions.

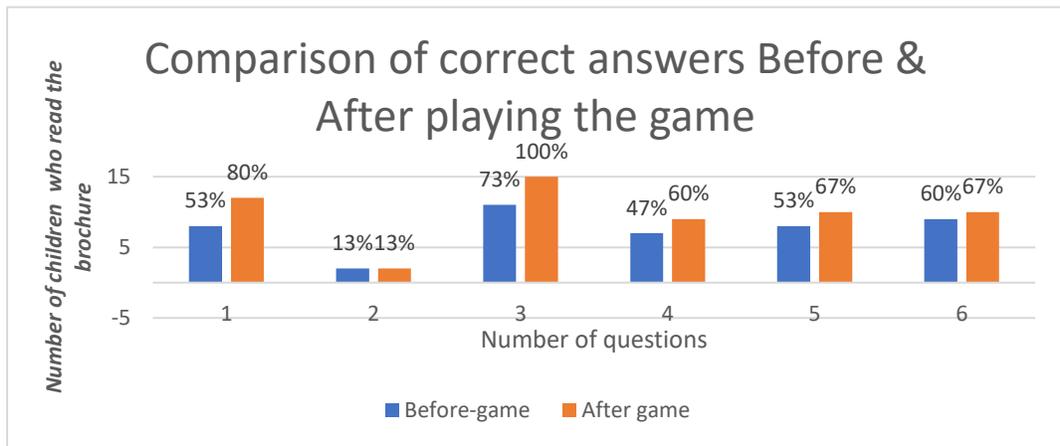


Figure 24. Comparison of children's correct answers before and after playing the game

To verify our hypothesis 1.2 (learning by the game), we defined:

- H0 (null hypothesis): The Game is not an effective way to teach the newcomer children the right behaviour.

-H1 (the alternate hypothesis): The Game is an effective way to teach the newcomer children the right behaviour.

Using the data given in fig. 17, we used the one-tailed and paired t-test. The obtained p-value for the given data is $P=0.0029$, (see Table 3) which is around $0.3\% < 5\%$, meaning that the probability of obtaining that difference by chance is low. This proves that the game is an effective way to teach the newcomer children the right behaviour.

	<i>sum before</i>	<i>sum after</i>
Mean	3	4
Variance	6	3.285714
Observations	15	15
Pearson Correlation	0.884798	
Hypothesized Mean Difference	0	
Df	14	
t Stat	-3.24037	
P(T<=t) one-tail	0.002963	
t Critical one-tail	1.76131	

Table 3. T-test for Game

5.3.1.3 Group B VS Group A

Figure 25 shows the difference between the correct answers of the children after reading the brochure and after playing the game.

- In Q1, we have 33% of the children from Group A answered correctly more than from Group B.
- In Q2, both Groups had the percentage of the same answers.
- In Q3, we have 7% of the children from Group A answered correctly more than from Group B.
- In Q4, we have 7% of the children from Group A answered correctly more than from Group B.
- In Q5, we have 7% of the children from Group B answered correctly more than from Group A.

- In Q6, we have 13% of the children from Group A answered correctly more than from Group B.

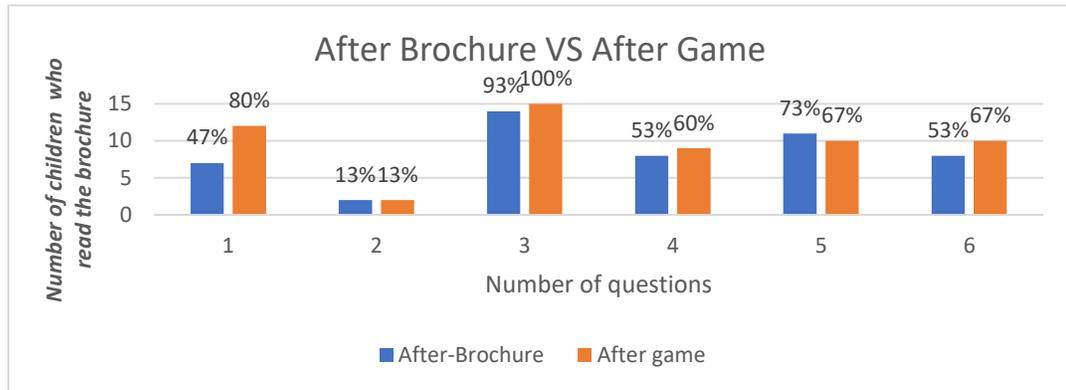


Figure 25. Comparison of children's correct answers after reading the brochure and after playing the game

To verify our hypothesis 1.3 (learning by brochure vs game, using post data only), we defined:

- _ H0 (null hypothesis): GBL is not more effective than a brochure
- _ H1 (the alternate hypothesis): GBL is more effective than a brochure

Using the data given in Figure 18, the obtained p-value for the given data is $P=0.179$ (see Table 4), which is around 17.9% $>5\%$ meaning that the probability of obtaining that difference by chance is very high. Meaning that the alternative hypothesis is rejected. The failure to reject H0 does not mean the null hypothesis is true. It indicates that we do not have sufficient evidence to support H1.

	<i>Total after</i>	<i>Total After</i>
Mean	4	3.33333333
Variance	3.28571429	4.38095238
Observations	15	15
Hypothesized Mean Difference	0	
Df	27	
t Stat	0.93250481	
P(T<=t) one-tail	0.17967005	
t Critical one-tail	1.70328845	

Table 4. T-test After Brochure and After Game

In Figure 26, we have calculated the difference in the correct answers between before and after playing the game in Group A (DA) and compare it with before and after reading the brochure in Group B (DB).

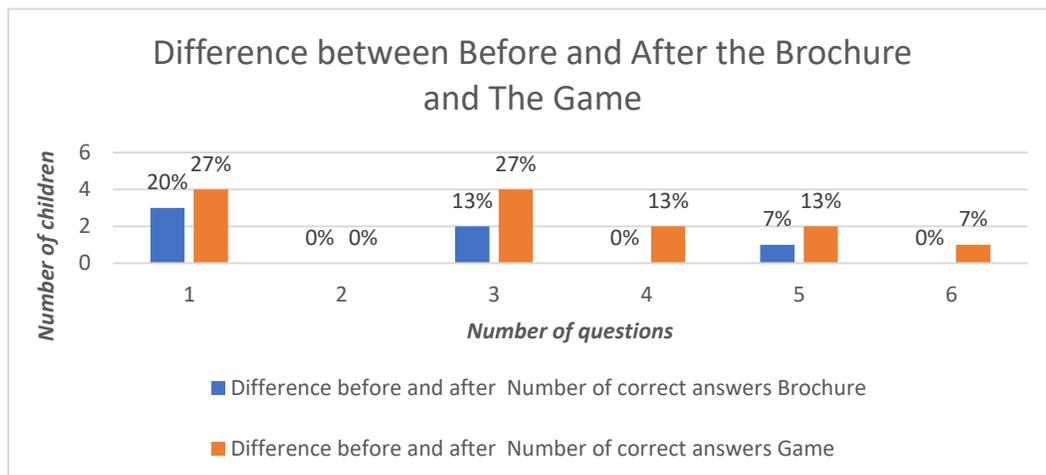


Figure 26. Difference between Before and After the Brochure and The Game

To verify our hypothesis 1.4 (learning by brochure vs game, using difference), we defined:

_ H0 (null hypothesis): GBL is not more effective than a brochure

_ H1 (the alternate hypothesis): GBL is more effective than a brochure

Using the data given in Figure 19, the obtained p-value for the given data is $P= 0.0447$, (See Table 5), which is around 4.4% <5%, meaning that the probability of obtaining that difference by chance is low. This means that the null hypothesis is rejected, and the alternative hypothesis is true. So, while the absolute correct answers after game and brochure cannot show a significant difference, the increase in correct answers does.

	<i>Difference</i>	<i>Difference</i>
Mean	1	0.4
Variance	1.42857143	0.25714286
Observations	15	15
Hypothesized Mean Difference	0	
df	19	
t Stat	1.78980162	
P(T<=t) one-tail	0.04471868	
t Critical one-tail	1.72913281	

Table 5 T-test Difference before and after for Brochure and Game

The next section shows the comparison of correct answers between two groups for each question.

5.3.1.4 Comparing the objective results for each question

Q1 does not fight back and inform an adult. We had a 7% more correct answers in Group A than Group B. Not only the advice was given in a text form, but also it was presented visually and by audio to present the behaviour advice in a multimedia way of presentation which affect the understanding of the content positively. Even though the armed man wants to fight Sarah, but Sarah should pick the right behaviour by not fighting him back and tell an adult.

It seems that Q2 was confusing for both Groups. Interestingly, it is worth to mention that both Groups had no changes on the number of correct answers in Q2, this could be explained that some student chose an answer that partially correct, while the questions have one entirely correct. We learn that we may divide this question into two questions or rephrase to make it simpler for kids to comprehend.

Q3 there is advice which mentions that Sarah should talk politely and directly she face a person and asked him a question politely. This advice is mentioned in the brochure, but seeing Sarah considering this advice and directly doing it, had left a better understanding of this advice, and that is why the students had a better answer questions percentage. It is effective by seeing the increase of the correct answers of Group A, and also the 14% when comparing the right answers from the brochure and the game.

Q4 In the game, we show the advice not only as text but also visual by presenting the armed man. The advice was given directly before seeing the armed man. In this way, the player will build a mental connection between verbal and visual representation. This keeps in the mind of the child that they should always inform a trusted adult about the problems they are facing.

Q5 we had 8% more students answered correctly from Group A than Group B. After advised at the beginning of the game. The players had to follow the rules of the new planet to keep Sarah alive through different obstacles. Not only in this stage, but also through the whole game. Which gives the player the fact that each place they are living in has a certain rule they should follow. We had an increase of 6% of the correct answers from Group B after reading the brochure, but we had more increase of 14% of correct answers from Group A.

Q6 Personal space. The children meet other children; they talk and play with each other every day. Knowing that personal space is a crucial topic is very important, especially in the children's early stages. After given the advice of the personal space, Sarah had faced two situations which are related to personal space. The players had understood that getting near the individual's space results in unpleasant consequences. The 7% difference in the correct answers is a result of this understanding.

5.3.2 Quantitative Subjective Analysis

In section 2, The Feedback Questionnaire measures the level of usefulness, enjoyment, and ease of learning.

5.3.2.1 Group B

- In Q1: regarding the measurement of the level of usefulness of the brochure we had 73% of the children agreed that the brochure was useful to learn about good behaviours, 13 % had strongly agreed, and 7% disagreed and another 7% were neutral. Some of the comments in the comment section mentioned how helpful and useful was the brochure.
- In Q2: regarding the measurement of the level of enjoyment of the brochure we had 47% of the children agreed that the brochure was enjoyable to read, 20 % had strongly agreed, and 13% strongly disagreed, and another 7% disagreed.
- In Q3: In measuring the ease of learning we had 67% of the children strongly agreed that the brochure was easy to read and understand, 20 % had strongly agreed, and 7% answered neutral, and another 7% disagreed.

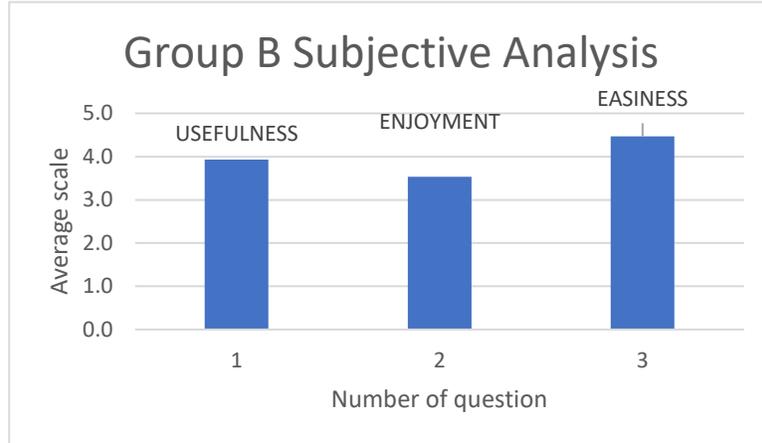


Figure 27. Answer's comparison between the children who read the brochure answering three Likert scale questions

Questions 1,2, and 3 responses were positive toward the brochure. More than half of the participants agreed that the brochure is helpful and easy to read. In the less, the number of correct answers in three questions had stayed the same.

5.3.2.2 Group A

- In Q1: when measuring the level of usefulness of the game, we had 53% of the children strongly agreed that the game was useful to learn about good behaviours, 47 % had agreed so.
- In Q2: regarding the measurement of the level of enjoyment of the game we had 53% of the children strongly agreed that the game was enjoyable to play, 40 % had agreed so, and 7% were neutral. One example from the comments which mentioned how enjoyable the game was to play is:
- In Q3: 27% of the children strongly agreed that the game was easy to play, 33% were neutral, 20 % had agreed so, and 20% strongly disagreed. There was a

considerable number of children who found the game, not an easy one and also the children had mentioned this in their comments.

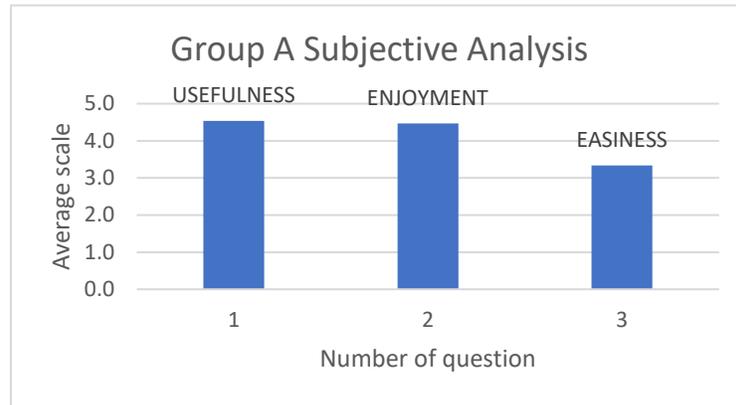


Figure 28. Answer's comparison between the children who played the game answering three Likert scale questions

5.3.2.3 Comparing the subjective results

We collected feedback and insight from children to measure the level of usefulness, enjoyment, and the ease of use for both brochure and game groups. The data which we had collected is considered a nonparametric data. In the previous analysis, we had parametric data that is why we used the t-test to verify our hypothesis. In the case of the Likert scale, we are going to use the Mann-Whitney test, which is equivalent to t-test but for nonparametric data.

The Mann-Whitney test statistic *U-value* reflects the difference between the two rank totals. The smaller the *u-value* is, the less likely it is to have occurred by chance. A table of *U-value* shows you how likely it is to obtain results by chance.

The hypothesis which we are going to use for the Likert scale is going to be:

-H₀: There is no significant difference between the Brochure and the GBL.

-H1: There is a significant difference between the Brochure and the GBL.

To check the verification of these hypotheses, we are going to use the Mann-Whitney test to check if there is a significant difference between the two methods or there is no significant difference. After that, we will check the average difference figures to see which method is more useful, enjoyable, and easier than the other.

Usefulness

Q1 compares the level of usefulness averages between the brochure and the game. We can see that the game got 4.5, and the brochure got 3.9, which means that most of the children felt that the game is more useful than the brochure. When using the Mann-Whitney calculator, we obtained the U -value, which is 60.5. The critical value of U at $p < .05$ is 72. Therefore, the result is significant at $p < .05$. Which verifies that H1 hypothesis is true and that the participants think that the game is more useful than the brochure.

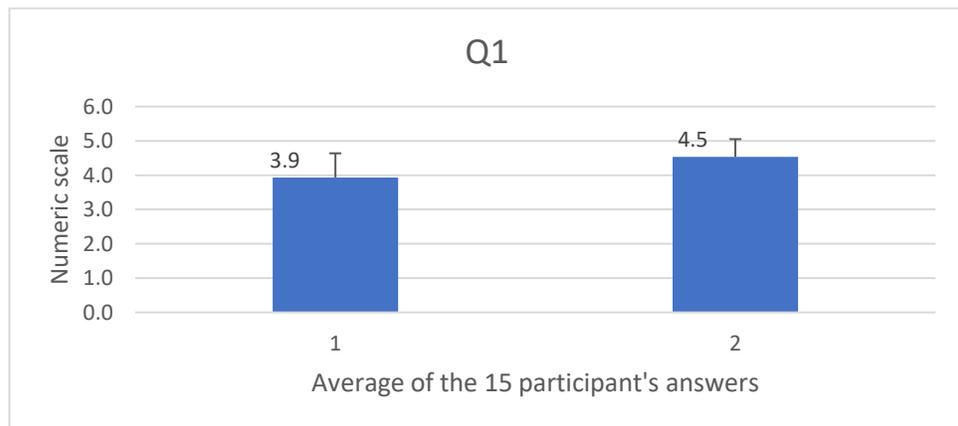


Figure 29. Average of the 15 participant's answers in Q1

Enjoyment

Q2 compare the enjoyment averages between the brochure and the game. The children who played the game enjoyed playing it more than the children who read the brochure. When using the Mann-Whiney calculator, we obtained the U -value, which is 62. The critical value of U at $p < .05$ is 72. Therefore, the result is significant at $p < .05$. According to the above-average figure in Q2 we can deduce that the participants think that the game is more enjoyable than the brochure.

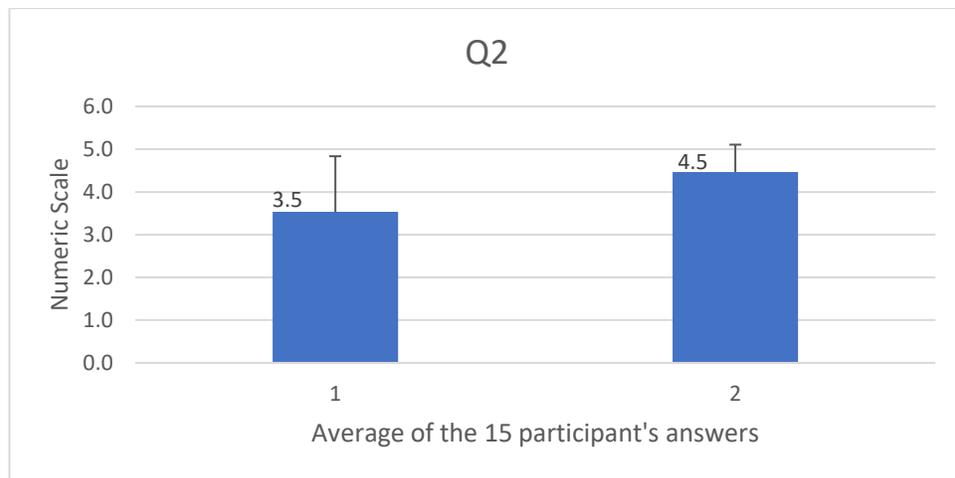


Figure 30. Average of the 15 participant's answers in Q2

Ease of Use

Q3 compare the easiness averages between the brochure and the game. It is noticeable that some of the children had found that the game was not easy to play and that the brochure was easier to read. When using the Mann-Whiney calculator we obtained the U -value is 58. The critical value of U at $p < .05$ is 72. Therefore, the result is significant at $p < .05$, which verifies that H_1 hypothesis is true, and according to the above-average result for Q2, we can deduce that the participants think that the brochure is easier than the game.

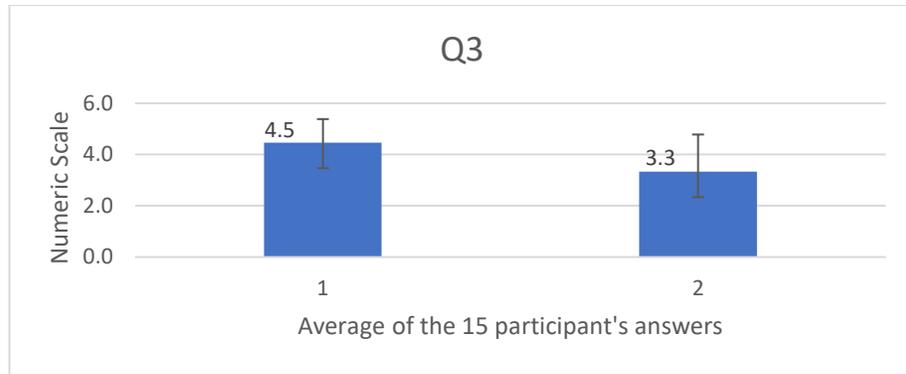


Figure 31. Average of the 15 participant's answers in Q3

5.3.3 Qualitative Tweens Experience

i) Level of Usefulness comments

- The following are some examples of the game group participants reflections:

“It is a really good educational game that teaches children good things.”

“It is a very nice educational game; I would love to see another game like this one.”

- Some of the comments about how helpful and useful the brochure is:

“I think that the brochure was helpful, but it only contained general ideas.”

“It was a beneficial brochure. Now we know how to behave if a kid was bullying.”

ii) Level of enjoyment comments

- The following are some examples of the game group participants reflections:

“I want to see more characters in the game, and it is very enjoyable.”

- One of the comments about how helpful and useful the brochure is:

“I enjoyed reading the brochure; it has good information and pictures.”

iii) Level of easiness comments:

- The following are some examples of the game group participants reflections:

” I think it was hard because it was hard to control.”

“The game is fun, but it is a bit hard. I would love to see another game like this one.”

“It was hard in some levels, but fun to play.”

- Some of the comments about how helpful and useful the brochure is:

“This brochure is really easy to understand and read, and you can also translate this to other languages.”

“The brochure was very helpful and easy to understand. All its missing is more information.”

5.3.4 Parents Experience

While children are the leading target group of this study still, we asked their parents who attend as observers for their children to express their thoughts and comment on what

they see during the study. Eight participants had filled the parent’s questionnaire. The invited parents are newcomers who came to Canada for less than five years. The average age of the parents is 42 years old. Half of the participants came to Canada in less than two years. Half of the participants have a master’s degree, and 3 have a bachelor’s degree, and one has a diploma. The below tables summarize the number of years which the participants had to spend in Canada so far and the educational parent’s background.

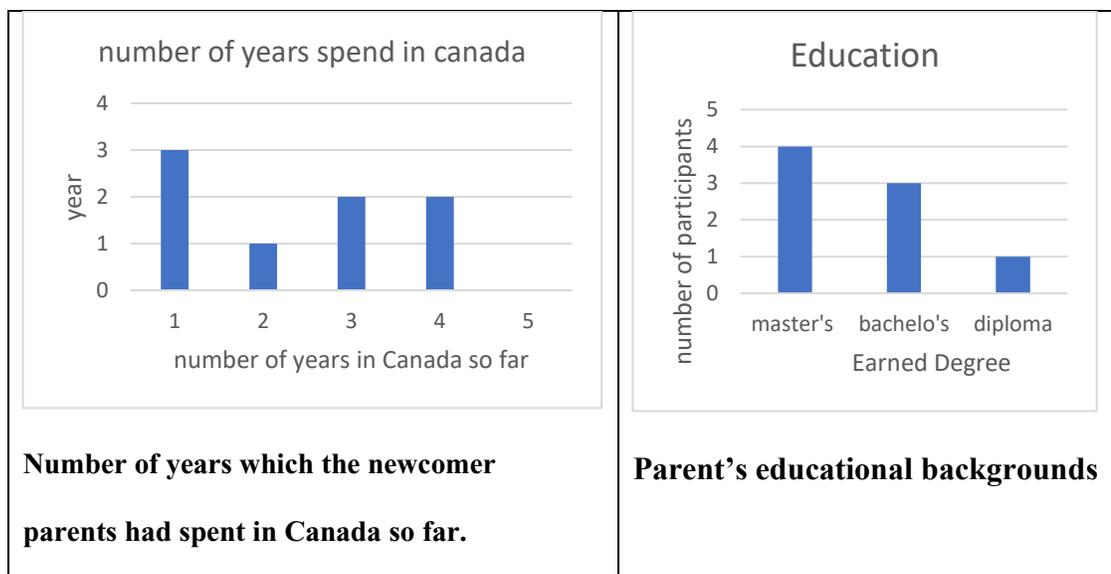


Figure 32. Number of years in Canada, and educational backgrounds

Following, we include a few examples of these quotes:

- *I like the idea and be sure the results will be very helpful for the newcomer families.*
- *A very useful tool as the kids will simulate behaviours and adapt to the given characters.*

- *I think it is a good and efficient way to educate children indirectly, and I believe it could improve their social behaviour positively.*
- *Computer games are majors in our children's life nowadays. I agree in deep to bring an educational game instead of the criminal games, but we want you to bring the attractive one.*
- *It is very good and one of the supporting ideas to children who are visual learners.*
- *It is a good experience to share the newcomer the Canadian behaviour principals by using educational games.*
- *I think using the latest technology such as digital games are more fruitful in helping kids since they can be more engaged. Additionally, integrating educational games with virtual reality an augmented reality can be beneficial in delivering the goals of newcomer adjustment.*
- *I am not a big fan of using technologies at a very young age. Instead, I like my child to socialize with her peers and interact with her teacher to get the information she needs regarding her acculturation process.*

5.4 DISCUSSION

In the literature review, we learned the importance of storytelling on the newcomer in general (Astrug, 2012) and how efficient for the children to exchange their tradition and cultural practices with each other(AMSSA, 2016) We have seen this in the game. Our game tells a story about a newcomer to the planet (Sarah) and the Helpers whom she meets exchange with Sarah several traditions and rules she may follow to help her accommodate faster in the new culture.

Some of the newcomer children may face behavioural problems when they arrive in a new culture. The teachers would sometimes solve those kinds of misunderstanding. It was proved that one-one tutoring is an effective way to solve such problems (Reinke et al., 2014; Katagami et al., 2010; Sun & Shek, 2012). If the newcomer children were given the right advice, their behaviour will improve. The advice given in our game were taken from multicultural liaison officers who provided us with the most common advice which the newcomer children should know once they arrive in the new culture. The advice is built on the frequent situations which the officers are facing.

The game is presented as a story of a newcomer (Sarah) who receives advice from others to provide her with instructions to continue her life in the new planet (culture). Moreover, since these kinds of advice should be given by an expert, we had talked and discussed the newcomer children difficulties in the new culture with two liaison officers who provided us with the advice which the students should know to adapt faster in their new environment. The teachers are not always available to provide such advice, so in this

computer game, children will receive the required advice given to them in an entertaining form, and these devices will always be available for them to review.

We used a video game as a tool to present the advice because we knew the positive effect of technology (Brito et al., 2017) to present educational content (Veith et al., 2007), especially that students are playing video games as a daily activity and enjoying it (Kalemis, 2011). Many studies recommended the use of educational games to be a helpful tool in the classroom (Kalemis, 2011; Cheng et al., 2017; Amaia et al., 2016, Li et al., 2017). Introducing the cultural information in an up-to-date tool like an application can be a very interesting and useful way (Drosos et al., 2018; Boididis et al., 2015; Thon et al., 2013; Christopoulos et al., 2011; Bampatzia et al., 2016), especially when there is a character (Sarah) who accompanies the player through the whole educational process (Rehm et al., 2016).

This video game is designed to teach specific social and cultural requirements to a newcomer child for a particular age which are shown to be helpful (Cheng et al., 2017; Dunwell et al. 2014; Gouveia et al., 2014; Alhumaidan et al., 2015; Hendriana & Ariyana, 2015; Sagae et al., 2010; Froschauer et al., 2010; Anastasovitis et al., 2018; Lane et al., 2008; Saleem et al., 2012).

5.4.1 Quantitative Objective Analysis Discussion

5.4.1.1 Group B

- In Q1, there is an increase of 20% of the children answering correctly. We had such an increase because the children have achieved the learning objectives after reading “Ways to deal with a bully” paragraph from the brochure.
- In Q2, there is no increase in the children answering correctly. Even though the children read “Physical Bullying” in the brochure, but not all of them could figure the right behaviour since other options can be correct but not suitable in this exact situation.
- In Q3, there is an increase of 13% of the children answering correctly. This increase is because the children have grasped the learning objectives after reading some information about how to deal with bullying while respecting rules from the brochure.
- In Q4, there is no increase in the children answering correctly. Although the children read about “Ways to deal with a bully” in the brochure, most of them could not know the right behaviour. None of the children picked the aggressive option.
- In Q5, there is an increase of 6% of the children answering correctly. We had this rise because the children have understood the learning objectives after reading the “Verbal Bullying “and “Written Bullying” paragraphs from the brochure.
- In Q6, there is no increase in the children answering correctly. The children read about “Physical Bullying” in the brochure, but they could not figure the right

behaviour. Some thought that helping the student would be the right choice, and they forgot about the student's personal space.

5.4.1.2 Group A

- In Q1, there is an increase of 27% of the children answering correctly. During playing the game, advice of not to fight back was shown, which seems to help the children to improve their understanding and answer the question correctly

- In Q2, there is no increase in the children answering correctly. Even though the children heard the advice about the personal space in the game, but not all of them could figure the right behaviour since other options can be correct but not suitable in this exact situation.

- In Q3, there is an increase of 27% of the children answering correctly. We had such an increase because the children have achieved the learning objectives after understanding the advice of "following the rules" given to them in the game.

- In Q4, there is an increase of 13% of the children answering correctly. During playing the game, advice of not to fight back was shown, which seems to help the children to improve their understanding and answer the question correctly.

- In Q5, there is an increase of 14% of the children answering correctly. We had such an increase because the children have achieved the learning objectives after listening to the advice of "Talk politely and pick your words carefully."

- In Q6, there is an increase of 7% of the children answering correctly. The children heard the advice about the personal space in the game, but not all of them could figure the

right behaviour. Some of the children picked the choice of helping the student in their way without considering his personal space.

5.4.2 Quantitative Subjective Analysis Discussion

Usefulness

The participants from the two groups gave their answers regarding the usefulness of the brochure and the game. The average for the brochure was 3.9, and the average for the game was 4.5. To be sure that the averages are significant, we did the Mann-Whiney test, and the result was significant, as mentioned in section 5.3.2.3. The result indicated that even though some of the children found that the brochure is useful, but most of the children think that the game was more useful than the brochure. This outcome verifies that game-based learning is a useful tool for learning, which aligns with the fact that most of the papers in the related work section had proven.

Enjoyment

The participants from the two groups gave their answers regarding the enjoyment of the brochure and the game. The average for the brochure was 3.9, and the average for the game was 4.5. To be sure that the averages are significant, we did the Mann-Whiney test, and the result was significant, as mentioned in section 5.3.2.3. The children who played the game enjoyed playing it more than the children who read the brochure. Group B felt a little bored while reading the brochure, even though it contains pictures, but they did not enjoy it much.

On the other hand, Group A enjoyed playing the game because in general the children like playing video games and this RPG game were made to be enjoyable and educational at the same time. So the game left a positive feeling linked to educating the children and improving their social skills. This kind of enjoyment is an essential element in the Flow Theory, which was mentioned in section 2.5.1.2.

Ease of Use

It is noticeable that some of the children had found that the game was not easy to play and that the brochure was easier to read. There are several reasons for this difference:

The game was developed on a high computer hardware specification I7, 7TH generation. Unfortunately, the provided computers to the participants were I3 with insufficient hardware specifications. This problem produced a slight lag while they were playing the game. Since most of the game needs a quick response from the player for specific events, due to the lag, the players were not able to reach their goals quickly, and it took them more time and effort to finish the game.

Some of the newcomer children were not used to play games on computers, which affected their performance while playing the game even though they were glad to play the game but they little frustrated from not being able to complete the requests easily.

In general, challenges are something that exists in the core of every game. If the player does not face some difficulty while playing the game, the game will become boring. This game also got some challenges, and since the players found that it is enjoyable, it means that it fulfills its goal.

The brochure was made simple and easy to grasp. It was taken from already made brochures from elementary schools. That is why most of the children found it easy to read and understand.

5.4.3 Overall Findings

The study started by identifying the main gap, which was the lack of investigation on the use of digital technologies and particularly GBL to help newcomer children. We identified the following research questions which the research managed to answer to varying levels:

1. Can technology help newcomer children adapt quicker to Canadian culture?
2. Is game-based learning a better way to educate newcomer children about social adjustment than more traditional methods? (more general)
3. Will game-based learning assist the newcomer tweens in improving their behavioural adaptation? (more specific)
4. What are the design considerations in successful game-based learning for newcomer children and particularly tweens?

Our research focused on the use of GBL for behavioural improvement, which was closely related to Question 3. The overall success of our GBL approach not only provides a positive answer to that question but is a good indication that technology, in general, can be used more effectively to help newcomer children, not just for behavioural changes but also in other aspects of social adjustment although further research is required to address other technologies and social issues.

As for Question 4, our research was too limited to provide detailed insight, but the feedback we received provided us with some guidelines:

- Educational games are appropriate methods for visual learners and children who enjoy playing games, potentially regardless of cultural background. This is also helpful in getting an approval of the parents who may not be in favour of too much screen time and playing computer games.
- Games are a fun way of teaching behaviours to children. Using universal themes that are not culture-dependent is a helpful way to make games more relatable for newcomer children.
- Variety of subjects and characters is key to provide enough appeal. Customization (avatar, gender, etc.) is particularly important.
- While we tried to avoid a "realistic" situation, more specific and directly related themes can be more successful in making a point.
- Easier control and the use of games is essential. While children may tolerate a "hard" game if it is fun and useful, we do not want to frustrate them.
- Using Virtual Reality (VR) and Augmented Reality (AR) can provide ease of use and extra attraction and engagement.
- Making the games more social not only can increase appeal but also helps with the learning as the goal is "social adjustment."

Our study was limited to a relatively small group, from only one cultural background, and also focused on one theme (interaction) with only one scenario and gameplay. All these limits the generalization of our findings and suggest the need for further research.

CHAPTER 6. CONCLUSION

6.1 SUMMARY OF FINDINGS

The objective of this thesis was to inspect the effectiveness of educational computer games to help newcomer children adjust socially.

Through the literature review, we noticed that there is a lack of research which focusses on the outcome that technology can provide to help newcomer children adjust and contribute positively to society. We have categorized the related work and mentioned the problems which the newcomer children are mostly facing when they are in their first years (section 2.2). We decided to focus on one problem which is the “Behaviour” (section 2.2.2)

Our primary research goal was to design and develop an educational game to support the newcomer children during their early years in their social adjustment and perform a preliminary evaluation to determine whether the game can improve their understanding of cultural behaviour basic acts. We hypothesized that educational games offer a better experience than more traditional printed material with respects to objective and subjective evaluation criteria such as the level of learning and perceived usefulness, ease of use, and enjoyment. Our research resulted in an educational game named *New Beginning* that sought to help newcomer tweens age 9-12 to learn about various social behaviour issues.

New Begining focuses on particular behavioural advice suggested by multicultural liaison officers who had dealt with newcomer children. The game follows the multimedia learning principles (Mayer et al., 2008), which guided us in designing useful instructional

material and ADDIE model as an instructional design model which helped us in designing an effective educational game.

Our study revealed that that educational video games are efficient and desirable tools in enhancing newcomer children an understanding of social interaction behaviour in comparison to other conventional mediums with ($p \leq 0.05$). The result aligns with previous studies that confirm the values and benefits of using game-based learning in teaching and solving various social and cultural issues.

We concluded our study by providing some guidelines for the design of educational games targeted at newcomer children.

6.2 LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

The research presented in this thesis was a first step towards investigating the role of computer games in the social adjustment of newcomer children. Due to its initial nature and our limited resources, we made a few restricting decisions that affected the size of the study and design of the game. We picked this theme of the game because it is suitable for the tween age group which we are targeting. The liaison officers approved the work and the combination which we had done between the game environment and the advice. But future research is needed to:

- Investigate the use of games for children in other age groups and from other cultural background
- Diversify the learning objectives and compare the effectiveness of games in learning other subjects

- Diversify the game design features and compare their effectiveness
- Investigate the effect of creating a multiplayer social game similar to this one, but can join more than one player from different cultures.
- Do a study which compares the results taken from three participant groups:
Group A: play a video game, Group B: read a brochure, Group C: watch a video.

REFERENCES:

- Ahmed, Bestoon M (2019). The Effect of Acculturative Stress on School-Place Bullying in Iraqi Adolescents Oklahoma City University, ProQuest Dissertations Publishing. 13883005.
- Akçayır, M., & Akçayır, G. (2017). Advantages and challenges associated with augmented reality for education: A systematic review of the literature. *Educational Research Review, 20*, 1-11.
- Alhumaidan, H., Lo, K. P. Y., & Selby, A. (2015, November). Co-design of augmented reality book for collaborative learning experience in primary education. In *2015 SAI Intelligent Systems Conference (IntelliSys)* (pp. 427-430). IEEE.
- Alley, L. R., & Jansak, K. E. (2001). The ten keys to quality assurance and assessment in online learning. *Journal of Interactive Instruction Development, 13*(3), 3-18.
- Amaia, A. M., Iñigo, A. L., Jorge, R. L. B., & Enara, A. G. (2016, September). Leihoa: A window to augmented reality in early childhood education. In *2016 International Symposium on Computers in Education (SIIE)* (pp. 1-6). IEEE.
- AMSSA, (2016). "Newcomer Youth : Challenges and Strengths," vol. 28, no. 35.
- Anastasovitis, E., Ververidis, D., Nikolopoulos, S., & Kompatsiaris, I. (2017, June). Digiart: Building new 3D cultural heritage worlds. In *2017 3DTV Conference: The True Vision-Capture, Transmission and Display of 3D Video (3DTV-CON)*(pp. 1-4). IEEE. Lane, H. C., Hays, M. J.,
- Bampatzia, S., Bourlacos, I., Antoniou, A., Vassilakis, C., Lepouras, G., & Wallace, M. (2016, December). Serious games: valuable tools for cultural heritage. In *International Conference on Games and Learning Alliance* (pp. 331-341). Springer, Cham.

- Beiser, M., Puente-Duran, S., & Hou, F. (2015). Cultural distance and emotional problems among immigrant and refugee youth in Canada: Findings from the New Canadian Child and Youth Study (NCCYS). *International Journal of Intercultural Relations*, 49, 33-45.
- Berry, J. W., Kim, U., Minde, T., & Mok, D. (1987). Comparative studies of acculturation stress. *International Migration Review*, 21, 491-511.
- Berry, J. W. (1997). Lead Article - Immigration, Acculturation, and Adaptation. *Applied Psychology* 46 (1):5-34
- Billinghurst, M., & Duenser, A. (2012). Augmented reality in the classroom. *Computer*, 45(7), 56-63.
- Bloom, B. S. (1956). Taxonomy of educational objectives. Vol. 1: Cognitive domain. *New York: McKay*, 20-24.
- Bloom, Samuel, B., and Committee of College and University Examiners, (1964). Taxonomy of educational objectives. Vol. 2. New York: Longmans, Green.
- Brady, R., (2017)" <https://www.theglobeandmail.com/life/kids-hockey-program-helps-newcomers-feel-morecanadian/article34652383/2017>, accessed: 15/8/2018.
- Brito, R., & Ramos, A. (2017, November). Digital technology in family environment: A case of children from 0 to 6. In *2017 International Symposium on Computers in Education (SIIE)*(pp. 1-4). IEEE.
- Brown, L.A. (2014), "Newcomer Youths' Experiences of School," no. May, 2014.
- Cheng, A., Yang, L., & Andersen, E. (2017, May). Teaching language and culture with a virtual reality game. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (pp. 541-549). ACM.

- Chen, C. H., Ho, C. H., & Lin, J. B. (2015). The development of an augmented reality game-based learning environment. *Procedia-Social and Behavioral Sciences*, 174, 216-220.
- Christopoulos, D., Mavridis, P., Andreadis, A., & Karigiannis, J. N. (2011, May). Using Virtual Environments to Tell the Story:" The Battle of Thermopylae". In *2011 Third International Conference on Games and Virtual Worlds for Serious Applications* (pp. 84-91). IEEE.
- Chiu, Y., Lam, L. (2014) The Society for Safe and Caring Schools & Communities in collaboration with Alberta Education, "The first day at school for a newcomer student," pp. 1–10.
- Chuang, S. S., & Alliance, C. I. S. S. (2010). *New start for youth study: An examination of the settlement pathways of newcomer youth*. Canadian Immigrant Settlement Sector Alliance.
- Clark, R. C., & Mayer, R. E. (2016). *E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning*. John Wiley & Sons.
- CMAS, (2015), "Caring for Syrian Refugee Children : A Program Guide for Welcoming Young Children and Their Families."
- Core, M., Gomboc, D., Forbell, E., Auerbach, D., & Rosenberg, M. (2008, October). Coaching intercultural communication in a serious game. In *Proceedings of the 16th International Conference on Computers in Education* (pp. 35-42).
- Csikszentmihályi, Mihály (1996), *Creativity: Flow and the Psychology of Discovery and Invention*, New York: Harper Perennial
- Csikszentmihalyi, M., (1990). *Flow: The Psychology of Optimal Experience*, Harper & Row.

- Diniz, G. C., Silva, M. A. G., Gerosa, M. A., & Steinmacher, I. (2017, May). Using gamification to orient and motivate students to contribute to OSS projects. In *2017 IEEE/ACM 10th International Workshop on Cooperative and Human Aspects of Software Engineering (CHASE)* (pp. 36-42). IEEE.
- Dunwell, I., Petridis, P., Lameris, P., Hendrix, M., Doukianou, S., & Gaved, M. (2014). Assessing the Reach and Impact of Game-Based Learning Approaches to Cultural Competency and Behavioural Change. *arXiv preprint arXiv:1402.5037*.
- Fazel, M., Reed, R. V., Panter-Brick, C., & Stein, A. (2012). Mental health of displaced and refugee children resettled in high-income countries: risk and protective factors. *The Lancet*, 379(9812), 266-282
- Findcourses, (2019). ADDIE vs. SAM - Which Learning Methodology is Better? <https://www.findcourses.com/prof-dev/l-d-articles/addie-vs-sam-which-is-better-11516>, Accessed: June, 17, 2019
- Fletcher, J. D., & Tobias, S. (2005). The multimedia principle. *The Cambridge handbook of multimedia learning*, 117, 133.
- Froschauer, J., Seidel, I., Gärtner, M., Berger, H., & Merkl, D. (2010, October). Design and evaluation of a serious game for immersive cultural training. In *2010 16th international conference on virtual systems and multimedia* (pp. 253-260). IEEE.
- Gentile D.A et al., "NIH Public Access," vol. 35, no. 6, pp. 752–763, 2009.
- Gouinn, R. (2016) "Boys and Girls club facilitating the integration of newcomer children and youth 2016." Study on the Government's Initiative to Resettle Syrian Refugees to Canada Submission to Standing Committee on Citizenship and Immigration.
- Gouveia, D., Andrade, A., Escudeiro, P., & De Carvalho, C. V. (2014, December). Skill and Competence Development Through Games. In *Proceedings of the 16th International*

- Conference on Information Integration and Web-based Applications & Services* (pp. 49-53). ACM.
- Greenwood, J., (2017) MERRILL'S FIRST PRINCIPLES OF INSTRUCTION, <http://instructionaldesign.io/toolkit/merrill/>
- Hall, B. (1997). *The web-based training cookbook with cdrom*. John Wiley & Sons, Inc..
- Hendriana, Y., & Ariyana, R. Y. (2015, May). Multimedia adventure game folklore "Doyan Nada" for improving the cultural understanding of Sasak (Lombok) to children. In *2015 International Seminar on Intelligent Technology and Its Applications (ISITIA)* (pp. 251-256). IEEE.
- Hoque, M. E. (2016). Three Domains of Learning: Cognitive, Affective and Psychomotor. *The Journal of EFL Education and Research*, 2(2), 45-52.
- Kalemis, K. (2011, November). Can games based learning assists teachers in achieving the aims of curriculum to bilingual students of different ethnic minorities?. In *2011 Third International Conference on Intelligent Networking and Collaborative Systems* (pp. 76-83). IEEE.
- Katagami, D., Ohmura, H., & Nitta, K. (2010, July). Investigation of social adaptive skills by cross-cultural simulation game and KiSS-18. In *International Conference on Fuzzy Systems* (pp. 1-6). IEEE.
- Kiat, L. B., Ali, M. B., Halim, N. D. A., & Ibrahim, H. B. (2016, October). Augmented reality, virtual learning environment and mobile learning in education: a comparison. In *2016 IEEE Conference on e-Learning, e-Management and e-Services (IC3e)* (pp. 23-28). IEEE.
- Kilgore N., (2012), "What life skills can video games teach kids," <https://electronics.howstuffworks.com/family-tech/tech-effects-on-family/life-skills-video-games-can-teach-kids.htm>, accessed: 2019-06-02.

- Kingsley, T. L., & Grabner-Hagen, M. M. (2015). Gamification: Questing to Integrate Content Knowledge, Literacy, and 21st-Century Learning. *Journal of adolescent & adult literacy*, 59(1), 51-61.
- Koster, R. (2013). *Theory of fun for game design*. " O'Reilly Media, Inc."
- Kurt,S. (2017),”Definitions of Instructional Design”
<https://educationaltechnology.net/definitions-instructional-design/>, 2017, Accessed: June, 17, 2019
- Li, J., van der Spek, E., Hu, J., & Feijs, L. (2017, October). SEE ME ROAR: self-determination enhanced engagement for math education relying on augmented reality. In *Extended Abstracts Publication of the Annual Symposium on Computer-Human Interaction in Play* (pp. 345-351). ACM.
- MacKenzie, I. S. (2012). *Human-computer interaction: An empirical research perspective*. Newnes.
- Madsen, C. B., Madsen, J. B., & Morrison, A. (2012, November). Aspects of what makes or breaks a museum ar experience. In *2012 IEEE International Symposium on Mixed and Augmented Reality-Arts, Media, and Humanities (ISMAR-AMH)* (pp. 91-92). IEEE.
- Mayer, R., & Mayer, R. E. (Eds.). (2005). *The Cambridge handbook of multimedia learning*. Cambridge university press.
- McGonigal, J. (2011), *Reality is broken: Why games make us better and how they can change the world*. Penguin
- Meschede, C., & Knautz, K. (2017). Gamification and Interdisciplinarity: Challenges in the Modern Knowledge Society. *International Journal of Information Communication Technologies and Human Development (IJICTHD)*, 9(3), 1-13.
- MIRSSA, (2016)“Recreation Resources, for school-age Newcomer children and youth”,
www.mirssa.org/youth-resources.

- Mortara, M., Catalano, C. E., Bellotti, F., Fiucci, G., Houry-Panchetti, M., & Petridis, P. (2014). Learning cultural heritage by serious games. *Journal of Cultural Heritage, 15*(3), 318-325.
- Nacke, L.E., and Deterding, S. (2017). Editorial : The maturing of gamification research. *Computers in Human Behaviour. 450–454. ISSN 0747-5632*
- Nardon, L., Steers, R. M., & Sanchez-Runde, C. J. (2011). Seeking common ground: Strategies for enhancing multicultural communication. *Organizational Dynamics, 40*(2), 85-95.
- Nicholson, S. (2015). A recipe for meaningful gamification. In *Gamification in education and business* (pp. 1-20). Springer International Publishing
- Onchwari, G., Onchwari, J. A., & Keengwe, J. (2008). Teaching the immigrant child: Application of child development theories. *Early Childhood Education Journal, 36*(3), 267-273.
- Ontario Community Integration Network,(2011). ”Resources for Working with Newcomer Youth,”
- Paas, F., Renkl, A., & Sweller, J. (2003). Cognitive load theory and instructional design: Recent developments. *Educational psychologist, 38*(1), 1-4.
- Paliokas, I., & Sylaiou, S. (2016, September). The use of serious games in museum visits and exhibitions: A systematic mapping study. In *2016 8th International conference on games and virtual worlds for serious applications (VS-GAMES)* (pp. 1-8). IEEE.
- Perrotta, C., Featherstone, G., Aston, H., & Houghton, E. (2013). Game-based learning: Latest evidence and future directions. *NFER Research Programme: Innovation in Education. Slough: NFER.*
- Prensky, M. (2004). *Digital game-based learning. McGraw Hill.*
- Prensky, M. (2001). Digital natives, digital immigrants part 1. *On the horizon, 9*(5), 1-6.

- Pribadi B.A, (2011). Model Desain Sistem Pembelajaran, Jakarta: Dian Rakyat
- Procci, K., Singer, A. R., Levy, K. R., & Bowers, C. (2012). Measuring the flow experience of gamers: An evaluation of the DFS-2. *Computers in Human Behavior*, 28(6), 2306-2312.
- Qiwen, Z., & Yongming, T. (2017, December). Design of an augmented reality teaching system for FPGA experimental instruction. In *2017 IEEE 6th International Conference on Teaching, Assessment, and Learning for Engineering (TALE)*(pp. 35-38). IEEE.
- Rathunde, K., & Csikszentmihalyi, M. (1993). Undivided interest and the growth of talent: A longitudinal study of adolescents. *Journal of youth and adolescence*, 22(4), 385-405.
- Rehm, M., & Jensen, M. L. (2015, October). Accessing cultural artifacts through digital companions: The Effects on children's engagement. In *2015 International Conference on Culture and Computing (Culture Computing)* (pp. 72-79). IEEE.
- Reinke, W. M., Stormont, M., Herman, K. C., Wang, Z., Newcomer, L., & King, K. (2014). Use of coaching and behavior support planning for students with disruptive behavior within a universal classroom management program. *Journal of Emotional and Behavioral Disorders*, 22(2), 74-82.
- Sagae, A., Johnson, W. L., & Row, R. (2010, June). Serious game environments for language and culture education. In *Proceedings of the NAACL HLT 2010 Demonstration Session*(pp. 29-32). Association for Computational Linguistics.
- Saleem, M., Anderson, C. A., & Gentile, D. A. (2012). Effects of prosocial, neutral, and violent video games on children's helpful and hurtful behaviors. *Aggressive Behavior*, 38(4), 281- 287.
- Settlement,(2018).<https://settlement.org/>,www.moving2canada.com,www.welcomecentre.ca
[a https://www.newcomerscanada.ca/](http://www.newcomerscanada.ca/) accessed 24/8/2018

- Shenfield, T., (2017) "Understanding The Challenges Faced By Immigrant Children", <https://www.psy-ed.com/wpblog/challenges-faced-by-immigrant-children/>, Accessed: June, 17, 2019
- Sommerville, I. (2011). Software engineering 9th Edition. ISBN-10, 137035152.
- Statistics Canada, (2017) "Immigration and ethnocultural diversity: Key results from the 2016 Census," Dly., pp. 1–8, 2017
- Sun, R. C., & Shek, D. T. (2012). Classroom misbehavior in the eyes of students: A qualitative study. *The scientific world journal*, 2012.
- Sweller, J. (1994). Cognitive load theory, learning difficulty, and instructional design. *Learning and instruction*, 4(4), 295-312.
- Sweller, J., Van Merriënboer, J. J., & Paas, F. G. (1998). Cognitive architecture and instructional design. *Educational psychology review*, 10(3), 251-296.
- The Ministry of Children and Youth Services, (2017), On MYWay · A Guide to Support Middle Years Child Development.
- Tobias, S. (1989). Another look at research on the adaptation of instruction to students characteristics. *Educational Psychologist*, 24(3), 213-227.
- Tobias, S. (1982). When do instructional methods. *Educational Researcher*, 11(4), 4-9.
- Tobias, S. (1976). Achievement treatment interactions. *Review of Educational Research*, 46(1), 61-74.
- Valencia, M., (2015) "Research Synthesis Report SETTLEMENT NEEDS OF NEWCOMER CHILDREN".
- Veith, M., Schubert, K., von Rekowski, T., & Wulf, V. WORKING IN AN INTER-CULTURAL COMPUTER CLUB: EFFECTS ON IDENTITY AND ROLE.
- Wang, J., & Komlodi, A. (2012, February). Children's formal and informal definition of technology. In *Proceedings of the 2012 iConference* (pp. 587-588). ACM.

Werbach, K., & Hunter, D. (2012). *For the win: How game thinking can revolutionize your business*. Wharton Digital Press.

APPENDICES

APPENDIX 1: GAP ANALYSIS TABLE

THE SITUATION AND PROBLEM FACING NEWCOMER CHILDREN		
Ref #	Reference Name	Gaps
33	The first day at school for a newcomer student	The school should have a clear and helpful program to make sure that the newcomer students are welcomed and inform them the basic rules in the school and the classroom and the right acceptable behaviour which the students must follow so that they will not face any misunderstanding action.

Ref#	Reference Name	Gaps
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25	Can immigrants heal through storytelling?	Even though the story telling idea was successful, but it was not made accessible for the whole time like to be online or an application. The results from this study were not shared with the readers
44	Classroom misbehaviour in the eyes of students: A qualitative study	It would be better to find a solution and overcome the limitations of this project.
23	Cross-Cultural Lessons: Early Childhood Developmental Screening and Approaches to Research	This guide book is important to learn from but is not enough. It does not contain all the information about the entire sides of the culture for each group family. The researcher should know more about the family culture before doing the field-based study.
34	Use of Coaching and Behaviour Support Planning for Students with Disruptive Behaviour	This study was made with a small number of participants, so it cannot be generalized to be used in another place. But mainly it would be effective when the teachers are well trained to handle such a support.

CHILDREN AND TECHNOLOGY		
Ref#	Reference Name	Gaps

2	Children ' s Formal and Informal Definition of Technology	They didn't mention the ages of the participants. Also, they should have taken into consideration that the children who use the technology often has a different point of view from those who don't use it in daily bases
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DIGITAL GAME BASED LEARNING		
Ref#	Reference Name	Gaps
12	Leihoa: A window to augmented reality in early childhood education	There is no formal evaluation and analysis for this project.
13	See Me Roar," Ext. Abstr. Publ. Annu. Symp. Comput	The authors did not mention how many students did they test this application on nor how they got the results of implementation.
21	A 3D serious game for cultural education.	It would be more enjoyable if the application contains more gamification elements. Or even to include some challenge activities which the student can enjoy while playing this application.
22	Exploring cultural heritage landscapes in an interactive game-based learning application	The idea would have been more powerful if the developers included more historical scenes in the same museum

30	Using virtual environments to tell the story: 'The battle of Thermopylae,	<p>Much time was spent to create such an application and it would be more helpful for the visitor to view more battles in this time.</p> <p>The authors did not share with the readers the results of the study.</p>
43	Aspects of what makes or breaks a museum AR experience	<p>One of the gaps is that the children were not interested in seeing the museum anymore, they just enjoy playing the application. Another gap is the long introduction which is not interactive.</p>
32	Serious games: Valuable tools for cultural heritage	<p>The implementation is missing for this game, so the user's opinion is not known.</p>
14	Assessing the Reach and Impact of Game-Based Learning Approaches to Cultural Competency and Behavioural Change	<p>The paper did not prove if the immigrant had improved their knowledge in the taught area or not. And how much comfortable were the users to accept such information through this application?</p>
15	Skill and Competence Development Through Games	<p>It is important to check if the goal of the application was achieved, thus improving the internationalization and language skills of SME managers.</p> <p>This result was not mentioned in this paper</p>

28	Serious game environments for language and culture education	The authors didn't provide a clear implementation results to prove that this application was effective and had achieved its goal
29	Design and evaluation of a serious game for immersive cultural training	Having 12 questions at the begging of the game will confuse some of the players who will feel board before even playing.
41	Digiart: Building new 3D cultural heritage worlds	Those games were not implemented nor evaluated by participants.
42	Coaching intercultural communication in a serious game	The authors mentioned also that they must improve the application to better suits the outcomes
39	Effects of Prosocial, Neutral, and Violent Video Games on Children's Helpful and Hurtful Behaviours	The results are built on short term experiments. The authors do not know the effect on the long term playing those games.
9	Teaching Language and Culture through a Virtual Reality Game	that the developers had faced is that they couldn't teach the users the right angle of bowing. One more issue regarding this game is that the developers didn't test the user's language learning outcomes.

18	Co-design of augmented reality book for a collaborative learning experience in primary education	The results were not shared, and it is not known if the results were as expected and were helpful for the society as was aimed to be.
19	Multimedia adventure game folklore “Doyan Nada” for improving the cultural understanding of Sasak (Lombok) to children	The authors didn’t provide proof of how they concluded such a result. Neither did they tell how many students were included in the implementation and their detailed feedback.
40	NIH Public Access	The authors did not do a quantitative approach to the obtained results.

Table 6 Gap Analysis Table

APPENDIX 2: CHILDREN QUESTIONNAIRE

Section 1. Pre-Questionnaire

[This questionnaire will be given to all participate children at the beginning and before they do any activity.]

Please choose the best action in the following situations:

- 1. You are in the playground, and one of your classmates pushes you hard.**

- Push back as hard as you can to teach that classmate not to do that again.
- Just Push back and say that you can defend yourself.
- Leave that classmate and go to the teacher in duty and tell what happened.
- Ignore that classmate's misbehaviour and walk away.

2. It is time to eat in the cafeteria. The cafeteria is crowded, and you cannot find an empty seat to sit except near another student. You go and sit in the available seat, but the student looks at you and asks you to not sit too close because that will be disturbing.

- Tell that student to change the seat if not feeling comfortable.
- Leave the seat and stand until another spot becomes available.
- Just start eating your food and ignore the student's request.
- Tell the student nicely, that it is time to eat and there are no other seats available.

3. You are walking with your friend when your friend starts to yell mean words to another student.

- Do nothing; it seems fun.
- If the other student is not angry, then it's ok because nobody is hurt.
- Do nothing; you are not the one saying those words.
- Tell your friend to stop or you would tell the teacher.

- Tell your friend to lower their voice so nobody else can hear these mean words.

4. You are in the playground, you want to play on the slide, but there is a student who always blocks your way.

- Push the student hard to not block your way anymore.
- It's ok you can try to play another game.
- Come very close to the student and ask the student to step away.
- Try to talk to the student and if it does not work tell the teacher on duty.

5. There is a new student in your school who struggles with English but can speak your first language. Sometimes in the classroom, the student yells or uses swearing words in that language that the teacher doesn't understand.

- Tell the teacher the meaning of those words.
- Tell that student that it is not acceptable to use those words with the teacher, and it is more appropriate to speak English in the classroom.
- Tell the student to talk to you using that language even in class but not to the teacher.

6. Students are playing Tag. One student doesn't like to be touched so won't play.

- Try to touch the student and run away. Students should get used to being touched.

- Leave that student alone. Let other kids do what is comfortable for them as long as they are not bothering others.
- Tell the teacher to help that student play such games.
- Tell the student's friends about this situation to force that student to play this game.

Section 2: Post-Study (Game Questionnaire)

[This questionnaire will be given to the children who participate in the game group once they complete their gameplay activity.]

Multiple-choice Questions: [Questions 1-6 of Section 1 will be given again.]

Circle the numeric answer to each sentence below

#	Questions	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
1	The game was useful to learn about good behaviours	5	4	3	2	1

2	The game was enjoyable to play	5	4	3	2	1
4	The game was easy to play	5	4	3	2	1

Do you have any other comments?

Section 3: Post-Study (Brochure Questionnaire)

[This questionnaire and will be given to the children who participate in the brochure group once they complete their reading activity.]

Multiple-choice Questions: [Questions 1-6 of Section 1 will be given again.]

Circle the numeric answer to each sentence below

#	Questions	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
1	The brochure was useful to learn about good behaviours	5	4	3	2	1
2	The brochure was enjoyable to read	5	4	3	2	1
4	The brochure was easy to read and understand	5	4	3	2	1

Do you have any other comments?

APPENDIX 3: PARENTS QUESTIONNAIRE (OPTIONAL)

General Questions:

- How old are you?
- What is your highest level of education?
- Which gender do you identify with?
 - Male
 - Female
 - Other (Specify)
 - Prefer not to say
- What is your country of origin?
- How long have you been in Canada?

Open Question:

Please tell us your thoughts about the use of educational games and other technologies in helping newcomer children to adjust socially. Please note that there is no right or wrong answer, so feel free to express your thoughts.

APPENDIX 4: COLLECTED DATA FROM BROCHURE

participants	Q1 Brochure		Q2 Brochure		Q3 Brochure		Q4 Brochure		Q5 Brochure		Q6 Brochure		Total Before	Total After	Difference
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER			
1	1	1	1	1	1	1	1	1	1	1	1	1	6	6	0
2	0	1	0	0	1	1	1	1	1	1	1	1	4	5	1
3	1	1	1	1	1	1	1	1	1	1	1	1	6	6	0
4	0	1	0	0	1	1	1	1	1	1	1	1	4	5	1
5	1	1	0	0	1	1	1	1	1	1	1	1	5	5	0
6	0	1	0	0	1	1	1	1	1	1	1	1	4	5	1
7	1	1	0	0	1	1	1	1	1	1	1	1	5	5	0
8	0	0	0	0	1	1	1	1	1	1	1	1	4	4	0
9	0	0	0	0	1	1	0	0	1	1	0	0	2	2	0
10	0	0	0	0	1	1	0	0	1	1	0	0	2	2	0
11	0	0	0	0	1	1	0	0	0	1	0	0	1	2	1
12	0	0	0	0	1	1	0	0	0	0	0	0	1	1	0
13	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1
14	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
total	4	7	2	2	12	14	8	8	10	11	8	8	44	50	

Table 7 Collected Data from Brochure

APPENDIX 5: COLLECTED DATA FROM GAME

participant numner	Q1 Game		Q2 Game		Q3 Game		Q4 Game		Q5 Game		Q6 Game		sum befor	sum after	diff
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER			
1	1	1	1	1	1	1	1	1	1	1	1	1	6	6	0
2	1	1	0	0	1	1	1	1	1	1	1	1	5	5	0
3	1	1	1	1	1	1	1	1	1	1	1	1	6	6	0
4	1	1	0	0	1	1	1	1	1	1	1	1	5	5	0
5	1	1	0	0	1	1	1	1	1	1	1	1	5	5	0
6	1	1	0	0	1	1	1	1	1	1	1	1	5	5	0
7	1	1	0	0	1	1	1	1	1	1	1	1	5	5	0
8	1	1	0	0	1	1	0	1	1	1	1	1	4	5	1
9	0	1	0	0	1	1	0	1	0	1	1	1	2	5	3
10	0	1	0	0	1	1	0	0	0	1	0	1	1	4	3
11	0	1	0	0	1	1	0	0	0	1	0	1	1	4	3
12	0	1	0	0	0	1	0	0	0	0	0	0	0	2	2
13	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1
14	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1
15	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1
Total													45	60	

Table 8 Collected Data from Game

