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University of Bristol

Designing an
Intergenerational Third-Space
to Develop
Critical-Digital-Literacy

Dulce Karina Rodríguez Nieto

A dissertation submitted to the University of Bristol in accordance with the requirements for award of the degree of Doctor of Philosophy (Ph.D.) in the Faculty of Social Science and Law, School of Education, March 2021.

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Abstract

A qualitative research was conducted to develop an **intergenerational third-space (I-3S)** where seniors (65+ years-old) who live in the USA, and children (10-13 years-old) from economically-challenged areas in Mexico, worked together through videoconference systems. Their collaboration aim was to develop critical-digital-literacy. Thus, the emphasis was not on acquiring technical skills, but reflecting on the cultural, political, and economic links of digital media in the world. Moreover, that seniors and children experience technology as something they can use and produce to impact society. Regardless of their age or socio-cultural context. During the intervention, learners developed critical-digital-literacy through the production of digital texts: animated film (cycle 1), podcast (cycle 2) and a coding-based technological prototype (cycle 3); as the research was conducted in three cycles of design-based research methodology.

The theoretical framework to design, implement and understand the construction of the I-3S, was based on three key theories: critical-digital-literacy, third-space, and intergenerational practices. Results showed that I-3S is a fruitful environment for seniors and children to develop critical-digital-literacy. Seniors overcame their anxiety of using digital technology, in part, because being in contact with the children becomes meaningful, and each participant developed diverse elements of digital literacy, depending on their personal socio-cultural contexts and needs. Participants claimed having had a positive experience, feeling benefited from creating digital products that improved their own communities. Learners also broke pre-established stereotypes of the other generation, created a sense of community, and forged new friendships across generational and international boundaries.

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I will be always in debt with **the participants of this study**. I cannot thank them enough for all the learnings and amazing moments we shared. Spending time with the seniors let me understand that life is meaningful at all stages, despite the challenges we face. They made me realize that what most matters in life is not about what you did or what you learned, but about the kind of person you have become. De los niños y niñas aprendí, entre otras cosas, que es posible hacer la diferencia en este mundo sin importar la edad ni la cantidad de recursos que tenemos. Me hicieron ser consciente de lo brillantes que somos desde temprana edad. Les agradezco mucho su cariño, y el haberme compartido un pedacito de su vida.

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Authors' Declaration

I declare that the work in this dissertation was carried out in accordance with the requirements of the University's Regulations and Code of Practice for Research Degree Programmes and that it has not been submitted for any other academic award. Except where indicated by specific reference in the text, the work is the candidate's own work. Work done in collaboration with, or with the assistance of, others, is indicated as such. Any views expressed in the dissertation are those of the author.

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DATE: ...20 – March – 2021

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1. Introduction and Context

I grew up in a family where helping “those in need”, particularly in our community, was a natural behaviour. We do not see it as an act of charity, but rather as helping people regain their footing (just because that is the way it should be!) and continue their journeys on their own. While attending college, I learned that being a professional was not only about being a skilled engineer but also about using my skills to create a better world for everybody, as a way to build a more just society. Thus, if reflexivity is a deconstructive journey to identify the intersections between the author, the others, the text and the world (Macbeth, 2001), I must say that the call to conduct this study and how it was constructed was largely influenced by who I am as a person and my personal and professional experiences.

In this chapter, first I identify the digital exclusion of seniors and children as a problem that must be overcome (Section 1.1). Then, I describe the social context of the populations targeted in this study, whilst pointing out how these populations are also at risk of isolation (Section 1.2). From these two arguments, I propose a research strategy (Section 1.3), which sets the groundwork for the study I conducted and present in this dissertation.

1.1 First research rationale: Addressing digital exclusion

Technology has brought a new social structure: the network society (Castells, 2010b). It has changed the way people relate, work, consume, and produce, among many other things (Graham & Dutton, 2014). Moreover, the continuous digitalization of all areas in society generates mechanisms that can benefit people if they are capable of linking their level of digital skills and their ability to use information and communication technologies (ICTs) for their own social, economic, cultural and political benefit (Mariën & Prodnik, 2014). For instance, being

able to use technology as a platform to benefit their personal finances by creating new businesses, or by using social media to organise protest activities to demand changes in society (Carty, 2015).

Within this context, countries are making efforts to provide internet access to their citizens (Hilbert, 2016). For instance, in Mexico the government has implemented several initiatives to provide internet access to everyone (Mecinas Montiel, 2016). However, having access to internet and ICTs is not sufficient (Rogers, 2016; Selwyn & Facer, 2007). People also need the means to use ICTs to participate in society, access information, adapt it and create knowledge from it; in other words, to develop digital literacy (Buckingham, 2007). This is why notions of what it means to be digitally excluded have been extended from having/not-having access to the internet, to how people make use of technological resources to fully participate in society (Selwyn & Facer, 2007; Van Deursen & van Dijk, 2014; Abascal, Barbosa, Nicolle, & Zaphiris, 2016).

Digital exclusion now encompasses people's ability to access and use the internet, and the outcomes they achieve when using ICTs (Helsper, 2016; Abascal et al., 2016; Van Deursen & van Dijk, 2014). For instance, Helsper & Eynon, (2010) found that young people who are exposed to a greater use of ICTs in their households, tend to take more advantage of the internet (e.g., engaging in learning activities) than young or older people that are not immersed in a digital environment in their households. It has been suggested that this exposure directly impacts people's economic, social and cultural well-being (Helsper, 2018).

1.1.1 Who is being excluded?

Although digital exclusion may happen to different groups in society, it is frequently associated with groups that already experience other types of social exclusion, such as poverty,

gender and certain other groups (Van Deursen & Van Dijk, 2011). For instance, people in economically challenged areas (Selwyn & Facer, 2007), people with physical and cognitive disabilities (Abascal et al., 2016), people living in isolation (such as those who live in jail or monasteries), or older adults (McDonough, 2016). Thus, it is important to develop strategies to address digital exclusion around the world as a global issue (Mariën & Prodnik, 2014). In this research, I decided to work with two populations that are left at the margins: Older adults and children from economically challenged areas, as explained next.

1.1.2 Seniors' digital exclusion

Although more seniors over 60 years old are making use of ICTs, they are still left behind in terms of engagement in digital technology (Schreuers, Quan-haase, & Martin, 2017). The literature shows that many seniors do not use the internet because they do not have access, whilst others are not interested in it (Vroman, Arthanat, & Lysack, 2015; Schreuers et al., 2017). In the latter case, the main reason is that seniors believe themselves as having deficient knowledge in using technology (Friemel, 2016; Nimrod, 2017; Martin et al., 2016). However, internet adoption among seniors is also related to their level of education, culture, income and age (Friemel, 2016).

Seniors' digital exclusion has social implications. For example, the internet is increasingly being used for health care delivery and monitoring (McDonough, 2016). This is a challenge for seniors who do not engage with ICTs. In addition, it has been suggested that the use of ICTs and the internet contributes to senior's social engagement, creating/reinforcing social-networks, having an impact in their well-being, such as alleviating seniors' social isolation by connecting them to the outside world, gaining social support, engaging in activities of interests, and boosting self-confidence (Chen & Schulz, 2016). Therefore, the development of

digital literacies is key to tackle the fear some feel in relation to the use of technology (Hill, Betts, & Gardner, 2015).

1.1.3 Young people's digital exclusion

Young people may also experience digital exclusion caused by a limited ability to use ICTs. In contrast to the idea that young people are 'digitally savvy' and confident users of technology, studies show that among this population, uses of technology vary significantly (Eynon & Geniets, 2016; Facer & Furlong, 2010). For instance, among the groups of teenagers who make use of social networking platforms, it was found that those from lower-income families are more engaged in the relational and communicational affordances of social media sites, while teenagers from high income families use their knowledge on technology affordances to focus more on the capital-enhancing opportunities of social media platforms (Micheli, 2016).

Being young and having access to technology does not automatically ensure the development of digital literacy (Selwyn & Facer, 2007; Schradie, 2011). There is a need to increase equality of opportunity for young people to access ICTs and to develop operational and critical skills, gain confidence, engage in experimentation, and experience different ways in which technology can be used in own's favour (Eynon & Geniets, 2016). Therefore, it is important to create spaces for formal and informal learning in which young people experience the internet as an integral part of their lives, developing skills not only to consume digital material but also to produce online content to benefit from opportunities derived from these activities, such as moving forward in their education or getting involved in online cultural activities (Van Deursen & van Dijk, 2014).

In this context, finding a strategy to work towards the digital inclusion of communities at the margins¹ resonates with my interest in conducting this research. Working with young people from economically challenged communities was important for me because I experienced myself challenges accessing quality education. I earned an engineering degree thanks to many people who helped me accessing resources I did not have, like a scholarship for attending university. Therefore, I know that having access to resources is as important as having access to good quality education.

Another turning point for me was when I did not have money to rent a place to live in the city where I got a scholarship to attend graduate school. Thanks to the request for help of a colleague, a retirement home opened their doors for me to live with them for free whilst attending school. While living there, I taught one of the seniors in the home how to use an iPad to search for music in YouTube. For her, it opened the door to countless other new experiences. This event awakened my interest to work with seniors and technology, making seniors' digital exclusion particularly relevant for me. Another reason for choosing to work with seniors and children simultaneously is the potential positive experiences both generations could gain, particularly the potential reduction of isolation that both generations might face. Therefore, in the next section, whilst I describe the social context of the populations targeted in this research, I will point out why they might be at risk of isolation.

1.2 Second research rationale: seniors and children at risk of social isolation

The literature on intergenerational practices (IP) identifies many advantages of encounters where seniors (65+) and children work together, including reduction of isolation (see Section 3.4, Literature Review). Social isolation refers to having a limited or small numbers of

¹ By “communities at the margins” I mean people or social groups who experience societal inequalities due to their age, socioeconomic status, gender, disabilities, among others.

ties with others (Newall & Menec, 2019). Social isolation is sometimes used as synonym of loneliness, but they are not the same (J. Wang et al., 2017). Loneliness is subjective, it refers to the negative feeling of imbalance between the level of desired relationships and the actual relationships someone has (De Jong Gierveld & van Tilburg, 2016). Someone being socially isolated might not experience loneliness and vice versa; but both could be experienced by young and old people (De Jong Gierveld & van Tilburg, 2016). In the case of seniors, social isolation and/or loneliness is associated with poor health and well-being, resulting in depression and psychological distress (Taylor, Taylor, Nguyen, & Chatters, 2018). In the case of children, it might happen because family dynamics prevent parents from spending more time with them (Reyes Miranda, 2012; Velásquez Pineda, 2013).

1.2.1 Seniors' social context. Why are they at risk of social isolation?

Seniors are at risk of social isolation because they have lost a partner, or due to experiencing loss of friends and family (Khosravi, Rezvani, & Wiewiora, 2016). Moreover, mobility and health deterioration often results in seniors having reduced contact with their social network (Yeom, Fleury, & Keller, 2008). Although all are at risk, seniors who live in care or retirement homes are more vulnerable because geographic segregation makes their already-established social connections difficult to keep (Medvene et al., 2016). Seniors in assisted living facilities are surrounded by other seniors living there, as well as the people that work there, such as nurses. However, having social relationships within the facility does not ensure that loneliness will not develop (Simard & Volicer, 2020).

In this context, there is a push for finding strategies to prevent seniors from experiencing social isolation and/or loneliness. Thus, research has been conducted on the use of technology, tele-care, and other activities that could impact this challenge (Khosravi et al., 2016; Cotterell,

Bu, & Phillipson, 2018; Simard & Volicer, 2020). Research shows that interventions which include adaptability to seniors' needs, community development and productive engagement were the most successful (Gardiner, Geldenhuys, & Gardiner, 2018).

1.2.2 Children from economically-challenged areas in Tijuana's social context. Why are they at risk of social isolation?

I will focus on the potential risk of social isolation and/or loneliness that children from economically-challenged areas of Tijuana could experience, because this is the sociocultural background that participants of this research have.

Before continue reading, I suggest to view this video because it contextualises the reader with the geographical area where this study took place, the narrative and discussion I use throughout this study, and the experiences that children participants face in their daily life. This video was created by a teenager a few years older than the children that participated in this research (Drowzzzy, 2020). It is public in YouTube; I added closed captions in English, and uploaded it to a personal space for use in this thesis: [Click here to see Context Video.](#)

Tijuana is a city in Mexico located in the Northwest region bordering the United States of America. Its closeness with the USA and its historical development gives Tijuana different social characteristics than other cities in Mexico. For instance, Tijuana and San Diego, California are considered twin cities, which complement each other in terms of economy and services (Zabala de Cosío, 1997). Tijuana's economic development is higher than the Mexican national average (Martínez Cuero, 2019). Its economy is based in commerce and services; where multinational industries -called maquiladoras- and foreign investments, play a major role in the city's employment and urbanization (Lopez-Estrada, 2009). However, this unique connection with the USA also brings social challenges to the city because its location is crucial for the trafficking of

drugs and people, and other illegal activities (Orozco & Lorenzen, 2018). Thus, crime and violence are in constant tension within the society.

Despite these challenges, Tijuana is an attractive destination for national and international migrants because of its good economy and job opportunities. Thus, its population keeps growing very fast, mainly due to the high percentage of migrants who come looking for better opportunities (Reyes Miranda, 2012). These changes in population result in two characteristics. First, people are exposed to languages other than Spanish, the official language. Second, the city's infrastructure and families' resources/incomes are insufficient, so family members need to work more, as explained next.

Due to migration, people in Tijuana are exposed to a diversity of languages. Mexican native languages such as Maya, as well as other languages such as English (Toledo-Sarracino & Garcia-Landa, 2018). English is the most common because many migrants come from the USA. For instance, some people only speak English because they have lived in the USA for a long time, but were deported to Tijuana (Camacho Rojas & Vargas Valle, 2017). Being exposed to English and other languages does not mean that people in Tijuana speak other languages, but people are familiar to bilingual experiences, mainly English-Spanish. I point this out because in this research, many activities happened in a bilingual environment, as will be seen throughout this dissertation.

Rapid demographic growth in Tijuana also causes people to have difficulties finding affordable places to live. Thus, people with low income -like the children who participated in this research- live in social housing, houses designed specifically for people with low income. Usually these areas are infrastructure-deficient and far from main urban areas and public services (Zabala-Mora, 2009). These homes are typically small (around 27 square meters), single level or

in apartment buildings (Zabala-Mora, 2009). Housing developments are commonly arranged such that there is only one way to access an entire area (see pictures below), in response to high levels of crime typically present in these neighbourhoods (Enríquez, 2007; Lara Garcia, 2018). Although they have all essential services (e.g., electricity, water and sewer), these high-density areas lack important services such as public spaces where people could interact, such as parks, schools or libraries, making these services very limited or null (Enríquez, 2007).



Figure 1. Abandoned social housing in Tijuana. (Notimex, 2019)



Figure 2. Social housing areas in Tijuana (Periodico-Zeta, 2020)

The design of these living spaces gives residents a false sense of security, while, at the same time, isolating them from the rest of the city, promoting segregation and disarticulation of Tijuana's society (Lopez-Estrada, 2009). Also, having limited public spaces makes people perceive these spaces as insecure (Enríquez, 2007). Thus, they end up not using them at all, and these spaces are prone to vandalism or crime related activities (Juarez, 2018). This challenge,

alongside the fact that homes are tiny and extremely close to each other, promote violence, not only within families but also among neighbours, resulting in lack of social cohesion (Zabala-Mora, 2009).

Another consequence of limited access these areas is the reduced public services they receive (López Levi, 2008). For instance, rubbish collection is insufficient due to the large amount of people who live in the same area and difficulty in accessing them. Thus, it is common to find rubbish in streets and in the very few public spaces and green areas (Enríquez, 2007). These challenges, plus violence in the area, often causes families to move, resulting in homes being empty/abandoned in these areas, up to 20% in some areas (Álvarez De la Torre & Ayala Macías, 2018; Lara Garcia, 2018). Empty homes, like public spaces, are often vandalised or taken over by homeless people, drug-addicts, dealers or gangs (Juarez, 2018). This complicates and reduces the daily social coexistence in the neighbourhood, impacting peoples' sense of belonging (Enríquez, 2007).

Besides the social isolation and segregation that people in these neighbourhoods face, it is common that children in these communities spend most of the day alone inside their homes. In Tijuana, 45% of female population participate in the labour force (Lopez-Estrada, 2007), particularly in industry, three times, the national average (Zabala de Cosío, 1997). Alongside, in 1980 family incomes started to decrease in such a way that men could not be the only providers. Women and older siblings (15-18 years old) need to work as well to increase their income (Piñeiro, Valle, Roble, & Chávez, 2017). This resulted in having to leave children in the care of grandparents, older siblings (less than 15 years old) or a trusted woman-neighbour, mainly because they cannot afford day-care (Lopez-Estrada, 2007). However, this strategy is difficult

when family members live far for other areas of the city, and for migrant families, because they usually lack this social network (Lopez-Estrada, 2007).

In this context, many children are left by themselves inside their tiny homes, restricted from going out because of perceived violence in the neighbourhood. Despite parents trying to organise their working-life to take care of their children, the rigor of long working-hours and commute makes this difficult. Moreover, it makes quality time with children very limited. Thus, children sometimes tend to feel abandoned and might have communication challenges with their parents (Lopez-Estrada, 2012a).

It can be said then that children from these economically challenged areas of Tijuana are likely to experience isolation and social segregation, like seniors, despite the radical differences in age. Moreover, these two groups also experience digital divide. Therefore, I explored a strategy that could potentially address these challenges among these two populations.

1.3 Research strategy

I believe in the importance of advancing knowledge whilst having an impact in society. Thus, my interest extends to working with vulnerable groups, particularly older adults and children who live in economically challenged areas (ECAs), in the city where I grew up. Thus, my proposal was to develop an intergenerational learning environment in which seniors from the USA and Mexican children from ECAs work together to develop critical-digital-literacy. To bridge the geographic separation between them, communication between them took place using videoconference systems. From now on, I will refer to this learning environment as

intergenerational third-space (I-3S)

By critical-digital-literacy, I imply that seniors and children develop the means to critically evaluate and use information from digital media or contemporary technology, to

transform it into knowledge, and to participate in the digital world. These means are not only technical skills, but also understanding the cultural and political consequences of digital media and contemporary technology (Buckingham, 2003). This definition will be discussed later in the Literature Review chapter (see Section 3.2, Literature Review).

I decided to design an online interaction because, first, seniors are more likely to have restrictions in going out from their households due to their physical conditions (Hooyman & Kiyak, 2011) and/or because of transportation challenges. For instance, many seniors can or choose to no longer drive (Yeom et al., 2008; Choi & Dinitto, 2016; Starbird, DiMaina, Sun, & Han, 2019). Thus, a videoconference system breaks their mobility barriers. Second, because a virtual interaction provokes seniors and young to have the need to use technology to connect with each other. Third, bringing seniors and children together into a common learning environment is important because, besides the learnings gained due to their development of digital literacy, there are several benefits that participants could get from the intergenerational interaction, such as friendship (see section 3.4, Literature Review).

1.3.1 The intervention to conduct this research

In this section I will briefly introduce the intervention that was used to conduct this research. However, all the details of each part of the interventions and how it was designed, will be explained throughout the following chapters of this document.

To design an I-3S, I carried out three Cycles of design-based research (DBR). The aim was to refine the learning environment in such way that the design was close to the desired goal in each cycle. Although the intervention changed every cycle, the general design was the following:

I organised a two-week summer camp, called **DigiCamp**. It took place in a physical space that I set up in an economically challenged area of Tijuana, Mexico, where the children (10-13 years old) live. During the intervention, children commuted from their homes to our working space. The senior participants (65+ years old), who live in California, USA, connected to DigiCamp through a videoconference system, making this is a hybrid learning environment.

Once seniors and children were together, I gave them the task of creating a digital-text: an animated film (Cycle 1), a Podcast (Cycle 2) and a coding-based technological prototype (Cycle 3). Within the task's frame, seniors and children performed a diverse range of activities (designed by me) that supported them to collaborate with each other, but also to develop critical-digital-literacy while creating products. Additionally, children experienced recreational activities where they just played (e.g., outings). These activities were not related to developing critical-digital-literacy but helped them create a cohesive community. Similarly, children had meals before and after every working session, an integral part of the intervention due to the children's limited access to food at home. Besides the two weeks of DigiCamp, I spent one week before this intervention conducting in-person workshops with the seniors, and setting up the DigiCamp working space. Also, it took one week after DigiCamp to conduct participants' interviews. Thus, the overall length of the implementation of the intervention was 4 weeks for each cycle.

As said before, each cycle was different from the previous one, not only due to the nature of DBR, but also because every cycle had different contextual characteristics that needed a response from the intervention. Details can be found in the chapters of each cycle.

1.3.2 Research questions

The aim of this research is to create a learning environment, specifically, to design and implement an intergenerational third-space (I-3S) where seniors and children could develop critical-digital-literacy.

The research questions of this study are:

1. What are the processes and practices needed to design and implement an intergenerational third-space where seniors and children collaborate online to develop critical-digital-literacy?
2. How do children (10-13 years old) from the Mexican context and seniors (65+) who live in the USA respond to such learning environment?
 - a. What emerges within the intergenerational third-space (I-3S)?

1.4 Conclusion

This chapter outlines the importance of developing learning spaces where seniors and children could work together to develop critical-digital-literacies. This statement is grounded in how seniors (65+), and those children who live in economically challenged areas, are populations experiencing digital exclusion. Therefore, this research aimed to design and implement an I-3S, using design-based research as methodology.

2. Methodology

2.1 Introduction

This chapter explains design-based research as methodology and how it was applied when conducting this research (Sections 2.2 to 2.4). Then, Section 2.5 and 2.6 contextualize the research, including how I got access to participants and who they are, and highlighting their background and sociocultural context. In Section 2.7, I detail how the physical space of this I-3S was constructed. Learning who the participants are, and the physical context in which this research took place, became key aspects for understanding the work participants did, and what they learned throughout the process.

Section 2.8 explains how digital diaries, semi-structured interviews, and video recording were implemented for collecting data when the intervention was running/ at different times during the research. Later, Section 2.9 describes how the collected data was analysed through an abductive method. To complement the data analysis, and being transparent to the reader, Section 2.10 talks about ethical aspects that impacted the data analysis and how this research was conducted.

2.2 Design-Based Research

Design-based research (DBR) is a methodology applied in education, characterized by having the potential to bridge the gap between educational theory and its practice (Bakker & Van-Eerde, 2013). DBR is referred to by different terms: design experiments, design research, development research, and formative research, among others (Van den Akker, Gravemeijer, McKenney, & Nieveen, 2006).

All these terms used for DBR interpret education as a design science (Van den Akker, Branch, Gustafson, Nieveen, & Plomp, 1999), that is, whilst natural sciences focus on descriptive knowledge (finding what is it), design science focuses on solutions for different problems in education (finding what it ought to be) (Collins, Joseph, & Bielaczyc, 2004). Furthermore, the term design-based research emphasises that the research is based on a design process (Design-based Research Collective, 2003).

DBR is a methodology well-suited for studying problems where a) how to start approaching the problem is unclear, b) the level of balance between results and aims of the research is unknown c) the means to move from initial approach to the problem to the final results are unclear (Kelly, 2007). The overall aim of DBR is not only to develop theories about a specific learning context, but also to develop the theory that underlies the means that were designed to support the learning (Bakker & Van-Eerde, 2013). DBR strives towards two main goals: The development of an intervention, and the scientific theory regarding how such intervention/product can be used in education (McKenney & Reeves, 2013).

The aim resonates with the needs and characteristics of this study, since there is no evidence of prior research on how to design and implement an intergenerational third-space, as the main aim in this study. Thus, the intervention of this research should be designed, implemented, and put it into practice “from scratch”, highlighting why this methodological approach becomes advantageous.

2.3 DBR iterative cycles

The steps followed to perform a DBR vary according to the study that needs to be conducted (Van den Akker et al., 2006). However, this methodology starts by identifying and analysing a problem in the educational field, as well as the intended goal to solve the problem

(Holmes, 2013). This information is used to design an intervention to reach the goal. The intervention is then placed in practice, in a natural setting, to test how it works. The initial design is revised repeatedly in cycles of design, execution and evaluation & revision, known as DBR iterative cycles (Easterday, Rees Lewis, & Gerber, 2014). The focus of every cycle is understanding and improving the intervention (Design-based Research Collective, 2003). Thus, the DBR iterative cycles are repeated in this phase until a balance between the results and the intended aims is found (Collins et al., 2004).

The process of iterative cycles of design refinement is a key characteristic of DBR, and interventions developed through DBR are valued by their innovativeness and usefulness, not only on the rigor of the research process (Bakker & Van-Eerde, 2013). However, it is required to go beyond understanding the happenings of the researched context, by also generating evidence-based claims about learning that address theoretical issues that advance the field of study (Barab & Squire, 2004).

Each cycle is organised in phases of design, execution, and evaluation and revision (Van den Akker et al., 2006), which are described as follows:

Design: This phase involves an investigation of the problems and the context in which an improvement is needed, including the search for strong connections between the problem and state-of-the-art knowledge in literature, as well as the opinions of practitioners and/or stakeholders (Van den Akker, 1999). This derives in the construction of a theoretical framework for the study that will be used to design the intervention (Plomp, 2013). The instructional starting points of the intervention should be documented in a detailed way that delineates a learning trajectory (Reimann, 2011). This

means to theoretically establish how students will move forward in their learning, and how can this be tested or identified.

Execution: In this phase the intervention is placed into practice and tested against predetermined criteria (Middleton, Gorard, Taylor, & Brenda, 2008). Data is collected through several methods, which are selected according to the type of data to be collected (Van den Akker, 1999). The theoretical framework is used to analyse and to interpret the collected data (Reimann, 2011), trying to identify how theoretical claims respond to contextual aspects (Middleton et al., 2008). The aim is to generate knowledge that can be used in the next phase to improve and refine the intervention (Plomp, 2013).

Evaluation and revision: A systematic reflection and documentation of the knowledge generated in the prior phase, such as a retrospective analysis, is conducted (Van den Akker, 1999). This leads to the re-design of the intervention and its theoretical links to the conceptual framework (Nieveen, McKenney, & van den Akker, 2006).

When the re-design of the intervention takes place, a new design-based iterative cycle starts and all phases in the cycle are followed. The objective is that each cycle contributes to a better understanding of how the intervention works (Pool & Laubscher, 2016). This cyclic iteration takes place multiple times until the researcher finds a balance between what was established as the main ideal or research goal, and what was reached during the iterations (Plomp, 2013). It is important to note that the number of iterative cycles is not defined in the methodology because it depends on the research aims. Therefore, many studies are conducted over the long term involving several iterations (The Design-Based research collective, 2003). However, this does not preclude the possibility to conduct a research in a shorter period of time (Pool & Laubscher, 2016).

Additionally, it is important to highlight that it is possible that during the execution phase, the activities or resources generated through the designed phase do not work during the implementation. In this case, they have to be modified in situ, without waiting until the end of the cycle (Bakker & Van-Eerde, 2013). Also, due to the iterative nature, during the evaluation and revision phase it might happen that new theories or new understandings of the theory emerges (Reimann, 2011).

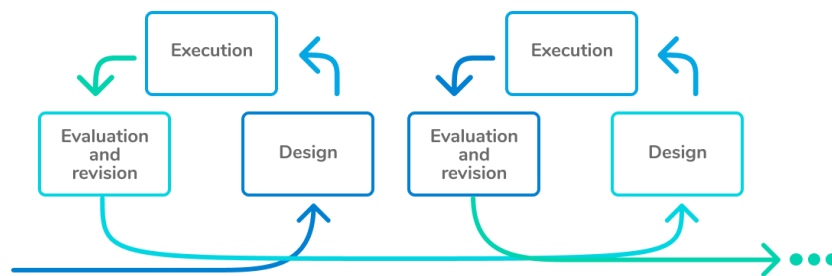


Figure 3. Design-based research iterative cycles

2.4 How DBR is applied to this study

To use a DBR methodology in this study I implemented three cycles, once cycle per year. The time frame of each phase varied in each cycle, however, the execution phase lasted one month in all cycles. The first step to apply DBR in this study was done through literature review and, from there, all the three cycles started to unfold. This is schematized in the next diagram, followed by a brief explanation of each cycle and their phases.

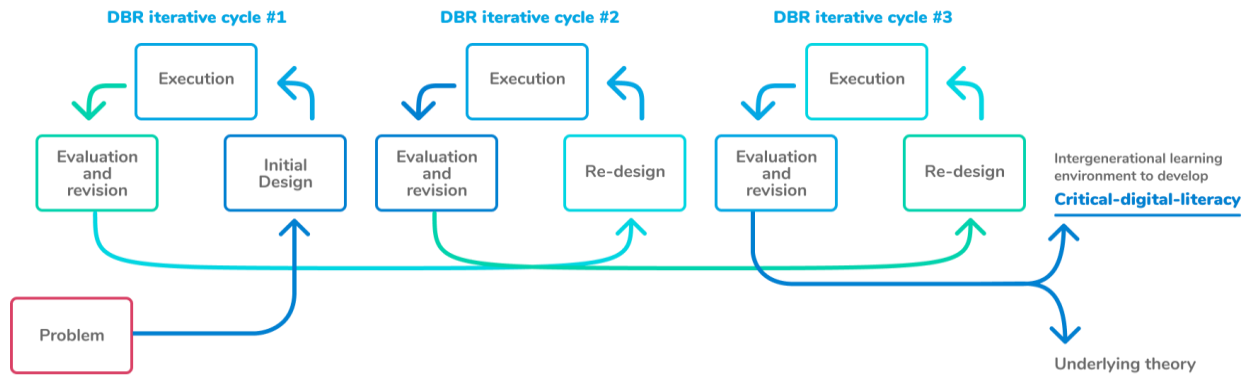


Figure 4. Design-based research cycles to develop an I-3S

Problem: The rationale of this research is the digital exclusion of children from economically challenged areas and seniors (see Section 1.1). The potential solution is developing an I-3S where these populations could work together to develop critical-digital-literacy. From here, literature review was used to identify links between the context of the learning environment, and state-of-the-art research that could frame theoretical concepts to build the initial design of Cycle 1.

DBR iterative Cycle 1: This cycle is fully presented in Chapter 4. However, I will now expose highlights of each phase in Cycle 1.

Initial design: From the literature review, I identified initial concepts to construct an I-3S from literature on intergenerational practices, critical-digital-literacy and third-space. Drawing from here I created the first design of the intervention. This design is based on theory derived from literature, as well as my experience as a digital literacy teacher and prior work on intergenerational practices.

Execution: The intervention was applied in a natural context, with seniors living in the USA and children living in economically challenged areas in Mexico. During the execution phase I collected qualitative data using diverse methods.

Evaluation and revision: I evaluated the experience of the intervention analysing the data collected with the theory that informed the design. The findings gathered in this phase underlie the re-design of the next intervention, in the next cycle.

The DBR iterative Cycles 2 and 3 followed the same stages as Cycle 1, with the findings from Cycle 1 used to re-design the intervention of Cycle 2; and the findings from Cycle 2 used to re-design cycle 3. At the end of the three cycles, the product was an I-3S that can be implemented, plus the theory behind the means that supported their learning. These cycles are described in Chapters 5 and 6, respectively.

2.5 Participants

The participants of this research were children between 10 – 13 years from economically challenged areas in Tijuana, Mexico and seniors of 65+ years old who live in California, USA. As frequently happens in DBR, participants in this research are considered collaborators (Barab & Squire, 2004). This is not a participatory research, but I view seniors and children as collaborators because their insights and opinions are as crucial as the data I collect from their interaction; particularly in the design and evaluation phases (Zheng, 2016). The reason for working with children from this age cohort was that research shows that children in this group have openness and positive responses when collaborating with seniors (Hanmore-Cawley & Scharf, 2018; Sánchez, Sáez, Díaz, & Campillo, 2018; Senior & Green, 2017). Moreover, I had already access to children in this age group through a gatekeeper in Mexico (see Section 2.5.1).

Similarly, I consider persons 65 years old or more to be senior participants because most of the research in intergenerational studies is done with people from this age.

I recruited participants based on their availability. The number of participants was chosen based on my capability to handle the intervention and the data that would emerge from it. However, the number of participants changed in every cycle due to the characteristics and needs of each intervention (see table in Section 2.6). Also, not all participants took part in all cycles of the intervention. This did not have an impact on the research because in DBR it is not necessary that the same participants collaborate during all research stages, as long as the naturalistic setting where the generated theory is implemented remains. This makes the theory generated from DBR flexible and adaptive to other contexts (Dede, 2005).

2.5.1 Getting access to participants

Regarding the senior participants, I worked with Heather, Litzy, Amalia and Dorothy, four seniors I contacted through a retirement home in San Francisco, USA. I worked with them because I already knew these seniors from when I lived in this facility for two summers. Moreover, these seniors witnessed an online intergenerational practice that I conducted there for my master's dissertation. Therefore, some of them were keen to collaborate with me in this new project. This means that, before conducting this research, I already had a relationship of rapport and trust with these seniors. On the other hand, seniors Edna and Jacob, who participated in Cycles 2 and 3 live in their homes in San Diego, California. I met them through a colleague, inviting them to participate in this project when it was necessary to include seniors who were Spanish speakers (see Chapter 5). Although I did not have a prior relationship with these seniors, they both were keen to collaborate.

Getting access to the children was different. When conducting qualitative research, getting access to the researched community is always a challenge (Matthiesen, 2018). Moreover, accessing vulnerable populations is extremely difficult, time consuming, and resource intensive (Emmel, Hughes, Greenhalgh, & Sales, 2007). It is suggested that researchers gain access through persons that are already inside the community, persons with strong links to the community that allow the researcher to understand the dynamics of the researched group, as well as their diverse needs (Sixsmith, Boneham, & Goldring, 2003). Researchers are more likely to gain access to these populations through persons that have spent long time addressing the needs of vulnerable people, since they already built a reciprocal relationship that derived on trust (Emmel et al., 2007).

Within this frame, I decided to gain access to children through a person that has been in the community for a long time and has already gained the trust of the community. This is my older sister, who from now on I will refer to as Carmen. She lives in an economically challenged area in Tijuana, Mexico. She is a retired nurse and has been living there for over 25 years, at the time in which this research was conducted. In this neighbourhood, Carmen is seen as someone whose family has good economic means and as a person with strong sense of empathy and altruism, thus people in the neighbourhood see her as someone who could help them in case of need. For instance, it is common that when someone gets sick in the neighbourhood, they visit Carmen for health advice or to get medicine. Similarly, it is common to find children from the neighbourhood having meals or watching a movie in Carmen's home. Most of the time this happens not because these children do not have a home, but because in their homes, access to food can be limited or they might not have television at all.

Every year Carmen loves to organise a ‘posada’, a traditional gathering in Mexico to celebrate Christmas, for around 40 children from the neighbourhood. She prepares Christmas food for all the kids and buys them piñatas and candy. She also asks our family members and her friends to donate gifts, allowing every child to receive a Christmas gift. The reason behind describing some of the activities that Carmen does in this community is because I will make use of these examples in the next chapters of this dissertation, to highlight aspects that were key in the development of this I-3S. However, now I will use them to illustrate how people in this community already see Carmen as someone who they can trust. Children already experience Carmen’s home as a safe space, and children’s parents already know that this home is a safe environment for their children. Parents already identify her as a person who genuinely cares for their children.

The strong trust connection that this community has with my sister was quickly extended to me. As Emmel et al., (2007) explain, when gatekeepers have a strong relationship of trust with economically challenged communities, this trust is, to some extent, transferred to the relationship researcher-participant. Although I am not a total stranger for the community, since they have seen me with Carmen many times throughout the years, it was the trust they have in her that allowed me work within this community. Therefore, when I asked some children and their parents to participate in the project, they did not have reservations to take part in this study. Here, I also acknowledge that Carmen played a key role, not only giving me access to the children’s community, but also throughout the cycles. Therefore, it is important to highlight that the support I got from Carmen, as a gatekeeper, might have been different or less strong if we were not relatives.

2.6 Introducing the participants

Here I will briefly introduce the seniors and children who participated, their sociocultural context and their relationship with technology. It is important to present this information because the design and refinement of the I-3S are closely related to who the participants are, as will be explained in the cycles' chapters. Therefore, my aim in this section is to set up the groundwork from which each cycle draws to ensure the reader has a feel for the people taking part.

The following table shows who participated in each cycle, and their age. As it can be seen, some participants remained through more than one cycle. The reasons will be explained in the cycles' chapters.

Figure 5. List of participants per cycle

	Cycle 1	Cycle 2	Cycle 3
Seniors (age)	Heather (76), Litzy (87), Amalia (72)	Heather (77), Litzy (88), Edna (65), Jacob (75)	Heather (78), Edna (66), Jacob (76), Dorothy (73)
Children (age)	Tommy (11), Nora (11), Brenda (10), Oscar (10), Ron (8), Marion (9), Ava (9)	Oscar (11), Liam (11), Marion (10), Ava (10), Janis (10), Isa (11)	Nora, Brenda (12), Oscar (12), Ron (10), Liam (12), Marion (11), Ava (11), Isa (12), Janis (11)
Total participants	10	9	13

2.6.1 Seniors

The seniors who participated in **Cycle 1** were three female seniors who live in San Francisco, United States of America: **Heather**, **Litzy** and **Amalia**. All three speak English only. They are all nuns and belong to a religious congregation that has schools where they taught for many years, as education and care for the vulnerable and powerless is a key aspect of their religious congregation (Sisters of the Presentation, 2004).

Heather and Litzy have been living in a retirement home for 13 and 15 years, respectively. While living in the home, their contact with people from the ‘outside’ or relatives is limited. Also, as commonly happens to seniors, they face mobility limitations due to factors such as physical challenges or the lack of availability of services in their communities (Yeom et al., 2008). For instance, Litzy explains in her interview that she does not go out by herself anymore because sometimes her legs ‘do not respond’ and she is afraid of falling.

Litzy used to work as an English and music teacher. However, ‘*music was always in the forefront of her teaching*’ (Sisters of the Presentation, 2004). She got interested in using an iPad two years before, when I gave her a 2-years-old iPad (donated to me) as a gift, and I taught her the basics of using it. Since then, she mainly uses it to listen to operas and other music in YouTube. Likewise, she sends and receives emails to keep in contact with friends; sometimes she searches for prayers using Google Chrome; and sometimes she takes pictures during special events. Although she knows how to use the computer to get emails, she uses the iPad instead because ‘in the computer you wait so long’, as she expressed in an interview.

Heather is an artist. She loves painting, drawing, and teaching art. She taught art in a high school for several years, as well as in some programs at a parish. Now, she leads the art program at the retirement home. Heather would rather not use technology much. Nevertheless, she knows how to use computers to send/receive emails. Heather and Litzy do not use any other digital technology, they do not have a cell phone or any other device besides the shared personal computers available at the retirement home where they live, and the iPad I gave to Litzy.

Amalia used to be a teacher in a high school. However, due to her high professional credentials -master’s degree in Education and leadership- she also has had administrative roles in different educational boards and institutions, such as being a principal at a primary school, as

well as in a high school for several years. Amalia describes herself as a *'night owl who loves to read after returning home from night teaching'* (Sisters of the Presentation, 2004). Her use of digital technology is different than that of the other seniors. She owns a smartphone, a laptop and an iPad; and she uses them all, depending on her needs. Amalia is keen on using software or hardware that is new to her, since she enjoys using technology and learning new things.

In Cycle 2, two seniors joined the project: Edna and Jacob. **Edna** is Mexican and has been living in the US for about 34 years, which helped her to be fluent in English and Spanish. She lives in her own home with her husband. She recently retired from her work as a Spanish teacher in a high school in the US.

Edna believes that she does not have a very good relationship with technology. She explained that she fully understands the great importance of getting involved with the new technology and social media, because she could learn a lot. However, she finds herself disengaged from technology because she is afraid of breaking the devices, and because her husband does most tech-related tasks.

Jacob is from Spain and has been living in the US for over 45 years. He is bilingual (Spanish-English) and holds a Ph.D. in Gerontology. This allowed him to work on community programs for old people for a US county, from which he is now retired. However, he still teaches some gerontology courses to masters' students at a local university. Jacob said that due to his job as a teacher, he knows how to use a word processor, and frequently creates PowerPoint presentations in which he knows how to add sounds, graphics, animations and his own voice recordings to each slide. He feels very confident in using technology, and very resourceful in how he takes advantage of his skills to use technology to reach the desired outcome:

'I mainly use the computer... maybe because it is bigger, because I can type, this is too small (the phone) and because I am used to it...(I do) mostly email, I

use Word a lot. I am very familiar with Word and with PowerPoint. I do a lot of slides, a lot of presentations, mainly PowerPoint.

Nevertheless, he realizes that it takes him a long time to learn something new in technology. For instance, he has an iPhone that he uses to do basics, like email and searching online but he knows that he could do way more things with it like reading the news or listening to a Podcast. However, he is not interested in these functionalities, not because he believes that he will not be able to learn them, but because he is just not interested. Investing time in learning a new technology is not a priority for him when there are many other things he could do, such as spending time with his family:

... it gets to a point that I say, if I am going to spend some time, which for me takes longer than for my son, to learn how to use those applications, because I haven't been born into it. My son says 'it is so intuitive', you just do it, it is so natural. But no, for me it is not like this. No, no. You youngsters have to accept it. It is not like this. I have to memorise it and say 'well, I have to press here and then this and it is not the opposite'. That's why I am saying, the time that I'll spend learning this I want to spend it in something, in my view, more productive, which is putting more substance into my life... So yes, I'd love to know other tools and so on but I am a little lazy and it is ok to be lazy.

In cycle 3, senior **Dorothy** also participated in this project. She is a 73 years old retired primary teacher and school principal. Dorothy specialises on Montessori method (Montessori, 2004) and worked in schools where the inclusion of technology was prioritised.

"We always had the best of the best. We always took care that children had access to the latest technology. In fact, we were one of the first schools in the area who had computers. Therefore, I have no doubt that if I were in school now, we would definitely be teaching coding and working with 3D printers".

2.6.2 Children

All children participants attend school. Some of them live with their parents, whereas others live with extended family members who take care of them, such as grandparents or aunts. This is common in ECAs in Tijuana, where children grow up in environments where the parent figure is replaced or shared by other adults (Lopez-Estrada, 2012b). All the children live in the same neighbourhood and know each other. Not all of them are close friends, but many times they play together in the street along with other young people from their neighbourhood.

Marion, Tommy, Oscar, Ron and Liam said that they do have a desktop computer at home, but only Marion has Wi-Fi internet service at home. Also, Marion is the only child that claims to have computer classes at school. Oscar, Liam and Tommy like videogames, so they use their own cell phones mainly to play online or to search for things when they have mobile data service, which is a limited amount of time because children don't always have money to pay for data. Ron does not have his own phone, but sometimes uses Oscar's phone. Not having internet at home means that children can only use data in their cell phones when they have money to buy a prepaid data plan.

Ava, Brenda and Nora are in a similar situation. They all attend the same school, have their own cell phone, and use it to play games and search for videos in YouTube. They only have internet whenever they have money to buy mobile data; none of them has a computer nor internet at home. Ava said that there is a computer room at her school, but it is closed most of the time, so children cannot access it. When she needs to do some school homework on the internet, she visits a relative.

As can be seen from all children's descriptions, the children in this project have very limited access to technological devices and therefore limited practices with technology. There is

clearly a digital divide between these children and other children with the same age who live in different sociocultural contexts (Mecinas Montiel, 2016).

In **Cycle 2**, **Isa** and **Janis**, who are Spanish-English speakers, were invited to participate. They are sisters and live in an economically challenged area that is 15 minutes away from the area where the children and I work. Their family has strong religious beliefs. They attend a religious primary school and go to church and other events that are organized by the same religious community. When they are not in any of these places, they stay at home with their other 3 younger siblings and their parents, since their budget is very limited, and it is challenging for the parents to take care of 5 little children in public spaces, thus they do not go out often.

Isa and Janis do not have internet service at home, but their father has a computer due to his teaching job. Both parents and Isa, have a cell phone. At the children's school, there is a computer room, but they are not allowed to use it, as Isa explains *'only when you get to 7 grade or when you're in high school you can use like a kind of TV where teachers talk to you...No, in schools we don't use technology at all'*.

Janis does not have a cell phone, but she uses either Isa's or her mom's phone to play games. She said that she has never used a computer, tablet, or has searched online. The family uses the computer together to play movies or videos, as expressed by Isa *'my dad buys internet and we watch videos... yeah like songs... I memorize them. I watch videos about the bible. Bible stories and that's it'*. Isa said that she does not play on the computer because she does not know how to look for the games on the internet.

Isa's phone is an old generation smartphone with limited functionality. She uses her cell phone for simple tasks, as she expressed *'sometimes I use it to read my bible because I have it*

in there and to look at the bible verses, and I play games, and sometimes I text my mom and my mom texts me'.

As it can be seen, Isa and Janis's experiences with digital technology are very similar to those of the Spanish speaker children, limited to manipulating an old generation smartphone to watch YouTube videos and gaming. Also, none of the children have access to digital literacy programmes at their school. Moreover, all the children have very limited access to internet, because it depends on the family budget and because their internet service is mobile data, not wired, thus the internet speed is slow and expensive, limiting the internet resources they have access to.

As it can be seen from their sociocultural context, all the seniors have access to technology and broadband at home. However, the children have limited access to digital technology devices and broadband internet service. Therefore, the I-3S needed to have a physical space where all the children participants could work.

2.7 The physical space of the intergenerational third-space

The physical space had to be in the same neighbourhood where all the children lived to make it easy for them to commute. Therefore, Carmen let me use a vacant two-floor apartment that she uses as storage space. It is next to Carmen's home, so for the children and their parents, the place was seen as an extension of Carmen's home, and was perceived as a familiar and a safe space for the children. Thus, the small apartment became our working space.

Our space did not have electricity nor furniture. I used extension cables from Carmen's home to provide electricity, and I equipped the space with tables and chairs where children could work, as well as bookshelves for didactic material, such as Legos, paper sheets, crayons, markers, etc. All furniture was second-hand, borrowed or donated by some neighbours in the

area who wanted to support this project. The internet service was also taken from Carmen’s house, since the wireless signal was strong enough to reach our working space.

We used this physical space all the three cycles, but the internet and furniture inside the space changed throughout the cycles; as explained in the next chapters.

2.8 Data collection methods

Design-based research makes use of multiple data collection methods used in quantitative and qualitative research (F. Wang & Hannafin, 2005), since data collection methods are selected due to their suitability to answer the research questions (Herrington, McKenney, Reeves, & Oliver, 2007). Therefore, the methods I used include: digital diaries, semi-structured interviews and video methods (video-recorded data and 360-degree time-lapse video). I will go on to explain why these methods were appropriate for my study.

Figure 6. Data collected throughout the DBR cycles of this research

Cycle	Method	Data	What did the data help me to understand?
1	360-degree time-lapse videos	3 videos	I used the videos to write fieldnotes
1	Diaries	64 Diaries	To understand learners’ daily experience within the intervention
1	Final interviews	10 interviews	to get the final thoughts of the overall experience
2	360-degree time-lapse videos	8 videos	To get sense of how children interacted in the physical space
2	Video recordings	11 videos (40 minutes average)	What happened during the intergenerational interaction
2	Diaries	70 diaries	To understand learners’ daily experience within the intervention
2	Initial and final interviews	17 interviews	Initial interviews to know about learners’ digital cultures. Final

			interviews to get the final thoughts of the overall experience
3	360-degree time-lapse videos	8 videos	To get sense of how children helped each other to build their digital-text
3	Video recordings	13 videos (30 minutes average)	What happened during the intergenerational interaction
3	Diaries	43 diaries	To understand learners' daily experience within the intervention
3	Initial and Final interviews	12 interviews	Initial interview just with the new participant. Final interviews to get the final thoughts of the overall experience

2.8.1 Digital diaries

Digital diaries are used in research similarly to written diaries, with the advantage that they have other resources available to “write” the information, such as the use of spoken language recorders, photographs or video recorders (Jacelon & Imperio, 2005). This characteristic is important because it allows participants to experience diverse ways to use technology as a communication tool, which is relevant in this research because it is related to digital literacy. Therefore digital diaries were chosen for this research, changing the modality in every cycle according to participants’ needs.

In Cycle 1, I guided the diary writing by asking seniors and children to answer three questions after each work sessions: What did you do today? What did you learn? What did you like the most today and why? I used them to understand how participants feel about the learning experience, as well as whether they felt that any learning emerged. However, there were some constraints.

First, children had difficulties giving elaborate responses to the questions. Also, they would rather write the diary in paper because they wanted to use colours and decorations.

Consequently, their diary was not digital. On the other hand, seniors wrote their diaries with deep reflections. Some seniors digitalized their diary by taking a picture of their thoughts written in a piece of paper. In light of this experience, I made some changes regarding to the diary use.

In Cycles 2 and 3, all children wrote their diary in Google Drive. Also, I provided them a set of detailed questions to guide their reflections (see Appendix A). Additionally, I read each child's diary as soon as they wrote it. This way I could ask them for more details when their answers were vague. However, one child, Janis, did not use Google Drive because she had a lot of difficulties to manipulate the software. Thus, she recorded the diary using a voice-recorder app. This modality let Janis express her reflections without feeling constrained by the software. In these cycles, all seniors sent their diaries through email.

2.8.2 Semi-structured interviews

This type of interview is a set of predefined open-ended questions, as well as questions that may emerge from the conversation between interviewer and interviewee (DiCicco-Bloom & Crabtree, 2006). I interviewed participants individually, either face-to-face or using videoconferencing (FaceTime). For instance, some final interviews with the seniors happened through videoconference because I was not at the same location as them.

Open-ended questions focused on getting a deeper understanding of participants experience with intergenerational interaction, as well as their reflections on what they believe they learned. Additionally, I used the interviews to listen to participants' suggestions about what could be improved in the next cycle.

I chose semi-structured interviews from other interview types because in this research there is no hypothesis or specific data to be collected. The objective is to explore participants' perspectives. Therefore, I needed the opportunity to follow up the interview according to

participants' answers. I interviewed seniors and children at the end of every cycle to obtain final reflections about the experience. I also conducted an initial interview at the beginning of Cycle 2 to get information about participants' prior experience with technology.

Having an initial interview with participants was a need that emerged after the experience of Cycle 1 (see Section 5.2). Therefore, it was conducted only at the beginning of Cycle 2; and with the new participant of Cycle 3 (senior Dorothy).

2.8.3 Video methods (video-recorded data and 360-degree time-lapse video)

In this research, I used two different video methods to collect data: Video-recording and 360-degree time-lapse video. I used two different techniques because I found that the original video-recording technique did not respond to the needs of the learning environment, and due to the nature of the data intended to be collected.

2.8.3.1 Video-recording

Video-recording data is a widely used method to collect data used in social research, mainly in areas such as education, anthropology and psychology (Jewitt, 2012) due to its powerfulness in collecting, representing and archiving practices that happen in natural settings (Derry et al., 2010). Its main strength is that it provides a multimodal and sequential record of an event, with expressions, body postures and gestures in a particular time and space (Jewitt, 2012). This characteristic makes video suitable to research moment-to-moment practices of learning (Vossoughi & Escudé, 2016), particularly due to the possibility to slow down and repeat observations in order to gain deeper reflection on what is perceived and its meaning (Prosser, 2007; Derry et al., 2010). Using video-recording I captured the full interaction between seniors and children. Since I could not take notes nor observing the interaction because I had to be

working with the participants, video allowed me to record the intergenerational interaction for later analysis.

2.8.3.2 360-degree time-lapse video

I could not use video recording to collect data regarding how the children were responding to the physical space in which they were interacting because the children were moving around the physical space, interacting with the other children, the technological devices, and me. Therefore, a video recorder could not capture all these interactions, and a full video-recording of all these interactions during each working session (4 hr/day) would have resulted in a large amount of video to analyse.

To overcome this challenge, I made use of a 360-degree camera in time-lapse mode to take photographs of the children's interaction in the physical space. Then, I used an open-source application to merge these photographs into a short video that resembled the interaction in the learning space. To my knowledge, this technique has not been used in research. However, I used it because I am familiar with the affordances of 360-degree cameras, as well as how these images can be manipulated. Therefore, I made use of my knowledge to improvise a visual method that responded to my research needs. As Pink (2017) points out, as researchers, our ongoingly engage in improvisatory ways with the materials, processes and things that we encounter as part of our lives also help us to conceptualise how techniques are developed within processes of research.

Time-lapse photography is a series of photographs that are taken sequentially at pre-determined time intervals. These series represent a visual succession of a phenomena in a time period, therefore it gives the impression of a continuous recording (Pauwels, 2016). In this research, I took time-lapse photographs with a 360° video camera system, which uses multiple digital cameras to capture an image of the entire 360° scene (Budagavi et al., 2015).

The 360° camera system took still photos of the entire physical space where children were working, every 5 seconds during the entire session. The photos were merged using an open-source application, resulting in a 360° time-lapse digital video that could be analysed in detail later. This technique reduced the time of video analysis from 4 hours to 5 minutes per session ([Click here for an example of how this technique works](#)).

With this technique, I collected data regarding how children socially interact with each other and with the available technology in the informal learning space, as they moved between work areas during the session. One of the advantages of using the 360° camera is that the entire space is recorded, making possible to observe any desired area of the learning environment. Moreover, I mainly used the 360-degree time-lapse videos to write field notes. The videos helped me remember what happened during the sessions while giving me the time to write about it, something that was impossible to do during the sessions because I was focused on working with the children. Additionally, sometimes I showed the videos to the children and asked them about what was happening or what were they doing at a given moment, as a photo-elicitation method (Torre & Murphy, 2015).

All the data collection methods used in this research let me understand the development of the I-3S from different perspectives. Each method captured data of different nature. Therefore, I made use of all the data differences to understand the complexities of the phenomena and to address it holistically.

2.9 Data Analysis: Abductive

Data analysis is a process in which the researcher organises, explains and makes sense of the obtained data (Cohen, Manion, Morrison, & Bell, 2011). Although there are several approaches to analyse qualitative data (Bryman, 2012), in this research I followed an abductive

method (D. R. Anderson, 1986), which involved iterations between theory and data to conduct the analysis (Van Maanen, Sorensen, & Mitchell, 2007).

Using an abductive method in this research required a constant interaction between the theory that supported the interventions' design, the data collected from the intervention in every cycle, and the searching of new theory to understand the unforeseen data. In every DBR cycle, the intervention's design implied the expectancy of specific results advised by the theory that underlies the design. In this sense, I analysed the collected data by deduction (Reichertz, 2007) because I looked for specific data, such as the elements that characterize a third-space, and for signs of critical-digital-literacy development. When those elements were not in the data, I made changes in the intervention to make them happen.

I also analysed the data by induction (Bryman, A., & Burgess, 1994), since I deliberately looked for the potential emergence of data that was not indicated by the theory, but that had an important role in the development of this I-3S. For instance, within this approach I identified data showing how the nonhuman entities impacted the interaction between learners. This resulted in the inclusion of sociomateriality theory to interpret this phenomenon as well as to re-design the physical space and to collect other kind of data in the next cycles.

I followed the above-described interplay between data collection and analysis iteratively, during the three cycles of the research process, where theory guided the data collection and the analysis, but the data also guided the research to use other theory or to collect other data. This ongoing process of analysis is what I mean by abductive method (Kennedy & Thor, 2018).

2.9.1 Analytical procedure

The analytical procedure was a non-linear process, which matured and changed throughout the cycles. Overall, I analysed data in two stages. First, after every working-session I wrote some fieldnotes, some of them gathered through the 360-degree time-lapse video, and did a post session researcher reflections with the fieldnotes, participants' diaries, and my own experience being in the space working with all learners. For instance, in Cycle 1, I approached the data intuitively, mainly using my experience being in the working space, and the theory shown in the literature review and used to design the intervention, to change the working-sessions and keep learners interacting. However, in Cycles 2 and 3, I followed a structured procedure where after every session I wrote fieldnotes, I read all diaries and I observed all the intergenerational interactions video recordings. I did not review the data deeply, nor with the theoretical framework, but going through the data to inform the changes I needed to have in the next working-session helped me to better understand the work that each team were doing.

Second, after every cycle I used Nvivo software to organise the data corpus and analyse it in depth. I based the decision of using a software in the fact that I collected a large amount of data, which was also multimodal (video and textual data). Therefore, a software was an efficient tool to organise all these materials (Hardy & Bryman, 2009). I started this stage by transcribing all interviews and classifying the diaries by participants (Bryman & Burgess, 1994). Doing this helped me organise the collected data, as well as to become familiar with the data. Once these materials were in Nvivo, I approached them deductively with the theoretical framework as reference to evaluate if learners' experience were towards the interventions goal, and I coded the data. However, the interviews and diaries also showed data that were unforeseen but important. Thus, I took that data inductively, and coded it. For instance, interviews showed that the I-3S

was, sometimes, seen as a place where children could forget the challenges they were facing at home.

Analysing the interviews and the diaries at the same time helped me to build an understanding of what learners experienced, and how they were constructing that experience through the working-sessions. However, the video-recordings of the intergenerational interaction let me analyse in depth how the interaction was happening. Therefore, I uploaded the videos in Nvivo and repeated the same procedure as with the other materials. I used the theoretical framework to code data, highlighting data that was not expected in the theory, but that was important to consider. This analysis informed the design of the next cycle, as well as the theoretical understanding of the I-3S. Therefore, I conducted the analysis after every cycle.

Once I coded the three cycles, I grouped the codes (see Appendix B). I did not follow a thematic analysis (Clarke & Braun, 2013), but grouping the data in themes helped me to visualize the different components of the I-3S. From the analysis, I came out with four very broad components: Fluidity in the communication, Reciprocity, Digital literacy and Enabling learners to take part of the I-3S. The empirical findings are presented later in this document (Chapters 4,5 and 6)

2.10 Ethics

Ethical dilemmas sometimes can be anticipated but many times decisions are taken along the way (Oliver, 2010). Thus, Guillemin & Gillam (2004) suggest approaching ethics from two dimensions: procedural ethics, to anticipate possible challenges, and ethics in practice, denoting that ethics is an ongoing process. In this research, procedural ethics happened by following the ethical frame proposed by University of Bristol. Before conducting the research, ethical considerations were taken in relation to safety, well-being, data collection, storage and

protection, confidentiality, researcher's access and exit, as well as participants right of withdrawal. Moreover, procedural ethics were done before starting every cycle of this research, and it was approved every cycle by the University's committee review board.

Although ethical codes and legal regulations proposed by institutions are important, they have to be extended when conducting the research because it is in the day-to-day where ethical challenges emerge in unexpected ways (Hammersley & Traianou, 2012). Therefore, the ways in which the researcher approaches the ethical decisions are influenced by professional/institutional guidelines and regulations, but also individual's ethical and moral views (Wiles, 2013). In this context, I expose some ethical challenges that emerged when conducting this research, emphasising that although all participants - and children's parents - signed an informed consent, other actions were needed to ensure that participants were understanding the characteristics of this study. Challenges were mainly related to working with seniors and children as participants, as well as risk and safety.

Ethical considerations related to working with seniors

For seniors to take part in research, it is imperative that the methods and methodology used are appropriate to the seniors' needs, sensibilities, capabilities and wishes (Quine & Browning, 2007). First, seniors should have full understanding of the informed consent sheet they are signing. However, some seniors might have difficulties understanding some of the technological aspects of this research. For instance, not understanding what is a videoconference or what would be required from them to take part in an online interaction. Researchers should be aware of this to overcome the challenge. For instance, during the first cycle of this research I worked with seniors who witnessed an online intergenerational interaction I had conducted a year before in the retirement home they live. Thus, I took this experience as a reference point to

clarify the seniors the aims and characteristics of this research. Doing this allowed me to make sure that the seniors had a better understanding of the characteristics of the research, thus, seniors signed the informed consent sheet with a better understanding of the implications of taking part in this research.

In a broad sense, ethics' aim is to protect individuals, communities and environments (Israel & Hay, 2006). Linking this to seniors' characteristics, it must be said that seniors may be prone to health challenges, getting tired in a short period of time, or any other unforeseen health situations. This was a constant ethical consideration through the research. I explained to them with concrete examples how we could manage her/his absence in the research, that they could withdraw at any time, and that they should give priority to their health. At times when seniors were in pain or distress, or their body languages indicated distress, they often decided to continue working in the project. In these cases, I paid more attention to their needs and, where possible, modified the activity, for instance by intervening more in their work to support them and to make their work easier. I did this as a way to hear participants' voice (Phelan & Kinsella, 2013) whilst keeping balance in who takes decisions in the research (Shacklock & Smyth, 1998).

Working with seniors also brings ethical challenges in relation to the memory challenges that people might have as they get older (Clegg, Young, Iliffe, Rikkert, & Rockwood, 2013). During interviews, some seniors often said that they did not remember some things they did during the sessions. Thus, in the spirit of helping seniors to remember, I sometimes had to use tools to support them to remember such as describing situations or moments that could prompt them. Similarly, memory challenges could have impacted seniors' diaries. This was an ethical dilemma because, at times, I started to question the accuracy of what seniors were saying, and the data being collected from them. I approached this challenge by asking seniors to write their

diaries as soon as they finished the session. I also stopped questioning the accuracy of the information they gave during interviews and took the information as such, in the way they remember it at the time of the interview.

Ethical considerations related to working with children

In the case of children, doing research with them does not mean having special ethical considerations, but a rigorous application of research methodologies and techniques that reflect the care of the person and the particularities of the persons being studied (Christensen & James, 2000). Nevertheless, because children in this research live in a challenging sociocultural context, special ethical aspects were considered due to the close relationship they had with the gatekeeper and the impact this has in the research. This was particularly important when I obtained consent from children and children's parents, who tended to immediately give consent without carefully reading the informed consent sheet, even though most of them had limited knowledge related to research nor the characteristics of the research project. For instance, one parent said "*You don't need to explain it to me. If Carmen says this is good. I'll let my daughters participate*". The parent trusted Carmen (gatekeeper), therefore, they trusted me. This was an ethical dilemma because they were not understanding the work we were doing, they were just trusting Carmen and maybe trying to please her. The challenge was to make sure that children and their parents understood the implications of the research and, based on that, agree to their participation. To overcome this challenge, I opted to start the research, and by asking again for consent at the end of the week. I chose this strategy because I assumed that during that week, the children would have better understanding of the research, and also children would have already communicated to their parents, using their own modes of communication, what they were doing in the project. Thus, the second time I asked for consent, children and parents would have better understanding

to make an informed decision. This ethical decision worked for this research. During the second visit, parents talked about how happy their children were and the things they were making with computers. Parents' reaction showed that now they had a clear idea about their children's participation in this project. In light of this, I strongly suggest researchers to consider that working closer to gatekeepers may cause that participants overlook what it means to take part in a research. Therefore, researchers are encouraged to propose strategies to make sure that there is full understanding of the research project before signing consent.

Another ethical challenge was that the children were also very familiar with Carmen, and through the everyday activities in the project, children were in a very comfortable environment. This can be an ethical challenge because when children feel comfortable, they might disclose sensitive information (Mishna, Antle, & Regehr, 2004) and/or they might feel obligated to perform their best (Burke, 2005). To overcome this challenge, I paid special attention to children's body language and their responses/reactions through our work. I aimed to identify if they felt uncomfortable during the activities. Also, I was attentive to the information children were sharing with me and with the senior. This was more challenging because there were many moments in which children were alone with seniors. Thus, I opted to review the intergenerational conversation at the end of every day, not to censure information, but to encourage children to reflect on what they were sharing. During the entire research, seniors and children did not share between them any sensitive personal information. However, it happened that during the interviews I carried out with the children, some children spontaneously shared with me personal worries they had. My response was to listen them and be supportive. No further action was needed. However, I took this as a sign that children felt in a safe environment.

Another ethical challenge emerged unexpectedly in cycle 3. The area where the children live and the research was conducted, became very violent. Shootings and assaults to passers-by (including children) were happening almost every day (Martinez, 2018). Consequently, I hesitated to conduct cycle 3 because I did not want to expose the children, nor myself, a basic aspect of ethical research in practice (Wiles, 2013). However, when conducting research, there is a constant fluid nature between what is risky and what is dangerous, thus, researchers must be attentive to this transition (Jamieson, 2000). In light of this, I reflected on whether conducting Cycle 3 as planned, or cancelling the intervention. I understood that there were real threats for everybody in the neighbourhood, not only for the children participants and myself; we were all at risk. However, many of these children -and their siblings- were by themselves at their home, because during this period children were on school vacations and their parents were working. Thus, these children were not only at risk, but in danger because in case of an incident they would be more vulnerable. I decided to conduct Cycle 3 by finding ways to support children to more safely commute from their home to the I-3S. More details on this can be found in Section 6.2.

2.11 Conclusions

This chapter presented the methodology, data collection and data analysis used to conduct this research. Design-based research was selected because it allowed me to develop an I-3S, as there is no prior research about how to create such environment. DBR allowed me to test the theoretically informed design in a natural setting. Data collection methods were digital diaries, semi-structured interviews and video methods (video-recorded data and 360-degree time-lapse video). Data analysis followed an abductive method, involving iterations between theory and data to conduct the analysis.

This chapter also presented the participants of this research, showing important aspects of their sociocultural context and professional background, and how these aspects later connected with the digital literacy and other learnings participants acquired through this intervention. Lastly, aiming to be transparent with the reader, the ethics section showed who I am as researcher and how this influenced the overall process of this study.

3. Literature Review

The aim of this research is to design and implement an intergenerational third-space (I-3S) where seniors and children work together to develop critical-digital-literacy. The rationale lies in the digital exclusion of both old people and young people from economically challenged areas, as well as in the potential benefit that these generations can gain from engaging in an intergenerational practice. To do this, I followed a Design-Based Research (DBR) methodology, where the cycles start by contextualizing the problem (see Section 2.3, Methodology). Therefore, this literature review chapter is the starting point of this research, where I expose the links between the context of the learning environment I wanted to build and state-of-the-art research literature within the context's field (Van den Akker et al., 1999). These connections led to a framework of theoretical concepts from which, in Cycle 1, I developed the initial design for this intervention (Plomp, 2013). However, it is important to clarify that throughout the DBR cycles, the theoretical concepts presented in this literature review evolved and stressed other key aspects that connect these theories with each other. Thus, what is shown in this literature review is the starting point for this study. In this vein, this chapter first explains the three main research fields that frame this learning space, how they connect with the aims of this research and how they are, at this point of the research, interconnected: critical-digital-literacy, third-space, and Intergenerational Practices (IPs). Later, starting from Section 3.5, this chapter presents initial concepts to construct an I-3S, which set the groundwork for the beginning of Cycle 1 in the next chapter.

3.1 Understanding literacy

According to critical pedagogy, education – formal or non-formal – must never be only about developing skills to be functional in the labour market, but it is about providing people with the means and tools to develop themselves as human beings, as well as to work

toward social justice for all (Giroux, 2013; Freire & Macedo, 2005). This perspective resonates with the rationale of this research in tackling digital divides by developing a space for communities at the margins to develop digital literacy. Thus, the stance taken in this research is linked to critical pedagogy, where seniors and children are not seen as empty containers that should be filled up with pre-constructed knowledge. Rather, they should be encouraged to develop the means to criticise their own reality and to take action in its transformation (Freire, 2012). The aim is to raise consciousness by providing people with the means to recognize and understand their own oppression; by doing this, people may realize that being oppressed is not their nature and they will be able to find their own ways to set themselves free and reach emancipation (Freire, 2005). Therefore, the kind of literacy that seniors and young people develop in this learning space and the outcomes they get from the intergenerational interaction must be aligned with this educational aim.

From a critical pedagogy perspective, literacy is neither neutral nor universal, but it is closely related to the sociocultural and political context (Roberts, 1963; Castells et al., 1999; Selwyn, 2015). Therefore, simply exposing people to literacy does not necessarily lead to positive improvements to their cognition skills and/or their economic prospects, nor does it necessarily imply the making of them into better citizens (Selwyn, 2011). Understandings of literacy change from one context to another, and from one culture to another; thus, when different literacies are applied in different conditions, they produce different effects (Street, 2003). In this vein, what counts as literacy should be understood in light of what it means to people in different cultural and social contexts; it can only be acquired by practice, which is embedded in that cultural and social context (Gee, 2008). Thus, because the contemporary world is dominated by digital media and digital culture, there is a need to understand literacy beyond traditional 'reading and writing' practices (New-London-Group, 1996; Gee, 2010; Potter & McDougall, 2017).

3.1.1 Literacy in the digital world

With the impact of technology in many – or perhaps all – areas of human life, the conventions of communication are no longer solely textual. Information and communication media use written linguistic modes of meaning as well as multimodal modes of meaning (Kalantzis & Cope, 2016). Thus, voices have emerged, highlighting the need to move from understanding literacy in relation to only written/reading text to a more extended definition that embraces all other digital media texts in which information is now embedded (Cappello, 2017; Gee, 2010). One of these voices is the New London Group (1996), which understands literacy as a social practice – as critical pedagogy also does – and from this perspective, they proposed a pedagogical framework called multiliteracies (New-London-Group, 1996). Within multiliteracies, the emphasis is not on developing skills but instead on enabling people to be active designers of meaning and open to differences, change, and innovation (Cope & Kalantzis, 2000).

Similar to the New London Group, the work of Ferrari (2012), Bazalgette & Buckingham (2013) and Erstad (2015) proposed ways to respond, in terms of literacy, to the changes in society that result from technological changes. They advocated for the development of digital literacy or media literacy and internet literacy, among other terms. Each term has its own meaning, which depends upon shifts in relation to how humans interact with/through technology within the sociocultural and historical context (Leahy & Dolan, 2010; Soby, 2015). Thus, in this research, it was proposed that seniors and children develop digital literacy but from a perspective, as explained next.

3.1.2 Different approaches to digital-literacy

The term “digital literacy” was first conceptualized in 1997 (Bawden, 2008) to describe the ability to understand and use information from different digital sources. Since then, many definitions have emerged (Meyers, Erickson, & Small, 2013; Bawden, 2008), but

most of the definitions can be classified into three broad groups, based on their approach to what counts as literacy: 1) technical skills, 2) multimodality of communication, and 3) critical digital consumption and production.

The first approach encompasses understandings of digital literacy that focus on the development of technical skills to use a specific set of technological tools and applications (Ferrari, 2012), such as internet searching skills, the ability to understand non-sequential information, and being able to publish and communicate information using a specific software/hardware, among others (Jones & Hafner, 2012). The challenge faced by this approach is that, due to the rapid changes in technology, those skills can quickly become obsolete (Meyers et al., 2013; Leahy & Dolan, 2010; Bawden, 2008; Selwyn, 2011).

The second approach, classified as ‘multimodality of communication’ focusses more on the capacity to evaluate digital media. This approach moves the scope of digital literacy away from learning only the technical aspects or technical conventions of using technology; instead, it emphasises understanding how meaning is made through multimodality (Potter & McDougall, 2017). In other words, this approach is concerned with how meaning is made from semiotics and the different modes available – such as sound, colour, images, gestures, and hyperlinks, among others (Kalantzis & Cope, 2016; Sefton-Green, Nixon, & Erstad, 2009; Kress, 2000; Bazalgette & Buckingham, 2013).

The third and final group, ‘critical digital consumption and production’, approaches digital literacy by extending the scope to critically reflect on digital content. With an understanding that technology is not neutral (Selwyn, 2015), this approach emphasises analysis of digital media in light of the politics or power-relations embedded in their content or in the technology artefact, per se (Bazalgette & Buckingham, 2013; Kavanagh & O’Rourke, 2016; Sefton-Green, Nixon, & Erstad, 2009) – a critical perspective of digital literacy. Further, this approach encourages not only critical consumption of digital content

but also critical production of digital content. The rise of Web 2.0 gave space for a bidirectional communication, where users became content creators and not merely consumers (Cormode & Krishnamurthy, 2008). Additionally, the emergence of new hardware and software made the production of multimodal digital-texts easier (Erstad, 2015), and people started ‘remixing’ available digital content to create new digital content (Erstad, 2008). Thus, this approach emphasises a critical stance in both consuming and producing digital content. Additionally, within this approach, what counts as digital literacy should be strongly linked to peoples’ digital culture (Pangrazio, 2017; Buckingham, 2007), defined as diverse digital practices that emerged in specific contexts, with specific uses of digital tools and media. This linkage is important because, in a digital world, people already engage in digital cultures that should be valued (Buckingham, 2006).

I ground my research in this critical-digital-literacy approach, and I am particularly guided by the work of the most prolific author for this perspective, David Buckingham (2003, 2006, 2007). This perspective is in line with the critical pedagogy stance taken in this research, in that any education should be about encouraging people to develop the means to criticise their own reality and to act in its transformation (Freire, 2012). The overlap between these two approaches is explained in the subsection that follows.

3.2 Defining critical-digital-literacy

Buckingham (2006) stated that critical-digital-literacy is about being able to critically evaluate and use information from any digital media or contemporary technology in order to later transform it into knowledge. This process involves questioning sources of information, the interests of information producers, and the ways in which that information represents the world, as well as critically considering how digital media is linked to social, economic, and political forces. When doing this, people not only develop critical thinking, but they also develop technical skills, since the entire practice involves immersion in the use of digital

tools and media (Buckingham, 2003). Buckingham's emphasis is on moving critical-digital-literacy beyond the technical use of digital media to stress the importance of developing the means to understand and criticise all digital media – in sum, a critical perspective.

Digital media and technology are understood as new ways to mediate, represent and communicate in the world, which is not free of bias nor does cannot deliver 'neutral' information. Consequently, technology shouldn't be used only in an instrumental way (Buckingham, 2007). However, the development of instrumental technical skills for digital technology is not excluded from the critical digital literacy concept; rather, it also includes the importance of understanding and analysing all digital media in terms of representation, language, production, and audience (Buckingham, 2007) (see Section 3.5.1). Thus, the development of critical-digital-literacy in the intergenerational learning space envisioned in this research will embody this approach and push a critical view of digital literacy, where seniors and children are encouraged to develop the means to understand technology and digital media, as resources to criticise their own reality and to transform it.

Critical-digital-literacy is understood in relation to the context in which it emerges (Leahy & Dolan, 2010), implying that it is vital that the learning space favours the inclusion of learners' cultural practices, sociocultural context, and lifeworld knowledges as a foundation for the development of critical-digital-literacy. This consideration was particularly important in this research because the aim was to construct a learning environment. Therefore, I draw from Potter and McDougall (2017) to include third-space theory in this research, utilising their extensive revision of diverse digital-literacy practices, where they indicate that third-spaces are ideal environments for critical-digital-literacy to emerge.

3.3 Third-space and the development of critical-digital-literacy

Some scholars use the terms 'first', 'second', and 'third' space to geographically refer to the learnings that happen in the different social contexts: home, school, and the space

which is halfway not-school/not-home, respectively (Schuck, Kearney, & Burden, 2017; Moje et al., 2004). Third-space lies somewhere 'in between' home and school, in places such as museums, afterschool programmes, or clubs, among other environments.

The development of the term 'third-space' is grounded in Bhabha's (1994) ideas, which originate from a cultural studies approach. Bhabha argues that ideas of 'pure culture' or 'original culture' are unsustainable, since, when different cultures coexist, the many beliefs, symbols, and meaning that are characteristic of each culture clash. However, within this clash, there is always a hybrid moment in which the cultural differences articulate with each other and transform into elements that do not belong to one distinct culture nor the other, but they function as something else that contest both territories.

These hybrid moments are fertile with new signs of identity and innovative signs of collaboration. In this context of cultural clash, Bhabha defines a third-space as a metaphorical concept that establishes the conditions that make possible the appropriation, translation, re-historicizing, and reading anew of cultural symbols and meaning (Bhabha, 1994).

Bhabha defined third-space from a cultural perspective. However, Gutiérrez, Rymes, and Larson, (1995) developed these ideas with specific relevance to learning and educational settings. The authors explained that in traditional classrooms, students and teacher have their own scripts, which are different and not equal since there are always tensions concerning whose knowledge has more value. In traditional classrooms, what counts as knowledge is predetermined by the specific beliefs or values that are established by the larger society, and the teacher is in charge of invoking and reinforcing these values (Freire & Macedo, 1987). Thus, the teacher has a pre-established script, and the power to control how students should participate within the pre-established script. In this scenario, all of the local knowledges or cultural knowledges that students carry with them can get displaced, and this displacement

causes students to develop their own counter script, which is a form of resistance to adapting their local/cultural knowledge (Gutiérrez et al., 1995). Therefore, teacher's scripts and students' counter scripts are parallel and remain as such. However, there are some moments in the classroom where both scripts overcome the hierarchy and meet to share information that does not belong to the teacher's script nor the students' scripts; instead, new information that contests both.

When the classroom has no hierarchical discourses, which means that no cultural discourses are secondary to a hegemonic, power discourse, and the value of multiple discourses is acknowledged, the communication between teacher and students becomes an authentic interaction. This authentic interaction is what makes the third-space; it is within these moments that both scripts create tension until new scripts develop: transcendent scripts. Thus, these moments of authentic interaction establish the third space (Gutiérrez et al., 1995). In this context, third-space is defined as a place where normative patterns of interaction intersect, creating a fertile space for the emergence of a genuine, non-hierarchical interaction and learning (Gutiérrez, Baquedano-López, & Turner, 1997).

The concept of third-space was later linked with sociocultural views of learning and a pedagogy of social justice, giving rise to learning practices that validate learners' knowledges, sociocultural contexts, and cultural practices through encouraging them to bring those aspects into the learning process and build literacy from them (Gutiérrez et al., 1997; Gutiérrez, 2008). This approach echoes with the concept of critical-digital-literacy used in this research, wherein the development of digital literacy is not focused on the use of technology per se but is situated in learners' context and practices. Moreover, third-space as a learning space where normative patterns of interaction intersect to produce authentic interaction and learning, responds to the needs of this research, since seniors and children each carry their own knowledges, sociocultural contexts, and normative patterns that are

commensurate with their age, and so they need to work together to develop critical-digital-literacy.

Given these points, third-spaces can be seen as fruitful places for the development of critical-digital-literacy, as Potter and McDougall (2017) have identified. However, it is evident that research with third-spaces has largely focussed on young people as learners. For instance, Schuck et al. (2017) explored mobile practices in the third-space amongst school-aged children. Similarly, Moran (2018) researched the collaboration of nine-grade students and their teachers in a digital third-space. In the same vein, Olson (2016) worked with teenagers who were engaged in a third-space designed for them to work on visual culture activities, and the teacher functioned as an expert in the field who supported students' work. Although there is an age-difference in the third-space between the teenage participants and the teacher facilitator, the focus on the research was on the transfer of expertise from the teacher facilitator and not on the generational exchange. From a review of the available research, it is evident that third-spaces have not been researched in relation to intergenerational contexts. Therefore, for the purposes of this research, it was necessary to consider how to set up an environment where seniors and children could work together and where a researcher could engage with how intergenerational learning happens. Thus, I explored the field of intergenerational practices to inform the construction of the third-space for the research.

3.4 Intergenerational practices (IPs)

There is a large amount of literature around intergenerational practice (IP), although most of it is 'grey' literature which draw upon several different definitions of the concept. For instance, Generations-United (2007) define an IP as practices to purposefully bring together seniors and young to interact and engage in activities concerning our society, and those practices are designed to achieve specific goals established by the programme. In a similar

manner, Hatton-Yeo (2006) defines them as practices that bring generations together in mutually beneficial activities, aiming to foster understanding and respect amongst generations. Consequently, emergent scholarly literature suggests that there is no consensus definition in describing what an intergenerational practice is (Vanderven, 2011; Jarrott, 2011; Hatton-Yeo, 2015; Springate, Atkinson, & Martin, 2008). Thus, important aspects of these practices are freely interpreted by researchers; those aspects may include the age of participants, the difference between multi-generational and intergenerational, and whether intergenerational activities happen among familiar or non-familiar members (Springate et al., 2008), among others. Hatton-Yeo (2015) stated that it is probably not possible to have a single definition for these practices; nevertheless, what matters is the impact they achieve. Thus, despite this diversity of interpretations, researchers and practitioners have carried out important IPs around the world. On the other hand, the lack of a consolidated definition, framework, or theory to research IPs suggests that these practices have been conducted mainly focused on the outcomes they produce, rather than emphasising adherence to scientific procedures, such as being theoretically informed (Vanderven, 2011). Thus, most of this research has been uncritical and based in specific case studies; as a result, it is difficult to assume conclusions or to compare lines of research, as will be seen below.

Hatton-Yeo (2006) reported on 27 IPs conducted throughout the UK, showing that these practices have developed in a variety of ways, but all of them have in common the overall aim of strengthening relationships among the generations as a way to mend the social arrangement (Vanderven & Schneider-Munoz, 2012). For example, the ‘Active ageing programme’ was conducted in a deprived area of Liverpool. Here, participants engaged in discussions about health and food, and seniors passed skills on to the young, whilst children helped the seniors by giving them tea at break time (Hatton-Yeo, 2006). Hatton-Yeo’s report does not indicate whether these IPs were theoretically-informed. However, the author

emphasised that these projects were framed not by researchers but by practitioners in the field; the practitioners had a history of implementing these practices in a wide variety of contexts, and brought in aspects such as music, history, creative writing, craft, and sports, among many others (Hatton-Yeo, 2006). Similarly, Springate et al. (2008) reviewed IPs conducted between 2001-2008 in the UK; there, the main outcomes of these practices were improvements in physical and mental health, social capital, community cohesion, relationships, and learning. The author highlighted that most of these projects did not conduct formal evaluations, and the majority were small-scale projects rather than robust, theory-driven programmes (Springate et al., 2008).

Extending from the UK to the European context, Schmidt-Hertha (2014) pointed out that the use of an intergenerational theory is still missing: whilst most of the research is conducted empirically, the rich diversity in how IPs are conceptualized and implemented can be seen as a step forward towards a robust intergenerational theory. In this vein, Schmidt-Hertha, Krašovec, & Formosa (2014) reviewed a variety of IPs in Europe, identifying the great diversity in how IP are conceptualised and implemented. These examples showed that IPs have potential in enabling old people to engage in learning in a non-threatening context. Similarly, in the East-Asia region, Lou and Dai (2017) reviewed instance of non-familial IP. The authors found that IP mainly take the form of activities related to art and cultural heritage, resulting in a reduction of stereotypes amongst the generations and increased well-being. In the USA, DeVore, Winchell, and Rowe, (2016) conducted a review of U.S.-based IP literature published between 1995-2013. Findings showed two main outcomes of IP. First, IPs are successful in changing attitudes towards the other generation, and second, both generations enjoy engagement and improve developmental functioning, such increasing their level of social-emotional development.

With these diversity of approaches, the literature also stresses the large variety of shapes that IP take, such as school-based programmes, community projects, health-related projects, mentoring activities, and learning and knowledge development projects (Springate et al., 2008; VanderVen & Schneider-Munoz, 2012), where activities are performed by groups of different age cohorts, and outcomes are dependent of the specific aims of the IP (Mannion, 2012). Very few IP from across these examples were theoretically informed (Vanderven, 2011; S. E. Jarrott, Stremmel, & Naar, 2019); among those that did utilise theory, the most-used were Erickson's theory of generativity (Knight, Skouteris, Townsend, & Hooley, 2014), contact theory and theory of personhood (Kuehne & Melville, 2014), whilst this research is grounded in learning theory and not psychological theory.

Much of the literature on IPs is generated by practitioners in the field and does not necessarily utilise scientific research approaches such as providing theoretical guidance (Feldman, Mahoney, & Seedsman, 2003; Vanderven, 2011). Thus, it is challenging to draw generalizations among these practices or even compare one practice with another. For this reason, many researchers have suggested that the advancement of this research field requires the identification of an homogenous definition, and the application of robust theory and conceptual frameworks to fully understand IP (Vanderven, 2004b; Vieira & Sousa, 2016; Vanderven, 2011; Jarrott, 2011b). Despite these challenges, researchers and practitioners in this field have engaged in impressive efforts to define and to research IP. Thus, literature in the field research which is associated with the implementation of IP in natural settings is prosperous, and these examples offer several frameworks and provide guidelines for implementing successful IP (e.g. Winchell, Rowe, & Simone, 2018; Vanderven, 2004a; Jarrott, 2011b; Hatton-Yeo, 2006).

These research projects are often uncritical and/or difficult to compare one with the other, authors such Vieira and Sousa (2016) and Jarrott, Stremmel, and Naar (2019) have

suggested that practitioners can benefit from suggestions on how to enhance relationships amongst generations, as well as suggestions related to the programme's sustainability. All of these studies and guidelines are an invaluable resource for researchers trying to implement new IPs. However, although this research benefited from practitioner's guidelines, it is important to consider that the IP outcomes presented in the literature cannot be assumed to be achievable for this research, firstly because the outcomes cannot be generalised due to the lack of theoretically-informed frameworks utilised in research in this field. Second, previous research and practice highlight outcomes that are based on IPs where the senior-children interaction happened face-to-face, this is, where seniors and the young were physically together interacting. Consequently, in the research I conducted, the outcomes common in previous studies and practices were not taken for granted, since for my research, the entire intergenerational interaction happened through videoconference systems.

Despite the challenges with applying theoretical frameworks to explore IPs, the whole intervention in this research was designed following theoretical frameworks that were identified as appropriated, considering the characteristics, aims, and the context in which it was conducted, as explained below.

3.4.1 Setting up an IP

The intervention conducted in this research has two main characteristics that distinguish it from most of the IPs found in literature. First, as mentioned above, the research is unique in that the senior-children interaction takes place online. Second, the focus of this research is on the development of digital literacy from a sociocultural critical pedagogy perspective as one of the aims for bringing these generations together. It is, therefore, theoretically informed. These characteristics, to my knowledge, have not been used before in IP, particularly the fact that the intergenerational interaction takes place online. However, from the literature in the field, two lines of research directly informed this research, providing

a) understanding of the elements that contribute to setting up any IP, and b) understanding of why and how some IP use technology in their practice. From these two lines, I established connections that allowed me to identify the starting point for constructing this intergenerational intervention. However, the purpose was not only to evaluate if those concepts found in literature “work” in different contexts but to understand how these concepts and theories can be applied and perhaps reshaped to respond to new learners and contexts.

3.4.1.1 Key elements when setting up an IP

Vanderven (2004) pointed out that what all IPs have in common is that they have at the core a constant involvement of an older adult and a younger person in their life and activities. Thus, the aim in all IPs is not only to bring generations together but to provoke engagement between those generations (Kump & Krasovec, 2014). In the same tenor, many authors focus on the activities performed by seniors-children for the development of a relationship amongst the generations, alongside aims that specifically address the programme’s needs (S. Jarrott, 2011). For instance, the REPRINTS programme in Japan engages seniors in reading books for kindergarten and primary school-aged children (Yasunaga et al., 2016). The aim is that seniors develop a network of relationships not only with the children but also with the children’s parents and other peer volunteers; seniors also share their cultural knowledges and values with the children. Similarly, the programme “Time After Time” runs in 75 schools in southwest England. There, the aim is to provide participants with spaces to share time, experiences, and knowledges by bringing together older adults with young students; together, they can be involved in artistic or creative activities such as singing, dancing, sharing memories, and crafting, among others.

As in all of these examples and in others not mentioned, many IPs focus their objectives on building a relationship between seniors and the young (e.g. Kaplan, 2002;

Smith et al., 2017; Smith et al., 2017; Hanmore-Cawley & Scharf, 2018). This is defined in the IP field as reciprocity; where both generations can contribute something to the relationship. However, reciprocity does not mean that the relationship seniors and children build is equal. For instance, IPs where seniors are mentoring children or vice versa. In these practices there is a hierarchical relation among the generations and not necessarily a reciprocal relationship. In this context, some authors, such as Mannion (2012), stress that at least one of the aims in any IP must be around building reciprocity. Thus, in this research, alongside the aim of encouraging seniors and children to develop digital literacy, an additional aim was to foster a relationship amongst the generations: namely, to build reciprocity.

Another characteristic in all IP programmes is the emphasis on the exchange of knowledges, learnings, and/or skills between the generations. A two-way learning experience is one where both seniors and children get something valuable from the exchange and the overall interaction (Pinazo-Hernandis, 2011; Kump & Krasovec, 2014; Withnall, 2016). In these practices, it is understood that whenever seniors and young interact in a shared activity, intergenerational learning emerges in the form of sharing knowledges or skills that each generation possess and offers (Newman & Hatton-Yeo, 2008; Withnall, 2016). Thus, IPs are closely related to intergenerational learning, although the literature often does not clarify the differences between intergenerational learning and an exchange of knowledge (Mannion, 2012; Schmidt-Hertha, 2014). Moreover, as shown before, learning theories are not among the most used theories that inform IPs, though there are a few examples, as with application of Vygotsky's learning theory in some studies such as Akhter (2016) and Kenner, Ruby, Jessel, Gregory, & Arju (2008). However, most of the literature on IPs claim that learning as an outcome but do not use a learning theory as a theoretical framework, as if the rise of new learning happens spontaneously when seniors and children interact. Also, learning as it is

presented in IP literature is often focused on getting new content or skills, meaning that learning is viewed instrumentally. For instance, learning is viewed merely as the acquisition of specific knowledges/skills that are usually associated with the labour market (McLaren, 1995), for example IPs where seniors teach a second language to the young (Bernard et al., 2011).

Within this frame, some authors, such as Greg Mannion, have advanced the IPs field by exploring how intergenerational learning happens. This was key in this research because, to design an intergenerational learning environment, I first need to understand how intergenerational learning emerges.

3.4.1.2 Intergenerational learning, how does it emerge?

Mannion's work (Lynch & Mannion, 2016; Mannion, 2007, 2012; Mannion & Adey, 2011; Mannion & Anson, 2004; Ross & Mannion, 2012) in the intergenerational field provides strong theoretical ideas on intergenerational learning, which highlight the importance of understanding intergenerational learning as place-responsive. Drawing from a relational, emergent, and spatial epistemology, Mannion's theories stress that the place where adults and children interact is not just a background, but the place – including its practices and objects – impacts how the generations participate, communicate, and behave (Mannion, 2007). Simultaneously, adults and children's relations make the place itself, since specific social processes and social relationships shape specific environments (spatial forms) and thus shape the specific place (Massey & Allen, 1984). In other words, it is through the adult-children processes and relations that the place takes on a purpose for existing and thus takes on certain characteristics or a specific definition. Thus, the social and the spatial needs to be conceptualised together, as the two are in relation with each other.

From understanding the social-spatial as a relation, Mannion helps us to understand the intergenerational field as one where places and intergenerational relations (adult-children)

co-evolve and are affected by each other (Mannion & Adey, 2011). Therefore, to understand the intergenerational aspects that emerge from this process (such as intergenerational learning), we need to engage with how adult-children-place come together as a relation, perhaps by looking at the objects and practices that are implied in how they come together (Mannion, 2007) and what they produce together (Mannion & Gilbert, 2015). This brings to light the importance of the nonhuman entities, such as objects, practices, or processes, which operate within and serve to embed the intergenerational interactions. Here I anticipate the reader that, later in this research it will be seen how in Cycle 3 (Section 6.4.3) this argument resonates with how critical-digital-literacy develops.

By taking a relational perspective, Mannion (2012) indicated that for intergenerational learning to happen, adults and children do not have to share the same place, nor the same ideas. Rather, generations need to engage in a kind of interaction and communication where meanings, practices, and places *shared in common* can be created (Mannion & Adey, 2011). A kind of interaction and communication where all aspects, such as actions, beliefs, ideas, understandings, and pre-established knowledges, are subject to reconsideration and revision until they are re-adapted to meet the group's intergenerational communication requirements. In this context, seniors and children do not need to be physically working together nor working simultaneously for learning to emerge, but the generations need to engage in communication – verbal communication, but also their thoughts and reflections – where their interactions encourage them to create meanings, practices, and places that are *shared in common*. Therefore, intergenerational education happens through the communication that generations share in an interesting, meaningful, and purposeful way (Mannion & Adey, 2011). This argument resonates with third-space theory; I will explain this link later in this chapter, Section 3.5.2. Mannion's work is especially relevant in this research, not only because it explains how intergenerational learning emerges, but also because it stresses that

seniors and children do not need to share a physical space; thus, the intergenerational learning may also happen when the interaction is through virtual environments, as in the case for this research.

On the other hand, alongside the need to theoretically understand how intergenerational learning emerges, literature on IP is often concerned with the logistics of how learning emerges, and so they often produce manuals which provide a guide for implementing a similar project (Kaplan, Haider, Cohen D Arch, & Turner B Arch, 2007; Martin, Springate, & Atkinson, 2010; Azevedo, Palmeirão, & Paúl, 2018; Orte et al., 2018). Thus, even though the information focussed on face-to-face interactions, those manuals provided three aspects for good practice that were useful and applicable to my own research:

- *Qualified staff*: Staff supporting the IP are key in the programme's results (Martin et al., 2010; Neda et al., 2015; DeVore et al., 2016). Thus, it is suggested that staff delivering the project have good skills for communicating with both generations and a 'hands on' approach to challenge misconceptions that might arise from the interaction; they should also be willing to put in the effort to resolve the many unexpected challenges that emerge in IP (K. Martin et al., 2010).
- *Advice in advance*: Across the literature, programme manuals suggest that the generation groups should be informed in advance about the role they will play during the interaction, and the overall expectations for them (Orte et al., 2018; Azevedo et al., 2018). Moreover, it is recommended that the generation groups become sensitised around the unique characteristics of the other generational group and how it is to work with them (Generations-United, 2002).
- *Activities*: The activities performed by the generations should consider seniors' and children's' needs and characteristics (Generations-United, 2002) (Orte et al., 2018) in order to allow both generations to explore their interests and skills (DeVore et al.,

2016). Also, the activities should consider seniors' and children's culture and contexts and be shaped them in light of both in order to be meaningful for the generations and to elicit their participation (Teater, 2016).

To close this subsection, I reiterate that the literature on IPs, where, because there are no established theoretical frameworks established to research these practices, most of the conducted research has been non-critically conducted. Instead, the literature is focussed on the outcomes and effective logistical aspects that are observed by practitioners in the field. Moreover, intergenerational-learning is assumed as something that automatically happens when seniors and children collaborate or share a common space. However, these learning outcomes cannot be taken for granted or generalised to other IPs, mainly due to the lack of robustness on the conducted research. On the other hand, literature on the field offers valuable information on what is considered "good practice" that other researchers can explore and adapt for their own IP projects.

Within this context, I took key concepts from literature to start developing the intergenerational learning space of this study, and I drew upon the importance of reciprocity, theory about how intergenerational learning happens, and the three logistical aspects described in the prior paragraph. I did not take for granted any outcome that could emerge due to the intergenerational-interaction, not only because of the critiques on how published research had been conducted but also because of the unique characteristics of this research. For instance, the intergenerational interaction happens through online environments, amongst people who do not know each other, and each learner brings with them a different sociocultural context. These characteristics are different than IPs found in literature, and so its outcomes cannot be assumed. Similarly, I did not assume that learning would emerge just by facilitating seniors and children to interact or exchange skills with each other. Rather, in this research, I am taking a specific stand on literacy (critical pedagogy) within a particular

learning environment (third-space): that is, the digital literacy that seniors and children develop in the I-3S is framed within these theory perspectives. It can be said, then, that the different aspects of this research were theoretically informed, as will be detailed later in section 1.6 of this chapter.

To inform my research, I also reviewed IPs where technology is involved, aiming to understand aspects of their design and implementation. I focused on practices where technology plays a key role in the intergenerational interaction, as well as practices related to developing digital literacy.

3.4.2 Intergenerational practices involving technology

Across the literature, the use of technological devices in IP is mainly to support or enhance face-to-face activities that participants do together, rather than functioning as the core of the IP. For instance, technology devices are used to take pictures, use blogs, or play digital games (Kaplan et al., 2013; Kaplan, Sánchez, & Bradley, 2015). In one sample study, grandparents and grandchildren shared time and learn from each other while doing computer activities and surfing the net together (Kenner, Ruby, Jessel, Gregory, & Arju, 2008). Similarly, a programme in Honolulu paired young people (14-20 years-old) with seniors in workshops where they explore age-friendly design solutions using the popular videogame Minecraft (Nishita & Terada, 2019). As in these examples, many other IP also make use of technology as devices that enhance the activities that seniors and young perform, such as playing together or using videoconference systems to stay in touch with grandparents/grandchildren (e.g. Davis, Vetere, Francis, Gibbs, & Howard, 2008; Moffatt, David, & Baecker, 2013; Costa & Veloso, 2016).

On the other hand, there are few programmes where the intergenerational interaction *depends* on the use of technology to get in touch (Matthew Kaplan et al., 2015). An example of such a project involved seniors and primary-school children exchanging emails as penpal

friends (Marx, Cohen-Mansfield, Renaudat, Libin, & Thein, 2005); the use of technology here enabled the interaction through email exchange. There are other IPs where the interaction happens through videoconference systems, as with the research that I conducted. For instance, Bernard et al. (2011) conducted research via a in a project called PACE-2-Face™ wherein seniors provided second-language coaching to younger people who live in other countries. The telementoring happened through a customized videoconferencing and web collaboration system, designed specifically for this project (PACE 2000 International Foundation, n.d.), implying that the results of their research are closely related to its customized system. Thus, similar results are difficult to be expected in IPs not using the PACE-2-Face™ customized system. From these limited examples, it is clear that the field of IP needs more research around programmes where the interaction between generations does not happen in the same physical space (Matthew Kaplan et al., 2015). Currently, technology is primarily used in IP research to enhance face-to-face interactions but not to enable the communication amongst seniors and the young.

There has been limited research around IP where the aim is the development of digital literacy, as seen in this study. One research project (Kenner et al., 2008) worked with Sylheti/Bengali-speaking families, where grandparents and grandchildren engaged in computer activities. There, the older generation shared knowledge of language and numeracy to the young, whilst the latter taught computer skills. Another project featured teenagers who helped and taught seniors in a care home to digitally reconnect with their families through videoconference systems (Cyber-Seniors, 2017). Similarly, in Israel, the Ministry of Education paired 60 seniors with sixth grade children in primary schools around the country. The intergenerational interaction took place in computer rooms where children taught seniors how to use computers and the internet, whilst the seniors shared their knowledge in national history and other life areas (Gamliel & Gabay, 2014).

As seen with these examples, there are many other projects where the young are in charge of teaching seniors how to manipulate computers and/or search on the web, whilst seniors are in charge of, somehow, sharing specific skills they might have or the knowledge they have amassed through life (e.g. Kaplan, Sánchez, Shelton, & Bradley, 2013; Thygesen, Macqueen, & Martinez; 2014 Lee & Kim, 2019; Leedahl et al., 2019; Seguí, De San Pedro, Verges, Algado, & Cuyàs, 2019). Towards these examples, I argue that the approach taken in these programmes understand digital literacy as simply acquiring technical skills, leaving behind the many other important aspects key to the critical-digital-literacy stance that I take in this research (see Section 3.2). Moreover, the assumption in these IPs is that young people are automatically tech-savvy, whereas the seniors lack of tech knowledge. However, this divide is not always the case (see Section 1.1.3), as in this research, where the child participants have very limited access to technology and limited knowledge of its use, as well as limited digital literacy. Thus, some seniors were more savvy than some children.

Additionally, I argue that in past IPs, the power relation among the generations is unidirectional, meaning that either the seniors are in the expert position and thus they teach/mentor the young, or the young people have more expertise, and thus they teach the seniors. Although at certain moments the seniors and young may swap positions, in those IP they both are positioned according to an unequal power relation from the beginning of the interaction. However, in the research I conducted, I looked that both generations had equal opportunities to develop learning. This was important because, as explained in Section 3.3, any third-space should look for authentic communication where the interaction is non-hierarchical and all knowledges are equally valued. Thus, it was key that both generations could make their knowledges and resources available to one another. These last arguments will unfold throughout the next chapters of this dissertation.

In sum, the I-3S initial design started to develop in light of the literature review I have been drawing from so far, and initially connects the three key theories of digital-literacy, third-space, and intergenerational practice, as explained next.

3.5 Initial concepts to construct an intergenerational third-space (I-3S)

I opened this chapter by explaining that in DBR, the literature review points to a theoretical framework which leads to theoretical concepts that set the ground for the initial design of the intervention. Thus, as a starting point, I identified the elements in which digital-literacy, third-space, and IPs could support each other to adapt to the initial characteristics of this I-3S. Making use of these three key theories was not about identifying the elements in which all three intersect, as with a Venn diagram. Neither was it about using each theory to design an aspect of the I-3S. Rather, the purpose is in simultaneously using all three in a way that the theories support one another.

In this subsection, I first explain how I used David Buckingham's perspective of critical-digital-literacy to guide the learning aims of this intervention, taking multiliteracy as the pedagogical approach. Secondly, I highlight how the literature on critical-digital-literacy connects with third-space theory, exploring how they both support the I-3S aims. Finally, I describe how intergenerational learning theory relates to the development of critical-digital-literacy.

3.5.1 Critical-digital-literacy in the I-3S

This research is situated in a critical pedagogy perspective, where developing digital literacy in this I-3S should encourage seniors and children to develop the means to understand technology and digital media as resources to criticise their own reality and to transform it. With this intention, I built upon Buckingham's digital literacy work (2003, 2006, 2007, 2010) to set up the boundaries that helped me guide and understand the digital literacy practices in which learners engaged. Thus, in the following paragraphs, I use Buckingham's

literature to explain how digital literacy is understood and applied in the construction of the I-3S.

Buckingham states that critical-digital-literacy is about developing the means to criticise digital media and contemporary technology by supporting learners/participants to consider how they represent the world and recognising their relationship with social, political and economic aspects of society. Thus, the aim is not to develop functional literacy nor fixed cognitive abilities but to enable learners with the means to critically engage in the consumption and production of digital media (and contemporary technology). To reach this aim, the practices should focus in two central components, namely a) a reflective process guided by a critical-digital-literacy theoretical framework, which b) is embedded in the production process of digital-texts. The critical-digital-literacy theoretical framework is a set of resources that guides the critical analysis and production of digital media (or contemporary technology) in terms of *production*, *representation*, *language* and *audience*:

- *Production*: Refers to the capacity to recognise that digital media production and distribution is consciously manufactured by people or groups, responding to specific interests (economic, social and political).
- *Representation*: Placed at the heart of digital literacy, representation focuses on understanding how digital media invites users to see the world in specific ways, promoting a biased view of the world, rather than an objective one.
- *Language*: Language helps in understanding the codes and conventions in which communication and meaning-making happen in digital media. For instance, language allows a user to make meaning of multimodal elements such as moving images, sound, and the sequence or combinations among them.

- *Audience:* This is about understanding how audiences are targeted, how digital media is distributed, and how different social groups interpret and respond to digital media.

This includes reflecting on our own and other peoples' practices.

This theoretical framework informs the reflective process in which learners, aiming to develop a "critical consciousness", engage. Buckingham (2003) uses the term "critical consciousness" to acknowledge the complexity and diversity of our engagement in digital media, recognising that the engagement – ours and others' – is shaped by the sociocultural context in which it happens. Consequently, meanings are not just found in the digital media or technology; rather, they are socially constructed within everyday practice. However, the reflective process needs to move from a theoretical discussion to something concrete and tangible for embodying a critical consciousness.

The making process stresses how digital-texts and technology are not neutral, but rather they are embedded in social, political and economic aspects. It can be said then that production is central for the development of critical-digital-literacy. First, because learners undergo the development of technical skills and can develop the metalanguage of digital media whilst manipulating the software/hardware. Second, and more importantly, production encourages an understanding of how digital media operates and, with this experience, learners can reflect on how to critically use and produce digital media. In this regard, there is a dynamic relationship between the making and the critical understanding that is vital to develop digital literacy (Buckingham, 2007). Within this context, developing critical-digital-literacy must be directly related to learners' digital culture because, if it is a research aim that learners develop the tools to understand and challenge the digital media that permeates their lives, the starting point should be their own everyday experience with it. Production interacts not only with the technical skills that learners already have but also the meanings they have already constructed (Buckingham, 2007).

Buckingham warns that the reflective process does not necessarily happen spontaneously through the making process, but it provides the opportunities for analysis and reflection. Thus, reflection should be provoked and encouraged, and here lies the importance of the critical-digital-literacy framework suggested by Buckingham in guiding the reflective process, as well as the facilitator's role. Nevertheless, he stressed that the purpose of this framework is not to identify the shortcomings of digital media, nor to impose a view of digital media based on pre-established moral or ethics positions. The framework gives space for learners to share their interpretations and feelings of digital media, and, from this, learners can move toward recognising how social differences such as class, ethnicity, age and gender shape the experiences of digital media. Thus, the framework is a form of guidance to provoke learners into reflecting on their own and with others, to focus their attention on digital media practices; thus, by a deductive process, learners take a critical position and make decisions based on it. In this view, that the critical-digital-literacy that each learner develops will differ within a group, or each of them will develop different aspects of critical-digital-literacy.

Here, it is relevant to stress that Buckingham's asserts that a pedagogy of multiliteracies favours the development of critical-digital-literacy (Buckingham, 2003, p. 145), so I will now explain how this pedagogy works.

3.5.1.1 Multiliteracies pedagogy to develop digital literacy

Multiliteracies was proposed by the New London Group (1996) to create learning opportunities that respond to the demands of the information age (Castells, 2010a). This pedagogical framework was originally conceptualised as four dimensions of literacy pedagogy: *situated practice*, *overt instruction*, *critical framing* and *transformed practice* (New London Group, 1996). Later, to make them more recognisable in pedagogical practices, the terms were reframed to *experiencing*, *conceptualizing*, *analysing* and *applying* (Cope & Kalantzis, 2009). However, in either case, the heart of multiliteracies pedagogy is the focus

“on action rather than cognition— not what we know, but the things we do to know” (Cope & Kalantzis, 2015, p. 1). The elements within the framework are not expected to be followed in a sequence; rather, it is suggested that a learner will move back and forward across them (New-London-Group, 1996).

In this research, I used the original terms because I found them easier to relate with critical-digital-literacy literature. However, the terminology can be indistinctively used, as shown in the following descriptions of each dimension of multiliteracy pedagogy, and for each, I also explain how the dimension connects with critical-digital-literacy:

1. *Situated practice/Experiencing*, which explains that human cognition is contextual and always grounded in real world experiences. Thus, the point of departure for all literacy activities should be grounded in real world patterns of experience-actions, exposing the learner to new/unfamiliar learning situations (Cope & Kalantzis, 2009) and being careful that the literacy activities are connected to learners’ contexts, needs, and competences (Rowse & Walsh, 2011). This allows the learners to be exposed to new/unfamiliar information that is sufficiently close to their zone of intelligibility and represents a small move from what they already know to acquire new information (Cope & Kalantzis, 2009). Also, learners are encouraged to use their own experiences, knowledges, interests, and perspectives as resources to approach the new learning situations and to make meaning of the new/unfamiliar, using their own codes of expressions and representations (Cope & Kalantzis, 2015). It can be said, then, that situated practice claims a hands-on experience, which relates to the argument that producing digital-texts is linked to learners’ cultural experiences of digital media and leads to the development of critical-digital-literacy.

2. *Overt instruction/Conceptualising*, which builds from pedagogies focused on teaching rules and conventions, emphasises that within literacy activities, it is when learners move from “experiencing the known” to “experiencing the new” that they should acquire the concepts and theories (metalanguages) which lay beneath the learning trajectory (Cope & Kalantzis, 2000). In other words, the time when learners are actively moving from “the known to the new” is the moment to expose them to the systematic concepts, key terms, and/or frameworks underlying the knowledge, so learners become active theory-makers (New-London-Group, 1996). It does not mean that learners need to be “taught”, but they are instead involved in an active and experiential pedagogy that encourages them to make sense of the metalanguages and the need to acquire them (Cope & Kalantzis, 2009). Consequently, learners understand their life-worlds within a new depth of meaning (Cope & Kalantzis, 2000). In digital-literacy, the making process of digital-texts is what provides the opportunities to acquire technical skills, technology metalanguage, and reflections around our own (and others’) digital media practices. However, this reflective process should be provoked.
3. *Critical framing/Analysing* happens when learners analyse logical and textual connections, or text functions (analysing functionally), but also occurs when they interrogate the relationships of power by evaluating their own and other’s perspectives, interests, and motives (Cope & Kalantzis, 2015). Thus, the literacy activity should encourage learners to critically reflect on how their learnings (old and new) connect with their culture, race, religion, social class, communities of practice/literacy, and the power relations around them (Rowse & Walsh, 2011). This characteristic of multiliteracy is directly related to the critical pedagogy approach

found in Buckingham's theoretical framework of digital literacy, detailed earlier in this section.

4. *Transformed practice/Applying* results when learners apply their knowledge and understandings in real world situations and test their validity: 'applying appropriately'. Learners also make truly creative and innovative interventions in the world: 'applying creatively' (Cope & Kalantzis, 2009). These transformations can be related to digital-literacy when, as a result of the making and reflective process, learners position themselves in a line of thought and action with respect to their cultural digital practices. Social action becomes evident as learners make use of their power within society.

The multiliteracies pedagogy has been applied in formal and non-formal settings. Regardless of the type of setting, this research's critical-digital-literacy stance indicates that the learning environment should provide learners with room to experiment and try different possibilities with digital media, without worrying that they are looking for the 'right' answer. Moreover, learners must be allowed to feel free to express and make use of all their knowledges as resources because, in the learning space, what learners already know is recognised as valid. Multiliteracies thus support the argument that third-spaces tend to be ideal for the development of digital literacy (Potter & McDougall, 2017).

Next, I outline why third-space theory is a key foundation of the learning environment that was constructed in this research.

3.5.2 Third-space framing the intergenerational interaction to support the development of critical-digital-literacy

The third-space concept applied in this research draws upon the work of Kris Gutiérrez (1995). Within this definition, there are key elements that allow a learning space to be a "third-space". However, these key elements require modification with intergenerational

learning theory to respond to the needs of an I-3S, and for this research, these key elements were also impacted by critical-digital-literacy theory and multiliteracy pedagogy.

One of the key elements within Gutiérrez's conception of a third-space involves developing literacy as seen from a sociocultural critical pedagogy stance (Gutiérrez, 2008; Vossoughi & Gutiérrez, 2017). There, developing new knowledge or literacy goes towards enabling learners to fully participate in the different spheres of society, such as the economic and political sphere, or enabling engagement with, sociocultural practices (Gutiérrez, 2008). That is, what counts as learning in the third-space is related to the learners' sociocultural context and their everyday experiences more than the acquisition of pre-established scripts. This characteristic resonates with the critical-digital-literacy aim in this research, where it is expected that seniors and children develop different elements of critical-digital-literacy because they have different sociocultural contexts and different digital practices (Buckingham, 2006). Moreover, it resonates with IPs when in stating that the outcomes from the interaction should be valued by seniors and children, as well as closely related to their sociocultural context (DeVore et al., 2016; Teater, 2016).

One consequence of viewing literacy from this position is that, if literacy is connected to the learner's sociocultural contexts, the learning space should encourage learners to bring all their knowledges (such as formal, cultural, or lifeworld knowledges) as tools to participate in the third-space and build literacy from them (Gutiérrez et al., 1995; Gutiérrez et al., 1997). Thus, in this learning space, everybody's knowledges count; they are encouraged to bring them into the learning process through activities where both generations can make use of their formal knowledges, as well as the knowledges from their own lifeworlds.

Encouraging learners to bring their knowledges as resources into the learning environment is often challenging because the diversity of the group might result in clashes, causing disruptions in the learning space (Daniela Krueel DiGiacomo & Gutiérrez, 2017).

Diversity is connected not only to differences in race, socioeconomic, and/or linguistic aspects, but is also evident in the differences between their roles within the learning environment (Gutiérrez, Baquedano-López, & Tejada, 1999). However, in the third-space, diversity is celebrated because it is through the clash of differences that new knowledge emerges. Instead of repressing diversity, the disruptions caused by diversity are taken as blocks to build learning (Gutiérrez et al., 1995). When people expose their own knowledges and their own normative scripts interact with others' scripts, everybody challenges their own perspectives until their scripts intersect, creating new scripts. These challenging moments are what bring the opportunity for new knowledge to emerge, but it is important to consider that, for scripts to intersect, learners should engage in a non-hierarchical communication: authentic communication (Gutiérrez et al., 1997).

Building knowledge from the diversity that learners bring to the third-space is relevant in intergenerational encounters because there, diversity is immanent. Seniors and children belong to different age cohorts, and they bring generational differences with them. Also, seniors and children bring their individual characteristics and their individual differences. Moreover, in cases like the one in this research, seniors and children also bring sociocultural differences due to their background because children in the study are young students and live in an economically challenged area of Mexico, whilst the seniors live in a middle-class environment, all of them have a professional background and live in the USA. However, seniors and children might also bring similarities, such as similar attitudes or similar values, despite their age. In this context, the fact that third-space makes use of diversity to build literacy responds to the needs of the I-3S because the differences that children and seniors bring can be used as resources to build critical-digital-literacy.

The explanation of how learning emerges from the differences that learners bring to the third-space resonates with the explanation that Mannion (2012) gives around

intergenerational learning. As mentioned in the IP (Section 3.4), the author states that intergenerational learning emerges through the relation between seniors and children when seniors and children make embodied responses to differences within a place (Mannion, 2012; Mannion & Gilbert, 2015). As in the third-space, intergenerational learning also happens as a response to changes or differences. However, Mannion's work does not point out the need to have a non-hierarchical communication (authentic communication) among learners, as stressed in third-space (Gutiérrez et al., 1997). Adding this element of having a non-hierarchical communication within the learning space I was developing in this research became key because, as will be seen through the DBR cycles and in the discussion chapter (Section 7.2.2), this connection helped me to theoretically conceptualise an intergenerational third-space.

It cannot be assumed that new knowledge develops spontaneously from the intergenerational interaction. In the third-space, the activities that learners perform are the resources that take learners from a position of differences to one of productive literacy learning (Gutiérrez et al., 1999). The differences that learners bring are taken as contexts to stimulate literacy development. In this vein, Kris Gutierrez and colleagues have published examples of how classroom activities can be modified when conflict emerges in order to develop language literacy (Daniela K. DiGiacomo & Gutiérrez, 2015; Gutiérrez et al., 1999; Gutierrez, Larson, Enciso, & Ryan, 2007). However, this information is best suited to activities where the aim is language literacy, and thus I only implemented those aspects which could be extrapolated and applied to digital literacy and IP:

- The third-space privileges collaborative work among learners (Gutiérrez, 2008).
- Learners should be involved in different types of activities that allow them to engage in a range of ways of participation. This exposes learners to more complex learning

events where they can develop more competency in their literacy development (Gutiérrez et al., 1997).

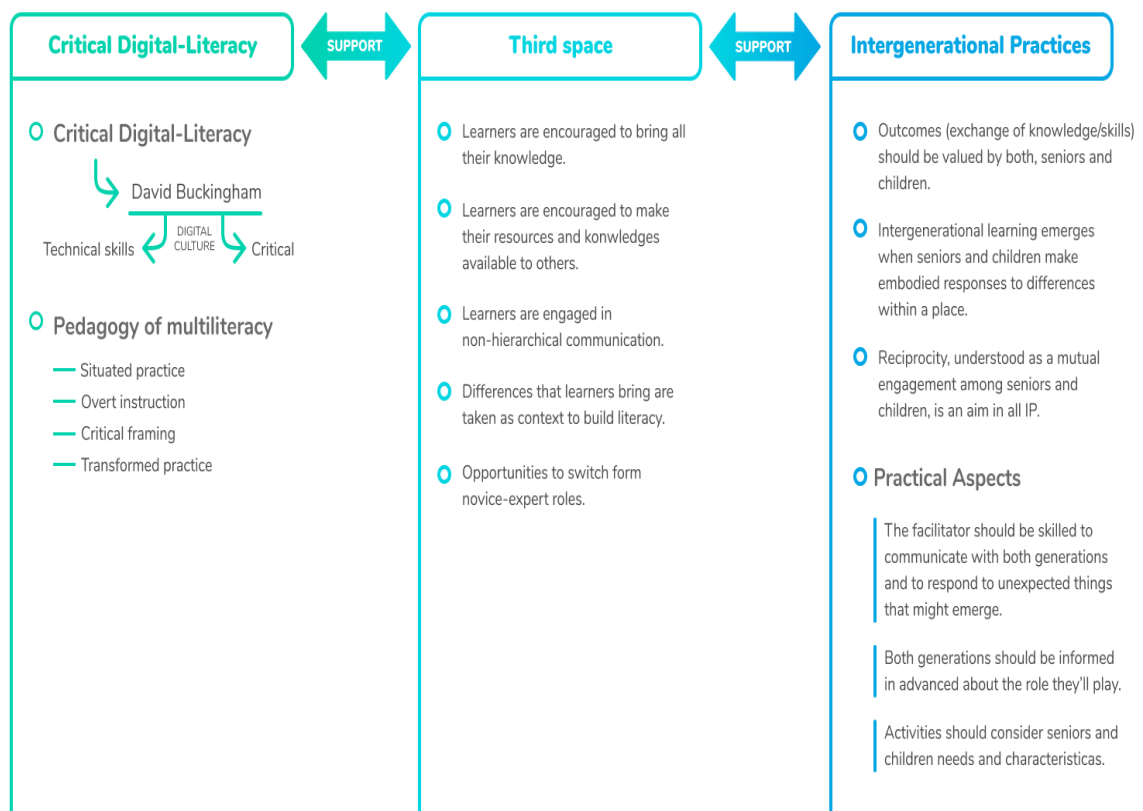
- It is also important to give learners the opportunity to swap from novice to expert roles, which supports the capacity to respond to what others offer (Daniela K. DiGiacomo & Gutiérrez, 2016).
- The pedagogy of multiliteracies can support the activities in the third-space (Gutiérrez et al., 1997).

These suggestions guided the pedagogical design of the activities in the I-3S to encourage learners to have opportunities for authentic interaction and exchange of resources, potentiating the emergence of new knowledge. However, I point out that the activities in the third-space are designed for communication and interaction among learners that is non-hierarchical. Although this aspect is key in the third-space, it might be challenging to reach in an intergenerational environment because, in the literature, it is not clear how to keep the communication non-hierarchical. However, literature on IPs stresses that if the activities performed look for reciprocity among the generations, learners could break pre-established stereotypes that they hold for the other generation (S. Jarrott, 2011; Senior & Green, 2017; VanderVen & Schneider-Munoz, 2012), implying that reciprocity impacts the interaction and communication channel between seniors and children. From this argument, it can be assumed that reciprocity is key in the construction of the I-3S to balance how seniors and children communicate each other, but it is not yet clear how that balance can be accomplished. Moreover, reciprocity is an aspect that should be present in any IP, including the I-3S, because here the aim is not only that seniors and children develop digital literacy, but also that the activity provoke an engagement between the generations (Kump & Krasovec, 2014).

3.6 Conclusion

This chapter exposed the theoretical framework to approach the development of the I-3S. I found no existing research on intergenerational practices conducted online with the aim of developing critical-digital-literacy from a sociocultural critical perspective, which is the focus of my research. Therefore, I identified concepts in the literature to create the initial design of the first DBR Cycle 1, which are summarised in the following diagram. These concepts unfold and evolved throughout all three cycles of this research, as will be shown in the next chapters.

Figure 7. Summary of the initial concepts to develop the I-3S.



Note: General structure of all the chapters exposing the DBR cycles of this research

Before getting into the first DBR cycle, this section reminds the reader that the iterative cycles of DBR follow three specific phases: Design, implementation, and evaluation and revision (see Section 2.3, Methodology). *Design phase* describes how every aspect of design of the I-3S was theoretically informed and how the design emerged and changed. *Implementation phase* explains what happened when the I-3S design was implemented in a natural setting, looking at to what extent each aspect of the design reached the I-3S' aim. *Evaluation and revision phase* presents those aspects of the I-3S that need to be revised, again, with theory to improve the re-design of the next cycle. Therefore, this chapter, as well as all cycle's chapters, follows the three phases to structure the information presented in each chapter.

Additionally, within these three phases, the information was classified in three broad subsections that emerged from the initial concepts described in Section 3.5, Literature Review: *non-hierarchical communication, reciprocity and critical-digital-literacy*. Similarly, all cycles include a section titled *Foundations*; which emerged from the implementation of the I-3S. It is titled as such because this section explains all those aspects that needed to be addressed before building the I-3S. Although these sections took different meanings and included different elements within each cycle, this general structure remained the same across all cycles. Therefore, the cycle's chapters present the information with the same structure.

4. Cycle 1 of DBR

4.1 Introduction

This chapter covers the first cycle of DBR, where the aim was to construct the initial design of the I-3S, as well as having the first implementation phase. This cycle was the starting point since the I-3S did not exist before. Therefore, although there are clear goals of how seniors and children should develop critical-digital-literacy, the focus of this cycle was to enable the hybrid structure of the I-3S and to enable the intergenerational communication; each phase will be detailed in the subsequent sections.

4.2 Foundations

In Cycle 1, seniors and children faced challenges that could have been barriers for them to take part of this learning space. Although it would have been easier for me to find other participants, it would have been contradictory to the heart of this project, which is to develop a space to include populations that are digitally excluded. Moreover, these challenges were related to who they are and their sociocultural context. Therefore, I made use of my creativity and the help of many people to enable learners to access the I-3S, by providing food, transportation and day-care.

4.2.1 Food

Some children had limited food at home. Therefore, it was important to provide breakfast and lunch in every working session, not only to fulfil a physical need, but also because in Mexican culture, feeding people is related to motherhood, thus, believed to contribute to the emotional growth of people and the strengthening of emotional links between the feeder and eaters (Lee Perez, 2009). In this context, preparing meals for the children became a way to “apapacharlos²” through food and to build an emotional

² Word used in the Mexican culture. Originated from the Náhuatl word “Apapachar”, meaning “To hug with the soul”.

relationship with them. For instance, children were asked every day what they wanted to eat. Many times they were surprised with creative food, such eggs and fries shaped in the form of their favourite cartoon characters. These meals became something that all children highlighted as important throughout all the research cycles, as exemplified in this interview extract with Isa.

Researcher: *How would you invite someone else to participate?*

Isa: *[...] They give you food! Ha, ha. That they should come because the food is very good... [Isa talking about her sister Janis, who is also a participant] When she leaves from here, she is like: 'Dad: guess what I ate today?' And she always tells my dad what we eat.*

Researcher: *What you eat?*

Isa: *Like when we ate pancakes, the green pancakes. My sister got so happy, went running when we got home to tell my dad [...] And she told him to make some one of these days and dad is like: "Ok".*

Researcher: *Ha, ha. What about you? Did you like the food?*

Isa: *Yeah*

Researcher: *Is there a lot of food at your home? Or not that much?*

Isa: *Umm. No, right now no, right now we only eat eggs because at my house right now we don't have, like, that much money to be buying the food because my school that I go, for me it costs \$100. For my brothers is \$50 or some of them is \$70.*

Researcher: *It is very expensive*

Isa: *Yeah. And I still need to buy my uniform, my shoes. And other things for me to go to school...*

4.2.2 Transportation

As explained in Section 2.7, Methodology, the physical space where we worked was located within walking distance from children's home. Thus, most of the children could commute. However, for the sisters Nora and Brenda this was not always easy. Although their home is in the same neighbourhood, because of their mother's activities, there were many times in which they had to spend the night at a different home, such as their sister's or aunt's.

These homes are not close to the neighbourhood where we worked. Therefore, whenever this happened, Brenda and Nora would not be able to come to the DigiCamp. Commuting challenges are common for Mexican children when accessing education (Ramírez Salazar, Casas Sáenz, Téllez Hernández, & Arroyo Álvarez, 2015). Although this intervention was free, in a non-formal context, children's family situation made it difficult for them to commute from home to the learning environment. Thus, I told these children that when they were not at their home, they could call me so I could pick them up. Additionally, I gave them a small amount of money so they could commute whenever they need it, in case I could not pick them up. I resorted to this option, even though these children were very young, because they are experienced in navigating in the city by themselves.

4.2.3 Day-care

Oscar lives with his parents and two younger siblings, Ron and Rebecca. As it happens with many families in Tijuana, Oscar's parents need to work long hours in more than one job to keep the family's economy afloat (Herrera-Rocha, 2018). People in economically challenged areas work 48 hrs/week in average, resulting in children spending large part of the day by themselves, without adult supervision (Coubès & Silva-Hernández, 2012). Therefore, in this family, Oscar is responsible of taking care of his younger siblings; something very common in Tijuana (see Section 1.2.2). All three children stay locked inside their home while their parents are working. Oscar's situation raised the fact that if he was going to take part of the I-3S, the space needed to be flexible enough to receive his siblings as well. Thus, I integrated them into the DigiCamp: Ron became a participant, and I asked Carmen to take care of Rebecca at her home because she was too young to participate.

4.2.4 Workshops and equipment for the seniors

As seen in Section 2.6.1, Methodology, all the seniors had access to Wi-Fi broadband and digital technology. However, some seniors did not have the means to “virtually

commute” to DigiCamp. Heather only had access to a computer that was not equipped for videoconferences; and Litzzy did not know how to establish videoconferences in her iPad. Therefore, I requested and received a second-hand iPad donation from a school in California, enabling Heather to have one. However, getting access to devices is not enough (Hill et al., 2015). Both seniors needed support, not only learn the steps to connect with the children using the iPads, but also to break the insecurities that seniors might experience when using technology (Vroman et al., 2015). Thus, I included in the intervention 1-on-1 workshops with the seniors before DigiCamp. As with the children, the workshops were resources to enable seniors to take part of the I-3S. These workshops became closely related to the critical-digital-literacy development of the seniors, something that will be explained later in this chapter. For now, I emphasize that the workshops were a resource to break the seniors’ accessibility barrier.

It can be reflected from this section that the I-3S per se do not include these populations (seniors and children from ECAs) if some barriers due to their sociocultural context are not attended to first. Although I knew that my role as researcher is focused on the development of a learning environment, the experience of Cycle 1 made me reflect in two main aspects: the extent to which the design and implementation of a learning environment must consider and attend to learners’ contextual challenges; and how creativity and the support of the community anchor helped to overcome these challenges. The latter highlighted the importance of deeply knowing the context where the I-3S will be implemented. Moreover, that the researcher alone cannot impose ways to overcome the challenges, but the researcher can work with the gatekeeper, who in this research is a community anchor (Carmen), to propose feasible solutions. It was only until these barriers were overcome, that I could work in the development of the I-3S.

4.3 Design Phase – Cycle 1

The literature review (Section 3.5) details the initial concepts to construct the I-3S, thus, this section points out how these concepts were woven to create the initial design. This section was divided in three themes that emerged from the literature: non-hierarchical communication, reciprocity and critical-digital-literacy.

4.3.1 Non-hierarchical communication

As explained in Section 3.5.2, Literature Review, the I-3S aims for a non-hierarchical communication, since this is what sets the groundwork for an environment that invites learners to bring all their knowledges to create new learning from it (Gutiérrez et al., 1995). In this first cycle, I focused only in enabling the communication within the learning space, to later move towards a non-hierarchical communication in the next cycles. The reason was that, at this point of the research, the learning space did not exist, seniors and children were not already communicating, nor children were working together. Thus, the first step was to enable a learning environment that allows communication to flow among its members. To do this 1) I established a physical environment for the I-3S, 2) I worked with the seniors on some technical aspects of critical-digital-literacy during workshops, and 3) I used technology to break the language barrier among participants, as detailed next.

It was already explained in Section 1.3 that the I-3S was thought as a hybrid space formed by a physical environment and a virtual environment. Since seniors and children live in different countries, their communication could only happen through videoconference; therefore, part of the I-3S was virtual. The geographical difference was key in this research to justify the use of technology to communicate seniors and children, and it also tackled the mobility challenges that seniors might face due to their age. Similarly, because children live in an area where access to internet and technological devices is limited, it was necessary to

enable a physical space with the infrastructure for the children to access digital technology and broadband internet. Thus, the I-3S became a hybrid space.

To set up the physical environment I borrowed an empty small apartment in the same neighbourhood where the children live (see Section 2.7, Methodology). I equipped the space with tables and chairs where the children could interact and work together, and use the equipment available. I did not follow any theoretical guidance to set up the physical space, but my knowledge as engineer to connect the technological equipment to the internet service. The internet was key to enable the communication, so I made sure that all the technological devices were connected to Carmen's WiFi (which was reachable from our working space).

To enable the communication from the senior's side, the approach was different. All of them had access to digital devices and broadband (see Section 2.6.1). However, some of them needed to learn not only how to get online, but also how to establish a videoconference to reach the children. In this case, enabling the seniors' communication overlaps with critical-digital-literacy. The seniors first needed to gain the technical skills to get online, before aiming for any other knowledge that could emerge through the intergenerational interaction. Although learning the technical aspects of using technology is not how critical-digital-literacy is understood in this research, developing technical skills was the starting point for many participants in this research, as it will be seen throughout the research cycles. Within this scenario, I included in the intervention's design having 1-on-1, face-to-face, workshops with each senior. The aim was to provide them with the means they needed to communicate with the children. I will explain in detail how the workshops were designed in the critical-digital-literacy section 4.4.2.2 of this chapter. However, I emphasize that these workshops are an important piece to enable the communication between senior-children, and they should happen before DigiCamp starts.

Another key aspect to enable the intergenerational communication was using technology to break the language barrier between participants. In Cycle 1, the seniors were English speakers, and the children were Spanish speakers. Therefore, to break the language barrier, I decided that children could use apps to translate from English to Spanish. Since in this research it is important to involve participants into using technology, encouraging them to learn how to use technological resources to break the language barrier was viable. I selected an app called 'Speak & Translate', which translates voice and text (APALON, n.d.). The app allows users to talk in one language and translates it into another language. The translation takes seconds, and it is shown as text as well as speech. The app is user friendly, so it was suitable to be manipulated by seniors and children. In addition, I could assist participants as a translator, since I am fluent in English and Spanish, and I would be the facilitator during the intervention.

Having participants that speak different languages is not new in intergenerational encounters. It has been used in research before in the frame of language mentoring, for instance, Akhter (2016); Bernard et al. (2011) and Kenner, Ruby, Jessel, Gregory, & Arju (2008). Their research had participants who do not speak the same language, aiming that the senior helps the younger person to learn/practice a foreign language. These research examples show that it is possible that language mentoring programmes happen through virtual environments, where seniors and young live in different countries. Thus, in this research, organizing activities where seniors and children could work together through a virtual environment, even when they speak different languages felt doable.

4.4 Activities of design phase – Cycle 1

Before explaining how the activities were designed, I remind the reader that the intervention in this research took the form of a two-week Summer Camp named *DigiCamp*, formed by intergenerational sessions and recreational sessions. The I-3S aims that seniors and

children **develop critical-digital-literacy**, which extends from learning the “know-how” of technology, to developing means to engage critically with technology (Buckingham, 2003). Furthermore, that both generations **experience technology as something they can use and produce to participate in society** (see Section 3.5.1, Literature Review). Additionally, because this is an intergenerational space, the environment should encourage learners to **develop reciprocity**; referring to how both generations develop a reciprocal relationship (see Section 3.4.1.1, Literature Review).

To take learners in this direction, I stress that in the I-3S, reciprocity and critical-digital-literacy develop simultaneously within the activities. I only separated them in this document to better explain to the reader how each concept was implemented within the design. Additionally, to design the activities I considered participants’ sociocultural context and their personal characteristics, because I took a sociocultural critical pedagogy perspective. Here, literacy should encourage participants to take action in their own transformation by producing their own literacy content, something that is valued within their context (Freire, 1970). Therefore, the activities that participants performed aimed to be linked to who learners -seniors and children- are, their experience with technology, the things they are passionate about and their social contexts (see Section 2.6, Methodology).

4.4.1 Reciprocity

Reciprocity refers to how seniors and children develop a reciprocal relationship when engaging in intergenerational practices. This must be at the heart of all intergenerational encounters because it is connected to the potential outcomes found in IPs, such as breaking stereotypes among the generations, seniors’ improvement of wellbeing and children’s growing self-confidence (K. Martin et al., 2010; Neda et al., 2015; Vieira & Sousa, 2016; Winchell et al., 2018). There are other outcomes that potentially emerge from the relationship

that seniors and children develop through their interaction (see Section 3.4.1). Thus, the activities in the I-3S should look for building a relationship among learners.

In this cycle, to implement reciprocity within the activities it was decided to engage both generations in the making process of the digital-text. This way, seniors and children not only could help each other through the making process, but also could have opportunities to spontaneously exchange experiences, and with this, opportunities to start building a relationship through “helping each other” (R. Vanderbeck, Worth, Kaplan, & Haider, 2018). In addition, it was planned to have ice-breaking activities during the first intergenerational session -when seniors and children meet-. This resource is frequently used in IPs to encourage learners to start sharing each other (Matthew Kaplan, Sanchez, & Hoffman, 2017).

The making process of the digital-text is a key element in the I-3S because it naturally encourages the interaction among seniors and children, alongside encouraging the development of critical-digital-literacy, as explained next.

4.4.2 Critical-digital-literacy

Critical-digital-literacy is developed through the manipulation of technology in making practices, since learning happens through exploration, experimentation, trial-and-error, and collaboration with others in the making process (Buckingham, 2003; Wilkin, Davies, & Eynon, 2017). Meaning-making is an active process of transformation (New-London-Group, 1996), because understandings are not gained only through mental analysis, but through the experience of a collaborative creative production (Buckingham, 2003). In this spirit, the activities were designed to engage learners in producing digital-texts. In Cycle 1, learners created an animated short film. The making process aimed to lead learners not only to develop digital skills, but also to experience technology as a resource they can use and produce to participate in society.

4.4.2.1 Film-making design

Creating a short-animated film involves writing/creating a story that is later represented by photographing individual drawings or inanimate objects frame by frame, each frame being slightly different from the previous, resulting in the effect of movement (Ward, 2015). Making the film emphasises how to communicate through digital-texts, and making meaning from what is being communicated through digital-texts. The *Language* component of critical-digital-literacy, moves from the textual ‘writing & reading’ approach to include the entire composition of the digital-text (Buckingham, 2007), including music and visual design, in sum, the multimodality (Kress, 2010) in which a digital-text communicates. Moreover, learners also make meaning through reflecting about the political, economic, and social aspects behind each element of the digital media text (Buckingham, 2006; Barrett, 2018).

Making a short-animated film is an activity that has been successfully applied in formal and non-formal learning environments to develop critical-digital-literacy (e.g. Burn & Durran, 2007); Hague, 2010; Burn & Kress, 2019). However, it has not been used in a learning environment with the characteristics of this intervention. Thus, I adapted the activity to fulfil the needs of this I-3S. First, seniors and children should collaborate in the making process, and should be encouraged to use their own knowledges, experiences, interests and culture (Gutiérrez, Baquedano-lópez, & Turner, 1997; Cope & Kalantzis, 2009). To do this, it was planned that each child chose a topic to create a story-script. Then, the seniors could collaborate with each child proposing ideas for the story-script, or advice to improve the story. Giving learners the freedom to be creative with the story could potentially encourage them to spontaneously exchange thoughts whilst getting to know each other.

Learners freely choose the story-characters, the materials to create the story (aquarelles or colours drawings, Lego figures, etc.), and the app to digitally merge the photos. However, I decided that only the children were in charge of the hands-on process of making

the film, such as the hand-making of the drawings, taking the film's pictures, and merging the photos into a digital film. Seniors were not included in the hands-on process because it was not feasible to remotely support seniors if they faced challenges during the hands-on process, as I, the facilitator, was physically located with the children, and seniors did not have technical-support where they live. Although this decision contradicts with the idea that critical-digital-literacy develops through the making process (Buckingham, 2003; Wilkin, Davies, & Eynon, 2017), I argue that even when the seniors do not manipulate technology to literally make the film, they were actively participating in the critical part of the making process (see Section 3.5.1, Literature Review). Seniors had opportunities to engage in the reflecting process with the children about how to communicate through digital-texts considering the multimodal aspects, thus, exposed to the development of critical-digital-literacy. Moreover, seniors manipulated technology to collaborate with the children in the making process by learning how to connect to the internet, how to establish a videoconference, among other technical aspects also related to critical-digital-literacy, learnings that started to develop through the workshops.

4.4.2.2 Seniors' workshops to develop critical-digital-literacy

As explained in Section 4.2.4, some seniors had challenges using technology to participate in the I-3S. In this context, it was decided to include 1-on-1, face-to-face, workshops with the seniors before the DigiCamp. The aim was to support seniors to develop the basic technical skills that would ensure that seniors could reach the I-3S. To do this, the workshops covered three basic aspects: 1) How to establish a videoconference session through FaceTime; 2) How to communicate with me, and exchange information, through emails or iPad's Messages app; 3) What to do if the connection fails during the interaction with the children. Additionally, the workshop gave seniors time to practice all the new learnings, as well as to ask any questions they may have about the project.

It is important to emphasise that literature on intergenerational practices does not specify the ideal time length to work with a senior. Thus, I asked the seniors who participated in this cycle to suggest a timeframe, resulting in a 1 hr workshop. I planned to start the workshop by explaining seniors that we could stop whenever they felt tired. Furthermore, I was attentive of any sign of discomfort, tiredness or stress, that the senior might show. In consequence, I foresaw that the number of workshops depended on the working speed of the senior.

4.4.3 Pedagogy in the I-3S

The pedagogy inside the I-3S draws from the multiliteracies pedagogical framework (see Section 3.5.1.1, Literature Review). Thus, I draw from learners' experience in watching animation movies (*situated practice*) to experience/learn the frame-by-frame animation technique (*metalanguage*) (Ward, 2015) by creating their own short films with the freedom of choosing their own story, characters, dialogues and materials. Learners were encouraged to bring their own knowledges as resources, not only to create their stories, but also to help each other. Learners were asked to help each other to try solving challenges they encounter with technology, or while making their films in general. I encouraged them to explore all the materials in the learning space, such as the available technological devices, searching the web for solutions, or asking for the help from other participants instead of asking me, not only to provoke learners to place their resources available to one-another to create new knowledge (Gutiérrez et al., 1997), but also to encourage the interaction among learners, particularly among seniors-children, and with this, increasing opportunities for them to create a relationship, reciprocity (see Section 3.4.1.1, Literature Review).

4.4.4 Working Schedule – DigiCamp in Cycle 1

This cycle stressed the need to include workshops with the seniors. Thus, the two-week DigiCamp working schedule included: Seniors workshops, intergenerational sessions,

and recreational sessions. Seniors' workshops aimed to ensure that seniors could reach the I-3S. The intergenerational sessions were the space for seniors and children to work together in their films, whilst getting to know each other. Recreational sessions were for the children to have a "Summer Camp" experience. Thus, once a week, instead of working on their film, I took the children to a park and swimming pool.

I did not follow any theory to organise the working schedule. The timeframes and the aims of each day were dictated by seniors' availability, since some of them live in retirement homes with fixed schedules, such as time for eating or doctors' appointments. Additionally, I planned to explain children -during the first sessions- what was expected from them during this intervention, as well as what can be expected from working with seniors. For instance, explaining that seniors might not hear us very well due to their personal challenges with hearing. In general, seniors and children were given a timetable indicating when they need to connect and general instructions of what they had to do, creating a short-animated film, and me guiding them through this process day-by-day.

Although the initial concepts found in literature theoretically-informed the initial design of DigiCamp, the implementation was challenging, as explained in the next phase.

4.5 Implementation Phase – Cycle 1

In a broad sense, this section answers what happened when the initial design was implemented. I approached this following the same general themes as in the design phase: non-hierarchical communication, reciprocity, and critical-digital-literacy. However, before getting into the sections, it is important to contextualise the reader by illustrating how an average working session at DigiCamp looked like during the implementation phase.

Children arrived every morning to our working place by themselves. Sometimes Brenda and Nora would need me to pick them up. It was expected that Oscar would bring his two siblings, one of them was included as participant, and the youngest would be cared for by Carmen whilst we worked.

Each day had a work objective and it was my job -as facilitator- to guide learners towards this goal. Children worked in teams, and as a team, they choose the film topic and the materials they wanted to use. At the scheduled time, I was in charge to connect the seniors with each team, so seniors could help children with the storyline, music, and aesthetics of the film.

At the end of the working session, Carmen cooked a meal for all the children so we could eat all together. After that, children had a couple of hours to use the space and equipment freely, as a gesture of appreciation for their participation.

On days in which we had recreational activities, children needed to get permission from their parents. Whenever the parents allowed them to come, children had to come to our working space, and I took them to the park/swimming pool. I covered all children expenses for these activities, as well as provide them with a meal.

From the seniors' perspective, a day in the DigiCamp meant to get online and to establish a videoconference through the FaceTime app at the scheduled time. Seniors had to stay online for about an hour. During this time, they chatted with each group of children and help them to improve their film. Seniors had freedom to choose the best way to help children with the task, as well as to make suggestions to improve the work.

4.5.1 Non-hierarchical communication

Cycle 1 focused on enabling communication between seniors and children using these aspects as the starting point: 1) to establish a physical environment, 2) to conduct workshops with the seniors, 3) to use technology to break the language barrier among the generations. Thus, this subsection details how each of these aspects responded to the implementation phase, towards enabling the communication within the I-3S.

The first design implementation was to set up a physical working space with infrastructure for the children. To an extent, this infrastructure worked. However, when many devices were connected to the internet at the same time, the connection became extremely slow, particularly for videoconferences, since they increased internet bandwidth usage (Vetter, 1995), resulting in connection loss, even when seniors connected one at a time. There were many disconnections during the intergenerational interaction, which children highlighted as disruptive. For instance, Ron mentioned in his diary '*...I didn't like that we cut off when we were speaking in the morning because I really enjoy speaking with the Sisters*'.

Similarly, Tommy wrote *'I enjoyed speaking with the Sisters despite it cut off XD'*; and Oscar said in his final interview *'More time was needed to discuss with the Sisters about the ideas, because when we were ready to discuss with them, we got disconnected'*.

Various reasons cause internet disconnections, but in economically challenged areas this happens frequently due to low quality of the internet infrastructure that characterise the digital divide in these areas (Hilbert, 2016). Although seniors did not explicitly identify disconnections as problems, data from my fieldnotes showed that disconnections were disruptive for seniors as well. Every time the intergenerational communication got disconnected, I had to re-establish the communication; something that not always happened immediately. In my fieldnotes, I registered that every time we got disconnected it took me a while to get the connection back. This impacted the intergenerational communication because all of us were losing track of the conversation, and it was difficult for me to take learners back into an engaging conversation. Thus, disconnections negatively impacted the emergence of new knowledge since they interfered in how communication flows in the I-3S.

Similarly, there were other disruptions in the working space that also impacted the intergenerational communication, such as noise in our learning environment and street vendors. Because the intergenerational interactions happened in the same room where all the other children were working in their own tasks, and sometimes children were playing music whilst working of their film, there was noise. Similarly, the neighbourhood has many vendors selling all sort of products in the street (food, water, gas, etc.). Thus, they loudly advertise their products while passing by the houses ([Click here for evidence](#)). These noises sometimes interrupted the communication with seniors, causing them to hear cuts in communication. The reason is that the intergenerational communication happened through iPads, which are designed for one-to-one communication. Therefore, the devices pick up the highest sound and filter all the others (Zwyssig, Lincoln, & Renals, 2010). Thus, in our working space, the

device could pick up any voice, not necessarily the voice of the children that was speaking with the senior at that moment, causing misinterpretations by the seniors because they might end up listening to different conversations or noises.

In addition to noise, there were visual barriers within the intergenerational communication because the seniors could only see what was captured by the iPad camera. Seniors could see the children that were interacting with them, but they were not seeing everything that was happening in the entire learning environment. Therefore, due to cuts in communication and the visual barrier, there were occasions in which the seniors misunderstood what was happening. An example of this is when Heather explained “*They were really focused in what they were doing as well, so I can understand it... were you translating for them in the background when we spoke?*”. Heather could not clearly understand what was happening in the interaction, therefore she didn’t feel engaged. She did not clearly notice that I was translating everything at the background. Misunderstandings due to communication barriers were also noticed in seniors’ diaries. For instance, Litzy expressed in her first session diary “*It seem two boys were not there when I asked for their names and age. Does that mean that there are too many (children)?*” To this, I point out that all seniors were teachers at a religious school many years ago (see Section 2.6.1), implying that they might not be used to student-centre learning environments. Thus, their expectation may have been to see children focused on what they were saying, but children in the I-3S were always working in their project whilst listening to the seniors talk. Also, it should be considered that seniors’ participation in the I-3S was limited to just one hour, specifically to support children in a specific task. Meaning that seniors were not aware of the dynamic within children’s working space. These two arguments point out the need to revise, in the next cycles, the role that seniors play within the I-3S and how to better explain seniors the working dynamics of this learning space. Additionally, to re-design the next cycles it should be revised how the

internet, technological equipment, and other materials in the I-3S environment -such as street-noises- impact the communication in the I-3S; not only the intergenerational communication but the overall work happening in the I-3S.

The second design implementation was to include workshops with the seniors, where they could learn how to establish a communication channel with the I-3S. The experience of this cycle showed that if it was not because of the support seniors had during the workshops, they would not have known how to reach the I-3S. Additionally, during the workshops I realised that each senior had unique needs, thus, the aspects they needed to learn -and the learning process per se- needed to be adequate to seniors' needs and characteristics. Not all seniors can learn the same, nor they can learn in the same way. Thus, it is not possible to design a workshop that fits them all. I will go in detail about this in Section 4.6.2 because this argument is more related to the digital skills that seniors developed. Nevertheless, in this subsection I address how seniors' personal characteristics implied changes in the activities' design.

I noticed that some seniors were overwhelmed when exposed to more than one task. For instance, Heather was stressed because she had challenges remembering how to turn the iPad on and the icon she needed to press to launch FaceTime. Thus, it was not ok to expose her to more information within the same workshop. Senior Litzy reacted similarly, when she needed to learn more than one task during the workshop, whereas Amalia was comfortable with any kind of tasks. All seniors have a similar background and age, but they responded differently during the workshops. This made me realise that it would be easier for some seniors to work with children focusing in one specific task. Therefore, I re-organised seniors' role during the activities. I identified that Litzy was passionate about opera and classic music, thus, I asked her to support children to understand the role of music in the short-animated film, as well as to select the best music for the film. Similarly, Heather was very passionate

about art, thus, she worked with the children to understand and decide the aesthetics of the film. Lastly, because Amalia's passion is reading books, she worked with the children around how to create the story-script. This way, all seniors collaborated with all the children but in a specific task that was linked to seniors' personal interests.

The third design implementation was to enable the intergenerational communication using *technology to break the language barrier*. Learners used different resources, 'Speak & Translate' app (voice translation), Google Translate (writing translation) and simultaneous translation by me. However, these technologies did not respond well. Using the voice translation app was not effective because the iPad could not discriminate the translation app "voice" from the children's voices, cutting off the conversation, causing difficulties for seniors to hear the translation made by the app (Robjohns, 2001). Moreover, sometimes seniors did not notice that children were using the translation app. When I asked senior Litzy, in her final interview, about how she felt when the children were using an app to translate their words to communicate with her, she answered *'We were not here for that. You must have done that with them but not with us. You did not do that with us!'* This shows that Litzy did not notice the translation from the app but she was relying on my translation of the conversation.

Similarly, I tried to use the Google Translate app but it was not useful for verbal interaction since it was designed for written interaction at the time this research was conducted. Therefore, the most effective way to break the language barrier between participants was me simultaneously translating their communication. However, translating involved my own interpretation of what the other person was saying, therefore it might be that I did not say exactly what the other person wanted to say, meaning that I was interfering in how the communication flows in the I-3S. Moreover, I was placing myself in a higher hierarchical position than the others at the I-3S because my words were directly impacting the

communication among seniors and children, thus, impacting the non-hierarchical communication that the I-3S aims.

Translating the communication between participants was not well taken by the seniors. For instance, in the final interview, Amalia suggested to eliminate the language barrier between seniors and children to better communicate with them. Similarly, Heather said: *'when they were working (children), the comments I made didn't seem to encourage them to do it because they didn't know what I was saying, and there was no connection there'*.

On the other hand, children did not find translation as a challenge as Marion explains in her final interview: *'it was easy that you helped us to translate; sometimes it was a little bit boring but not that much'*. Also, when I asked Nora if it was hard or boring that she needed to wait for me to translate what the seniors said, she expressed *'No, it was the same as when we speak in Spanish'*. In a similar way, all children expressed that they were OK with having someone to translate for them. In their final interviews for instance, all children said that they enjoyed being exposed to English language and, using an app or a person to translate, was not a problem for them.

Children's perceptions can be explained by the relative familiarity with bilingual contexts. Although children do not speak English, nor they study in bilingual environments, they are exposed to multimodal materials in English that are present in the city where they live (see Section 1.2.2, Introduction and Context). Additionally, children had other elements in the I-3S that could have added to their experience. For instance, children were excited when using the translation apps and they were having fun translating phrases for the seniors. However, the seniors could not notice this when being on the other side of the iPad.

Similarly, children were excited of having the opportunity to talk with someone in English. The novelty element meant a lot for them, as children expressed in their final

interviews. For instance, Ava said that during the project she learned “*to speak English and to be with my friends. To speak to people in English. And to learn how to speak English whenever is needed.*”. Ava enjoyed speaking English, but she also learned that whenever she needs it, she can break the language barrier with technology, such as using a translation app, but also by asking someone to translate for her. This connects with multiliteracy pedagogy when it states the importance of exposing learners to unfamiliar learning situations (Cope & Kalantzis, 2009) whilst grounded in real world experiences connected to their sociocultural contexts.

Data shows that a bilingual environment was enjoyed by the children and the use of apps helped them to experience technology as tools to break the language barrier. However, seniors did not have the same experience. From the seniors’ perspective using apps or a person translating did not help or enable a good communication with the children. In this context, having a bilingual environment is something that needs to be revised when re-designing the next cycles.

Another aspect that interfered with the communication in the I-3S were the disruptions due to unforeseen situations that affected the working schedule. I highlight these challenges, not only because they affected how the communication flows in the I-3S, but also because challenges are not always shown in research literature. Thus, there is no advice to address them. However, in this research, understanding these challenges was important to re-design the next cycles.

When working with the children, there were unforeseen situations that delayed the working schedule. For instance, DigiCamp took place during Summer in Tijuana, where temperature rises over 40° C. The room we used did not have air conditioning, so it was common that the children and I had to stop working to take breaks to refresh or to finish the session early. This caused delays in the planned work.

Additionally, there was one child who sometimes did not want to do the activities, he just wanted to be there talking with the other children or observing what the others were doing, but he refused to do his work without a reason, as he expressed *“I didn't finish because at first I did not feel like doing it so much, but later, when I saw what it was, I liked it and started working...I got lazy, because I was not motivated, I had no desire, I just had laziness”*.

Every time this happened, my first approach was to positively encourage this child to work and to remind him that he could withdraw from participating if he was not enjoying being here. He sometimes went back to Carmen's home to watch TV, but kept returning every day, at times to work and other times just to be there. His attitude impacted the children he teamed with, particularly the youngest participant who sometimes got frustrated because of clashes within his team. As explained before (see Section 3.4, Literature Review), differences are taken as learning moments. Thus, whenever we had clashes in the I-3S, we all discussed and reflected on these situations in plenary where everybody contributed with solutions to address the challenge. This action helped us always to overcome the challenges and to continue our work. However, the challenges delayed the working schedule, not only due to the time we took to do the plenaries, but also because to advance in the working schedule, I needed to cancel some sessions with the seniors, and work only with the children so they could advance quicker in their projects.

These decisions highly impacted the overall work and communication within the I-3S. Not only because creating the digital text took longer -in terms of time and resources- but also because not sticking to the working schedule that was agreed upon with the seniors caused trouble for the seniors, highly impacting their participation in the I-3S. As Amalia points out in her final interview *“... you can't cancel different sessions with us. For various*

reasons, you know. I think that is the big thing and I still don't understand ...I thought you clearly knew what you were doing".

Literature on IP does not specify information on how to overcome situations when the working schedule has delays and impacts participants' expectations/schedule, interfering with communication and interaction in the I-3S. This challenge is something that needs to be revised when re-designing the next cycles, managing situations such that they have less impact in the working schedule.

4.6 Activities of implementation phase – Cycle 1

This section describes how learners responded to the activities design. These short-animated films are the digital-texts that learners produced ([Click here for Cycle 1 digital-texts](#)). Some design aspects moved learners towards building reciprocity and/or developing critical-digital-literacy, whereas other aspects did not support the interaction.

4.6.1 Reciprocity

As suggested in literature review, the first activities in the intervention aimed to start building a connection between seniors and children. Data shows that both groups responded empathically to this aim, exchanging basic personal information, and naturally discussing general aspects about their culture. For instance, the children spontaneously decided to sing a traditional Mexican song for Litzy and Heather. Then, the seniors felt that they had to reciprocate, so they sang for the children. This cultural exchange was not planned in my schedule, but participants enjoyed it, as Heather's diary shows *"Our collaboration and communication centred on communicating with one and other and singing together. I enjoyed it, and them so much!"*. Similarly, Tommy wrote in his diary *'Today was the first day of this experiment... I spoke with the Sisters and we sang, it was very funny, I loved it. I met Litzy and Heather'*.

In the diaries and final interviews, all participants showed a positive reaction to meeting the other generation and felt engaged. However, each generation showed it differently. All children repeatedly expressed in their diaries that the best part of the session was when they interacted with the senior. The reasons they gave were that it was funny, that the seniors helped them and gave them new ideas. For instance, Brenda said *'What I liked the most today was when we spoke with Sister Amalia because she told us how to improve our work'*; and Tommy said *'I liked that the Sisters gave us like tips to better organise our work and to make the film, so that we do the best we can... they were part of the team'*. Similarly, Nora stated *'I liked a lot to talk with the Sisters and to work with them as a team. I liked that they taught us things, such as the things about the colours'*.

Also, some children mentioned that they liked it because the seniors helped them to learn English, as Oscar expressed *'What I liked the most was to speak with the Sisters because I learnt some words in English'*. Marion said something similar,

I liked speaking with the Sisters because they helped us with the colours, the music, and they taught us some words in English that we couldn't properly pronounce... Without their help, I think we could not have realised that there was a lack of music, or about the colours, or the things that each one did, each participant.

Ava, Brenda and Ron gave the same reasons, but they added the emotional feeling of the interaction, which can be noticed in the words they used to express themselves, as well as in the sound of their voices in the recorded audio. Brenda said *'I liked speaking with the Sisters because they helped us, and because it was beautiful to speak with them'*; similarly, Ron mentioned *'I really liked a lot, a lot to speak with the Sisters ... because I learnt more English and they gave me advice for my film'*.

In terms of reciprocity, the above-mentioned examples show how seniors were bringing their knowledge/skills to the 1-3S to share it with the children. There was an

intergenerational exchange and children recognised it. However, I point out that the exchange was hierarchical because children took the seniors as teachers, not as peers. This happened because the activities I designed placed seniors as teachers; seniors were asked to give advice to children about how to improve their films. Thus, seniors became automatically the experts. This clashes with the aim of having a non-hierarchical communication in the I-3S, thus, the activities design should be revised for the next cycle.

Data also shows that the emotional response that children had, is a starting point of how the relationship among seniors and children started to grow. Despite the language barriers and other challenges faced in this intervention, children valued the seniors' participation and identified the intergenerational interaction as the most important aspect in the overall experience. They highlighted that seniors helped them to create the film, that they learnt English words from the seniors, and that interacting with the seniors provoked a positive feeling in them. Thus, reciprocity started to happen. On the other hand, even though all seniors claimed that they enjoyed interacting with the children, seniors stressed that the enjoyment was, many times, diminished by language barriers and misunderstandings of their role during the sessions. To further explain this claim, first I will describe certain events that impacted the film making process.

When children were given the task, they decided by themselves who would be in their teams, as well as how they would organise the work. The second day we worked together, we discussed in plenary how the storyline, the characters, the music, and the aesthetics were combined to produce the film. In this context, children were asked to think about the story they would like to create and to start writing it.

However, all children skipped the textual writing of the story. Children were vigorously working in the task but were not creating the story using written text, but other multimodal forms such as drawings, photographs or collages made with the stationery

available in the room. This caused a gap in how seniors would work with the children. For instance, it was planned that Amalia would work with the children creating the storyline, but the senior was expecting a written text, as stated in her diary:

'I thought each child was going to do his or her own story and film. I also thought that my task today was to get across to them that every "film" begins with a story or "script". I was disappointed to see that the children had characters for a story they had not yet created. I think that beginning with a narration would have been best. (maybe not easier, but best).'

Amalia's quote shows that she was having a hard time during that session, not because of the children, but because of other elements that prevent her from having a fluid interaction and enjoyment. For instance, children were constantly changing their mind about the kind of story they wanted to tell. Therefore, Amalia tried to encourage the children to write but she did not succeed, as she mentioned in her diary.

'The boys; Anthony, Ron and Oscar have, for the third time, changed their characters and really do not have a story to go with the figures they are selecting. They indicated that they have an ending, but they did not share that with me. I could see by their expressions that they knew I was unhappy about this. I told them that this project is very important to Dulce and that they have to "buckle down" and get their story written, characters chosen, and finish their film. I told the boys that I didn't feel like a partner in this film, as they did not take my words of encouragement or build on my suggestions. They dismissed my involvement'.

Amalia had a similar experience with another team, as she indicates in her diary:

'Ava and Nora did not have their story written down yet and that is a concern for me, as they may continue to change it and we are almost finished with this project. I am hoping that Dulce will encourage them to write down what they shared and get their characters chosen. They had nine animals as part of their first story and had those animals drawn. Now their story is basically about one dog who has an unhappy home'.

The discrepancy in the expectation of a storyline did not have a good impact in Amalia's work because she could not participate with the children in the way she was expecting to. Also, from Amalia's perspective, my role was to encourage children, or to make changes in the learning environment to encourage children to do the activities in the way they were planned. Moreover, the fact that the seniors did not participate in the plenaries refrained seniors from understanding how/why children were taking decisions along the making process. This makes evident that the intergenerational activities were designed in such way that the relationship between seniors and young was quite traditional, and made seniors take on 'teacherly' roles.

Similar to Amalia's experience, Litzy felt that she could not work with the children in the way she was expecting. Because children did not have the story written in detail, it was difficult for Litzy to advise them on which music to use in the different scenes of the film. Her expectation is related to her teacher background (see methodology, 1.6.1), which is implicitly reinforced by the way in which the activities were designed, placing seniors in a teacher's role.

Litzy wrote in her diary *'I did quite a bit of preparing music but it was not wanted! One of the girls on two octaves of piano, drums, etc. did the music. It was a waste of time for me! Hopefully, something good come from that time!* It happened that Litzy spent quite some time before the session searching for pieces of music that she could provide to the children accordingly to the scenes, as can be seen in the email she sent me *'It just dawned on me that I need real music for the children! My idea now is to stay in my room and record music while I work with you and the children. Is that feasible?'*. However, the lack of specifics in the scenes that children were using made that she could not share the material. This clearly disturbed her role in the intervention and made her feel that her work was a waste of time. This situation connects with the literature, when pointing out the need of clarifying the

seniors what is expected from them (Azevedo et al., 2018; Orte et al., 2018). However, literature does not emphasise to which extent clarification should be extended. Also, this situation highlights that it is difficult to predict what is going to happen inside the I-3S, and these unexpected situations impact seniors' expectations.

Senior Heather had a different experience with her intervention. Heather started working with the children by explaining them the 'colour wheel'. She showed them the wheel and explained how colours can be used or combined to represent specific emotions or situations. Children enjoyed that session and learned from it. Moreover, one team applied what they learned in their film, as Nora explains *'We painted one house in purple colour because it was the bad house, and the other one in yellow and brown because it was the good house'*.

The approach that Heather took was different because she prepared something generic to share with the children. Instead of trying to help each team specifically with the aesthetics of their film, Heather shared something without specifically knowing whether this was important for filmmaking or not. Heather explained *'I didn't really know that I'd have an impact in them (children) when I showed the colour wheel. I just thought it was pretty, so I don't know if they actually used them or what they learned from it'*. Heather's approach made that her participation did not depend on how developed the children's film was. Thus, there was no clash.

During the workshops, I gave all the seniors the same general instruction about what they needed to do *"help the children to improve the storyline/music/aesthetics of their film"*. I did not specify anything else. However, the different approaches they decided to take had very different impact on the entire project. The role that seniors play in the I-3S will be explained in the Discussion chapter, Section 7.2.4. Although creating an animated film involved the two generations in the same task, seniors and children had different expectations

about how they needed to work together, causing a negative impact because seniors did not feel that they were fully collaborating. Thus, the relation senior-children can be improved, in terms of reciprocity, suggesting that the instructions/indications seniors receive should be re-evaluated.

4.6.2 Critical-digital-literacy

As explained in the literature review, the aim was for I-3S learners to develop critical-digital-literacy, but also to experience technology as a resource they can critically use, and produce, to participate in society. Within this context, it can be said that the experience moved children towards feeling capable of producing an animated film, but the seniors did not have the same experience. Nevertheless, both generations developed new technical skills, as explained next.

4.6.2.1 Children's learnings

All children learned technical aspects of how to manipulate technological devices and to communicate through multimodal texts because they indeed produced the film. This included manipulating a tablet, taking pictures, using editing apps, among others. For instance, Brenda mentioned "*I liked taking pictures because it was like in real life. I also learned how to use apps*". Also, Oscar said "*I learned how to make movie-scenes from drawings*".

Similarly, some children were able to critically make use of the multimodal learnings they acquired (Adami & Kress, 2014). For instance, Nora said that after learning from the senior about the colour wheel, "*We (Nora and Ava) painted one house in purple because it was the bad house. In the other house, we used yellow and brown because it was the good house*". Similarly, Tommy said "*Today I learned how to use colours that complement each other.*" This is an indication that the children were making-meaning of the semiotic characteristics of the text they were producing (Kress, 2000).

During their final interview, children's answers showed some of the critical-digital-literacy knowledges they got that after the experience. For instance, Ava and Nora said:

“you always have to move the characters because if not, they will stay there. And make many drawings and put them in place to make the movie. Take 230 pictures per minute and that's it”. (Ava)

“Now, when I watch a movie I think about the struggles to make it (laughs). We did not struggle that much because ours was short. Because some movies are long, so they must take a lot of photos, and we didn't do that”. (Nora)

Children's auto-criticism showed that they acquired some of the digital learnings by trial-and-error. As advised in the literature, children moved back and forward from experiencing the known and the new, acquiring digital-literacy metalanguages (see Section 3.5.1.1, Literature Review). Thus, the making process supported developing new knowledge. In a similar way, the children acquired new learnings by showcasing their films at their neighbourhood-community.

Buckingham (2003) states that any digital production practice aiming to develop critical-digital-literacy, must have at its heart to the goal of provoking a reflective process to understand how the media is linked to other societal spheres. Although the reflective process should happen throughout the production process, in this cycle I responded to this aspect by closing DigiCamp with a showcase. The children presented their films to an audience, where people asked them about the filmmaking process. This experience was a way to reflect on how digital technology can be a resource to impact society. Whilst children discussed with the audience, they were not only reflecting on their own process of making the digital-text, but they were also sharing the knowledge with the audience, thus making an impact. For instance, at the end of the session, a teenager from the audience told me *“I did not know that animated films can be made by taking pictures”*. Similarly, Ava said *‘I felt very happy*

because everybody saw what I did. My grandpa asked me how I did it and I told him that by taking 230 photos and moving the figures. He understood me!' . Also, Tommy expressed

It was very exciting to watch the films. I also felt excited that I presented mine, but at the beginning I didn't want to present because I was embarrassed that my film was so bad. But later, when I saw how they were organising everything and how excited everybody were, I felt motivated, so I wanted to do it.

Tommy highlighted that he was not satisfied with his film, therefore he felt embarrassed when showing it to an audience. Other children expressed the same feeling. They recognised that their films could have been better. Furthermore, they have a clear idea of what should have been done to improve their work, as Ron and Marion said:

"I liked it but I was very embarrassed. I don't know why but I was very, very embarrassed because I did the drawings really bad and my film was very short... I could've improved the drawings, the background, and the camera, like in a way that it doesn't move a lot." (Ron)

I was a bit nervous because we did our film in a hurry. Other teams did take their time, so it was nice to see their films, but ours... it was good but not that good...

It could've been improved by having the camera in a fixed position because all of us were moving it, only Oscar did it right. Also, we needed to work more, and harder. With more encouragement because some teams, including mine, we were a bit lazy. But at the end we realised that we really needed to work harder because it was already the last day and we had not finished our film. (Marion)

The fact that children presented their films with people they know, and openly discussed about the making process and getting feedback from the audience, simulated the experience of uploading something to the internet. Moreover, sharing their digital-text with people they care about within their own community, motivated children to deeper reflect on the work they did and to clearly identify how to improve their work. It can be seen from

children's expressions that they felt responsible for the information they presented. The experience provoked them to reflect on the quality of their work, in terms of what they wanted to communicate. Also, through self-criticism, children demonstrated that they developed critical-digital-literacy knowledges because they were capable of explaining how the digital-text can be, technologically, improved. In general, children developed the means to communicate through a multimodal digital-text. Thus, the overall experience was a transformed practice, because children could make a digital-texts and used it in a meaningful communicative action (Cope & Kalantzis, 2015), as recognised by all the children.

In addition to the critical-digital-literacy learnings, children's final interviews draw attention to other aspects they identified as learnings acquired in the I-3S: How to speak with people in English, how to be with old people, how to work as a team, how not fight with classmates, and to help each other. An example is this quote from Brenda "*[I learned] to work as a team, doing things better and well, well, we all helped each other, and I liked that because it was as if we all were making the same movie.*".

These learnings can be explained as a positive response that children had to the I-3S environment, particularly to multiliteracy pedagogy. Children valued being exposed to creative, hands-on activities where all of them could help each other to create their digital-texts. Moreover, they used their own codes of expression and representation (Cope & Kalantzis, 2015). All children stressed the learnings they got through teamwork, being this at the core of the I-3S, not only to develop digital-literacy but also to build a relationship among learners.

4.6.2.2 Seniors' learnings

The seniors also developed critical-digital-literacy through this experience, particularly through the workshops. However, seniors had difficulties in identifying the outcomes or learnings they got from this intervention. Amalia did not identify having any

learning through this intervention, even though she enjoyed interacting with the children. In equal manner, Heather and Litzy did not recognise having learnt something from this intervention. However, when I asked them to reflect more around learning related to using technology, they identified some technical learnings that they gained through this third-space. For instance, Heather said:

I learnt everything. I learned to use the iPad for the things that you just mentioned (take pictures and send them). But just to use the iPad, you know, turn it on, and FaceTime and call you, and, you know doing it over and over again until I made it part of me... it is not difficult either to take a picture and send it.

Also, Litzy remembered that a priest sent her a homily, so she could review the English grammar. Then Litzy printed the document and corrected it by hand, to later take a picture of it and send it back to the priest by mail. Then Litzy adds:

But then he didn't get the pronunciation, so we went to the telephone and he read it for me, and I would say 'delete that', or 'this is the way you pronounce that particular word'. So, that was a whole new way of doing things, you know, the playing teacher.

Litzy and Heather learnt how to communicate with people by blending digital and analogue technologies, something they developed by hand-writing their diary in a piece of paper, taking a picture of it, and sending it to me. They both could transfer this knowledge to other settings, a transformed practice (Cope & Kalantzis, 2015). Litzy used the new learning to correct the English grammar of a text, and Heather used it to take pictures in a museum, to later use them in her art class:

My brother and I went to the museum and took pictures of one artist work and we're going to use them in the first class. You know on the iPad and the sisters could look at and give them ideas on how they down colours. It is abstract but, you know, it helps. I wouldn't have thought to do that without our experience.

These examples showed that seniors recognised they acquired learnings on technical aspects of digital-literacy due to their participation in the I-3S. Although the digital-literacy approach taken in the I-3S aims to go beyond acquiring technical skills towards a critical reflection (see Section 3.5.1, Literature Review), seniors could extrapolate the technical skills to their everyday practices, suggesting that seniors experienced technology as resource they can use, an aim in the I-3S.

4.7 Evaluation and revision phase – Cycle 1

Implementing the first cycle of the I-3S in a natural setting responded to the question, what happens when the theoretically-informed I-3S design is implemented in a natural setting? To an extent, the prior section evaluated whether the following aims were reached:

- 1) Non-hierarchical communication and knowledge among learners, which in this cycle focused on enabling the intergenerational communication; establishing a physical environment for the children, organising workshops with the seniors and using technology to break the language barrier.
- 2) Seniors and children developed critical-digital-literacy, engaging critically with technology.
- 3) Seniors and children built a relationship.

On one hand, the implementation uncovered elements that were not considered during the design-process but highly impacted the I-3S development which are important to consider in re-designing the next cycles, such as supporting learners to overcome the challenges that prevent them to reach the I-3S (see Section 4.2, Chapter 4). On the other hand, the implementation pointed out some aspects in the design that needed to be revised and modified for the next cycles because they did not fulfil the needs of the I-3S, as explained in the next subsections.

4.7.1 Social justice – Aspects to be revised

The challenges that seniors and children faced to take part of the I-3S were not expected prior to implementing the intervention. In Cycle 1, this experience raised questions about the value of developing an I-3S if the populations it targets (seniors and children from economically challenged areas) cannot access it. This experience raised questions around what needs to be considered to design learning strategies for vulnerable populations and the need to support them, as part of the learning strategy, to overcome these challenges. In this spirit, it should be considered that children might need support to overcome challenges related to accessing food, assistance to commute from their home to the I-3S, and assistance to take care of their youngest siblings. Similarly, seniors might need support to access technological equipment that is easy to use and workshops where they could learn basic digital skills that allow them to virtually connect to the I-3S.

It can be assumed that the challenges faced by seniors and children in Cycle 1, will not be the only challenges that could prevent these populations to take part of the I-3S. However, it is suggested that to re-design Cycle 2, it is fundamental to look closer to participants' sociocultural context and anticipate some of the challenges in which learners might need support. Within this context, the I-3S should assume as part of the design, supporting learners to reach this learning space.

4.7.2 Non-hierarchical communication – Aspects to be revised

Organising a physical environment where children could access technology and internet service, indeed enabled the communication among seniors and children because otherwise children would not have the resources to connect with the seniors. However, it is suggested to revise how the infrastructure in the physical space is organised, in terms of how the internet is connected and the kind of technological devices available in the space. The experience of Cycle 1 showed that the limitations/affordances of the technological devices

and internet used played an important role enabling/disabling the communication among seniors and children. For instance, the intergenerational communication got interrupted every time that the internet connection failed. Similarly, revising how the materials and organisation in the room, such as furniture, impact the intergenerational communication. For instance, noise excess in the room limited seniors from understanding what children were saying, affecting the intergenerational communication.

The workshops conducted with the seniors also enabled the intergenerational communication. However, data showed that workshops must be personalised to each senior's needs. Therefore, instead of designing a standardised workshop, it is suggested to revise and identify the minimum digital skills that all seniors need to acquire during the workshops, regardless of their personal needs. This information could be used as a starting point to personalise the workshop. Additionally, using apps to break the language barriers or using the facilitator as a translator between participants was challenging and not effective in enabling a non-hierarchical communication. Therefore, it is suggested to revise whether is necessary to have seniors and children that speak different languages at this stage of the development.

Lastly, data showed that unexpected situations might happen, and this could imply making changes in the schedule, which could negatively impact the communication across all participants. Therefore, it should be revised how to design a working schedule that can be flexible enough to absorb changes.

4.7.3 Reciprocity – Aspects to be revised

Cycle 1 showed that there was an intergenerational exchange of skills and knowledges. However, the exchange was hierarchical because the seniors played a teacher role. To an extent, the activities were designed to place the seniors in a teacher position. However, it also needs to be considered that all seniors have a teacher background, from a traditional-school perspective. Similarly, the many changes in the working schedule and the

lack of clarity in the role that seniors were playing, limited seniors to feel engaged with the children. Thus, seniors and children started to build a relationship, but a sort of non-reciprocal relationship.

In this context, it is suggested to revise how reciprocity can be improved. Data suggest that, besides finding ways to clarify the seniors their role, the instructions/indications that seniors and children receive could impact the communication hierarchy and reciprocity among seniors and children. Thus, it is important to revise how seniors' collaboration can be adjust to better support reciprocity building.

4.7.4 Critical-digital-literacy – Aspects to be revised

Data shows that both seniors and children acquired some technical skills and metalanguages of digital-literacy. The critical aspect of digital-literacy was addressed throughout the making process and by asking children to showcase their digital-product with their families, friends, and other people in the neighbourhood. However, the seniors were excluded from this experience because the internet infrastructure and the technological devices in the I-3S did not support connecting all the seniors at the same time during the showcase. Therefore, it is suggested to revise how to move learners beyond developing technical skills and involving them more in a critical reflection throughout the process, not just at the end. Moreover, how to encourage seniors and children to experience technology as something they can use to transform their reality.

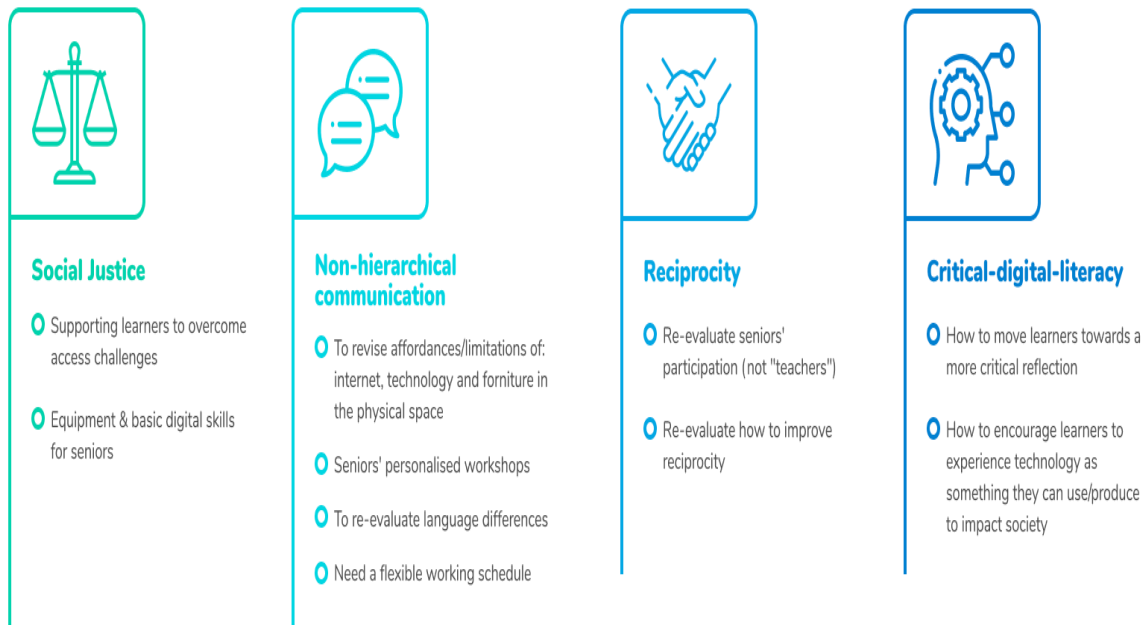
All the aspects pointed out in this subsection were revised using theory during the design of Cycle 2. This is discussed in the next chapter. Moreover, it will be explained how this revision was implemented in the different components of the intervention.

4.8 Conclusion – The starting point to re-design in the next cycle

This chapter exposed how theory was used to create the initial design of the I-3S, to later implement it in a natural setting. This experience was evaluated to identify those aspects

that need to be refined in the next cycle of DBR. Therefore, the following diagram summarizes what should be revised and be used as a starting point to re-design Cycle 2.

Figure 8. Aspects to be revised in Cycle 2.



5. Cycle 2 of DBR

5.1 Introduction

This chapter presents the second cycle of DBR. As it happened in the prior chapter, I will unfold Cycle 2 in a Foundations section, three DBR phases: design, implementation, and evaluation and revision. The chapter closes with a summary of the overall Cycle 2.

5.2 Foundations

Cycle 2 also provided children with food and assistance to commute to the I-3S and to take care of their youngest siblings. In the case of seniors, the design kept the workshops as tools to enable seniors to “join” the I-3S (see Section 4.4.2.2, Chapter 4).

During Cycle 1 I also identified the need to look closer at learners’ sociocultural context, not only to design the activities in a way that connects with learners’ lifeworlds (to situate their learning) but also to look closer at their digital cultures and understanding the critical-digital-literacies they could potentially develop in the I-3S. Cycle 1 enabled me to identify specific directions and actions for implementing theoretical ideas. For instance, the need to conduct a first interview with all participants to let them express their relations with technology. Conducting interviews at learners’ homes helps to build trust and rapport, as well as to give me insights about seniors’ lifeworlds. This is how I started to “know my participants” and, from here, to design Cycle 2 by revising theory and data from Cycle 1. (Who participants are, can be found in Section 2.6, Methodology).

5.3 Design phase – Cycle 2

In DBR, the re-design of Cycle 2 must build from revising the experience of the prior cycle, with the theoretical concepts that frame the intervention (Reimann, 2011). Therefore, the following sections explain how the revision produced the intervention of Cycle 2.

5.3.1 Non-hierarchical communication

An aim in the I-3S is that people equally interact by using their own lifeworlds, their resources and knowledges. The reason is that when learners interact in a non-hierarchical manner, their different knowledges intersect and create tension, emerging new knowledge (Gutiérrez et al., 1995). Additionally, Mannion & Gilbert (2015) point out that when people from different generations interact in an environment that supports them to share and negotiate their knowledges, it is the clash of the differences they bring within a place, which leads them to develop new knowledge (see Section 3.5.2, Literature Review).

The later point is emphasised in this cycle because it stresses the importance of place as an aspect that impacts the intergenerational learning. Mannion (2012) argues that intergenerational learning is always situated, thus, the place where learning happens is part of the action because it offers people opportunities or conditions for learning to happen or not. Moreover, the author suggests that the nonhuman entities, such as technological devices and/or other materials within the physical or virtual space where the intergenerational interaction happens, plays a role in how intergenerational learning emerges (Mannion & Adey, 2011). This perspective became key to re-design Cycle 2, thus, to walk towards a non-hierarchical communication I looked at the relations among human and nonhuman entities in the I-3S, as explained next.

Cycle 1 took as a first step to enable the intergenerational communication. Cycle 2 built from that experience, to move towards fostering a non-hierarchical communication within the I-3S. I focused on two key aspects: overcoming communication barriers and fostering non-hierarchical communication.

To address the first aspect, I revised the communication barriers in Cycle 1 (see section 4.7.2, Cycle 1) in light of some concepts from the sociomateriality field, as Mannion's work proposes when exploring how intergenerational learning emerges connected

to the place where the interaction happens (Mannion, 2007; 2011; 2012; 2015). This revision resulted in two main changes for re-designing Cycle 2:

- Seniors and children were grouped in small working teams, where all of them speak the same language.
- The physical space was modified by strengthening the internet connection and by isolating the intergenerational interaction from environmental noise.

For the second aspect, I revised situations that in Cycle 1 caused a hierarchical intergenerational communication. To do this, I used third-space and intergenerational theory. The revision resulted in modifying the activities' design to promote non-hierarchical communication, emphasizing in looking for an equal involvement of the generations in the activities.

All these theory-practice revisions are explained in the following subsections, and the activities' re-design to impact the non-hierarchical communication is explained in section 5.4.

5.3.1.1 Teams speaking the same language

In Cycle 1, seniors spoke English and children spoke Spanish. Learners used translation apps and simultaneous translation to break the language barrier. However, none of these resources allowed a fluid communication among the generations, negatively impacting intergenerational learning. Additionally, seniors strongly suggested that the interaction with the children would have been better if they both could speak the same language because they could have better exchanged thoughts with each other. In this context, I decided to eliminate the language differences from the intergenerational interaction while using technology to overcome the geographic separation.

I invited 4 new participants to Cycle 2: two seniors who speak Spanish and two children who speak English. This change was doable because of the geographical location where this research took place (see Section 1.2.2, Introduction and Context). Tijuana has a

high population of migrant families from the USA whose first language is English (Reyes Miranda, 2012). Likewise, California has a high population of migrants who speak Spanish (Toledo-Sarracino & Garcia-Landa, 2018). Thus, the change did not affect the research process and it let me focus on important aspects constructing the I-3S. For instance, how to provoke a fertile space for the fluid intergenerational communication to happen. In this spirit, I changed how seniors and children worked together.

Literature emphasises on both generations participating in activities that engage them with each other whilst working together (See Section 3.4.1.1, Literature Review). Similarly, Multiliteracies encourages a pedagogy where children actively participate in activities where they could make use of all available resources, implying teamwork as essential to completing a task (New-London-Group, 1996). Thus, in the re-design of Cycle 2, to encourage teamwork, I paired each senior with one or two children too. Although grouping them does not guarantee engagement, I aimed to explore how to bring seniors to the place/space more effectively through teamwork and building relationships.

5.3.1.2 Setting up the place/space

In Cycle 1, the physical and virtual components of this I-3S were designed and organised based on the infrastructure available at that moment to conduct the intervention, and my technical knowledge in setting up telecommunication networks. As often happens in research, I overlooked how the nonhuman entities in the space (e.g., technology, software, furniture, the place itself, etc.) impact the emergence of new learning (Fenwick & Edwards, 2010). Although it is called out in literature that the materials and the place/space itself impact learning (Gourlay & Oliver, 2014; Fenwick, 2015), when building the I-3S “from scratch,” it is difficult to know how to establish that relation. Thus, in Cycle 1 the focus was just on enabling the intergenerational communication without following this particular theoretical guidance. However, in Cycle 2 I used Mannion's work (2012) to draw attention to

how the place (physical or virtual) where the intergenerational learning happens, plays a key role enabling/disabling learners' communication, thus, impacting the emerge of new knowledge. To do this, I used ideas from theories that draw attention to sociomateriality to understand the role that all the nonhuman entities involved play in the third-space and used this information to re-design the physical space of this cycle; as detailed next.

Latour (2005) explains that in any social interaction, humans and nonhumans are always involved in a network of relationships that is constantly shifting, enabling, disabling or changing how communication flux among them. Taking this stand, Gourlay and Oliver (2014) explain that literacy development is not centred in the knowledge that emerges only from the human interaction, but in the network formed by the human, nonhuman entities and the virtual/physical space. This resonates with Mannion's argument of how intergenerational learning happens. Similarly, Potter & McDougall (2017) extend the concept of third-space by pointing out that the materials and non-materials involved in the interaction between learners, are also fundamental parts of the third-space because all of them impact the interaction, thus the knowledge produced.

Understanding Cycle 1 from this perspective it can be seen that the physical arrangement, such as the chairs, tables, environmental noise, and the virtual elements, such as the internet and online platforms, enabled, disabled and regulated the forms of participation within this third-space, as did the human entities, seniors and children (Latour & Stark, 1999). For instance, when there was interference in the internet signal, communication among participants 'comes and goes' during short or long periods of time. Thus, learners got only segments of information that the other person was sending, causing participants to make meaning from a message that was incomplete. Also, when the connection took a long time to be re-established, participants lost engagement in the interaction, impacting their relationship building.

The internet, as a nonhuman entity in the I-3S, played an important role to enable/disable learners to create knowledge and build a relationship. Thus, developing new knowledge was not only a cognitive process, but the internet and other materials involved in the communication, and the way they were arranged in the I-3S, impacted the learning as well (Fenwick & Edwards, 2010). Therefore, the nonhuman materials in the I-3S can be re-arranged in other forms of links that create new negotiations, new forces and/or new exclusions (Latour, 2005; Fenwick & Edwards, 2010), leading to other communication connections, thus, impacting learning. As part of designing this cycle, I identified the importance of re-arranging nonhuman materials in the I-3S.

I set up a hidden Wi-Fi connection and a dedicated router for our working space, connecting the internet from Carmen's home using a long cable that I ran through the windows. The hidden wireless connection prevented other people on the area to use our network. This arrangement offered stronger internet signal to all the equipment we were using because a router was physically close to the digital devices, reducing the probability of getting disconnected from the internet (Pullen, 2015). These decisions also relate to digital divide because due to the limited resources, it is common that people in the area find ways to unlawfully consume services -such as internet or electricity- from a neighbour that has the service (Cave & Mariscal, 2020; Vivanco-Saraguro et al., 2020). In our case, Carmen did not know that other people were using her internet, reducing the broadband we needed for our work. I identified this when I ran a test in Carmen's router. Moreover, the overall internet infrastructure in the area is limited (Palacios, Jena; Flores-Roux, 2013; Leal Guemez & Duarte, 2019), resulting in lower internet speed compared to other areas in Tijuana, a common issue when talking about digital divide (Hilbert, 2016).

Another change was to set up a quieter environment for the intergenerational interaction. During Cycle 1, the interaction senior-children happened in the same room where

all the other children were working on their own tasks. This caused a noisy environment, not only because everybody was talking at the same time, but also due to the many street vendors passing by the neighbourhood. All these disturbed the exchange of information when seniors and children were virtually interacting (see Section 4.5.1, Cycle 1). Environmental noise should also be considered as nonhuman entities within the I-3S network relationships that impact communication (Gourlay & Oliver, 2014), mainly because children's dialogues and street vendors will be always present in the I-3S. As such, they can be re-arranged to impact differently the communication within the learning environment (Latour, 2005).

With this in mind, I placed a working station shared by all teams, equipped with an iPad and internet service, in the upper floor of our learning space dedicated for the virtual intergenerational communication. Thus, every time children needed to interact with a senior, they went to this dedicated space to work together. This change aimed to isolate the intergenerational communication from the area where the other children were working, reducing environmental noise, including street vendors.

Another change was to setup a dedicated working station for each team. This arrangement was designed to give learners agency to manipulate the equipment and seeing it as an important part of the learning process (Fenwick & Edwards, 2010). Also, having an assigned working session would allow each team to have control of their own equipment. Therefore, they could organise by themselves when and how to use the equipment, in other words, to have an overall agency in the organization of their media product development (Cooper, Lockyer, & Brown, 2013).

The re-design of how seniors and children interact, and the changes in the physical environment aimed at having a fluid communication among learners. However, the experience of the prior cycle implied that it is through the activities that learners are encouraged to make use of their knowledges as resources that can be exposed, exchanged,

and contested to develop new knowledge. The activities of Cycle 1 positioned the seniors in a teacher's role, which was not hierarchically equal as children's role (Section 4.7.3, Cycle 1). Additionally, the activities should address other aspects of the intergenerational learning space: the development of critical-digital-literacy and reciprocity. Therefore, the activities were re-designed as described next.

5.4 Activities re-design phase – Cycle 2

The development of critical-digital-literacy is viewed from a sociocultural critical perspective, linking critical-digital-literacy to learners' lifeworlds in such way that encourages them to reflect on their reality, whilst giving them the means to transform it (Freire & Macedo, 1987). In this context, the I-3S builds from the production of digital-texts to 1) develop critical-digital-literacy, 2) encourage learners to perceive technology as a resource that can allow their voices to be heard and transform their contexts, and 3) build reciprocity among learners as part of this learning process. All three aspects are not separate and should happen simultaneously.

In Cycle 1, making an animated film was a way for learners to use technology as a resource to express themselves; experiencing that in the digital world, communication extends 'reading' and 'writing' (familiar concepts from non-digital contexts) to the use of multimodal digital-texts. However, whilst Cycle 1 data showed that learners had developed some critical-digital-literacy (see Section 4.6.2, Cycle 1), these learnings were often related to technical aspects of their process and there was still room to improve the link between critical-digital-literacy and perception of technology, i.e., the link between what they learned and how they perceive technology as a resource to transform their context. This critical aspect was weak in Cycle 1.

Another change in Cycle 2 was the use of second-hand technological equipment. I requested a second-hand equipment donation from a private school in the USA and was

granted 5 Chromebooks. I deliberately requested second-hand equipment instead of new equipment having in mind the sociocultural context in which the I-3S is implemented. After looking closer at children's digital cultures and sociocultural contexts through the first interviews I conducted with the children, it was clearer the challenges they have due to their limited resources they have, particularly the difficulties accessing technological equipment. Thus, I questioned the fact that during Cycle 1, children used resources that they are not able to afford. Moreover, digital-literacy does not depend on the cost of equipment. Thus, I decided to only use affordable hardware and free software, so learners could realise that having access to expensive hardware/software is not required to produce a digital-text because there are alternatives that satisfactorily fulfil the purpose. All the changes in the activities re-design that were just pointed out were linked to the need of developing reciprocity and critical-digital-literacy, as explained next.

5.4.1 Reciprocity: Re-understanding the concept

In the field of intergenerational practices, reciprocity refers to how seniors and children build a reciprocal relationship between them, and how they both get outcomes from it by sharing skills/knowledge each other (Knight, Skouteris, Townsend, & Hooley, 2014; Generations-United, 2002; DeVore, Winchell, & Rowe, 2016). However, as we combine intergenerational practices with third-space, the concept of reciprocity must be further developed.

In a third-space, knowledge emerges from those moments in which teacher and students' interact with a non-hierarchical communication (Potter & McDougall, 2017), supporting their knowledges to meet each other, and share information that does not belong to any of them but to something else that contests both perspectives (Gutiérrez et al., 1995). This tension is what makes new learnings emerge. Moreover, Gutiérrez et al. (1997) explain that in practice, these moments are supported by activities that let students constantly switch

between novice–expert roles (Daniela K. DiGiacomo & Gutiérrez, 2015). This resonates with multiliteracies *situated practice* (see Section 3.5.1.1, Literature Review), emphasising in grounding learning in real world experiences that expose learners to new learning situations, within a constant movement between knowledges that learners already have and new learning situations (Dewey, 1938).

In the I-3S, both seniors and children are learners. Thus, they both need to have equal opportunities to switch between novice–expert roles. Neither remains in only one role throughout the process, potentially leading them to create new knowledge together (Gutiérrez et al., 1997). Therefore, in the I-3S, ‘reciprocity’ has two dimensions: 1) Seniors and children should gain outcomes from building a reciprocal relationship; and 2) Seniors and children should be equally involved in opportunities to switch between novice-expert roles. In this spirit, reciprocity is something that is in constant building, and it can be provoked through tasks within the I-3S. The facilitator in the I-3S not only needs to design the learning experiences in such way that seniors and children had opportunities to be expert and novice, but also to focus her/his role to encourage learners to equally place their resources available to one another and to use all available resources to solve the tasks. The importance of the facilitator’s role became more obvious to me as this research progressed.

5.4.2 Critical-digital-literacy – Making a Podcast

The understanding of reciprocity in the I-3S, and the purpose of developing critical-digital-literacy, whilst reinforcing the view of technology as a resource that can be used to make our voices heard to transform the environment, emphasised that the process of making a digital-text is as important as the digital-text itself, in terms of moving learners towards the aims of this research (developing critical-digital-literacy and reciprocity). Moreover, the production process of digital-texts is key because it faces learners to develop technical skills and metalanguages, but also opportunities to reflect on how to critically use and produce

digital media during the process (rather than just in presenting to an audience at the end) (see section 3.5.1, Literature Review). Thus, I decided that as digital-text in Cycle 2 learners would create a Podcast, following this procedure:

- 1) Seniors and children identify a social problem in their local communities -each of them in their own communities- that they personally believe is important to overcome.
- 2) Each team discusses between them the social challenges, and why it is important to solve them.
- 3) Based on the discussion, the team chooses one challenge and creates a Podcast around that topic.
- 4) The Podcast is uploaded to SoundCloud (an online podcast platform).

To promote reciprocity among intergenerational encounters, Kaplan (2002) suggests provoking the exchange of dialogue among the generations. Similarly, other authors suggest that reciprocity can be reached by involving seniors and children in practices related to civic engagement or community service projects because the generations engage in something meaningful for both (Hake, 2014; Matt Kaplan, 1997; Generations-United, 2002; Penick, Fallshore, & Spencer, 2014; Hake, 2017). This resonates with the critical pedagogy approach taken in this research. When seniors and children engage together in something meaningful for both, it is a way to learning whilst being in communion with others (Darder, 2015). Moreover, in this research, based on the sociocultural critical standpoint, it is hoped that seniors and children would move from the psychological reflection of sharing/exposing their experiences, to a political analysis that would potentially lead them to take action (Freire & Macedo, 1995).

In this context, I decided that involving seniors and children into a deep reflection of social challenges in their communities was a way to find common interests, and something

meaningful to work together. Moreover, the reflective exercise was in line with critical pedagogy because it takes them to a new awareness of the contradictions they live (Freire & Macedo, 1987). This is not me telling them what should be changed in their environment, but me setting up an environment to listen what seniors and children have to say, and taking them into an embodied process of making a digital-text to try to overcome those contradictions, a link to what Freire (1970) stated (see Section 3.1, Literature Review). I say this because learners themselves came up with their own ideas of the best ways to overcome those contradictions. I only encouraged them to embed those ideas in a digital-text. This way they could experience how to make use of critical-digital-literacy to participate in the world, regardless of being too old, too young or residing in an economically challenged area.

Additionally, I divided the DigiCamp working-sessions in three categories: (1) intergenerational sessions where children and seniors worked together; (2) sessions where only the children or only the seniors were working; and (3) recreational sessions for the children. Although building reciprocity, developing critical-digital-literacy, and experience technology as a resource to transform society are aspects that happen simultaneously, dividing the working-sessions in categories helped me to embed reciprocity and critical-digital-literacy according to the characteristics of the session, and the learners per se, as explained below.

5.4.2.1 Embedding reciprocity in the DigiCamp working-sessions

During the intergenerational sessions, reciprocity was emboldened by provoking the exchange of thoughts and reflecting together. For instance, the first session where senior and children meet, they engage in a one-to-one session dedicated to foster dialogue between them and the exchange of basic personal information to start knowing each other and building rapport. For instance, Oscar, Liam, and the senior Jacob found out that they all have musical talents.

Jacob: Do you like singing?

Oscar: Yes I do. I like it so much.

Jacob: Do you play any musical instrument?

Liam: Yes, the piano

Jacob: Wonderful! I also play the piano. Do you take classes?

Liam: No, I play just because I like it.

Oscar: Actually, Liam plays the piano very well.

Jacob: Do you teach yourself?

Liam: Yes

Jacob: That is amazing! I had to take classes, and I didn't like them but my parents made me do it when I was 6 years old. But now I like it.

I planned to continue this kind of information exchanges through all the intergenerational sessions. For instance, when learners were asked to exchange information about the social challenges in their communities, this supported them to learn more about the sociocultural context of their partners, and potentially be more empathic about the challenges that the other generation faces. Moreover, involving them in the reflective dialogue, and later practice, could have challenged their own beliefs and knowledges; something important to develop new knowledge (Gutiérrez et al., 1997) and reciprocity (Matthew Kaplan, 2002), but also to reflect on their own oppression and finding their own ways to transform it (Friere, 2005).

Similarly, building reciprocity among the children when seniors were not present was important, so I included some sessions where children worked by themselves in their media product. In these sessions, children were encouraged to ask for help from other children, if they need it, and to share with others what they were learning when building their digital-texts. For instance, I included activities that intentionally made each team of children search for the different elements of how to create a Podcast. One team had to find out what is a Podcast and how it works, whilst other team searched for suggested techniques to write a

podcast' script, and technology needed to create it. In the second part of this activity, each team shared the information they found with everybody in the room and, in a second moment, with the senior. The exchange of this information encouraged collaboration among all the children because they helped each other to understand different aspects of how to create a Podcast.

Similarly, during the second week of DigiCamp, I planned that children would explore for themselves how to use Audacity, a software for creating audio podcasts. I indicated to the children the basic functionalities of the software, and they explored how the tools work by "trial and error". For instance, how to add audio files, how to add sound effects, how edit the audio files, among others technical aspects. Then, each team shared the information they found with everybody in the room, and later with the senior. This is how learners were provoked to place their own resources available to everybody in the I-3S (Daniela K. DiGiacomo & Gutiérrez, 2015).

I also included recreational activities for the children where they did not work on the digital media product. I took them out around the city, for instance to the swimming pool. These activities were important because this intervention was framed as a Summer camp. Also, because this way children could foster a stronger relationship between them, building reciprocity. However, in this cycle I planned that the first recreative session was a workshop with Roberto Castillo, a well-known Mexican poet and fiction writer in the city, who is also a senior (65+) and a retired literature teacher (Wikipedia, 2018) .

I planned that during the workshop the writer could explain the children how to create a Podcast script using the appropriate literary grammar elements (*metalanguage*) (Cope & Kalantzis, 2009). Even though I, as the facilitator, could search for information around how to write a podcast script, I decided that this information be given by a professional in the area. This would make the children feel engaged in a more professional environment, rising their

self-esteem and strengthening their engagement with the task (Ito et al., 2013). Additionally, children might benefit from learning from someone that is very knowledgeable and impassioned on the topic. Moreover, the fact that the writer is a senior sharing his knowledge with the children goes in line with the aims of this research project.

5.4.2.2 Embedding critical-digital-literacy in the DigiCamp working-sessions

Critical-digital-literacy is not only developing mechanical skills to manipulate software/hardware, but also taking a critical approach to digital media. Thus, to lead seniors and children towards this direction, I planned activities for seniors and children to be equally exposed to develop technical skills, but not the same technical skills. Similarly, they were both exposed to critically reflect on digital media, but sometimes these reflective processes were different for seniors and children. Here, I want to highlight that, within the same activity, seniors and children were equally exposed to develop critical-digital-literacy but not necessarily through the same tasks, even though they were working together in making the Podcast. I examine the reason why next.

Critical-digital-literacy must be linked to how learners make use, and make meaning, of technology in their everyday life. It is from here that new learnings build upon. It can be said then that seniors and children would be exposed to different learnings experiences, since they have different digital cultures, technical skills and meanings. This argument was supported by the fact the children were assigned to make/edit the Podcast, and not the seniors. This decision was taken because seniors could not get technical support from the facilitator, since I was physically located with the children. However, this decision does not limit seniors from developing critical-digital-literacy, but what can be expected is that seniors and children develop different aspects of critical-digital-literacy. In the same vein, multiliteracy pedagogy warns about the importance of exposing learners to the new/unfamiliar information in such way that it is sufficiently close to what they already

know, so they could make use of their existing resources (Cope & Kalantzis, 2009). In this context, seniors and children cannot be exposed to the same new/unfamiliar information, or at least not in the same way, because they have different knowledges/resources. However, they both should be equally exposed to opportunities that lead them to develop critical-digital-literacy (reciprocity).

In sum, both generations were equally exposed to develop critical-digital-literacy, but their exposure was different. The activities were framed in a multiliteracy pedagogy, building from learners' knowledges and sociocultural context. In this spirit, seniors were engaged in technical skills -mainly through personalised workshops-, whereas children were more engaged in technical skills related to editing the Podcast. However, both generations engaged together in the critical reflection process during the intergenerational sessions.

Critical-digital-literacy and seniors' workshops

Seniors' workshops aimed to make sure that the seniors had the equipment and the basic technical skills/knowledge to get online and connect to the I-3S, and that they had a clear understanding of their role and activities to be performed. To do this, I started by conducting a first interview with each senior to better understand their sociocultural context and digital culture. This was used to personalise the workshops and the activities that seniors performed in the I-3S. (Seniors' biography is in Section 2.6.1, Methodology).

Each senior has different needs to learn the "know-how" of manipulating technology, thus, each senior needs a type of support that adapts to their own needs (Hill et al., 2015). Their differences in skills, needs and sociocultural context implies that each senior gets exposed to different types of software/hardware and different elements of digital-literacy. Therefore, the facilitator's role is key, not only to be sensible to identify the software/hardware that it is convenient for each senior to use, but also to be sensible to how best to support each senior to learn how to use the software/hardware. For instance, in Cycle

2, exposing seniors to explore diverse software during the workshops let me identify the software that each senior found as easy to remember how to manipulate.

Despite the need to personalise the workshops, there are minimum technical skills that all seniors need to acquire during the workshops: 1) To learn more than one way to establish a videoconference (FaceTime, Skype and/or Google+), as well as basic troubleshooting, such as turning the device off/on if they faced a challenge. Data from Cycle 1 showed that the virtual connection frequently got lost during the intergenerational sessions. Thus, using a different platform, or rebooting the device helps re-establish the communication. 2) To learn how to send/receive text messages to/from the facilitator, so seniors could share their diaries or any questions they might have, such as asking for help.

Additionally, considering the importance of place/space in the learning process, I realised that having the workshops at seniors' home supported their development of critical-digital-literacy. The argument is that walking the seniors through the technical steps they needed to follow for establishing the communication in the same physical space and with the same equipment that they would use when working with the children, is a way to implement *situated practice* (New-London-Group, 1996). Under a multiliteracy pedagogy, seniors would acquire the new technical skills based on their current experience, the current steps they follow in their real context to get online and participating in the I-3S.

Having the workshop at seniors' home was particularly relevant for seniors who believe themselves 'not good with technology,' as in the cases of Edna and Heather (see Section 2.6.1, Methodology). For them, having someone that guides them through every step they need to follow when using technology gives them confidence (Schreuers et al., 2017), not only because they experience that they can actually use technology, but also because they know that if something goes wrong, I could help them. Moreover, having me in their home working with them helped us building trust and rapport, something important in the I-3S

because the personal interaction impacts the socio-emotional aspects of their digital engagement (Haight, Quan-Haase, & Corbett, 2014).

After conducting all workshops with the seniors, I identified information that impacted the re-design of the activities for Cycle 2.

Learnings from the workshops that impacted the re-design in Cycle 2

I identified that seniors Edna and Jacob could use Google Drive to work on a document simultaneously with the children. Even though none of them are very familiar with Google Drive, they both learnt how the software works, and that using it with the children would help them practice and explore the affordances of this software. Since the children are not familiar with this software either, Edna and Jacob could learn with the children simultaneously, and could help each other to overcome the challenges they might find when using it. Also, I noticed that Edna and Jacob were capable of learning how to use other software, or to do more complicated tasks during their interactions with the children. First, because both are keen to try new things, but also, because they both can follow more elaborated/complex instructions without having a person next to them. Edna needed more support to perform tasks because she needs more detailed instructions/explanations to execute them. However, even if the instructions are complex, by explaining them to her in more detail, she could do any task.

On the other hand, Heather and Litzy's context is different. Their collaboration with the children is suggested to focus on using verbal interaction, and the use of the technological tools they experienced during the workshop (i.e., email, establish a videoconference). Heather and Litzy need closer and stronger support to manipulate technology and, as said before, they need more time to practice and memorize every step of how to perform a task in a technological device. Therefore, in Cycle 2 it is suggested not to push Heather and Litzy to learn how to manipulate other kind of software/hardware but to focus on what we practiced in

the workshops. In other words, this suggested the need to design different kinds of participation for these seniors.

Clarifying seniors' role

Another aim was to clarify with the seniors what was expected from them; it is necessary to satisfy seniors' needs about clarity in what their role is, and what they needed to do in every session (Generations-United, 2002). However, 'clarity' is an ambiguous term among research papers because it is not explained how to do this in practice. I argue that it needs to be unfolded in detail to better design intergenerational spaces. For instance, in Cycle 1, I explained seniors what was expected from them. However, for some of them the information was not clear, such as Litzy who connected this experience with her expectation of the new cycle, and expressed in the initial interview of Cycle 2:

(I hope) we could have a clear passage about what is expected of us... We need a script or something. If I know what is expected from me then I'll give my all, you know. But if I don't know, then it's just a hit and miss. I don't like that. I want to know what is expected from me, then I'll go 100%.

Litzy was constantly confused about what she needed to do during the intervention, which caused her anxiety, and the feeling that she was not giving her best. Litzy made visible that some seniors need to have instructions explained in an easy way and be constantly reminded of what they have to do. Thus, during the workshops I clarified seniors that they would collaborate with the children, and not "teach" the children. Additionally, I gave seniors a detailed schedule describing what was the goal in each day (see Appendix C) and clarified doubts. I reinforced seniors' role during working sessions by, at the beginning of every session, reminding them the goal as written in the schedule.

Critical-digital-literacy and children's working-sessions

I planned that in the first children-only sessions, we would talk about how digital media and the internet are being used to make our voices heard and to impact our society.

Also, we would discuss web pages that people use to make the world aware of social issues, such as Change.org (2019), and the use of blogging as a protest, by exploring the well-known Malala's case (Malala-fund, 2018). I linked the discussion to learner's podcast making as a way to use digital media to make an impact in society. Also, about the responsibility we have when posting/sharing something online; as well as reflecting about exposing or sharing our personal data on the internet. Although this reflective moment only happened with the children, it was planned that in the next intergenerational session, children shared with the seniors what was discussed and exchange thoughts about the topic. This way, seniors and children would have reflective moments. I planned to have this type of reflective moments and exchanges throughout all the sessions, intergenerational sessions or children-only-sessions, whenever is pertinent to bring them in because the critical reflective process is not spontaneous but encouraged (see Section 3.5.1, Literature Review). All this highlights the importance of the facilitator's role, particularly when working in a critical pedagogy framework.

When children were working by themselves in their media product, the activities were organised to let them manipulate the software and learning by experimentation or "trial and error", as well as by encouraging them to search for online resources to learn how to use a software (e.g., online tutorials). For instance, during the activity in which each team of children find out about basic tools of Audacity, I expected that children develop critical-digital-literacy focused on how to mechanically edit digital audio files. Additionally, I expected that the exercise of freely manipulating features of a software, implicitly teach them what to do when encountering a new software. Although searching for online resources might look like and intuitive action of the new generations, many of the children mentioned searching online as something they do not usually do. Therefore, I deliberately included it as

a digital-literacy skill to be developed in the I-3S. These exemplifies how children were engaged in developing technical skills whilst having critical reflective moments.

Building critical-digital-literacy together

The activities design aimed to equally involve seniors and children in opportunities to develop digital-literacy. The first step is to reflect on the social challenges that learners, seniors and children, face in their communities. This is connected to learners' sociocultural context, since they need to take their context into account to identify, from their perspectives, why something needs to be changed and how it could be changed (Freire, 2012). By representing this social challenge in their podcast, learners are using digital media to interpret and represent the world. Moreover, learners would experience how technology can be used as a tool to have an active impact in their communities, both, seniors' and children's communities. Similarly, once the Podcast topic is decided, learners need to discuss about the audience they want to target, so they can choose elements such as the kind of story and vocabulary to be used in the Podcast. Reflecting on audiences is related to critical-digital-literacy because it is a way to understand how the different digital media text target people as consumers, and how people respond to it (Buckingham, 2007).

Once the audience is selected, learners will create the story line and the characters. They can use the vocabulary and expressions used in their sociocultural context to create the story and base the characters in something that is familiar and meaningful to them. This exercise is a link to critical-digital-literacy because learners would be using their own voice to interpret and represent the world, using digital media to create their own discourses and designing their own possible solutions. The next step is to learn how to add audio effects and the impact they have in the Podcast, reflecting on how sound effects reinforce the message in their podcast. I planned to encourage learners to discuss about audio files copyright and Creative Commons attribution (Creativecommons.org, n.d.). The discussion would be around

why is important to use digital material that is deliberated shared to be used and modified by internet users.

Making a Podcast is associated to the production aspect of critical-digital-literacy, particularly to persuasion and influence, since I expected that learners experience how to use a digital media text to persuade an audience to change a social challenge faced in their communities (Buckingham, 2007). Moreover, sharing the podcast in the web to be accessible for any user was planned as a way to use technology to impact society.

5.4.3 Designing a flexible working schedule

Cycle 1 showed that the working schedule can be easily impacted by many unforeseen situations in the I-3S (see Section 4.5.1, Cycle 1). Thus, although there is no guidance in literature about how to organise an intergenerational working schedule, multiliteracy pedagogy implies a flexibility for learners to go back and forth in their learners' process, instead of following pre-established steps given by the teacher (Cope & Kalantzis, 2015). Thus, I aimed to have a flexible schedule, where I set up specific goals for every session, but each team had freedom to organise themselves on how to reach those goals. For instance, the instructions in the schedule are: *“Seniors and children will share each other the social challenge they identified, and the reasons why it is important to overcome it. Then they will choose one challenge to create the Podcast”*. From this instruction, each team will organise themselves in terms of sharing-times, or what information to share and how to share it. On one hand, learners would have goals at the beginning of each day, and potentially use them to make changes by themselves in their work if unforeseen situations emerge. On the other hand, seniors and children could themselves organise their role and expectations within their teams, clarifying everyone's role. The full working schedule can be found in Appendix D.

5.5 Implementation phase – Cycle 2

This subsection responds to the question **what happened when the re-design was implemented in Cycle 2?** To some degree, this section evaluates the extent in which the re-design reaches the proposed goals. To answer, I return to the same structure I followed in the design phase: non-hierarchical communication, reciprocity, and critical-digital-literacy.

5.5.1 Non-hierarchical communication

The overall aim is to reach a non-hierarchical communication in the I-3S, where learners are encouraged to bring their knowledges and make them available as resources to create new knowledge. To move toward this, the re-design implemented the following changes:

- Seniors and children were grouped in small teams, where everybody speaks the same language.
- A working space was dedicated for the intergenerational sessions, aiming to reduce ambient noise.
- The internet connection was reconfigured, as well as the physical space, allowing each team to have its own working station and technological equipment.
- Seniors' role was modified through the activities' design to equally involve seniors and children in the production process (addressed later in Section 5.6.3).

It was challenging to identify in the data collected for Cycle 2 how each of these changes, as separate entities or decisions taken in the re-design, impacted the communication in the I-3S, particularly, because no single change moved the I-3S towards the goal, rather it was the overall re-design planned for this intervention. However, viewing the above listed changes as an *infrastructure* (Star, 1999) is helpful; the ensemble of all these changes can be seen as the invisible infrastructure of the I-3S; as such, it is embedded in other structures of the I-3S and its functionality can be only seen through the overall ecology of the I-3S because

it permeates all its functions (Star, 2002). Therefore, the effectiveness of the ensemble of changes, as infrastructure, can be only seen through the other elements of the I-3S, by identifying whether the I-3S moves towards a non-hierarchical communication. This way, the infrastructure will remain invisible unless it breaks (Star, 1999). For instance, in this cycle, data shows that there were moments of non-hierarchical communication among seniors and children, thus, it can be assumed that the changes made on the internet were effective but we will not notice it until the internet breaks again and interfere in the intergenerational communication.

In this context, the ensemble of all changes is the infrastructure of the I-3S, and I indirectly evaluated their relevance through how the overall implementation moved the I-3S towards a non-hierarchical communication. Thus, understanding how the activities moved the intervention towards this direction is crucial.

5.6 Activities – Response to the implementation phase in Cycle 2

In this section, first I briefly describe how an overall session in the I-3S looked like. Second, I present an example of how seniors and children produced their Podcast to illustrate how the work in the I-3S simultaneously fosters reciprocity and the development of digital-literacy. Additionally, subsection 5.6.3 and 5.6.4 specify, respectively, the different shapes that reciprocity and critical-digital-literacy took in the overall intervention.

5.6.1 DigiCamp summary – Cycle 2

All learners received a printed DigiCamp work schedule, each child arriving to our working space at the time assigned for her/him. The children worked either with the senior or by themselves, according to the schedule. When collaborating with the senior, children worked at the isolated working station in the second floor; otherwise, children worked in their digital media product, at their working station with their team's equipment. At the end, all the children filled out an online diary using Google Drive. Then, all of us had lunch together at Carmen's home. Moreover, children were advised that they could arrive earlier to the sessions to have breakfast if they wanted to.

Seniors also followed DigiCamp's work schedule. Two or three times a week, seniors established a videoconference with the children at the assigned time. Every session had a goal, thus, seniors collaborated with the children to complete the tasks. Seniors Heather and Litzzy worked with the children mainly verbally, whilst Edna and Jacob, in addition to working with the children verbally, used Google Docs to simultaneously write texts with the children. Intergenerational sessions lasted 45 minutes in average; at the end of every sessions, seniors sent me an email to share their experiences during the session (reflective diary).

It can be noted that although all seniors and children worked together in making the Podcast, the technical manipulation of the software (Audacity) to create the digital file is a task completed by the children. However, the overall Podcast production, including the critical reflective process, involves the reciprocal participation of children and seniors as a team (see section 5.4.2.2).

5.6.2 Illustrating the work in the I-3S: the “Best Friends” team

Cycle 2 had four intergenerational teams. All of them finished their Podcast, which can be found in this link: ([Click here for Cycle 2 digital-text](#)). Although each team worked in a unique way, here I use the work of senior Edna and children Marion and Ava (who named themselves as the “Best Friends” team) to illustrate the process of how all teams worked, during the intergenerational sessions towards developing critical-digital-literacy and reciprocity.

The “Best Friends” team worked together in 5 sessions. The children were shy during the first session, but Edna took a friendly attitude, and started to ask questions, engaging the children in the proposed conversation of knowing each other. The children realized that the senior knows the city where they live, so they all found their way to engage in the conversation by talking about the cultural matters about the city, such as food. They named themselves “Best Friends” because they found many things in common, such as the fact that all of them play musical instruments. At the end of this session, I noticed that I did not record the session, and I expressed that in a loud voice. Then, Marion said *‘oh no! it was a very*

funny session, Edna is very nice and funny'. This denotes that the children enjoyed chatting with the senior. Moreover, in their diaries, Edna, Marion, and Ava expressed joyfulness of meeting each other. It can be said then that having the first intergenerational session designed to engage learners into knowing each other resulted in a positive experience for all of them and impacted in their engagement (Matthew Kaplan, 2002; Matthew Kaplan, Sanchez, & Hoffman, 2017), with the senior assisting this encounter.

In the second session, children were keen to start because Ava took some pictures of a green area that was burned behind her home and she was excited to share it with the senior. Ava took pictures because, from my experience interacting with her, she has difficulties articulating her ideas. Thus, I suggested the child to borrow a tablet and take pictures related to the social challenge she wanted to talk about. However, during the session, Ava had problems with the tablet and could not show the photograph, thus, she could not explain her ideas. Marion intervened and started to explain the social challenge to the senior, then Ava fixed the tablet and once she found the photograph, she clearly shared her thoughts.

It is frequent that Ava experiences difficulties expressing her opinions. Many times, she forgets how to articulate certain words, so she ends up asking someone else for help or shrugging her shoulders and saying *'No, no, no, forget it'*. However, this time Ava used the photography as prompt to support her communications skills. Moreover, the photograph provoked the senior to make specific questions to the children around burning rubbish, the reasons for that to happen and what they think that could be done to solve the problem. The senior was careful in asking children questions to engage them in reflecting on the problem from different perspectives. The senior also exposed the social challenges affecting her community and the children gave their opinions about it. Marion participated more than Ava, but the senior was aware of this and constantly made direct questions to Ava to involve her more in the conversation. The senior was conscious of the collaborative role she was playing;

thus, Edna was frequently finding ways to engage children in a dialogue to take consensual decisions around their Podcast. In this spirit, the team chose the phenomena of burning rubbish on the street as the social challenge they wanted to address.

Later, I intervened to remind them that the next step was to think about the kind of audience they wanted to target, and to think about the kind of story that could be used for that audience, in line with critical-digital-literacy, since it is important that learners reflect on how audiences are targeted by digital media designers to create new technology (Mihailidis & Thevenin, 2013; Buckingham, 2006). This exemplifies how the facilitator provokes reflective moments throughout the sessions, because they might not happen spontaneously. Moreover, it emphasises the facilitator's role as key to scaffold learners' thinking. During this discussion, the senior explained to the children more details about what it means to target an audience. Similarly, the senior led the conversation towards how the story might look like, in terms of content. Edna guided the team to reflect on aspects that needed to be considered to create the story -the metalanguages. In this case, it was not that the senior was imposing her own ideas, but her prior experience in teamwork came to light in how she was guiding the work, and how the senior was involving the children's opinions into the story. This shows that the senior understood her role as being a facilitator. Thus, the senior was aware of bringing children's opinions into the discussion, and many times, keeping children engaged in the reflective process.

The day after this session, I took the children to visit Roberto Castillo, the writer and poet (Wikipedia, 2018). He gave them a workshop on how to write Podcast scripts. Therefore, Marion and Ava had a clear idea of what could be done with their own Podcast. In this context, on the next intergenerational session (session 3), I started by asking the children to share with the senior what they learned with Roberto Castillo before writing their own Podcast script. Children were shy to do this. However, Edna was kindly encouraging them to

talk -again, fostering an equal collaboration. I intervened to explain to the senior about the workshop, as a way to engage the children and giving them confidence. I also asked the children specific questions about the experience; children started to feel more confident and began to talk. The children could identify all the elements that are involved on a Podcast - metalanguages- and share it with the senior. This highlights how the facilitator identifies opportunities to encourage learners to have an equal communication; sharing each other their knowledges to build from that.

The team started to write their script. Again, the senior was guiding the story making by asking the children key questions. For instance, on the session 3 video (minute 3.32 - video part 2), the senior asked: *Do you want that only one person talks in the story? Or all of us? and Ava answered: 'All of us.'* The senior was not imposing ideas, rather using her experience to identify the elements needed to construct the story and to organise the work. Edna started to hand-write the story based on what was being discussed in the team, and Marion started to do the same, writing the story in a piece of paper, as if she was imitating what the senior was doing or because Marion realised that taking notes can be a useful resource/technique that children can use. This highlights how seniors and children developed their own ways to collaborate and learning from each other; Marion noticed the importance of taking notes when the senior did it. It can be seen from this example that in the I-3S learners do not do the same things, nor take the same roles, but they collaborate making use of their resources and knowledges.

The children quickly became involved in the work, giving opinions to the questions the senior was highlighting. The children were not just agreeing with what the senior proposed, but they were also giving new ideas and proposing new options. An example of this can be seen in the following dialogue extracted from the video recording of session 3. The extract also shows how the technology plays an important role during the interaction:

Edna: Then, what would the "comadre"³ say to the other "comadre"? what would be the fresh news?

Marion: mmmh... I don't know

Edna: Imagine that the fire just happened and this "comadre" saw everything.

Ava: Ooh! yes, that the comadres were like chatting, when the fire started to happen. At that moment we could get the plastic bags and squeeze them to make the fire noise.

(The internet connection cuts at this point, and the children did troubleshooting to get the senior back.)

Marion: Edna you got frozen!

Edna: Yes, you too. I said aww! then I just turned it off. Then it went back. Did you connect it again?

Marion: Yes, but you, the camera was not on, so I pushed the button quickly but you did not answer.

Edna: Well, it works now. Let's continue. What would the "comadre" say?

Marion: She could say something like "you won't believe what just happened".

Ava: Well, let's imagine that the "comadres" are chatting when it starts burning, and then we add what Marion said.

Senior: Ok, I'll write it down like that.

It can be seen that the senior plays an important role to keep the work on track, as well as making sure that children reflect and give opinions on the work. At the end of this session, the senior asked if she could keep writing the story on her own and send it by email to me, so I could share it with the children. This way, the children would have time to read it and highlight suggestions that could be discussed in the next session. I told Edna that it was a good idea, so she did that. During the story making, Edna was again encouraging the children to give opinions and keeping track of the time. In her diary, Edna said that during this session she thought that there would not be enough time to finish the work. Therefore, she was

³ "Comadre" is a word used in the Mexican culture to refer to a close friend. Could be a synonym of friend, chum or buddy.

focused on keeping the team working in the task and not moving the conversation to other topics. Edna wrote:

I think in today's session, I talked too much. I had the impression that we were not going to have enough time to complete our story, so I asked a lot of questions and suggestions. However, I feel that my "compañeritas" contributed in an important way to the story that we are trying to put together.

Session 4 was dedicated to record the Podcast. The two children and the senior were using their own laptop to edit the document and recording the podcast. This time, the children uploaded the story that Edna finished writing to Google Docs, so they all could edit it together. Even though the children and Edna were new to Google Docs, they all could easily edit the document simultaneously and to help each other when needed. The children were using Google Docs to write their online diaries, and Edna only used it during the workshop with me.

It can be seen in the video recording of session 3 how the children and the senior make use of the available resources, technological resources, and personal skills, to work together and exchange their knowledge. An example of this can be found in the following extract of the video recording of session 3:

Marion: ...There!, the music gets downgraded to the third plane (showing with the mouse in Google Docs).

Edna: You mean here? (showing in Google Docs)

Marion: Well, at the very, very beginning, we have the Mexican music with the harp, in a second plane. Because in the first plane we will be talking.

Edna: Yeah!

Marion: So, the music is in the second plane. Then you read all this. But then, the Mexican music gets downgraded to the third plane, and we get the "cheering" effect for 5 seconds, in the first plane, so we could hear it. Then, after 5 seconds the sound vanishes, and the effect is off. But the Mexican music is still on in the third plane, and you keep reading. What do you think if, right there, we add another music in the third plane, to introduce the new conversation? (While talking, Marion used the mouse cursor to point in the document the aspects she was discussing)

Ava: A music like this one? (playing a song in YouTube)

Marion: Yeah. What do you think?

Edna: I like that song; the sound is nice. Do you both like it?

Marion: Yes. I do.

Edna: Ok. Let's use that one then.

Marion: Well, this song is in YouTube. But we were told that we must use this other website, can you see it? (turning her laptop to the senior's visual range). Here you can search for any sound. For instance, you can type "zombie", and then you got all the zombie effects here. Can you hear it? (Marion does the demonstration to the senior while explaining it). So, I think is better to use this website. Don't you think?

Edna: Sure! (laughing because of the zombie sound)

Marion: We also have here another website where we download music.

Edna: Can we find some birds sound? When birds are singing.

Marion: Aah! We found that in this website (Marion is doing the search). Birds you said?

Edna: "Trino", that is how you name the birds' sound.

Marion: T R I N O...oh, this one! Can you hear it? (playing the bird sound)

Edna: Yes, it is perfect. We could use that one in the second plane, while in the first plane someone is saying "good morning!"

Marion: Ok. Let's write it down. (they both made changes in Google Docs)

In terms of reciprocity, the dialogue shows how the generations collaborate and communicate at the same level. It is noticeable how children and senior constantly switch from the novice, to the expert role, and vice versa. The senior was still indicating the aspects that needed to be followed in the making, as well as giving options to use in the story. However, the children were giving feedback making use of the learnings they acquired in prior sessions. For instance, Marion explains the senior that is better to use music and sound effects from a specific website than from YouTube. Although Marion does not explain in depth the reasons for using one website over another, the explanation is that in a prior session, with only the children, we discussed about copyright. In the frame of critical-digital-

literacy, we discussed that songs, music, and other digital media material have owners and we cannot make use them unless we have consent from the authors. Therefore, we needed to use websites where the materials have a creative commons license (Creativecommons.org, n.d.).

Similarly, the children used their learnings from the workshop with Roberto Castillo about how to create a podcast script. In the dialogue, it is noticed that Marion starts talking about the podcast's elements using the formal metalanguages. Marion talks with good knowledge and agency about the different layers of sound, foreground and background sounds, and how they can be used in their story. Then, the senior learnt from the child, and started using the same metalanguage to continue the work. This is how they both shared and created new knowledge.

The work done by Edna, Marion and Ava illustrates how reciprocity, critical-digital-literacy and non-hierarchical communication among seniors and children happens simultaneously. As said before, each of the other teams worked differently, but had similar experiences, in terms of reciprocity and critical-digital-literacy. I include these experiences throughout the following sections.

5.6.3 Reciprocity

The activities were re-designed to foster reciprocity, with the term extended to mean: 1) seniors and children should get outcomes from building a reciprocal relationship; and 2) seniors and children should have equal opportunities to switch between novice-expert role. In relation to this, data shows that seniors and children enjoyed interacting with each other and built a reciprocal relationship, even though they interacted through videoconference instead of face-to-face. Moreover, data indicates that children broke stereotypes about the seniors. In this context, the next paragraphs explain how seniors and children built a more equal, non-hierarchical, communication (than in cycle 1), allowing them to work collaboratively, helping each other to switch between novice-expert role to create the Podcast.

All seniors said that the intergenerational interaction was a positive experience, allowing them to strongly connect with the children. However, some seniors missed the face-to-face interaction and would have prefer it over the virtual interaction. For instance, Edna said:

'I think it was good (her connection with the children). They (the children) gave me a compliment: Do you have grandchildren? We want to ask you, we want to ask you '... yes, I have three ...' ah! How good! How funny it must be to have you as a grandmother, or something like that ... and me, ooh well! What a great compliment, thank you very much... Yes, we had fun and had a good time'.

When Edna narrated this anecdote, she said that she did not miss the physical interaction, that it was not as talking to a machine, it was the same as having the children there. Litzy, Heather, and Jacob said that interacting with the children virtually was almost like having the children physically there with them, however, working face-to-face could have been better. For instance, Litzy said: *'It would have been nicer if we had been physically present to each other, but under the circumstances, you have to adapt to what is being done. But it was good, that's the way it is. So, you do the best to adapt to the situation.'* On the other hand, Jacob hesitated more about the virtual interaction and argued that a face-to-face encounter would have been preferable:

I think not. I would have liked to see them and have them there. I think we would have enjoyed it more. At least I would, and maybe they would too...Seeing them would have been much better. Having them sitting here, or being able to hug them when they arrive, things like that. And give them a glass of water, or show them something, or I do know, maybe if we meet at their place, so they can show me their house, their neighbourhood, their playground, where they like playing, the park of which we talked about once. I miss a little that personal interaction, closeness. I would have liked more, yes. Despite everything, it was good...but I say it could have been more.

It can be said that seniors prefer having a face-to-face interaction but, due to the geographical separation, they understand the need of a virtual interaction and do not resist it; particularly because all seniors had a positive experience with the children.

Similarly, children said they had a positive experience with the senior. All children recognised that it was very funny being with the seniors, and that the project would not be the same without them. Moreover, children recognised the seniors as an equal member in their team. For example, Marion said that what she liked the most about being in the project was *'That I worked with Edna; I liked that while we learned something, we were also having fun'*. Marion went beyond and detailed more about how the senior had an impact in the teams' performance:

I liked that we agreed on the ideas that each of us had, sometimes Edna gave an idea and we agreed if we made that idea or another, it was very cool that she was working with us... I think that it changed because Edna was there, because we would not have had the same ideas, the same funny moments in the story, we would not have had it without Edna, and I think everything would have been different if she had not been with us.

As Marion, Liam and Oscar also felt that they built strong connection with the senior Jacob. Liam said that it was very funny to work with Jacob, particularly when they were making mistakes (whilst recording the story). Oscar added: *'I liked it because I met Jacob and he gave us many ideas to do the podcast and we worked as a team'*.

Additionally, as highlighted in the literature, the I-3S showed signs of breaking stereotypes among the other generation after the interaction (Vandervan & Schneider-Munoz, 2012; Vandervan, 2004; Hernandez & Gonzalez, 2008; Gamliel & Gabay, 2014). For instance, the senior Jacob said *'I expected that, maybe, when talking to an older person, they would go, well, to feel shy, or let me to talk all the time and do everything, but no. Quite the contrary. They took decisions, by saying "we will do it like this, and so on".'* Similarly, Marion said: *'... (working with a senior) I would have imagined a serious person, who was always saying "Do this, this and this"; But no, working with Edna was fun.'*

These examples show that children considered the senior as an equal member in the team, someone that equally contributed to create the Podcast. Thus, it can be inferred that the activities' design fostered a non-hierarchical communication among learners, as well as a reciprocal collaboration. Moreover, learners' ideas of the other generation were challenged.

The fact that learners worked in teams had an impact in how the two generations engage with each other. Unlike the prior cycle, this time seniors and children were grouped in teams. Data showed that being with the same team during all the sessions gave generations the space to better know each other. Activities were intentionally designed to allow seniors and children to know each other, but also being with the same team gave them time to spontaneously exchange information, helping them mature and grow their relationship. Being always in the same team allowed learners to share about their living context, exchanging cultural aspects to create a clearer picture of who is this other person at the other end of the tablet. For instance, Isa and Heather exchanged information of the places where they live.

Heather: I can see the sign on a store's window. If they walk on the street, the thieves will look at it and say "What???" (Senior and child laughing)

Heather: Do you have stores near where you live?

Isa: Yeah, there are two stores

Heather: Oh. That's super helpful, isn't?

Isa: Yes

Heather: Can you put it on their window?

Isa: Yeah, I can put it on a window. Do you know Oxxo? That is another store like "7/11", and it is close by our house.

Heather: Oh, that is better.

Isa: Do you have a store around there?

Heather: In the street, yes. About 3 or 4 blocks there is Target. It is called Target.

Isa: Uhm. The one with a red dot in it, and the other things around?

Heather: Yeah

Isa: That is my favourite store because it smells like popcorn.

Heather: I know, because they want people to know they have popcorn in it.

Isa: It smells so good.

Sometimes learners explicitly express their feelings to each other. For instance, a dialogue between Isa and Heather during session 2 showed that the child feels pleased to be with the senior.

Isa: You're so cute!

Heather: I am?

Isa: Yes (shy-laugh)

Heather: Thank you (shy-laugh). I have all this wrinkles (shy-laugh). Did you grandma have wrinkles?

Isa: Yeah.

Heather: Yeah, that is what happens when you get older. But not everybody has wrinkles. Maybe I inherited it. My mother had wrinkles. And my grandmother. I do remember. I was only 10 when she died. I just remember she was a good cook (laugh). She would make dinner for my grandpa at lunch time. He would come home for lunch but it was dinner (laugh).

Isa: My grandma always like to make hamburgers. Those little, tiny hamburgers.

Isa: But you look so cute with the glasses on

It is through the spontaneous exchange of information that learners built a relationship with each other. Through the above dialogue, it can be noticed that the relationship grew because the child speaks to the senior with more familiarity or closeness. Isa is a child with an introvert personality, as she expressed in an interview. However, she and the senior quickly built a close relationship, which made Isa comfortable to share her feelings, and expressing the senior that she was happy chatting with her.

Similarly, learners got space to explore aspects they have in common, which was relevant to create connections with each other. For instance, Isa and Heather found that they had a lot of aspects in common, despite their differences in age and sociocultural context. They found that they both have inclinations for drawing and painting, that they both know many aspects about birds; and that they both have a strong connection with religion. It was very frequent that this team exchanged information about religion and spirituality. Also, it was usual for them to resort to religious resources to propose solutions to some of the challenges they encounter. This happened mainly because, as said before, Isa lives in a family that has very strong religion beliefs, and Heather is a nun. An example of this is the following conversation from session 1.

Isa: How old were you when you received Jesus in your heart?

Heather: Oh. Hum.. I was already a grown up, but I must have done it when I was little too because after I finished high school, I became a Sister. So... hum... tell me your question again. I got distracted (laugh). This is what happens when you're older (both laugh). Can you guess how old I am?

Isa: Mmm. about 50?

Heather: No. I am 77.

Isa: You don't look that old. I think that is how old my grandma was. She died because she fell off the bed. That was barely two months ago.

Heather: Oh! (sorrow) Really? Oh, I am sorry! What is your grandma's name? I will pray for her.

Isa: (Isa spells the grandma's name). My mom was very sad when she died.

Heather: Yes, I understand. When you love someone, it hurts and you just want to let it all out. Well, all the people I live with here, they're all women, and they're all in their 80's and 90's. One sister was 104, she just died last week. She slept at night, and didn't wake up.

Isa: My grandma died because she fell.

Heather: Well, all these ladies pray a lot. I will ask them to pray for your whole family, and we could do it every day.

Isa: Do you think you could pray for my uncle?

Heather: Sure. Give me his name. I'll write it down. Anyone else?

Isa: My aunt, because she's not doing it right.

Heather: She's not doing right?

Isa: Yeah, she does a lot of bad things.

Heather: She does bad things. Hum. ok

Isa: Is there anything that you want me to pray for you?

Heather: Oh (very surprised)... mmm... The first thing that comes to my mind is pray for my memory, that it will improve. When I do art, I don't have any problems, so it must be a different part of the brain when you do art. But when I want to remember things, I must write it down. I don't keep it.

Isa: Ok (smiling). That happened to my grandma too.

(They both laugh!)

The conversation showed how the generations identified with each other, felt confident enough to share personal information, and engaged in discussing difficult topics, such as death, getting old, and memory loss. In this conversation, they equally exchanged thoughts, building friendship and understanding among the generations. The senior comforts the child by sharing her experience with the death of Sisters at the retirement home. This was Heather's way to help Isa to better understand the grandma's death. In a similar way, Isa takes the role of comforting the senior when Heather lost the threat of the conversation. Heather explained Isa that she has memory challenges. Isa sympathetically supports her by smiling and telling Heather that there are other people like her, such as her own grandma. The relationship and support between Heather and Isa were reciprocal.

In addition, the exchange of experiences opened the conversation about what it means getting old, becoming an opportunity for learners to build empathy and understanding of the seniors' generation. Similarly, when Isa shared with the senior her worries about her mom's sadness, as well as her uncle and aunt "not doing things right", Isa opened the door for the senior to better understand how it is to be a child in a sociocultural environment like hers.

This was also an opportunity for learners to build empathy and understanding of the children's generation, something key in any intergenerational encounter, and one of the purposes of re-designing the activities for this cycle.

In terms of reciprocity, seniors and children did reciprocally engage with each other. Key elements for this to happen were being able to work in small teams, pairing one senior with one or two children, as well as being in the same team during all the sessions; giving teams the chance to grow and mature their relationship; giving learners the time and space to know each other, by encouraging them to exchange who they are during the sessions.; and by dedicating the first intergenerational session only to know each other, instead of start working on the Podcast.

5.6.4 Digital-literacy

Activities were re-designed to equally expose seniors and children to opportunities to develop digital-literacy, to engage in a critical approach to digital media, making use of it as a resource to transform society. Anticipating that seniors and children would develop different aspects of critical-digital-literacy, the following paragraphs explain how 1) both generations acquired different technical skills; 2) both learners had reflective moments to critically engage with digital media; and 3) learners experienced technology as a resource to transform society.

Seniors Litzy and Heather claimed as learning the use of iPads to communicate with people outside the retirement home. However, Heather said that she will not adopt the iPad in the future, whilst Litzy said that she enjoys the iPad, since she can use social media to be more connected with people. Heather is not very engaged with technology, but she uses the computer for email, or when she needs to look for something related to art in Google or YouTube. Although Heather recognises the iPad as a powerful tool, she will not adopt it because, as she explains, *'I'd like to use the iPad but I don't like to have to delete the*

messages there to come in'. Therefore, she rather keeps using the old computer at the retirement home. Moreover, she explains 'I feel that everything that I use the computer for is all I really need. I don't use it for much else... I Google if I want to know something about it. I do Google for that. Nothing else'.

Heather's preference for the computer, even though it is slow, and that she needs to wait until one is available, is justified because the iPad does not meet her needs, and it does not add to her user activities. Heather does not have the critical-digital-literacy knowledge to configure the iPad to respond to her needs. Moreover, Heather does not think of this as a possibility and automatically rejected the iPad. However, Heather expressed in her interview that being able to work with children is what she enjoyed the most in this intervention. Thus, Heather agrees that technology is something that allows her to be in contact with people from outside the care home, although using it might be challenging.

In contrast to Heather's experience, Litzy was more engaged exploring the iPad as a communication tool. Litzy opened a Facebook account and was continuously asking me about its features. Litzy found that she could use the iPad not only to get emails and to take pictures, but also to engage with social media, Facebook in particular:

I like to see who's there and what people are doing... I only get things that are of religious nature. Most everything about the Jesuits, the Franciscans... Of course, my friends, if they put things on the iPad I get that... There is a priest that was living in Peru and he died. They put down that he is a friend and we miss him and all that kind of thing and I wrote down and I sent a comment... And I get news about family friends, not particularly my friends but family friends who use the iPad and Facebook.

Litzy found in Facebook a way to overcome the lack of social relationships with people outside the retirement home, as she states:

Sometimes when I am tired, you know, it is alive, it is somebody alive who talks to me... but it is like a telephone message, a news of people you like not just people you live with or people you used to know. It is like a

companionship, you know, it is like having a friend sitting next to you and talking to you.

Moreover, Litzzy seems to see Facebook as if it were a person. She knows that the platform helps her to not to feel lonely, but at the same time she sees the platform as a person who has kind gestures towards her:

...(in Facebook) there are only good things. They are very good to me, they don't put any junky stuff for me. And, for my birthday, they put the cutest little card...yes, Facebook you know. It is a cake, and little by little different things fall off and all the sudden there is a big explosion. That was the cutest thing I ever seen. So, I said thank you Facebook, you know, it was lovely. and I'd comment on that. I'd do that, does not everybody do that? But that was nice.

Litzzy now feels more confident, compared to last year, in using technology as a tool to keep in touch with people. Therefore, similarly to what Heather said, Litzzy thinks that she already knows everything she needs about technology:

...I am only familiar with the things that I am doing now but I don't think I have a reason to learn something else. I am not doing technological things. I am not in business. It is enough for what I need... I have company when I use Facebook, so it is nice in the evening before you go to bed you talk to a few friends, find out about few friends, so I can't imagine what else would I need.

Although Heather and Litzzy had different experiences through the I-3S, they both learned that technologies are tools that enable you to do things, working as bridges to keep them connected with people in the outside world. This relates to their sociocultural context, since they both live in a retirement home and do not go out or receive visits often.

Seniors Edna and Jacob had a different experience. They both use technology in their daily practices and were already familiar with the resources used in the I-3S, such as the use of videoconferences and word processors; thus, they did not acquire new technical skills. However, they both said that experiencing Google Docs let them learn a new tool that will be useful for them, particularly because it allows simultaneous editing by multiple people,

something helpful in their regular practices such as their teaching practices. Therefore, Google Docs will be something that they will use in the future. Moreover, Edna highlighted the value of learning how to use different applications to establish a videoconference:

'I have to tell you that it seemed a very good idea that, when we were in the previous preparations, that we learned how to use Skype, but also the service to do it by FaceTime. Because, this time, when we got stuck several times... at the end of the day, we couldn't use Skype, so we ended the session with FaceTime.'

In the case of children, they recognised learning technical skills related how to edit audio files, how to use Google Docs and Hangouts, how to add audio effects, and to download sounds from public licensed pages. Additionally, Isa and Janis, who are the children with less experience in digital technology among this group, said that they learned how to turn on/off a computer and how to type. Janis said that she learned how to type, but that it was difficult because sometimes she could not find the letters. Similarly, as shown in the following interview abstract, Isa realised that she learnt how to type in the computer, and that the learning improved during the intervention:

Interviewer: Do you remember how you used to type at the beginning?

Isa: With one hand.

Interviewer: With one finger!

Isa: (Giggles) Oh, yeah!

Interviewer: How about now?

Isa: I use all my fingers.

Interviewer: Two hands, right? That was quick.

From seniors and children's data it can be said that the digital-literacy learnings that learners identified were related to the mechanical use of hardware/software. Moreover, as anticipated in the re-design, each learner acquired skills related to their needs and digital-

cultures. For instance, the seniors who were more familiar with technology were open to adopt Google Docs in their future practices because the software responded to the seniors' needs, whereas seniors less experienced with technology acquired other technical skills that were more apt to their needs, such as the use of social media to keep contact with people. Similarly, some children learned more advanced skills on manipulating software, whilst children who were less familiar with technology focused on more simple technical skills, such as typing. In addition to developing technical skills in the I-3S, seniors and children learned from critically engaging in the production of digital-media.

Children said that they were very proud of their final product -the Podcast- and believed it was an important contribution. For instance, Marion said *'I think, yes, it was important, because people would realise, if they see it, that there are places where people burn rubbish in the green areas, so that they should be alert; and at least in their home, to have the firefighters' phone number.'* Similarly, in their final interviews, Liam, Isa, and Oscar talked about the importance of their Podcast. Liam expressed that it was important because it could be heard by the President or other important people that could make a change. Also, Isa said that the Podcast was important because people who throw rubbish on the street would listen at it and some of them might stop doing it. Oscar said that the podcast was an important contribution because if it goes viral, people could take action.

In her final interview, Marion expressed that she knew that burning rubbish in green areas was common, but when reflecting about it with the senior, she realized that it was a big problem in the community.

Marion: I had not realized that it was so important, the fires in the green areas.

Researcher: Why do you think that happened? Because you've seen it before.

Marion: Yes.

Researcher: Did you become more aware after you all reflected on this?

Marion: Yes, because it was dangerous, because exactly where the burning happened, the green areas, there were some houses and there were some people living there, so that's why I was more alarmed.

As it can be seen, children understood their work as something that could make a difference in their communities. They do not claim that their Podcast makes the change, but they all recognise that their media product, being online, has the potential to make a change in the community. Most importantly, all children were satisfied with their Podcast and felt proud of their work.

5.6.5 Other intergenerational learnings

Alongside recognising that they developed critical-digital-literacy, children also identified other learnings they gained inside the intergenerational-third-space. Those learnings were related to cultural aspects and sharing knowledge with others. As cultural aspects, Oscar and Liam said that they learned about Spain and other countries. This happened because the senior they work with, Jacob, was born in Spain. Therefore, he shared with the children some things about his culture. Similarly, Isa expressed in her diary that she learned that in San Francisco, '*...kids that are only 13, 14, 15, steal in the buses*'. Isa and Heather, who lives in San Francisco, discussed about this in one of the sessions.

Some children said they learnt some words in English-Spanish. As Isa and Janis were mainly speaking in English, the other children were picking up some words from them. Moreover, some children explicitly asked Isa and Janis for some words they found in the software they were working with. For instance, Oscar explains:

I learned how to use technology more, and new applications such Audacity. I did not know how to use it, and then I was experimenting how to use it I also learned some English stuff, more or less, Isa taught me...well, (I also learnt) the dishes from Spain. The paella. Yes, and that he (senior Jacob) had visited many other countries as well.

Similarly, Isa mentioned that they learnt some words in Spanish because the other children were telling her how to pronounce correctly the words. For example, Isa said: *'Yeah, Spanish words because there were words I didn't pronounce them right and Marion showed me how to pronounce them right and said them right. And sometimes I didn't say the right word and she said I had to say it like this'*.

Even though the activities that learners performed did not focused on language exchange, being exposed to people who speak both languages, as well as being immerse in a learning space where the two languages were used indistinctly, depending on the users' needs, allowed the children to learn some words in a second language. Moreover, the atmosphere inside the intergenerational third space provided a safe space for the children to exchange English/Spanish words by themselves, and to learn from the experience.

Another learning that some children mentioned was the experience of sharing their own knowledges with others or, as they said, *'being able to teach others'*. It was explained in the design section that, building from a multiliteracy pedagogy, some of the activities were organized in a way that children needed to explore by themselves how solve certain tasks or how certain software work to later share it everyone in the I-3S. Therefore, in their diaries and final interviews, some children mentioned that sharing their knowledge with others provoked them to have a positive feeling, because it was like *'being the teacher'*. For instance, Liam said *'Today, together with Oscar, I taught my classmates how to use Audacity, which is the program to create Podcasts; and I felt as if I was their teacher. But I think they knew more than I :('*.

Similarly, Marion said *'I felt like a teacher! good. I think Janis was the person I helped more with the music, and Isa, I helped her to learn how to re-arrange, or where to put*

the audios, or something like that. (Was it difficult?) More or less, because sometimes we kind of got tired, and that's it, but then we calmed down and we were ready to work again.

5.6.6 Flexible working schedule

In Cycle 2, the working schedule was planned to give seniors and children agency in how they organise their work. I gave learners a printed working schedule where each day had a goal. This way, seniors and children could have agency to organise themselves to reach the goal according to their working pace. Moreover, they could re-adjust their working time in case an unforeseen situation emerged. Additionally, this action assumed that agency in the working schedule would give seniors clarity in their role, so they would know what to do in each session. In this context, the implementation showed that indeed each team took agency in their work and organised their collaboration to reach the proposed goals. Moreover, it shows that the senior played a key role in keeping track of the time and the overall teamwork. This can be seen in Section 5.6.2 when the senior is frequently guiding the team to work towards reaching the goal. Thus, it can be assumed that having agency to organise their time gave seniors a clear idea of what their role was in the making process.

Seniors Heather and Litzy had challenges following the schedule and understanding what was expected from them. Heather did not take the role of keeping track of the teamwork but focused on building a friendship with the child. Heather was focused in listening to the children and getting engaged with everything the children said. Thus, Heather was not worried about reaching the daily goal. Moreover, Heather frequently forgot that they were working in making a Podcast; she was just enjoying building a friendship with the child, and the child working with her -Isa- adopted the same behaviour. Therefore, as the facilitator, I took the role of working close with this team to keep track of time and the teamwork.

Every time Heather and Isa worked, I started the session by explaining both the goal of that day and helped them to organise what they needed to do to reach the goal. Also, I was

constantly approaching them to make sure that they were moving forward in their work because it was common that they engaged in conversations, sharing thoughts with each other but not doing their Podcast work. Thus, many times I interrupted their conversation to keep them on schedule. Working closer with this team was important to help them finish their digital-text but even with this, sometimes Heather got confused with what she needed to do. As Heather expressed in her diary:

I learned that we make a good team. It was easy to choose one idea from the three brought by Isa because we decided together. I felt that I somehow missed the task, so I did not come prepared, but it worked out. Isa came prepared with three scenarios and we easily chose one. Thanks Isa!!

It can be seen that sometimes Heather did not understand what she supposed to do, however, my help as facilitator and the work I did with Isa in the sessions where Heather was not present, were key to advance the teamwork, but also to include the senior in the making process, despite her challenges to remember what she needed to do.

Litzy also had challenges with the working schedule but related to health challenges she suddenly faced, such as hearing and knee challenges. Litzy missed some sessions because she had to visit the doctor:

'I just received a notice that on Monday I will have an x-ray on my knee. I don't know what time or if I will be coming home in time for my time with you and Janis. I'm very sorry this had to happen on our scheduled time'.

Due to the missed sessions, Litzy had difficulties to keep track of what she needed to do in each session and to keep track of how the child was moving forward with the work. In this case, I had a similar approach as with the other team. I worked closely with this team and helped them keep track of time and teamwork. Moreover, I worked with the child when the senior could not connect, so the child kept moving forward. Thus, the way in which the

schedule was designed in this cycle helped me, as the facilitator, to keep the working pace of all the teams. Also, this highlights the importance of having a facilitator within the I-3S.

I will highlight that despite Litzy missing some sessions and I having to teamwork with the child, they both said that there was engagement among them and gain from the experience of being together. For instance, Litzy expressed in her diary how she felt reflected herself in Janis:

I had the unique experience of seeing myself in Janis. I too, was terribly cross-eyed as a young child! No wonder she is shy. I too, learned not to talk to people! Hopefully, she will outgrow this difficulty! ...I enjoyed the time together with you and Janis. I learned that I must be very patient and give her time to think things out. I liked having you there to facilitate the process and giving ideas to us. I think you should be there to direct us. Thank you very much!

The child -Isa- also had a good time when working with Litzy, despite I working with her some sessions, as Isa expressed in her diary:

I learned...well, I had so much fun talking with Litzy ...and...ah.. I learned how to like highlight the things that you want to change the colour or not. Writing that much. I also... I talked with Litzy but this was, I think, my last day ... and I had so much fun.

Litzy and Janis collaborated to produce the Podcast and enjoyed being together. However, to an extent, I directed their collaboration. I was constantly provoking conversations among them and creating a warm environment so they could engage each other and built a relationship. For instance, I asked Janis to explain the senior how we were constructing the storyline and the role that Litzy should play in it. Thus, the conversations among the generations were most of the time prompted and directed by me. My intervention was necessary to compensate Litzy's absence, and to set the ground for a relationship to grow among the generations.

It can be concluded that having a flexible working schedule with daily goals responds to the needs in the I-3S. Having clear goals for every session gives learners agency to organise their working pace and their overall collaboration. Additionally, it responds to unforeseen situations that could impact the teamwork, for instance, senior's absence. As it can be seen, the facilitator is key in the I-3S to support learners to overcome the challenges they face during the making process.

5.7 Evaluation and revision phase – Cycle 2

This section describes the areas that need to be revised to re-design the next cycle.

5.7.1 Foundations – Aspects to be revised

Part of the design of the I3-S was to help seniors and children to overcome the challenges they might face to access this learning space. To this respect, the implementation phase emphasised that considering these aspects turned to be positive. During Cycle 2, more children needed to bring their siblings with them. Thus, anticipating the need to take care of youngest siblings let me integrate them as “assistants”. This way, the young siblings helped me with simple things such as delivering school-materials during the sessions. Similarly, they helped Carmen prepare the food for all of us.

The food continued to be a way to build rapport with all the children and our way to show appreciation. Moreover, Carmen prepared food extra, so the children could share it with their parents and other siblings at home; this action helped us create a connection with the children and their families. Similarly, anticipating offering transportation was key with the English-speaker children because they lived a bit further from our working-space and there is no public transportation where they live. Thus, my father picked up these children every morning and took them back home at the end of the session.

Overall, Cycle 2 reinforced the need to look closer at participants' sociocultural contexts and digital cultures, to use this information as key resources to design the cycle,

including the identification of those challenges that refrain learners from accessing the I-3S, with the purpose of anticipating those challenges and helping learners to overcome them. Therefore, it is suggested that the next cycle keeps supporting learners; understanding that this could be done by providing food, assistance for commuting, and taking care of their siblings.

The implementation phase also highlighted that it was efficient to conduct a first interview with all learners prior starting DigiCamp. Looking closer to their lifeworlds and digital cultures provided key information to re-design the activities inside the I-3S and the learnings that seniors and children acquired. Thus, it is suggested to keep having an initial interview in the next cycle.

5.7.2 Non-hierarchical communication – Aspects to be revised

To move towards a non-hierarchical communication, the re-design in Cycle 2 emphasised in how intergenerational learning emerges from the generations' interactions that happen within a place (Mannion, 2012). Thus, I draw from sociomateriality ideas to change three aspects that later became the infrastructure of the I-3S (same language teams, re-arranged physical space, improved internet). All the three changes became the invisible infrastructure supporting the communication of all the other elements in the I-3S, human and nonhuman. However, as infrastructure, its efficiency can be only evaluated in light of its ability to support the development of reciprocity and critical-digital-literacy. Thus, because data shows that indeed the overall re-design of Cycle 2 moved towards the development of reciprocity and critical-digital-literacy, it can be said that the infrastructure worked as desired. Therefore, the changes done in the re-design, drawing from sociomateriality and third space, were efficient and should be kept in the next cycle. I noted that not only the changes done in the infrastructure, but also the changes done in the activities to look for reciprocity and

critical-digital-literacy, and the changes in the working schedule impacted the communication in the I-3S.

Also, the experience of Cycle 2 suggested that other nonhuman elements, such as the software and hardware used in the I-3S, impacted the intergenerational learning. Therefore, a deeper understanding on how the relation human and nonhuman impacts learning in the I-3S is still needed. For instance, Section 5.6.2 illustrated how the hardware/software influenced the interaction and the learning beyond only supporting it, as the infrastructure does. First, when Ava had difficulties to express her thoughts around the social challenge and took photographs of the fires in her community to discuss it with the senior, the tablet and the photograph, as nonhuman elements, influenced the interaction. Ava used technology to break her communication barrier by using multimodality to express her thoughts. Second, when the “Best Friends” team used Google Docs to write their Podcast’ script, they were scaffolding their learning by using the software as a mediator, but at the same time, when Marion made the changes simultaneously in Audacity, the hardware/software characteristics or affordances were impacting what seniors and children were learning. The implementation of Cycle 2 suggested sometimes nonhuman entities were not an infrastructure, but another important element in the interaction; the human and nonhuman interaction from which learning potentially arise. Therefore, it is suggested that the next cycle re-evaluates how to use sociomateriality ideas to explore and understand this relation.

5.7.3 Reciprocity – Aspects to be revised

The implementation showed that seniors and children indeed built a reciprocal relationship and enjoyed being together, despite interacting only through videoconference systems. However, some seniors would have preferred a face-to-face-interaction. Also, seniors and children broke stereotypes among the other generation and key for all this to happen was the fact that seniors and children worked all the sessions in the same team (a

small team pairing one senior with one or two children only). This gave them space to grow and mature their relationship.

Similarly, data showed that the interaction among the generations in their teams gave them equal opportunities to exchange thoughts, feelings and lifeworld knowledge and experiences. Moreover, the reciprocal exchange let them both switch from novice-expert roles whilst building a relationship. For instance, it was common that senior Heather and the child Isa spontaneously shared their worries and feelings. Sometimes the senior was comforting and advising the child as the expert, but in other moments the child was cheering or counselling the senior, showing empathy as the expert. This suggest that seniors and children grew a reciprocal relationship where they both had equal values, knowledges and agency to share and communicate. Therefore, it is suggested to keep this activity re-design in the next cycle, and to continue having intergenerational sessions dedicated for the seniors and children to know each other instead of only working in the digital-text. Reciprocity, in relation to critical-digital-literacy learnings, is addressed in the next section.

5.7.4 Critical-digital-literacy – Aspects to be revised

Both generations recognised that all of them contributed to create the Podcast, despite each of them did something different and were happy about their contribution; both generations recognised that their Podcast would not be the same without the other generation. Moreover, data showed that sometimes the seniors played a facilitator's role leading the working-process, such as keeping track of the time, but also in engaging children in discussions and reflections among the different moments in the making process. This means that the re-design in the activities reciprocally involved seniors and children in the making process and it should be kept in the next cycle. Also, that in the I-3S, seniors and children take different roles despite being involved in the same team.

In terms of critical-digital-literacy, senior and children were equally involved in learning opportunities. All learners develop technical digital skills close related to their personal needs and digital cultures. For instance, those learners who were more familiar with technology developed more advanced skills on manipulating software; whilst those with less technical skills focused on more basic technical learnings such as how to type, in the case of children, and how to establish a videoconference or to use social media to keep contact with other people, in the case of the seniors. This connects with literature when highlights that critical-digital-literacy must be connected to learners' sociocultural context and digital culture, thus, each person learns something different.

Additionally, seniors and children were equally involved in reflective moments to critically engage with digital media. Both generations, together, reflected in social challenges that affected their community, reflected of the importance to overcome those challenges and created a digital-text with the potential of transforming their community. To this, data showed that children were proud of their Podcast and believed that their work could make a positive difference in their communities. Although I did not directly ask seniors how they felt about the Podcast relevance, I conclude they were also proud of their work because they deeply engaged in the critical reflective moments and enjoyed the making process. Therefore, it can be said that seniors and children, to an extent, experienced that they can use and produce technology as a resource to transform society, despite being too old, too young or living in an economically challenged environment. Therefore, it is suggested to keep the digital-text production connected to the social challenges in their communities.

About the workshops with the seniors, it can be said that each senior had different needs, as well as different knowledges, in terms of critical-digital-literacy. Therefore, having personalized workshops is a must, not only because seniors get the support that each of them needs to be included in the I-3S, but also as a space where the facilitator can better get to

know the seniors, in terms of the digital skills they have, as well as to build rapport. This information can be used to reshape the activities that learners will perform during the DigiCamp, thus, the importance of conducting the workshops prior the DigiCamp sessions in the next cycle.

5.7.5 Other intergenerational learnings and a flexible working schedule – aspects to be revised

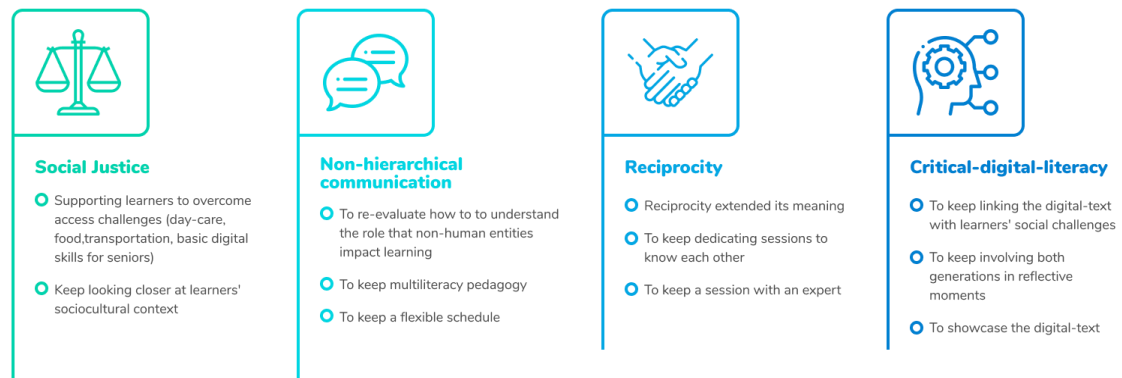
Besides developing digital-literacy, the children recognised other learnings that were important for them. Children learnt about other cultures due to the exchange of experiences with the seniors, who were living in another country. Similarly, children learnt some English/Spanish words because they were interacting with bilingual people, within a learning space that indistinctively uses both languages depending on the situation needs. Therefore, children felt safe to communicate in any language and to learn from that. Additionally, children expressed that they enjoyed being able to explore and look for answers by themselves, to later “teach to each other”. Children particularly enjoyed being able to share with others what they knew and developing teamwork skills. In this context, it is suggested to keep the bilingual and bicultural environment, as well as the multiliteracy pedagogy where all learners have opportunities to switch between the novice-expert role.

In relation to the working schedule, data showed that giving learners a printed working schedule with specific goals to reach in every session was positive. On one hand, this gave each team agency to organise their working timeline and collaboration steps. Moreover, it gave seniors clarity in what was expected from them in every session. On the other hand, having a flexible schedule let me, as the facilitator, to support the children to advance their projects when the seniors could not connect to the sessions. Therefore, it is suggested to keep having a flexible schedule in the next cycle.

5.8 Conclusion

This chapter described the second cycle of DBR, making explicit how I improved the re-design and implementation of the I-3S. Although the experience of this cycle showed that this re-design is already moving towards the established aims of the I-3S, it was also noticed that the nonhuman entities also impact the intergenerational learning, thus, a deeper understanding of the human-nonhuman relation needs to be explored in the next cycle. Therefore, the following table summarises what should be revised and used as a starting point to re-design Cycle 3.

Figure 9. Aspects to be revised in cycle 3.



6. Cycle 3 of DBR

6.1 Introduction

This chapter presents the third cycle of DBR, following the same structure as the prior cycles: foundations, non-hierarchical communication, reciprocity, and critical-digital-literacy. This is the last cycle because after this intervention, as it will be seen, data showed that the I-3S design provoked that seniors and children were sufficiently close to reach the aims of developing reciprocity and critical-digital-literacy.

6.2 Foundations

Data from the past two cycles made it clear that seniors and children face challenges that refrain them from taking part of the I-3S. Thus, the I-3S design should support learners to overcome them. It is anticipated that the support takes the shape of having seniors' workshops and for the children, it takes the shape of food, resources to commute, and providing day-care for children's siblings. However, it was also anticipated that other challenges could emerge, since the sociocultural context is always changing and the I-3S should be attentive to respond to these changes. In Cycle 3, I encountered two challenges that were different from prior cycles. First, I could not help senior Litzy take part of the I-3S. Second, the overall implementation of Cycle 3 was jeopardised due to the high levels of violence in the children's neighbourhood.

As explained in Section 5.2, Cycle 2, part of I-3S design strategy would be helping seniors and children to overcome such challenges. This statement is linked to the need to closely look and understand learners' sociocultural contexts, mainly through conducting interviews with participants. This information should be used as a starting point to design the strategies to overcome the challenges. In this spirit, when I looked closer to senior Litzy's sociocultural context, the strategy was not to have her participate.

Litzy missed many sessions during Cycle 2 due to health challenges, which happened again the following year. When it was time for Cycle 3, Litzy was right in the moment of adjusting to her new reality - memory loss, severe hearing deterioration, and arthritis. Although I could have used assistive technology to support Litzy and enable her to take part of the I-3S, I decided not to do it. Through my conversations to Litzy, she continuously expressed being very worried about not being able to attend sessions if she feels unwell, or not being able to hear properly what the child said.

Litzy's arguments let me see that the possibility of not being able to do what was expected from her in the project was putting a lot of pressure on her. Thus, as I claimed in Section 2.10, Methodology, my stand when working with vulnerable communities is to be empathic and see beyond by identifying what these populations can do and to build from there. Therefore, I understood that Litzy did not need to take part of the I-3S; Litzy needed time and support to assimilate the new physical challenges she was facing. Nevertheless, I reiterated Litzy that she could always contact me for help with technology. This experience stressed the importance of looking closer at learners' sociocultural contexts and needs. Moreover, this experience highlighted that sometimes learners do not have to take part of the I-3S.

Another challenge faced in Cycle 3 was that the neighbourhood where the children live, and where we have the I-3S physical space, became highly violent. These neighbourhoods have always had safety challenges, but in 2018, there were constant murders, shootings, and assaults in the area (Orozco & Lorenzen, 2018). Thus, I felt it was risky to have all these children with me if an incident occurred. Moreover, it could be dangerous for the children to commute by themselves (Martinez, 2018). However, again, looking closer to children's sociocultural contexts I noticed that despite the violent atmosphere children were home alone because their parents were working. Therefore, in case of an incident, children

would experience a stressful situation being by themselves. In this context, I decided to go ahead with Cycle 3, along with strategies that could help us to be safe.

First, I drafted an action plan for the children and I, in case of a shooting, based on violence prevention manuals written by the Mexican education minister (SEP, 2012; CEPAE, 2012). I discussed the draft with all the children in our first working session and, based on children's experiences, we all agreed an action plan: Stay away from the windows, to lay on the floor, and trying to reach the safest area in the room ([Click here for evidence](#)). Having this conversation with the children was not only cathartic for all of us because we could openly talk about the stress we were all feeling, but also a learning experience because we discussed and learnt about why our decisions in the action plan were likely to work. For instance, we all identified the safest area in the room based on understanding how a bullet loses speed if it goes through the walls. We converted this sad and dangerous situation into a learning experience, as it is aimed to happen in the I-3S (see Section 3.5.2, Literature Review).

In addition to the action plan, Carmen helped me to contact 3 neighbour-women who were keen to make sure that children safely commute from their homes to our working space. Each of these women live in different buildings facing the street in which children walk. Their job was to notify Carmen that the children were on their way, and to remain vigilant until the children arrived the I-3S. At the end of the session, the same woman watched the children's return to home. Also, for those children who lived further away, my father was in charge of picking them up and returning them back at the end of every session. This was my way to support children to break the commuting barriers to take part of the I-3S.

In Cycle 3, as in prior Cycles, children were provided with meals in every session and some extra food to share later with their families. Also, children had the freedom of bringing their youngest siblings if they needed to. However, the latter worked differently this time,

since some children brought their siblings not because they need to but because they wanted their siblings to experience what we were doing in the I-3S.

First, I point out that, in the same way as it happened from Cycle 1 to Cycle 2, some links remained from Cycle 2 to Cycle 3 between the learners and this research project despite a year of separation: The permanence of Carmen in the neighbourhood as someone to whom the children can turn if they need to; the friendship that children keep building among them, since they all live in the same neighbourhood; and the posada that Carmen organises in the community every Christmas. The posada allowed me to keep in touch with the children and their parents, and a key moment to find out if children were keen to participate in the next cycle (see Section 2.5.1, Methodology). The posada between Cycle 2 and Cycle 3 was particularly different. First, because Nora and Brenda, who did not participate in Cycle 2 because they moved to another city, were back in this neighbourhood and asked me if they could participate in Cycle 3. Second, because some of children brought their siblings to the posada, with the hope of asking if the siblings could be integrated as participants in Cycle 3. Isa and Janis brought her younger sister Henriette (8 years old) because they wanted her to live the same experience they both had in the third space. Ron (9 years old), who took part in Cycle 2 as helper, wanted to be a participant because he wanted to do the same activities that all the other children were doing. Lastly, Brenda and Nora wanted their older brother, Pablo (15 years old), to be a participant because he has not been in school since he was 13 years old, and he wanted to learn how to use technology.

In this scenario, I followed the same principle. If the overall aim of this research is based on inclusion, it is coherent to find a way to allow these children to take part in this third space. However, it was clear that to respond to the parameters of this research project, the number of participants needed to be manageable, as well to keep the age of children participants between 10 to 13 years old. Thus, I decided to include Nora and Brenda as

participants and Ron, Henriette and Pablo would be able to take part in the activities that were designed for the participants, but I did not collect data from them, nor they would work with a senior in a team. This way, all the children were included in the I-3S, but it would not impact the research parameters.

Children's action of inviting their siblings to take part in this learning space, and the fact that two children wanted to return for Cycle 3 shows that children had a positive experience on the other Cycles, as well as seeing the I-3S as an experience that more children should take part of. Therefore, this intervention had eight children participants and three children who performed the activities but did not work with seniors. Also, there were four senior participants: Edna, Jacob, and Heather, who took part of Cycle 2, and Dorothy, who participated in this research for the first time (see Section 2.6.1, Methodology).

6.3 Re-Design phase – Cycle 3

The experience of Cycle 2 showed that the re-design took learners towards a non-hierarchical communication. Also, in terms of reciprocity, learners built a reciprocal and meaningful relationship as well as being equally involved in opportunities to switch from novice-expert role. Additionally, seniors and children developed, to an extent, critical-digital-literacy; not only acquiring technical digital skills but also engaging in critical reflections on digital media and experiencing technology as a resource to impact their communities. However, it needed to be further explored how the materials impact the development of reciprocity and critical-digital-literacy, thus, I did another DBR cycle.

The re-design in Cycle 2 is the same design I used in Cycle 3. Thus, what needs to be done to design an I-3S and the theoretical arguments supporting such design were already explained in the prior cycle. that is, although learners produced a different digital-text during this intervention, the re-design followed the same theoretical structure as in Cycle 2. Thus, in this chapter, I do not explain in detail the theoretical concepts that justify every aspect of the

re-design. Instead, Cycle 3 stresses the importance of considering the role that nonhuman entities and how they are entangled with the human, within the physical and virtual space where the intergenerational interaction happens, play in how learning emerges, a role that goes beyond being tools or resources harnessing the interaction, but to actively work with learners to make meaning.

Cycle 3 kept the same re-design as in the prior cycle. However, in this cycle I drew from ideas in theories of sociomateriality to explore how the nonhuman entities also impacted how reciprocity and critical-digital-literacy emerges. In this context, the following section (Section 6.3.1) briefly reminds the reader how the design of the I-3S in Cycle 3 followed the same structure proposed in the prior cycle. Section 6.4 explains the re-design of the activities that learners performed in this cycle to produce a digital-text related to coding. It includes exploration of how coding relates to critical digital-literacy (Section 6.4.1) and how sociomateriality can help to understand how learning emerges the I-3S (Section 6.4.3).

6.3.1 Framing an I-3S – Summary

Theoretical aspects justifying the re-design structure can be found in Section 5.3, Cycle 2. However, here I briefly introduce the re-designed elements of the infrastructure of the I-3S that remained the same from cycle 2. Cycle 3 kept the three aspects that became the infrastructure of the I-3S: same language teams, physical space arranged to have dedicated working stations for each team and intergenerational sessions, and improved internet. This infrastructure was the harness for potential non-hierarchical communication to happen in the I-3S, stressing that the activities also play a key role to reach this aim. The activities were also designed to foster reciprocity, understood as building a relationship among the generations but also that they both have equal opportunities to switch between novice-expert role. Similarly, to encourage learners to develop digital-literacy, both generations were involved in the production of a digital-text that connects with the social challenges faced in

learners' communities. I highlight that the technological equipment used must be second-hand equipment, or non-expensive equipment that learners could potentially afford outside the I-3S. Similarly, it is suggested to use only free software to produce the digital-text.

The I-3S follows a multiliteracy pedagogy, where seniors and children are encouraged to experiment and to try different possibilities with learning and digital media. Moreover, learners are encouraged to bring all their knowledges as learning resources and to make them available to each other to create new knowledge; aiming to have non-hierarchical communication.

A week before starting the DigiCamp, all seniors had a personalised workshop, at their homes, to develop basic digital-skills: How to learn more than one way to establish a videoconference, basic troubleshooting, and to send/receive messages to/from me. It has to be considered that, based on the prior Cycles' experiences, seniors take longer time to assimilate and retain new information. This aspect should be considered to re-design the information covered through the workshops and the overall new information that seniors are expected to retain. The workshops also aim to clarify seniors what is expected from them, stressing their role as collaborators and not as teachers. Additionally, workshops should identify information that could impact the re-design of the activities in the I-3S.

The DigiCamp working schedule has three types of sessions: intergenerational sessions, children-only sessions, and ludic sessions. Additionally, it is suggested that children had a workshop with a professional that exposed children to the metalanguages related to the digital-text they will produce. Additionally, each participant should receive a printed working schedule pointing out the goals during the intervention, but each team has the freedom to organise their working pace and teamwork. Additionally, to close Cycle 3, children should share or showcased their digital-texts in their community.

6.4 Activities re-design phase – Cycle 3

In this cycle, seniors and children were introduced to coding to produce a technological prototype as a digital-text. First, I explain how coding is connected to digital-literacy. Second, I detail how the activities were re-designed to materialise reciprocity and critical-digital-literacy in this cycle.

6.4.1 Coding as digital-literacy

This research is framed in a digital-literacy concept that privileges critical engagement with digital media, focusing on how digital media and technology are linked to the social, political, and economic aspects of society; how the world is represented through digital media (see Section 3.5.1, Literature Review). In this spirit, I decided to engage learners in coding, not focusing on learning a programming language, but experiencing coding as a resource to impact in society. Engaging learners in experiencing the social responsibility we have when creating new technology.

Our current society is highly impacted by software, embedded in digital technology, that captures, measures and process many aspects of our everyday life -how we live, speak, think and many others- (Berry, 2011; Stalder, 2018). That is, many of our actions are mediated by whatever the assemblage of digital technology -hardware and software- dictates; generating behaviours, opportunities, meanings, readings, and interpretations (Kitchin & Dodge, 2011). However, these assemblages are not neutral but arranged by humans and, as such, these arrangements are linked to specific social, economic, and political structures (Kitchin & Dodge, 2011; Bucher, 2018). Therefore, many academics claim the need to understand how these links are made, not necessarily focusing in the technical process of how the assemblages were made but focusing in the impact they make in society (Fuller, 2008; Berry, 2011; Kitchin & Dodge, 2011; Berry & Fagerjord, 2017; Bucher, 2018). In this spirit, understanding how technology is created and how the human beliefs are embedded in the

assemblage of digital technology is part of critical-digital-literacy (Fuller, 2008; Bucher, 2018).

Within this scenario, I designed activities where learners got introduced to basic language syntaxes of coding and basic knowledge of electric circuits. With these technical knowledge, seniors and children experienced how technology is created and how human philosophies/intentions are embedded in technology. Doing this is in line with Buckingham's frame of digital-literacy because creating a new technology evidences how a technology represents the world through the lenses of the creator; moreover, it makes evident the link between technology and the social, political, and economic aspects of society (see Section 3.5.1, Literature Review). Thus, engaging learners in an intergenerational coding experience is based on this position. Additionally, as it happened in the prior cycle, the process of creating a new technology in the I-3S is also linked to a critical reflection on learners' sociocultural contexts and the role they can play in transforming society.

Coding with Micro:bit

There are many ways to involve learners into coding to create a technological prototype. However, the I-3S has specific needs that should guide the choice of software/hardware to be used: It must be affordable, so people could have less barriers to get it; it must be user-friendly, so users do not need to have high technical skills to manipulate it; it must be designed to support the use of simple electronic components such as sensors or LED⁴s, since in this cycle part of the task is to build a prototype of a technology.

Additionally, the hardware/software needs to be supported by mobile devices, such as tablets, iPads, cell phones, as well as computers. This is important because in the I-3S not all learners

⁴ LED: light emitting diode. A semiconductor diode that emits light when a voltage is applied to it and that is used especially in electronic devices (as for an indicator light) ("Merriam-webster dictionary," 1828).

have access to a computer, but they do have access to a mobile device. Considering these, I decided to use Micro:bit to involve seniors and children into coding.

The Micro:bit is a programmable microcomputer developed for primary and secondary schools to teach students how to code (Micro:bit-educational-foundation, n.d.). I evaluated the device and its software following the above guideline, but also my experience working with seniors and children from economically challenged areas, and my knowledge as a telecommunications systems engineer. I identified that the device was affordable, it was user-friendly, it supported the use of simple electronic components, and it could be used in mobile devices. Additionally, the device had other features that were an advantage for this context, as explained below.

The platform used to write the code -the editor- is free and online. Thus, it does not require to be installed in a device. This is important because in some of the devices used in the I-3S, and in the devices that learners are likely to afford in the future, such as Chromebooks and simple smart phones, it is not possible to install any software. Additionally, the software editor does not require an internet connection to work. If you connect to the internet once to use the editor, it remains in the browser to be used at any other moment. This feature was ideal when the internet bandwidth is limited, as in the case of economically challenged areas.

Another important feature is that Micro:bit has all the coding syntaxes and routines embedded in colourful boxes that look like pieces of a puzzle (see Micro:bit's editor: <https://makecode.microbit.org/>). The colours classify the commands according to their functionality, and the puzzle-shape helps users identify where it makes sense to place the commands. Also, Micro:bit has a simulator in which users can immediately verify that their code is correct. This simplifies and facilitates users learning coding syntaxes by easily manipulating the boxes and verifying what they do immediately in the simulator. This is like

a trial and error system in which the user can intuitively experiment with the coding instructions and have immediate feedback of the result (Micro:bit-educational-foundation, n.d.).

These latter features were important in the I-3S because the seniors and the children are not required to have prior knowledge in coding or high technical skills to manipulate the coding boxes and see the response in the simulator. Moreover, the colours and the puzzle-shape could help them identify how to organise the commands in a way that they create a program that works. Thus, these features go in line with the pedagogy of multiliteracies because they allow learners to use their knowledges, human and nonhuman entities available in the space, and the space itself, to act and experiment imaginatively in situations of uncertainty to create new knowledge (Elkjaer, 2018).

In addition, the technical affordances of the Micro:bit allow connecting it to other electric components with a maximum of 3.6 volts. This is important for safety reasons, since the seniors/children could freely connect circuits to the Micro:bit while avoiding an electric shock or causing any damage to the infrastructure. Nevertheless, 3.6 volts is enough to create basic circuits such as turning on a LED or a small speaker; which could be used to create the prototype.

As it can be seen, Micro:bit responded to important needs of the I-3S. Therefore, I requested to the Micro:bit Educational Foundation a donation of devices, being granted 25 Micro:bits for Cycle 3. Having access to the devices was not enough because involving seniors and children into coding to produce a digital-text simultaneously is something that, to my knowledge, has not been explored before. Moreover, an intergenerational coding based on a critical perspective of critical-digital-literacy is something that has not being explored before either. Thus, in Cycle 3, learners engaged in producing a technological prototype as a digital-text following a specific procedure, as explained below.

6.4.2 Digital-literacy – Making a technological prototype with coding

To engage learners into coding to produce a digital-text, learners explored basic language syntaxes of coding and, in the case of children, the most basic learnings of electric circuits to create their digital-text. Stressing that, the emphasis is not on learning the coding commands, but in how the human beliefs are embedded in the assemblage of digital technology. To do this, each team (senior-children) followed this procedure:

- 1) Seniors and children should identify a social problem in their local communities -each of them in their own communities- that they personally believe as important to overcome.
- 2) Each team discusses between them the social challenges and to reflect on why it is important to overcome them.
- 3) Based on the discussion, each team needs to choose one of those social challenges to work with. Then, the team needs to imagine a technology that should be invented to overcome the selected challenge.
- 4) Each team will use basic knowledge of coding and electric circuits to develop a prototype of the technology they imagined.
 - a. By this point, seniors and children would have already being exposed -during the workshops- to 3 different basic language syntaxes of coding: How to display text and figures on the Micro:bit.
 - b. Although seniors and children would define the technological prototype and coding its algorithm together, only children would be in charge of using electric circuits to build the physical prototype. Thus, only children would be engaged in learning how to create electric circuits.

- c. Facilitator needs to closely support each team to define a viable prototype, considering the coding syntaxes that learners explored during the sessions and the available materials in the I-3S.

I remind the reader that this procedure not only aimed to develop digital-literacy, but also to foster reciprocity and non-hierarchical communication in the I-3S; stressing that all these aspects happened simultaneously within the same activities. The full DigiCamp working schedule can be found in Appendix E.

As it has been emphasised since the beginning of this chapter, Cycle 3 was framed following the same design structure as in Cycle 2. Thus, the DigiCamp's working sessions and the theoretical roots supporting to how reciprocity and critical-digital-literacy is fostered through the activities, were already explained in the prior cycle (see Section 5.4.2). However, when involving learners in an intergenerational coding experience -through the process described above-, there were additional steps in which reciprocity and digital-literacy were fostered through Cycle 3, as explained next.

Embedding reciprocity in the DigiCamp working sessions

As argued in Cycle 2, to foster reciprocity in the I-3S it is key to engage seniors and children into activities to know each other by exchanging basic personal information and thoughts. However, in Cycle 3 all participants -except Dorothy and Janis- knew each other because of their participation in prior Cycles. Thus, for Cycle 3, I included a virtual reality experience where seniors reordered a 360-degree video to share with the children a physical space in their neighbourhoods that they enjoy. For instance, this is the video that Heather recorded for Isa ([Click here for evidence](#)). The purpose was to use these videos as a way to virtually share a personal space with the other generation. Moreover, both generations could exchange their experiences within that place.

Additionally, reciprocity was also encouraged through the digital-making process when seniors and children were equally involved in exposing and discussing the social problems affecting their local communities, and why it is important to overcome them. Also, reciprocity was present when both generations equally gave opinions to select the social problem they wanted to work with, and equally gave ideas about the technology that should be invented to overcome the social challenge. These actions reinforced the fact that everybody's knowledges are equally valued. Similarly, seniors and children were engaged in different tasks assigned based on their knowledges, skills and needs. However, making sure that both generations engage in equal opportunities to switch from novice-expert role, as explained below.

Embedding critical-digital-literacy in the DigiCamp working sessions

During this intervention, seniors and children had equal opportunities to engage into basic learnings of coding. As in the prior Cycles, even though all learners engaged in digital-literacy activities, it is expected that seniors and children develop different aspects of digital-literacy, mainly because their learnings should be connected to their sociocultural contexts and digital cultures (Buckingham, 2007).

To introduce coding, each individual received a Micro:bit; then, seniors and children had a workshop. Seniors' workshops happened before starting the intergenerational interactions, whilst children's workshops happened during the first children-only sessions. However, all workshops included activities to expose learners to the concept of algorithm, how to write an algorithm, and how to manipulate the Micro:bit to display figures and text. These three items can be seen as the technical skills required to start critically engaging with coding. Details of what seniors and children did during the workshops, as well as participants' responses to these learnings, are explained in the implementation section of this chapter (Section 6.6.1).

The fact that each learner received their own Micro:bit had the purpose of allowing each individual to experiment with coding in the Micro:bit's editor by themselves. First, allowing each person to explore the device at their own pace. Second, each learner could explore their own ideas on how to create an algorithm, whilst receiving immediate feedback from the simulator. This way, learners built knowledge from their mistakes through the “trial and error” experimentation process in the Micro:bit. This goes in line with multiliteracy pedagogy because the self-experimentation allows learners to actively *conceptualize* the coding commands or syntaxes they are exposed to during the making process (Cope & Kalantzis, 2009).

Encouraging learners to individually experiment and explore the Micro:bit does not clash with the aim of fostering reciprocity among learners. Contrarily, this allowed learners to choose between writing the prototype's algorithm together as a team, or independently to try simultaneously different algorithmic ideas, experimenting and testing their own hypothesis, to later share them within their teams. This way, despite seniors and children being geographically distant, each learner could create their own coding programmes and compare results with each other. This is another way of collaboration, each of them could try a possible solution for the whole team.

To build the technological prototype, children were endeavoured to the physical making but the coding process was endeavoured to both generations. This implied that, besides coding, children learnt basic concepts of electrical circuits to connect the Micro:bit with physical materials (*metalanguages*). Specifically, they learnt how to wire a simple electric circuit to turn a LED and/or a speaker on. The seniors were not involved in learning how to manipulate electric circuits because seniors can take longer time to acquire new learnings and also because this was challenging to do virtually. Therefore, involving them into exploring coding and electric circuits during the workshops, would have been too much information to

cover with the seniors. Moreover, assisting the seniors with the physical manipulation of electric circuits would have been complicated, mainly because neither the facilitator nor any children were physically close to the senior. Consequently, only children were involved in working with electric circuit. As with the workshops, the details of how seniors and children were engaged into coding and electric circuits are presented in Section 6.6. It is presented in that section because detailing what participants did in parallel to how participants responded to such activities, helped me clarify my arguments to the reader.

This section described how the activities were re-designed to involve learners in the production of a digital-text involving coding. The next section will describe how, in Cycle 3, sociomateriality was used as a lens to understand how learning emerged in the I-3S.

6.4.3 Sociomateriality ideas to explore learning in the I-3S

Throughout the Cycles, data showed that in the I-3S the human and nonhuman entities together play an important role impacting how communication happens and flows, thus, impacting learning. For instance, the physical space, the internet, and the working teams, all together, function as the infrastructure of the I-3S, supporting the communication among all its entities, human and nonhuman. However, the analysis of Cycle 2 pointed out the need to deeper explore how the nonhuman entities impact learning beyond only supporting the interaction, as the nonhuman entities in the infrastructure do (such as internet's setup). In this spirit, Cycle 3 took this layer of exploration.

Developing critical-digital-literacy is bounded to the making of digital-texts. However, to account for the meaning-making on digital-literacy practices, there is a need to consider the humans, spaces/places, materials, sociocultural context and all other nonhuman entities involved in the performance of literacy (Burnett, Merchant, Pahl, & Rowsell, 2012; Dezuanni, 2015; Potter & McDougall, 2017). The argument is that place/space and materials (tangibles and intangibles) such as software, feelings, memories, among others, are more than

mediation tools (Wertsch, 2007; Miller, 2011). In the digital-making, agency and meaning happens through the assemblages of elements within the space/place; in other words, human and nonhuman entities are entangled (Fenwick, 2015). Thus, authors in the critical-digital-literacy field point out that thinking sociomateriality can support the understanding of the social and material forces that continuously assemble and re-assemble to allow learning to happen (Johri, 2011; Burnett et al., 2012; Gourlay & Oliver, 2014; Fenwick, 2015; Potter & McDougall, 2017; Jensen, 2019; Kajamaa & Kumpulainen, 2019; Kumpulainen & Kajamaa, 2020).

To explore how learning happened during Cycle 3, I looked at how human and nonhuman entities in the I-3S worked as an entanglement (Barad, 2003; Barad, 2007; Jensen, 2019) to produce learning. I looked at what happens and what is produced when humans and nonhumans entities, in entangled agency, co-create sociomaterial actions that influence learning opportunities, thus, how learning emerges (Orlikowski, 2007; Bennett, 2010; Fenwick & Landri, 2012; Fenwick, 2015; Burnett & Merchant, 2019; Kumpulainen & Kajamaa, 2020).

Taking a relational-sociomaterial perspective means emphasising not in human and nonhuman entities' interactions as separate elements, but in how and what the assemblages of relations among them produce; how and what the entanglement of entities in the I-3S produce. In the same vein, Mannion (2012) claims the need to understand intergenerational learning through relational-sociomaterial lenses, arguing that intergenerational learning happens when people of more than one generation respond to generational differences within a place (Mannion & Gilbert, 2015). The claim builds from relational-sociomaterial perspectives under the premises that 1) people and places -and all the nonhuman entities within a place- are reciprocally enmeshed and co-emerge; and 2) people learn through making embodied responses to differences (Mannion, 2012; Mannion & Gilbert, 2015). From

this view, intergenerational learning is relational because learning is always situated, thus, it needs to be understood within the practices and places that allow learning to emerge; including the intergenerational relations that co-evolve and are affected by each other within the practice (Mannion & Adey, 2011). Therefore, to understand how learning emerges in the I-3S, alongside looking for reciprocity and non-hierarchical communication, I looked at the entanglement of human and nonhuman entities to understand how/what critical digital-literacy emerged.

6.4.3.1 Exploring learning from a relational perspective

There are different approaches to understand learning from a relational-sociomaterial perspective. For instance, Kumpulainen & Kajamaa (2020) propose to look at “sociomaterial movements” and Dezuanni (2018) suggests to look across nodes for assembling digital media literacies. As such, there are other emerging proposals to trace the interactions among human and nonhuman entities in learning environments that certainly represent implementation challenges. However, Burnett & Merchant, (2019) propose a set of questions that can be used as a starting point to reflect on the relations between human and nonhuman entities in critical literacy environments for the digital age: 1) Who is making what, and with whom and with what? 2) What are the ethics of production? (focusing on what is made, who and what else is implicated, and whose interests are served) 3) How do the different layers of making interface?

I used these questions as guidance to understand how/what critical-digital-literacies emerge in the I-3S. The flexibility of these reflexive questions is advantageous for this research because the I-3S is a newly developed space, where human and nonhuman’s interactions, relations, assemblages, and re-assemblages, are not easily predicted and/or foreseen. Thus, these questions were the starting point to revise the collected data; alongside

revising the data to understand whether reciprocity and non-hierarchical communication emerges.

6.5 Implementation phase – Cycle 3

This subsection evaluates whether the designed aims in Cycle 3 were reached sufficiently enough. Thus, the focus is to look at the key elements that were defined as relevant in the I-3S: non-hierarchical communication, reciprocity, and critical-digital-literacy.

6.5.1 Non-hierarchical communication

As, explained in the prior cycle (see Section 5.5.1), infrastructure's functionality can only be seen through the way in which all the other elements of the I-3S work. In relation to this, data shows that all seniors and children concurred that their collaboration was not obstructed by the internet. Moreover, all learners expressed that collaborating through videoconference felt the same as if they were physically together in the same room. For instance, Liam said in the final interview *"I felt as if he (senior) was here in front of me, with me. It was the same"*. Senior Jacob said *"It seemed that there was no distance (very effusive). I felt like I was there with them. The distance did not exist. The technology at that point is wonderful because you seem to be there with them"*. In the same vein, senior Dorothy said *"...we were losing the signal, it was fine, you know [...] Probably it wouldn't be the same being at the same room, because I think we probably would have been working on the same thing, with the same piece of equipment instead of working separately. But I think it worked well, I think it was fine"*.

On the other hand, the videos showed that internet interruptions did happen during the intergenerational sessions. However, learners reacted more casually when facing this challenge, compared to prior Cycles, being more knowledgeable of what they can do to overcome it. For instance, see the following dialogue:

Oscar: Jacob, can you see us?

Jacob: Yes, I can see all of you.

Liam: We cannot see you.

Jacob: What could be the problem?

Oscar: The internet maybe?

Liam: Yes, it's the internet connection.

Oscar: Maybe too many people is connected down here

Jacob: Can you now see me?

Oscar: No. Should we both hang up and call again?

The dialogue shows that the children knew what could be causing the challenges and directed the senior towards a possible solution. In both cases, seniors and children were not surprised or stressed because they knew how to approach the situation. This attitude is related to digital-literacy because they developed some troubleshooting technical skills. This knowledge let them overcome the challenge and to carry on, letting them keep track of the conversation and the work they were doing. This argument is also supported with what Marion expressed during her final interview:

Interviewer: Did you feel that the senior was here with you?

Marion: Yes, it was the same. I felt that we were just like you and me.

Interviewer: Even though the internet was cutting off?

Marion: Yes, even though it was cutting off, and sometimes we heard each other very low or we couldn't see at all, we did our best to be truly connected. Although it is a person-screen, being connected like that and being connected physically was the same.

These examples suggest that the digital-literacy skills they acquired positively impacted learners' perception of videoconferencing, making it very similar to a face-to-face interaction. Additionally, the internet setup, the physical space set up, and being able to speak the same language within their team (the infrastructure) positively impacted the engagement

among learners. Thus, it can be inferred that the infrastructure allowed and supported a fluid communication among seniors and children. Nevertheless, the activities that learners performed also impacted how the communication flows, as explained next.

6.6 Activities – Response to the implementation phase in Cycle 3

The overall activities that learners performed in Cycle 3 were designed to foster, simultaneously, a non-hierarchical communication, reciprocity and digital-literacy. Thus, I now explain how learners responded to this aim by detailing each item separately. First, I explain how seniors and children responded to their workshops, prior to engaging in intergenerational coding sessions. Second, I expose how reciprocity and digital-literacy were developed through the intergenerational sessions, focusing on the work of Dorothy and Janis as an example. Later, I explain the different shapes that reciprocity and critical-digital-literacy took among all teams who participated in Cycle 3.

6.6.1 Seniors and children’s response to the workshops – Introduction to coding

As flagged in the design section (see Section 6.4.2), before engaging learners in the intergenerational activities, it was necessary to expose seniors and children to basic concepts of coding. Both generations were first exposed to coding through workshops. Seniors had individual and personalised workshops at their homes, whilst children had their workshops all together as a group in our working space in Mexico.

Seniors’ workshops – Algorithms and coding

The experience of prior Cycles showed that seniors cannot get the same support as children do, thus, it is not feasible to engage seniors in physical/digital making of their digital-text. Thus, in relation to coding, the aim was that seniors reflect on how humans use coding and devices, like the Micro:bit, as a tool to create technology, giving seniors first insights into what it means to make a technological prototype and how our ideas become embedded in technology.

To reach this aim, in our first workshop I discussed with seniors the ideas they have around how technology is created, and how it is programmed to do what they do. Then, I moved seniors to the concept of algorithm and how write simple algorithms offline -on paper- ; such as how to bake a cake. The seniors wrote different simple algorithms and, whilst doing that, I explained them that coding is basically placing our ideas in a set of instructions (Resnick & Siegel, 2015). An example can be found this is audio, where Heather writes an algorithm to brew a cup of tea ([Click here for evidence](#)); to some extent, Heather *conceptualized* (Cope & Kalantzis, 2009) what we theoretically discussed when defining an algorithm.

Heather reflected on the fact that an algorithm can be very detailed in how the instructions are given. The other seniors had similar responses, each of them *conceptualized* what is an algorithm. In the second workshop, I helped seniors to display their name and figures when clicking a button on the Micro:bit. When doing this, all seniors showed engagement. Coding was something new for most of the seniors but all of them showed openness to learning. Moreover, senior Dorothy was very excited and said *“I always wanted to be an engineer.... I did coding in the 70’s when it was line coding, ‘go to’, and ‘loop’, and that kind of thing, but very simple. So, this was so different for me.”* Seniors easily learned how to write basic algorithms in paper, but they had challenges translating the algorithm into syntaxes of coding. Although displaying text and figures is a simple and intuitive process for many users, seniors had more challenges. For instance, Jacob said *“...It helps a lot to have a teacher, in this case, someone that guides you, instead of doing it by myself. After the first workshop, I tried to do it again, and I searched a bit but I got tired, and I gave up, because I didn't know where to go. So the introductory class in the second workshop was very important [...] to see how the Micro:bit looks, what it is, and how to use it”*.

As Jacob mentioned, to better support seniors, we had an third workshop to keep practicing in the Micro:bit's editor. Although this was not enough time for the seniors to retain the information, seniors said they were confident that they would reinforce the knowledge when practicing more with the children.

On the other hand, Heather, who has limited digital technical skills compared to the other seniors, could not assimilate nor remember the coding process. Heather's challenges were not only related to acquire new information on how to code, but also with remembering the website she had to access to get the Micro:bit's editor and how to save/download a file. To overcome this challenge, I lent Heather a computer, walked her through the whole coding process using that computer, and I video recorded the entire session so she could watch the recorded session in her iPad any time she needed to remember what to do ([Click here for evidence](#)). Having the recorded session gave Heather confidence to keep practicing herself and get ready for the intergenerational-sessions. However, this experience let me anticipate that Heather needed longer time to learn, thus, she might not be able to use the coding software when collaborating with the children. Nevertheless, this would not be a problem because Heather could always collaborate with the children in discussing ideas and all other elements of the digital-making process. This is how the workshops can be personalised for coding because, as seen in prior Cycles, each senior has unique needs and characteristics that should be addressed.

After conducting the workshops with the seniors, I was confident that focusing the seniors' work in collaborating with the coding and the critical reflective process of digital-literacy was rational. Seniors were sufficiently challenged with learning 3 syntaxes of coding in the Micro:bit's editor, thus it would have been overwhelming for the seniors to work with more information -such as learning about electric circuits-, something that I had been carefully trying to avoid (see Section 2.10, Methodology).

Child-only sessions – Algorithms and coding

As seen in Appendix E, the first children-only session was designed to explore how an algorithm is a set of instructions that we create and write, aiming to have a specific response or impact in something else (Gillespie, 2014). To do this, children wrote paper-based algorithms to draw a pattern in an 8x6 grid, using only a set of symbols as instructions -Arrows pointing right/left/front/back-. Each child tested their algorithm by dictating the instructions to a peer (see pictures below). In session 2, children explored by themselves 3 different basic language syntaxes of coding: How to display text and figures when clicking a button on the Micro:bit. Children explored the Micro:bit by themselves, guided intuitively by the platform's affordances, such as the puzzle shape and colours of the interphase (see Section 6.4.2).

Figure 10. Children testing their paper-based algorithm.



The third session was designed to have a workshop with the same senior writer that worked with the children in the prior cycle -Roberto Castillo. The workshop's aim was to incite children to imagine things that do not exist yet; first, discussing how literature writers make us imagine new things through their texts. Second, by asking children to imagine and to build, with recycled materials, an artefact that does not exist yet, but it should. All children presented their inventions in plenary and responded to questions from peers.

Figure 11. Texts discussed during the workshop before building imagined artefacts.



Asking children to work in offline activities, not only to create algorithms but also to review literary texts and imagine surreal artefacts, had the purpose of encouraging children to experience that to get into coding, we do not need a computer but paper-based algorithms, and “thinking out of the box” prepares us to write coding programmes (Prottzman, 2019).

The next DigiCamp sessions were intergenerational-sessions but, simultaneously, children worked on what is an electric circuit and how to create one using the Micro:bit. Here I highlight that multiliteracies pedagogy stresses agency in the meaning-making process (Cope & Kalantzis, 2009). Thus, instead of seeing learners as empty vessels (Freire & Macedo, 1987) that should be filled or taught with pre-established formal concepts, multiliteracies stresses the need to design learning experiences where learners develop strategies to reading and responding to unfamiliar situations; making use of all their knowledges, theories and concepts as tools to think with (Dewey, 1938; Elkjaer, 2018). It does not mean that learners cannot be given any formal concept or metalanguages, but that formal concepts should be introduced to learners within a framework of agency in the meaning-making, waving between the experiential and the conceptual (*conceptualizing*) (Cope & Kalantzis, 2009). Therefore, I decided to directly explain all children how to create an electric circuit using the Micro:bit to turn on a LED ([Click here for evidence](#)). When

doing this, I included children's opinions and knowledges they got when they explored -by themselves- the 3 syntaxes of coding. However, I asked each child to do a hands-on practice to turn a LED on, helping each other with any challenge they might encounter -instead of asking me. Children were provided with electronic equipment -LEDs, protoboards, cooper wire, alligator clips, and wire cutters to make their circuits. Although, collaboration is naturally encouraged in learning-to-code environments (Kalelioglu, 2015; Popat & Starkey, 2019), in the I-3S fostering collaboration is key to look for reciprocity and non-hierarchical communication.

After these workshops, seniors and children started making their digital-text from the same starting point, the knowledge of writing algorithms as a set of instructions and 3 different basic language syntaxes of coding (displaying figures and text when pushing a button). This way, seniors and children would use all their knowledges to help each other to work with coding and, if necessary, learning other language syntaxes together. This approach was similar to what we did in Cycle 2, where some seniors and all children started to collaborate in Google Docs starting from the same basic technical knowledge of using the software; and through the making process, both generations explored and learnt new functions. Additionally, the fact that seniors and children are placed at the same starting point is related to foster reciprocity and non-hierarchical communication because neither the seniors nor the children were familiar with coding. Thus, they both would be equally involved in opportunities of learning and would equally help each other to complete the task, making use of all the knowledges that both generations could bring. The emphasis in this intervention is not on the technical skills or in learning coding syntaxes, but on reflecting how personal believes and thoughts get embedded in technology. These reflective moments were planned to happen together with the seniors, during the intergenerational sessions.

6.6.2 Illustrating the work in the I-3S: Dorothy & Janis team

Cycle 3 had four intergenerational teams. All of them finished their technological prototype using coding, which can be found here ([Click here for Cycle 3 digital-texts](#)).

I highlight that the video was recorded during the showcase, thus, it includes the prototypes made by children's siblings who also participated in the I-3S as guests.

In this cycle seniors Dorothy, Edna and Jacob closely engaged with the children in the technical aspect of coding, but each of them did it differently. Heather kept her engagement (as in prior Cycles) mainly through the critical moments of discussion, but not in the actual coding making. In this context, this section illustrates how seniors and children collaborated during the intergenerational sessions through the work done by Senior Dorothy and child Janis. Although all intergenerational teams had similar collaborations, I chose this team only as an example of the many variations that the intergenerational collaboration might take, not only to develop critical-digital-literacy, but also reciprocity. Later, sections (6.6.3 and 6.6.4) show how the other teams responded to the collaboration.

Dorothy & Janis building a technological prototype using coding

This was the first time that Dorothy and Janis met, as Dorothy is the new senior in the project. Therefore, they started their conversation by exchanging basic personal information such as their names and age. Both generations were asking the questions and engaging in a dialogue, something different when compared to the other teams where mainly the senior was conducting the conversation. Although the senior was not leading the session, Dorothy played a key role in keeping the conversation lively.

Janis: When is your birthday?

Dorothy: It is in August.

Janis: Oh! August, we're almost there. How old are you?

Dorothy: I'll be 73. That's old!

Janis: Oh, yeah! but it is ok

Dorothy: so, if I'm 73 and you're 11, how many years difference is there?

Janis: Let me see (thinking and counting with the fingers). 73 minus 11 (doing math in a paper). 62!

Dorothy: yeah! we're 62 years apart. I'm probably your grandma's age

Janis: Yeah! My grandma already died but I have another one, because I had two.

A similar conversation and exchange among Janis and Dorothy kept happening throughout all their sessions. For instance, when discussing the social challenges affecting their communities, they equally collaborated in narrowing the ideas. The senior avoided putting her ideas on child's thoughts -the same reaction that all seniors had during Cycle 3. Instead, Dorothy gave Janis time to organise her ideas, helping her mainly by asking questions that guided the child to refine her thinking, as seen in the following conversation.

Dorothy: Janis, now we have to deal with our project. What will we do with our computer stuff?

Janis: Ok. Let me think (very serious).

Dorothy: Ok (Laughing) [Dorothy gives the child time in silence to think]

Janis: Mmmh (thinking). Do we have to write a story, or what do we have to do?

Dorothy: Well, it can be like a story, but then we have to figure it out how to make it like a programme. Something that help us solve the problem... I've never done this before, so we're both beginners.

Janis: Yeah, me neither. I haven't done it.

Dorothy: Are you a computer person?

Janis: not that much, I don't have a computer at home. Maybe we can...well, let me think about it (very focused and thinking in silence).

[The senior also keeps in silence waiting for the child thoughts. Meanwhile, Janis starts sketching her thoughts in a paper]

Janis: Maybe... Like (pause). No, maybe not that thing.

Dorothy: You can keep thinking, we have time.

[The child keeps thinking and looking at her notes for a while]

Janis: Do you think we should choose something more easy? Like the problem solving?

Dorothy: No. We could do any idea. Easy or something else.

Janis: Because I saw that a lot of people. People threw a lot of trash at the beach. And animals could die for that.

Dorothy: Oh yes! Trash at the beach. That's very dangerous.

Janis: Yes! We could pick up the trash at the beach.

Dorothy: Yeah, and how do we do that?

Janis: We could use globes or that stick to pick up the trash.

Dorothy: Ok, but how are we going to develop a computer programme for that?

Janis: Oh yeah! (surprised)

D: Oh yeah! But trash is a good problem.

This conversation continues and moves towards a rich and long discussion of the marine species in the Pacific Ocean, discussing how species travel across the USA and Mexican border, thus, they are affected by pollution. The exchange of experiences and opinions among the generations is how learners reflect on their reality. Moreover, in creating a robot to solve the pollution challenge, both generations experienced technology as a resource to act and try to transform society. The dialogue also shows that the senior was making sure of not leading the session but supporting or scaffolding child's thinking through the reflective process. Moreover, throughout the overall work, Dorothy made sure of focusing their conversation towards developing the digital-text. Again, this role of guiding the teamwork to keeping focus on the making process, is a role that most seniors naturally took. For instance, Dorothy explained in her diary that she deliberately took the role of helping the child to refine ideas.

It was fun to listen to how the Robot would look. It is to be a girl robot. Her ideas got bigger and bigger and I think it helped her a bit when I asked

questions. E.g. would it be difficult for the Robot to walk in the sand? She thought for a while and said maybe it should be on wheels. Eventually she decided that maybe she could push the robot and she (the Robot) could play music and remind people to pick up trash.

As it was planned, once learners had their idea of the technology that should be created to counteract a social challenge, the facilitator should work with the generations to define a prototype of such technology, considering what is possible with the kit we had (Micro:bit) and the coding syntaxes planned to be explored during the intervention. In this case, we narrowed their idea towards a robot that displays phrases, makes sounds and has blinking eyes; something doable considering the 3 coding syntaxes that both generations were exposed to.

Dorothy: Why don't you tell Dulce about the robot that we want. Describe the robot.

Janis: Ok. [Janis looks at her notes whilst explaining]. We think that she's gonna, mmmh, we're gonna make her play music while she's picking up the trash and she turns on lights and we're gonna, like, we're gonna make her walk, move her arms and she talks and she says "toss the trash".

Facilitator: I like your ideas! Perhaps to do the prototype we won't make it walk.

Janis: Ok, but we could put her on wheels.

Facilitator: Yes, and you could push her with your hand...My suggestion is, in terms of coding, to find out how to play sounds and how to turn the light on/off.

Dorothy: sounds good!

Facilitator: So, what I can do is to help Janis to start working on building the robot. How to turn the light on/off with the hardware, to create the code to physically turn the light on/off. Thus, probably Dorothy could explore how to create a code to play sounds?

Dorothy: ok with me.

This conversation exemplifies how I, as facilitator, worked with each team to narrow or to delimitate a technological prototype considering the topics they could cover during the intervention. Considering that each team had agency to organise their work and to help each

other, exchanging skills and exploring together, to make the prototype. For instance, in this team, Dorothy worked on creating the code to play sounds and text using the Micro:bit's editor, whilst the child worked on the physical building of the robot. Later, both generations met to make changes together; as shown below.

Dorothy: Show me what you're up to.

Janis: Since in the Micro:bit, there is like a card, I'm gonna put it in the back. Because you know, I want to put it there. So now we just need to put the lights here, so she could see. Well, the fake eyes with the lights. But Dulce will help me to put the plugs to the...well... where the music is gonna be out.

[Janis draws the robot and captured her ideas there, so Janis reads and shows the drawing to Dorothy when explaining]

Dorothy: Good. About the music, I put only this sound (Dorothy imitates a sound with her voice). But you might ask if we can put something better on it. Something you could play from the radio. I don't know that. [Dorothy coded an algorithm and she has it there, in a computer screen]

Janis: [...] What kind of sound did you choose?

Dorothy: Ok, it is just dha dha!! (Dorothy imitates a sound).

Janis: Oh! like the one on a funeral, the wedding one, or which one? (Melodies' titles in the Micro:bit).

Dorothy: Oh, we could switch that! Do you want me to put a different one on?

Janis: I just want to know which one you choose. Because I think I know that one too.

Dorothy: Which one did you like?

Janis: I liked the one called "chase".

Dorothy: Chase. Ok, let me put that one (Changing the code). Ok. Now it got chase.

Janis: Ok. Now we need to change it (the code) to make her speak and to move her arms.

Dorothy: I don't know how we can make her move her arms with this (the coding). We might need to figure it out with something external.

Janis: [...] Ok, let me find it out what else we have to do. Let me see (Reviewing her notes). Oh! now we have to figure it out if she's gonna play another song or to talk.

Dorothy: Well, I don't know how to make her talk. But I just have something here in the little screen, saying "Trash it". And then the little hart, and it plays the music all the time.

Janis: Ah! Ok! so we can do that. But how? like a little screen?

Dorothy: Yes, the little screen on the Micro:bit

Janis: Ok.

[...]

Dorothy: How are you gonna make the robot?

Janis: I don't know yet. I think I'll use cardboard.

Dorothy: And then are you gonna paint it?

Janis: Yeah... Because on the cardboard the paint will stay.

[Learners continued discussing ideas about their robot's characteristics]

It can be seen how both generations reciprocally collaborated in making decisions around their digital-text, as well as exchanging skills. Even though they did not do the same activities, both generations were placing their knowledges and resources available to one another. As seen in the dialogue, Dorothy focused on coding and sent me a picture of the algorithm she created. Janis used the picture as guideline to recreate the code and connecting the wires in the Micro:bit. Thus, in their next meeting, Janis shared the senior how she plugged the speaker and the LEDs to the Micro:bit.

Janis: Dulce already gave me the speaker.

Dorothy: Great!

Janis: Now I just have to pass the music right here and then is gonna come up right here (Pointing at the speaker).

Dorothy: What did you hook the speaker to?

Janis: [only shows Dorothy the Micro:bit with the connected wires]

Dorothy: But where did you hook it in the Micro:bit?

Janis: (Janis shows Dorothy the wires)

Dorothy: Hold it so I can see

[Janis moves the iPad guided by Dorothy to show her how the Micro:bit is wired to the speaker and the computer]

Dorothy: Ok. Now tell me about it.

Janis: The green is on the ground and the red is on the, the, mmh, the other thing.

Dorothy: Do you have just one thing connected to the Micro:bit?

Janis: I have like four. (Janis is speaking whilst manipulating the Micro:bit). Oh! here, it came out! (Bringing the speaker closer to Dorothy because it is playing the music).

Janis: Oh! I was gonna tell you that, you know that in the music you put "forever"?

Dorothy: Yes.

Janis: Dulce told me to put it once, because otherwise It would be playing the whole other time.

Dorothy: Ok. Sounds good.

Janis: So I changed it to "once". So now we got the speaker ready and we just need to hook up the LEDs. Do you want me to go pick up the LEDs?

Janis and Dorothy were advancing in their prototype, but they had challenges connecting the LEDs, thus, they asked other children for help. As aimed in the I-3S, when learners face challenges, they are encouraged to make use of all the resources available such as finding help from one another. For instance, in this video ([Click here for evidence](#)) it can be seen that children had equal opportunities to move from the novice-expert role. Also, it can be seen how Janis is confident to introduce other children to the senior, although she felt shy when the senior starts expressing positive aspects about Janis. Moreover, the other children respond familiarly to the senior, despite it being the first time they met her.

The work that Janis and Dorothy did illustrates one example of how seniors and children collaborated to make their digital-text, and how both generations developed reciprocity and critical digital-literacy. The work of other teams pointed out the different shapes that reciprocity and critical digital-literacy can take, as explained next.

6.6.3 Reciprocity

In the I-3S, reciprocity is understood as seniors and children building a reciprocal relationship, but also that seniors and children have equal opportunities to switch between the novice-expert role (see Section 5.4.1, Cycle 2). In respect to this, in Cycle 3, all learners claimed they had a positive experience when working with the other generation, stressing that the other generation was crucial to make the digital-text. For instance, Nora said: “In my team everybody equally helped each other. He (Senior) was also part of the team because he gave us advice. Well, he told us what we could do to improve the project”. Oscar, who was in the same team as Nora, added that the senior learnt from the children too: “*More or less we learnt from each other, because sometimes he told us "This is how we used televisions", for example, "and right now I don't even know how these things turn on", he told us*”. Oscar experienced that the senior was learning about technology through his collaboration within the team, thus, the senior was learning from the children.

As Oscar and Nora, other children said that both generations learnt from each other, and that they had a reciprocal relationship. For instance, Marion said:

Interviewer: How was working with Edna?

Marion: Super good! Super, super, super good.

Interviewer: What did you like the most about working with her?

Marion: Being with her. It's like talking with a child our age. Like we are between 11 and 12 years old and talking to her is like talking to a schoolmate. She is very funny, very charismatic and she taught us many things, she gave us ideas about the drawings. It was very nice to be with her.

Interviewer: Do you think she learned something from you?

Marion: Yes, because we taught her various things that she didn't understand. For example, about the wires. We told her that wires connect under the shirt. You make a hole and the wire goes through it. Then you put the conductive tape. Also about the Micro:bit, that the phrase had to come out by pushing the button. And so many things like that.

Interviewer: How do you feel about having finished the work with her?

Marion: Bad, horrible, very sad.

Interviewer: Well, but at least it was good to meet someone like her, right?

Marion: Yes, it was very nice. I'll never forget her, never, never in my life.

Marion's interview shows that there was a positive relationship between senior-child, as well as how both generations scaffold each other, switching from novice to expert role. Unlike the previous Cycles, in Cycle 3, the children clearly identified aspects that seniors learnt from them. Moreover, the seniors as well identified that they learnt from the children in a reciprocal relationship, and that friendship grew among them, as senior Jacob said:

(I learnt) that it is very easy to share between generations. Sometimes people say that we are so different and that it is difficult to speak with the other generation. And I saw that this is not true. If we're open, and honest, and we present ourselves as we are, anyone -in this case children-, any generation accepts us. I don't think children saw me as an old or very old person, or someone from another planet, but that we treated each other as equals and that made me feel good. [...] Overall, I feel admiration for the boys. I think they were very involved, and they were intelligent with technology, much more than I. They were very understanding and very patient with me when they noticed that I was not understanding some things. They were always taking the initiative and that was very beautiful.

Data shows that even though seniors and children did different tasks within the same activity, they both exchanged knowledges and skills to build the digital-text, constantly moving from novice-expert role. Nevertheless, I highlight that data also shows that the seniors sometimes also take a facilitator role, keeping track of the work and engaging children in scaffolding their thinking.

Additionally, data shows that children were mainly in charge of coding the algorithm in the Micro:bit editor, to later share with the senior. When doing this, children were looking for senior's feedback to improve the work. However, seniors not only gave feedback to improve the work but sometimes, seniors also questioned the children to think deeper on their

coding and to foresee the next steps. This is exemplified by the dialogue between Senior Jacob, Liam, Oscar and Nora:

Oscar: (He takes the iPad where the senior is talking and focus the camera towards the computer's screen where Liam is writing the algorithm)

Liam: Here, what we wrote was that, where it says input, button A, it will sound like this (Playing a sound)

Jacob: Perfect! You already advanced a lot. Yes, looks good!

Liam: Yes, but the problem is that, in the speaker we have, the sound is very low.

Jacob: well, that's one of the problems. It is possible to buy a bigger speaker, but if it works when clicking the A button, then it is ok. But, how will the button A get activated?

Nora: We already have a speaker.

Liam: Yes, but, the question is how will the button be activated, right? (Liam shows the Senior a small-scale cardboard prototype children constructed) You mean how could we activate this (manipulates the cardboard), but we still don't know.

Jacob: I see. Well, looking at your algorithm I can see that you used in input music.

Liam: Yes, we clicked here (demonstrating in the Micro:bit's editor the steps they followed).

Jacob: Very good. Now, how will the alarm shut off?

Oscar: That's true! How will it turn off?

Nora: We said that we'll click a button to turn it off.

Liam: Yes, the reset button at the back of the Micro:bit

Oscar: Yes, but how will the reset button activates by itself?

Nora: We need to click the button for the alarm to sound. So, we'll turn it off in the same way.

Oscar: I don't think so. Well, we don't know yet, but it is looking good so far.

Liam: There are things that we still don't know how to do

Jacob: Ok. Maybe we should explore how to add loops? because maybe we want the alarm to keep sounding until it stops. Or you already coded for how long it will sound?

Nora: Let's make it sound twice.

Jacob: Maybe 4 times

Oscar: 10 times is better!

(Liam adds a loop in the algorithm whilst listening the discussion)

The dialogue shows that Jacob takes a facilitator role, supporting children to scaffold their thinking. Also, despite the senior not writing the algorithm, he engaged with what children coded. Jacob understood how the algorithm worked and, making use of what he learnt during the workshops, the senior was able to propose an idea (the loop coding syntax) to explore further the Micro:bit affordances to improve their work. On the other hand, not all seniors moved children towards a deeper reflection on their algorithm. In this cycle, only Jacob and Dorothy gave advice on the coding syntaxes. Edna and Heather engaged with the coding differently; mainly by asking children how they wrote the algorithm and collaborating to take decisions, such as choosing sounds or figures that best fit their projects. However, they also played a key role in the making of the digital-text.

In the case of Edna, this video ([Click here for evidence](#)) shows that Edna is trying to do coding herself, but she has difficulties and asks children for help. Thus, Marion gives the senior instructions to continue writing her algorithm. This situation shows that even while Edna did not engage in coding as Jacob and Dorothy did, Edna was capable of creating some coding with the children's support and advice. Moreover, it shows that the children were also the experts sometimes and seniors were confident to ask children for advice. This can be seen as a non-hierarchical communication among Edna and Marion.

Similarly, Heather did not advice the child on coding, but engaged differently. Heather used her artistic skills to conceptualise a drawing representing the social challenge they wanted to address. To illustrate this claim, the image below shows the drawing made by

Heather, followed by a dialogue between Heather and Isa taking decisions together in their algorithm.

Figure 12. Sketch of technological prototype.



Isa: What kind of sound do you like for the picture?

*Heather: Oh, the sound. Let's see. It could be a screaming sound. AAAAH!
(Senior screams and they both laugh)*

Isa: I actually tried to do that but, on the piano, it was very hard. It is easier to choose a song.

(Whilst talking, Isa makes changes in the algorithm to play different sounds)

Isa: That's one song. And that is the second song. Let me see what else is on there.

Heather: Ok.

Isa: There is a song for a birthday and for wedding and for a funeral. And this one too. (Plays a melody). You could hear it, right?

Heather: Yes, I can hear it. It is good.

Isa: This is a ringtone. (Plays a sound.)

Heather: That one is too happy.

Isa: Yeah!

Heather: I like the first one.

Isa: Here is another one. (Playing another sound.)

Heather: That one is too soft.

Isa: What about this one?

Heather: I like that one.

Isa: Yeah, I think so too. Do you prefer this one or the first one?

Heather: Play the first one again

Isa: (Plays both songs)

Heather: The second one

Isa: Yeah! That's a good one. (Happy)

Data shows that seniors engaged in different ways when making the digital-text, stressing that all the I-3S is an inclusive environment where all seniors used their knowledges and skills to advance the teamwork, something that children valued. For instance, Ava and Brenda, who worked with senior Edna expressed: *“What I liked the most were her jokes and the things she explained to us, such as how things were before technology. But we also taught her how to use the Micro:bit”* (Ava). *“It was better to have worked with Edna because otherwise we couldn't have thought about what we were going to do, what our Project would have been about.”* (Brenda). Seniors and children figured out, together, how to improve their work, placing their knowledges available to one another as resources to overcome the challenge.

The activities' design contemplated that children were in charge of exploring different aspects of the Micro:bit to later share that knowledge with everybody in the I-3S. As happened in Cycle 2, in Cycle 3 this action provoked children to look for help overcoming “knowledge challenges”. They asked for help from other children they recognised as being the “more knowledgeable other” that could help them understand certain technical aspects,

instead of asking for the facilitator's help. Thus, all children had opportunities to switch from novice-expert role and to build reciprocity between them. For instance, Janis said: *"I also liked that Isa helped me, and that Dorothy met some of the people here. Because when you left, she (Isa) went up there, and they (Isa & Liam) helped me."* Ava said: *"Oscar told me how to put the music, and Isa how to transfer things to the Micro:bit."* Liam said *"With Janis, I showed her how to connect the speaker; and Isa too."* And Brenda said: *"I liked that we all helped each other. As if we were like a single team all of us."*

It can be said that the activities, and the overall design of the I-3S, encouraged learners to build reciprocity. Moreover, alongside, it also fostered the development of critical digital-literacy, as explained next.

6.6.4 Critical-digital-literacy

Building on guidance from Burnett & Merchant (2019) to explore critical literacy practices (Section 6.4.3.1), I explored the entanglement of humans and nonhuman entities within the I-3S; identifying the senior-children-materials (tangible/intangible)-facilitator relation. Therefore, the following sections explain how each of these entities is entangled with each other, and how critical-digital-literacy emerges from the relation.

6.6.4.1 Senior-children relation

All teams created a technological prototype using coding. Seniors and children discussed and reflected in social challenges that they believe are affecting their communities. When doing this, data shows that seniors took the role of engaging children in a deeper reflective experience, both genuinely listening to what children were expressing and advancing the conversation towards considering other perspectives. These reflective moments together allowed seniors and children to build empathy and connections among them, thus, overcoming the social challenge became important for both generations. Therefore, it can be

said that what they produced emerged from the senior-children relation. For instance, the work that Marion, Ava, Brenda and senior Edna did.

This team made a wearable technology prototype whose purpose was to prevent bullying at school. They designed and painted drawings in t-shirts that, when a drawing was touched, the Micro:bit displayed anti-bullying phrases that learners created. They would encourage children to wear T-shirts they could play with, whilst reflecting on phrases like “*We’re all the same*”, “*Nobody is perfect*”, among other phrases. They decided to approach bullying because after reflecting on the frequent violent episodes happening in the children’s neighbourhood, they realised that negative childhood experiences, such as bullying at school, might be the reason why some people harm others when they are adults.

Marion: Everyone is thinking of making robots, but we want to do something different. We want to do something about the murderers, but we don’t know.

[...]

Ava: The day we went to the beach, there was a house on the road with caution signs.

Marion: Ah yeah! when we come back from the beach. In that house, there was a patrol car and, in the courtyard, there was a container, like a bucket, and we passed by slowly in the car. We saw a policeman who pulled out a human head out of the bucket.

Edna: Oh my God! Did you get to see that? What an ugly thing!

Marion: All of us were in the car because were coming back from the beach, but those in the back were playing and did not see it. Carmen, a friend, and I saw it. We passed by exactly the moment when the policeman pulled the head out.

Edna: Oh no! It is horrible that those things happen. Maybe we could do something to help families who have been through that. I don't know what you think, what experience have you had? Or what ideas do you have to prevent these things?

Marion: I don't know. I thought about putting up signs, but that has already been done and they do it anyway.

[...]

Edna: Maybe the bad guys become bad because they haven't had many opportunities to be good.

Marion: I think so, maybe they become bad because they have not had other opportunities in life, or because their families did not want them.

Ava: Or they were mistreated

Edna: Yes. Some people who have been abused sadly react in a violent way. Why would that be? Maybe we could promote that there are other opportunities and not just do bad things. But, how can we do it? I cannot think of something.

Ava: Maybe if we build cameras, so the police can see the bad guys

Marion: Well, but it does not work. There is no justice anyway.

The dialogue shows that the senior is surprised and affected by what children narrate; thus, there is an empathic connection with the children's experience. On the other hand, the senior moved the reflective process, from the current negative experience, to think about the root causes. This way, they both could foresee an opportunity to tackle the problem.

Data in Cycle 3 stresses that senior's role was key to deepen the discussion towards different reflective levels that moved the conversation forward, as well as keeping track of the advances in the overall making process. For instance, senior Dorothy explains:

"I think we really worked together. That was part of my goal, that we worked together. I really wanted her to be the one to make the decisions. The only time when I pulled back a little bit was because she, for a while, she was so keen on what the robot was going to look like, and we had a time frame. You know, if we had a year to do it, we could have talked about the robot but I knew we had to do this in so many sessions, so I wanted to pull her back to what we want that the robot does."

This role that seniors took was noticed by some children. For instance, Janis said: "...Dorothy wouldn't give me the answer, but she would like, tell me kind of, like clues where I can learn myself". Similarly, Marion experienced: "Seniors were there helping us, showing us new things. In other words, teachers also teach us new things and help us, but seniors would be different. Because the teachers are from the school. They teach you only what we

need to learn, like history, Spanish, but the seniors teach you several things even though they are only working/collaborating with us”.

This shows that seniors and children shared each other their life experiences within their communities, in a reflective practice where seniors played a key role engaging the children in understanding the social challenge from different perspectives. Both generations integrated their thoughts into an idea that could potentially overcome a social challenge. Therefore, it can be said that the prototype started to build from the seniors-children relation. However, as it will be analysed in the next section, the nonhuman entities, such as the materials (tangibles and intangibles) and the facilitator, also played a key role in how learning emerges. Thus, they are also important elements of the I-3S entanglement.

6.6.4.2 Nonhuman entities and the facilitator as part of the I-3S entanglement

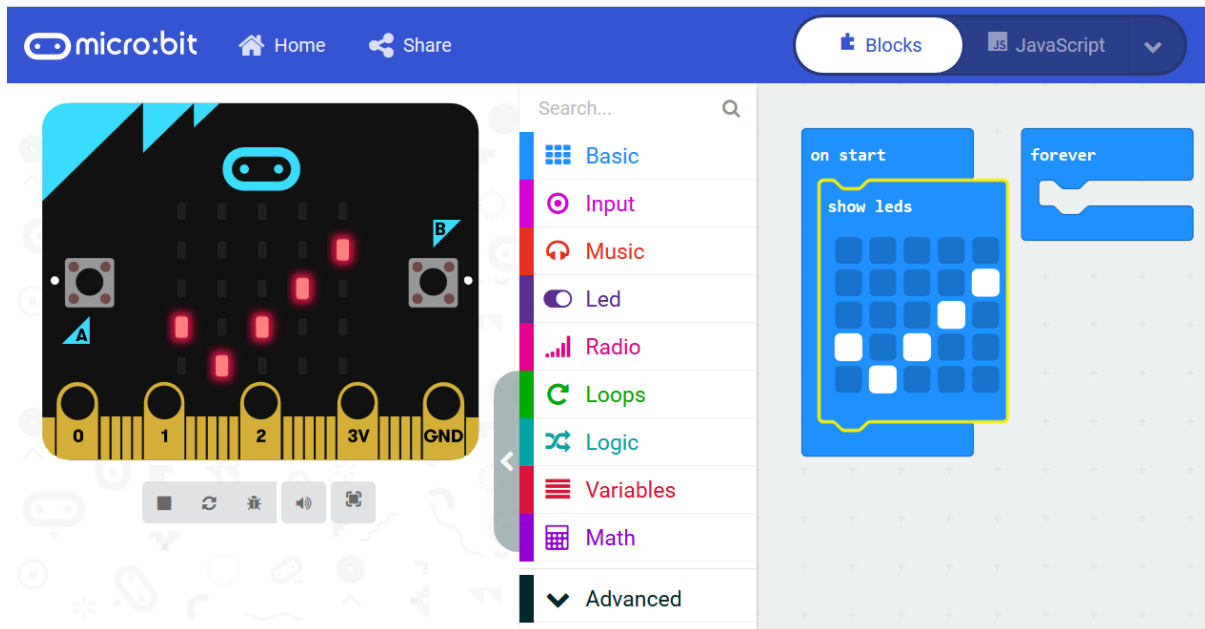
In this cycle, once the teams had a solid idea of the technology that should be invented to tackle a social challenge, the nonhuman entities and the facilitator, as part of the senior-children relation, becomes more visible. Therefore, in this subsection I will first explain how the nonhuman entities are part of the senior-children relation, thus involved in the learning process. Later, I will explain how the facilitator is also part of this entanglement.

Nonhuman entities as part of the entanglement

The nonhuman entities, in relation with the senior-children relation, also impact what emerges in the I-3S. By nonhuman entities I mean the materials, tangibles and intangibles, involved in the making process. For instance, the Micro:bit device, electric wires, electronic components (LEDs, speakers, conductive paint), recyclable materials (cardboard, t-shirts, paper sheets), scissors and many other tangible materials that learners used. Similarly, the non-tangible materials that learners used; such as the Micro:bit online editor, email software, videoconferences systems, search engines, among other software.

Nonhuman entities, like the Micro:bit online editor, for instance, played a crucial role in the learning process. The editor is a website where learners code their algorithm; thus, its features (e.g., its colour-coded blocks and its simulator) directly influence learning.

Figure 13. Micro:bit, colour-coded blocks and simulator.



The colour-coded blocks resemble a puzzle that implicitly indicates which commands can be linked together in an algorithm. Thus, when learners are new to coding, they can visually guess the right way to organise the coding commands. Additionally, the simulator immediately reacts to code changes, simulating what the Micro:bit device will do with such algorithm. Thus, learners get immediate feedback on every change they make in the code, letting learners to immediately realise if their algorithm does exactly what they wanted it to do or if they need to keep modifying the code. These features encouraged users to learn from their mistakes, as well as to explore other coding commands available for them in the editor. As seniors Jacob and Dorothy point out, these features are helpful to develop coding skills.

“About 25 years ago, I took one coding lesson in Basic language. It was very complicated but I got it. Thus, now, I was all the time comparing the Micro:bit with what I learned on Basic. Now, everything is already pre-packaged. It is already prepared and you - if you know how- you just have to keep moving the blocks and everything works. However, before we had to be very precise when putting a comma or a period. Even writing a simple

word -a 'go to' or 'now'- had to be precise. So, I believe that new generations have it very simple” (Jacob).

“I think I learned the whole idea of putting things in order and how they fit with one another, and I think that the nice thing about using Micro:bit is that you knew right away if you made a mistake because the pieces didn’t fit. Oh! Well, I think I’ll put this up, underneath this, such and such, but that wouldn’t work. So, you have to re-organise what you have, or insert something in between. It really was a good way to learn because you got instant feedback. Otherwise, you could get frustrated because you finish the whole thing and it does not work. Then you don’t know how to go back, and where it stopped working. But Micro:bit let you to do that. You can also use the simulator, you don’t have to set up anything” (Dorothy)

These seniors highlight that they started to develop coding skills, and the Micro:bit software features impacted their learning process, allowing them to engage with coding. Seniors particularly stressed the importance of getting immediate feedback through the editor and the colour-coded boxes. Thus, it can be said that the software encouraged learners to explore, together and individually, different configurations of their algorithm until they obtained the desired results. Thus, the final coded algorithm emerged not only from the senior-children relation but also from the senior-children-software relation.

The software impacted how learners engaged with coding but, to an extent, it also framed the possibilities of what learners could code because learners were bounded by the Micro:bit coding features. For instance, section 6.6.2 shows different dialogues between Dorothy and Janis, where it can be seen how the senior contributed by coding the algorithm to display text and plays sounds, to later taking a picture of the algorithm and emailing it to the child, so Janis could use it as guideline to continue the coding and the physical making of the prototype.

It was already explained how seniors Dorothy and Jacob started to develop coding skills, but children also developed coding skills. For instance, Marion, Oscar, and Brenda said,

“I learnt how to use the Micro:bit, its functions. How to connect the wires with the shirt for example, and that when you touch the drawing, something will be activated. I learned how to turn on an LED and to play sound in the speaker when you click on the

Micro:bit. I also learned how to use Isa's conductive painting. That you could touch the paint and the LED turns on” (Marion).

“I have heard the word Algorithm, but I didn't know what it was. Now I know how to play sound in a speaker. It is not only about connecting the speaker. You need to connect the positive and the negative wire, and you also need to code the time, how long you want it to play” (Oscar).

“At the beginning everything was difficult because we did not know anything, but when we started to make our code and we began to discover things, everything was easy. Like downloading things to the Micro:bit. [It was easy] because you explained some things to us, but it was also easy after we paid a lot of attention on how we were going to make the code to create our project.” (Brenda).

These children developed coding skills by exploring and interacting, not only with the humans such as the senior and the facilitator, but also with the many materials, tangibles and intangibles, within the I-3S. However, it has to be stressed that the materials available for children to use also framed the possibilities of what learners could built, as explained next.

To build the prototype, learners were constrained by the number of pins that the Micro:bit has: they could only connect four cables at a time, thus, they could only activate four features in their prototype. Although there is a possibility of buying external devices to increment the number of pins (like an extension), this would have been expensive and would have require more time to explore and learn how to use, thus, it was not achievable for this intervention. Another example is the fact that the prototypes were bound by the maximum voltage that the Micro:bit can output, meaning that learners could only use electronic devices (e.g., LEDs, sensors, speakers) that work within this voltage range. This also stresses that critical-digital-literacy is also about understanding the limitations of technological devices, and how other developers have access to additional tools. The latter was discussed with the children saying that their prototypes was a proof of concept, as Ron highlighted during the showcase of this cycle *“This is just a small prototype to inspire others to make it big”*.

Another way in which the nonhuman entities frame the possibilities of what learners can built is when, in the I-3S, due to the limited resources we had, learners were encouraged

to make their prototypes using only available devices (mostly recycled materials) and to make sure that there were enough for everybody. The boundaries and possibilities that the materials offer impacted learning. For instance, children expressed that they learnt from manipulating materials (in this case, electric devices).

“I was afraid of wires. I was scared because I never really touch them, and I was always very scared of touching them. But after this experience, I am not scared anymore but I’ll never touch those in the wall” (Isa).

“I learned about LEDs and how they light up. I also learned how electricity works when it goes through the wires, and that I didn't have to connect the positive and negative wires together because they burn” (Oscar).

“To keep inventing stuff, we need the things that you have. The wires, the cable of ground and electric current. The LEDs and the radio too.” (Janis).

I clarify to the reader that limiting learners to use only recycled materials, cheap electronic devices and using only the Micro:bit features as they are, was intentional. As said before, it is important that learners experience technology as something anybody can use and produce, even with limited resources, despite I not explicitly discussing this point with the children during the making process

Facilitator as part of the entanglement

The facilitator’s close intervention during the making process became more visible in this cycle. Throughout the Cycles, I, as facilitator, needed to be attentive to when was the time in which seniors or children needed help or assistance to scaffold their thinking. Moreover, I needed to be attentive to identify what was the best way to support each learner. However, in Cycle 3, the facilitator role became more visible and important in how the generations created their digital-texts. The facilitator had the “whole picture” of the available materials (tangibles/intangibles) and their affordances (Micro:bit and electronic devices), the coding syntaxes that each team explored and the confidence in which each team use the syntaxes. Also, the facilitator knows each team’s social challenge to tackle, the technological

device that each team believe should be invented, and the time constraints of the whole intervention. Therefore, the facilitator was key to guide each team to select an achievable prototype they could build.

Being able to guide learners throughout the making process required that the facilitator, knowing the “whole picture”, suggested specific actions of how to materialise learner’s ideas into something achievable within the bounds described above. For instance, Heather and Isa’s original idea was to create an interactive mural as an installation that could travel around the city, allowing people to touch the different images in the mural and, activated by the touch, the images would speak aloud phrases related to incite people to keep parks clean. To narrow down this idea into something achievable, I suggested to create a small picture, resembling the mural, that when touched in specific areas it could light up an LED and/or turn on a speaker to play a melody. Doing this was achievable because I knew that Heather was good at drawing/painting and Isa quickly learnt how to turn LEDs on with the Micro:bit, thus, it could be easy for Isa to extrapolate that learning to activate a speaker. Here, I highlight that I only helped learners to narrow down a prototype, but each team was encouraged to organise their work by themselves. For instance, after working with Heather and Isa, I told them: *“Now that you have a clear idea of the prototype, it is important to discuss who will do what and when. For instance, what should be done by Monday, Tuesday and Wednesday. I know you won’t meet every day but that’s why it is important to agree in who’s going to do what. Also, think of all the details. Like, if the picture will be black and white, if you need any materials, and so on”*.

As facilitator, sometimes I needed to scaffold learners by introducing them to new concepts that were helpful in their projects, but that were beyond the scope of what was planned to cover during the coding sessions. For instance, the team Liam-Oscar-Nora-Jacob designed an alarm system. Thus, they wanted to activate a sound when a piece of cardboard -

that simulated a door- was opened. To do this, using only the Micro:bit, I had to explain the team that the Micro:bit has a function that works like a light sensor. If the sensor detects no light, it means that the door is closed; but if the sensor detects light it means that the door is being opened. The team quickly understood the concept, so I asked them to explore by themselves how to use the light sensor in the Micro:bit editor. However, when the children were exploring the function in the editor, they realised that they needed to use a command called “create a variable”, but they did not understand what it was. Therefore, I had to explain them, to an extent, the mathematical concepts of “function and variable”. The children of this team and I worked extra time in understanding these mathematical concepts until they understood the basic idea. It was challenging but at the end they learnt it, as Liam explains in his final interview: *“It was difficult! Well, it was hard to understand some things. Like about functions and variables. That was complicated. It was the first time I saw that, but later, I was understanding it more. Little by little (I understood) the logic.”*

The facilitator played an important role in the learning process; guiding learners to narrow their ideas in an achievable prototype, but also guiding them to explore and learn other concepts that were not on the plan, but that might help them to create something close to the technology they imagined. Similarly, the tangible and intangible materials shaped the learning process by setting out boundaries of possibilities.

Overall, this section points out how the human and nonhuman entities, in an entangled relation, impact how learning emerges, but it is also important to recognise that the I-3S itself impacted the learning process by fostering an environment in which learners freely and equally exchange ideas, experiences and thoughts. That is, an environment with the potential of allowing seniors and children to have moments to safely reflect on their sociocultural context. In other words, an environment where learners are encouraged to exploring their own ideas of solutions that could positively impact their communities.

Also related to critical-digital-literacy, data from Cycle 3 showed that the activity of showcasing their digital-texts and the act of coding, was particularly important for the children, as explained in the next section.

6.6.4.3 Feeling capable of producing technology

It was already said in Section 6.4.1 that a reason to involve learners into making a technological prototype using coding, was to let them experience how humans' beliefs/intentions are embedded in technology, thus, there exists a social responsibility. In this vein, all prototypes emerged as potential technological solutions framed by learners' beliefs/intentions. Emphasising that, neither the facilitator nor the activities imposed any pre-established or moral beliefs in learners. This is not about me telling learners what is the "right" thing to do, but the I-3S fostering an environment where learners could find their own ways to take action and transform their reality. Thus, all prototypes emerged from the possibilities that learners envisioned, and those technologies are indeed an initial step to take action and to transform learners' communities. Moreover, learners showcased their prototypes to their friends and family, as a way to have an impact in their immediate inner circle. The showcase was important for children to experience technology as something they can use and produce to impact society.

During the showcase, the seniors did not participate because it was logistically complicated for me to organise their virtual presence. This is a limitation that refrains seniors from experiences within the I-3S. However, seniors' participation was already embedded in the technological prototype per se.

On the day of the event, all children presented their prototypes, including learners' siblings, who did not work with a senior but did all the activities during the intervention. Children organised the entire event and decided who to invite, thus, we received parents, friends and some neighbours from the community. Each team explained to the audience the

intention behind their prototype, demonstrated how the prototype works and explained how they build it. This experience was remarkable, particularly for the children. It made children feel very proud, not only because of the work they did, but also because they could share it with their community, as children expressed:

“My parents were really happy and they were really proud of me. I was also proud. I even slept with it (the robot) right next to me” (Janis)

“I felt very, very shy. I got very embarrassed because I do not really like to talk to a lot of people and to say things out loud. [...] I was very proud. Yeah! I was proud because even my daddy liked it and my mom. They told me that it was very nice. Then my mom told me that I’m very smart” (Isa)

“I liked this cycle more because we presented our project to people we know, and we explained to them how we made it. I liked that they learnt how we did it. [...] I only explained to my mom how we built it, because my father works all day. She told me that it was good, that I should keep exploring other ways to use the Micro:bit”. (Liam)

The action of presenting to others had a positive impact in children, not only because they were proud of their digital-text but also because they got recognition from their family and friends.

Additionally, many children expressed that this cycle was different because what they did was very challenging. However, they overcame the challenges and they were very proud of it. For instance, Nora said *“I liked this year more because, it was like that more difficult and we learned a lot”*. Similarly, Brenda said *“I liked this year more because this year we had to learn many things. It was more difficult because we had to learn many things and we had to go around finding out things, but we reached our goal”*. Marion had a similar experience but I included other comments she said during her interview, because this child rounded up how the whole prototype making was a challenging learning process; and breaking the barriers made children feel proud.

Inventing the Micro:bit was a great idea! It is a very cool device because it has many, many functions. I would like to thank the inventors for letting us

use the Micro:bit [...] it was easy to display the sentences, to touch the images and to display a drawing. It was easy to code the Micro:bit to play "rock, paper or scissors" [...] It was difficult when we tried to code how to roll the dice. Aaah! It was also difficult that when you touch a drawing, it goes through the cable all the way to the Micro:bit. Because the first time I did it, it didn't work for me. I put the wire on the shirt, with the conductive-tape and everything, I clicked on it, and it didn't work, and it didn't work!! I think it happened because the wire was not properly attached to the Micro:bit. Oh! That was also something very difficult! Making sure that the wires, well, that with your finger you have the power of touching the wire, and the code is sent straight to the Micro:bit, so the Micro:bit could do its job [...] Our t-shirt was the project I liked the most, and I feel proud of it [...] Now I know that technology is not magic!

It can be said that the making process was challenging and learners worked hard to complete the task. However, the challenges did not stop children because they were having fun whilst exploring and developing new learnings. Marion's comments show that the child developed some coding skills, acquired some learning to manipulate electric circuits, and feels proud of their digital-text. However, when Marion said: "*Now I know that technology is not magic*", the child is implicitly saying that after this learning process, she understood how technology is created. Ava said something similar "*I had no idea how technology works. I thought that everything, mmmh, like, I thought that the cell phones had something inside that sends messages flying. I thought messages had like wings to fly; but now I know how they work.*" These comments show that, to an extent, learners may have corrected mistaken ideas of how technology is created. Moreover, these comments accentuate that children understood that they are capable of producing technology, despite their age or social position.

The coding experience was valued by the children and encouraged them to develop critical-digital-literacy. In contrast, seniors experienced coding differently.

Seniors experience with coding

Seniors pointed out that although they enjoyed the intergenerational coding experience, deciding to continue learning coding depends on how important it is to achieve other purposes that interest them. Jacob said, "*Learning coding, just for the sake of it, I*

wouldn't do it. But only because I have other interests, things I rather be doing". Similarly, Dorothy expressed "I don't really have any reason to keep learning coding. I do other things. I'm tutoring kids in math, and then doing other things, so I don't really have time for coding". Seniors believe that if they had a meaningful reason to continue exploring coding, they will do it. Deciding to stop learning coding is not related to the difficulties of learning or because they did not enjoy coding, but because there is no reason to continue. However, Dorothy added:

"I think seniors would enjoy anything that involves work with children, maybe to learn with them. I don't know whether a senior would do coding on their own, I don't know. But I think that if you have children to be with you in the room, and you can show them how to do music, you know, change the notes or make a sign, or use lights. Specially if you can use the LEDs and other things. I think that would be fun to work alongside. Working alongside them, that is fun!"

Seniors denote that the children were key in their engagement with coding. First because creating the prototype together was something meaningful, but also because being with the children, interacting and learning together, was something enjoyable. Thus, learning coding had a purpose so they did not give up with this challenging activity. Furthermore, Edna said that she would like to continue working with the Micro:bit she could share it with her granddaughter. "I think she'd love to try it and we can do it together", said the senior.

Similarly, Jacob expressed

I have a 10-year-old grandson who is involved in this and I plan to use it (Micro:bit) with him and see that he learns. I plan to teach him the 4 things that I know and to see if he is encouraged to do more things. For example, he plays Minecraft a lot, which is something like this, I believe. [...] I'll do it the next time I see him, because every time he sees me, he makes me sit down at the computer and says 'look, now in Minecraft I have this house ...' and he teaches me how to add houses. I think what it does is quite similar, in a certain way, to programming, because he has to go to a menu and go down and put in that part, etc. So, I think he's going to like the Micro:bit. So, I think that I will actually keep using the Micro:bit.

It can be said that Edna and Jacob saw in the Micro:bit, and in the overall experience of this intervention, as a way to connect with the younger generations in their family.

Although Edna and Jacob already have a close relationship with their granddaughter and grandson, respectively, they foresee that an intergenerational coding experience could be something enjoyable where both generations could develop critical-digital-literacy whilst growing a deep emotional connection.

I conclude the overall critical-digital-literacy section pointing out that the technological prototypes can be seen as the representation of how both generations imagine their communities or environments in the future. Although it cannot be said that indeed these prototypes transformed society, it can be said that throughout the making process, seniors and children developed some technical skills, they also involved in opportunities to experience how peoples' ideas or intentions are embedded in technology.

6.7 Evaluation and revision phase

The implementation phase showed that the re-design used in this cycle were sufficiently close to reach the aims proposed for this research, since data showed that seniors and children experienced technology as something they could use and produce, regardless of their age, the place where they live, or the limited resources they might have. The making process that learners followed enabled both generations to reflect on how media and digital tools are put together to bring about certain kinds of meanings. Also, developing a technological prototype often allowed learners to experience the affordances and limitations of technology. Even though I did not openly discuss these points with seniors and children, the activities within the making process implicitly let them have these experiences, moving from seeing critical-digital-literacy as merely acquiring technical skills to a more critical reflection.

In terms of reciprocity, seniors and children developed a friendship, recognising each other as an important part of the teamwork. Moreover, seniors and children recognised the knowledges and resources that the other generation brings as something valuable. The activities within the I-3S often allowed learners to hold a non-hierarchical communication, where both generations were constantly switching from the novice-expert role. Thus, both generations had learning opportunities during the making process, regardless of their age or the knowledges, skills or resources they have. Therefore, it can be said that the I-3S is an inclusive space for seniors and children.

It can be said that the I-3S, in the way it is re-designed in this cycle, has the potential to foster a learning space where seniors and children develop critical-digital-literacy in such way that experience technology as resources with the potential to transform or impact society. Additionally, a learning space where seniors and children had opportunities to interact and communicate as equals, helping each other with their own resources whilst building friendship. In this context, it can be concluded that, the re-design in this cycle can be used to create an I-3S.

6.8 Conclusion

This is the last DBR cycle, where the activities performed by participants demonstrated to be sufficiently close to the aims of this research. As such, I deemed that another cycle was not necessary. Therefore, in the next chapter I will explain how to establish an intergenerational third space (I-3S) to develop critical-digital-literacy, responding to the research questions of this study.

7. Discussion and Conclusions

As a response aimed at closing the digital divide and reducing the risk of isolation amongst seniors, as well as children who live in economically challenged areas, I designed and implemented an intergenerational third-space (I-3S) where seniors and children collaborated online, aiming to develop critical-digital-literacy. In this environment, individuals would benefit by developing literacy, but both generations collaborating in the same learning space would also potentially bring other benefits, which have been claimed across the intergenerational practices (IPs) literature (Generations-United, 2002; Hatton-Yeo, 2006; Kuehne & Melville, 2014). Moreover, online collaboration amongst seniors and children responds to the physical and/or geographical barriers that seniors might face to commute or to reach places, such as in-person learning environments (Yeom, Fleury, & Keller, 2008; Choi & Dinitto, 2016; Starbird, DiMaina, Sun, & Han, 2019).

A learning environment with the above-mentioned characteristics has not, to my knowledge, been developed before. Therefore, using a design-based research methodology (DBR), I built onto foundational concepts taken from three key theories (digital-literacy, third-space and IPs) to construct the initial design of the desired learning environment. The design was executed, evaluated, and re-designed in a specific context where seniors (65+) living in the USA collaborated online with children (10-13 years old) living in economically challenged areas of Tijuana, Mexico. Within this context, I conducted three Cycles of DBR in which I experimented with different approaches, drawing on theory and literature as well as my experiences in the field. This enabled me to establish the concept of an intergenerational third space (I-3S) to develop critical-digital-literacy. In the process, I have been able to develop responses to the following research questions:

1. What are the processes and practices needed to design and implement an intergenerational third-space where seniors and children collaborate online to develop critical-digital-literacy?
2. How do children (10-13 years old) from the Mexican context and seniors (65+) who live in the USA respond to such a learning environment?
 - a. What emerges within the intergenerational third-space (I-3S)?

Throughout the research, the foundational concepts unfolded and evolved, impacting the fields of critical-digital-literacy, third-space and intergenerational practices by responding to gaps found in the literature. Therefore, my contributions to knowledge are methodological, theoretical and practical. My aim in this chapter is to present the methodological contribution in Section 1.1, and the theoretical contributions to design and implement an I-3S are outlined in Section 1.2. I plan to publish my contribution related to practice at a later time in the form of a Practitioner's Manual.

7.1 Methodological contribution of DBR to develop an I-3S

To my knowledge, DBR methodologies have not been used in intergenerational practices before. However, from the many methodologies that can be used to research learning environments, DBR is well-suited for situations when it is unclear how to approach a problem (Kelly, 2007), as was the case in this research. DBR methodologies were chosen for several reasons. First, the aim was to create an intergenerational learning environment with specific characteristics, but it was unclear which theories would guide its development. Second, although the aim was clear – that seniors and children develop critical-digital-literacies – the means for advancing the initial approach towards reaching this aim, or to which extend the aim could be reached, was unknown. Thus, the I-3S needed to be designed and implemented “from scratch”, so a DBR approach became advantageous. In this context, I highlight four main inputs provided by DBR to develop an I-3S.

The main characteristic of DBR is its iterative process (T. Anderson & Shattuck, 2012), which allowed me to engineer holistic learning within the context of application in order to build an effective learning design. Whilst most research conducted on IPs involves a single period of data collection and analysis, DBR allows multiple moments for a researcher to collect and analyse data, which occur not only during the evaluation and revision phase of each cycle but also in the everyday process. In DBR, when something is “not working”, processes can be modified in situ (Bakker & Van-Eerde, 2013); the researcher does not need to wait until the next iteration. Therefore, the everyday modifications and the design modifications after each cycle can respond to the emerging needs of the participants and/or the context in which the intervention was implemented. Within this scenario, the modification solutions were effective because they were designed and re-designed whilst being closely guided by the application’s context.

An example of this design/re-design process happened in Cycle 1. The seniors’ workshop design was theoretically-informed to cover the minimum technical skills that a senior would need to develop to reach the I-3S, but, at this stage, the design was “one-size-fits-all”. The learning outcomes that seniors should acquire, along with the way in which seniors were instructed, were the same for all the seniors. Following a DBR process, the research found that seniors’ personal characteristics clashed with the “one-size-fits-all” design. These findings could not have been foreseen before beginning to work with each senior and understanding how she/he responded to the learning plan. Therefore, it was after working with the seniors that the need to personalise the workshops became clear. Moreover, it was only during the workshops that it was possible to identify the technical skills that were appropriate for each senior to learn. This instance also exemplifies how, in this research, DBR required an alignment between the theories framing the research, the affordances of the

chosen materials and other instructional tools, and the contextual limitations, with the latter dominating all other design components (Mingfong, Yam San, & Ek Ming, 2010).

Another contribution of DBR was that the Cycles exposed those barriers that can contribute to learners being left behind in literacy experiences. With DBR, the constant focus on the tensions between the design and the context in which it was applied provided opportunities to observe the details of learners' personal characteristics and context and allowed for the design of learning experiences that did not let individuals remain at the margins. An example of this occurred in Cycle 2 when I asked all the learners to think about a social challenge faced in their communities and to discuss it within their teams in the next session. I asked Ava (one of the children) to take pictures related to the social challenges and to use the pictures as prompts during the activity the next day (see Section 5.6.2, Cycle 2). I adapted the activity for Ava because I knew that she has challenges with verbally expressing her ideas; thus, pictures helped her mediate the conversation within her team. Without this adaptation, Ava would have been at the margin of the conversation because she would not have been able to express her ideas. There were many other examples like this throughout the Cycles, where adjustments were needed to include all learners in the literacy experience.

Ford, McNally, and Ford, (2017) have stated that DBR is powerful to surface methodological issues associated with research conducted on learning processes. This argument was evident in this research because the I-3S was naturally changing throughout the Cycles, and thus the theories and data collection methods I started to work with were (to an extent) changing throughout the Cycles. For instance, at the beginning of the research, I planned to video-record the intergenerational interaction; therefore, in Cycle 1, as all of the children were simultaneously working with the seniors, I used a 360-degree camera to record a time-lapse video of the overall learning environment. However, as I was the facilitator in all of the sessions, I realised the importance of capturing the intergenerational dialogue in detail,

data that time-lapse video cannot provide. Video provided information about the intergenerational interaction but not the rich data that dialogue can offer. Consequently, in the next Cycles I used a regular video recorder to capture the complete interactions between the seniors and the children, and a 360-degree camera to capture the interaction between the children and the materials whilst making their digital-texts within the working space. Similarly, when analysing children's diaries at the end of Cycle 1, I realised that children's responses were too short and failed to provide clear, rich information. Thus, in the next cycle, in order to get richer data from them, I re-designed the instructions in the diaries and reconfigured the schedule to change the moment in which it was best for the children to write in the diaries. As a researcher, it was key that the iterative Cycles let me adjust the data collection methods, as well as allow me to collect better data throughout the next Cycles, which compensated for the missing information in Cycle 1.

Lastly, having three iterative Cycles in this research allowed me to observe change over time, similar to what happens in longitudinal studies (Leavy, 2017). However, in this research, the change was observed in relation to the modifications within the design and how participants responded to it. Throughout the overall three iterative Cycles, this approach allowed me to identify the many different components of the I-3S and how they were related to each other.

I conclude this section by again highlighting that DBR methodology played a key role in developing this research. However, as also indicated in the literature, using DBR was time-consuming, expensive, and challenging for implementation in a doctoral study (Dede, 2005; Van den Akker, Gravemeijer, McKenney, & Nieveen, 2006; Herrington, McKenney, Reeves, & Oliver, 2007; Pool & Laubscher, 2016; Goff & Getenet, 2017). Nevertheless, I overcame these challenges and developed a final design to create an I-3S, as will be explained next in section on the study's theoretical contribution.

7.2 Theoretical contribution to develop an I-3S

The theoretical contribution responds to the first research question: *what are the processes and practices needed to design and implement an intergenerational third-space where seniors and children collaborate online to develop critical-digital-literacy?* The answer developed throughout the DBR cycles, through a process that refined the design within the implementation context; the research simultaneously considered how both children from the Mexican context and seniors who live in the USA responded to the learning environment, which is the second research question. The initial design of the I-3S improved in every cycle, as is the nature of DBR, and the process finished after Cycle 3, when the I-3S design was producing results that were sufficiently close to the desired aims of this research (The Design-Based Research Collective, 2003). In other words, the three DBR cycles produced the final design of the I-3S because the data showed that the seniors and children were sufficiently close developing reciprocity and critical-digital-literacy within an intergenerational third-space learning environment. The overall theoretical contribution establishes the final design of the intergenerational third-space to develop critical-digital-literacy, alongside the theory that underlies it.

Here, I present the theoretical contribution in five sections. First, I establish the foundations of the I-3S, stressing the key aspects that need to be addressed before designing the learning space (Section 7.2.1). Second, drawing from different theoretical fields, I conceptualise the I-3S as a place/space (Section 7.2.2). Third, once the I-3S has been conceptualised, I explain how to set up an I-3S, describing both the physical/virtual setup and the design of activities (Section 7.2.3). Fourth, I explain what emerges within the intergenerational third-space under the proposed setup (Section 7.2.4). Fifth and finally, I point out the potential outcomes of the I-3S (Section 7.2.5).

7.2.1 Foundations of the I-3S

The I-3S was conceived as a learning space for communities at the margins, which are those communities that are left behind from developing critical-digital-literacy. However, when working with these populations, it is easy to overlook the different challenges that can arise across different contexts (D. Miller, 1999). Therefore, I point out three elements that need to be addressed when building an I-3S for seniors and children from economically-challenged areas: supporting learners to access the I-3S, knowing the learners and their sociocultural context, as well as finding a community anchor.

Supporting learners to access the I-3S

I start by accentuating that literature on IPs does not tend to explain, nor question, which seniors/young people have access to IPs. They do not ask who is benefitting from these encounters or who is left behind. IPs focus their reports on what seniors and children achieved during the intervention, but they typically do not provide information on whether some seniors/children faced challenges in taking part in the intervention. This information is overlooked in IP literature, and yet this missing piece was crucial in my research. I will come back to elaborate on this point at the end of this section.

The I-3S was developed specifically for seniors and children who each live in economically-challenged areas. However, from the first implementation cycle, it was evident that some seniors and children had challenges related to their sociocultural context which made it difficult for them to access the learning space (e.g., lack of technological resources, the need to take care of siblings, etc.). Although it would have been an easier option to invite the participation of only those seniors/children who did not have constraints, this would have reinforced current social power structures, and those marginalised seniors and children would be again left behind. Therefore, the I-3S required that the project provide support for seniors

and children, regardless of their situations. Thus, enabling access is the first aspect that should be given attention to start building the I-3S.

Knowing learners and their sociocultural context

‘Supporting learners’ might be an ambiguous claim because not all learners need the same kind of support. However, to identify how to support participants, it is important to know the learners and their sociocultural context. Although this aspect is vaguely mentioned in IP literature, few examples would specify what was meant by “knowing learners”, and thus they would report on practices that were not necessarily framed with theory. In contrast, this research took a sociocultural critical perspective, and so “knowing learners and their sociocultural context” had specific purposes: first, to build rapport with learners by identifying anchor figures in the community; second, to support learners to overcome challenges that get in the way of their taking part in the I-3S; and third, to situate the practice.

Community anchor

Building rapport with the seniors and children who take part in the I-3S is fundamental for accessing these communities and keeping them engaged during the intervention, but it is something that takes time (Emmel et al., 2007). This research indicates that identifying and working closely an anchor figure in the children and seniors’ communities is highly desired. The anchor figure is a person – or a trusted organisation – who is already known, trusted, and supportive within the seniors’ and children’s communities (Sixsmith et al., 2003). When the facilitator/researcher allies with the anchor, it is not only easier to overcome the challenges of accessing communities at the margins (Matthiesen, 2018), but it also reduces the time required to build rapport among learners. When the anchor embraces the facilitator/researcher’s project, the trust that learners already have in the anchor can be extended to the facilitator/researcher. Thus, the researcher/facilitator is more likely to gain access to these communities (Emmel et al., 2007).

In the case of this research, my sister Carmen was the anchor in the children's community (see Section 2.5.1, Methodology), and her closeness with that community facilitated my work with the children for several reasons. First, the rapport and trust children already had with her was, to an extent, automatically transferred to me. Second, Carmen deeply understood the social dynamics within this community, and she gave me expert guidance in what could or could not be applied. Like Carmen, a community anchor opens the door for the facilitator/researcher to understand the sociocultural context of communities and, with that knowledge, the different dynamics and needs that these communities have (Sixsmith et al., 2003). This information is key because it is closely connected with the meaning of 'knowing learners' and their sociocultural context; for my research, it involved a deep understanding of learners' digital cultures, digital skills, and what they like/dislike, as well as the characteristics of their sociocultural contexts. Knowing learners and their sociocultural contexts make evident the challenges that learners face in accessing the I-3S and thus implicitly suggests how the I-3S could better support learners to overcome them. Additionally, knowing learners and their sociocultural context informs how to design the activities that learners should perform, such as how to situate the practice, which is discussed in greater detail in Section 7.2.3.3.

There are no accurate directions on what to do to know learners and their sociocultural context because each depends on different people's lifeworlds, and cannot be captured simply in assumptions about people framed in stereotypes around age, gender, or life situation, among others. However, as said before, the community anchor plays a fundamental role because this figure already understands the challenges in the community and can foresee viable options to support learners. Moreover, the community anchor keeps the link between learners and the I-3S once the facilitator/researcher is not present or once the intervention has finished. Therefore, working hand-in-hand with a community anchor is

important and desired. Additionally, conducting interviews and having conversations with learners before implementing the intervention will complement the information given by the community anchor and can build rapport with the participants beforehand.

In this research, a community anchor was only identified in the children's community, and not in the seniors' community, limiting the support that seniors could get during the intervention and subsequently limiting the role that seniors could play in the making process. For instance, for the process of physically making the digital text and the manipulation of specialized software, seniors relied on the children because the children had the support of the facilitator and peers, which was not feasible with the seniors due to the geographical distance. I address this point later in Section 7.2.3.3. Nevertheless, in this research, although I did not know all the seniors at the beginning, the relationship I built with them throughout the cycles helped us to grow a relationship, trust and rapport. Thus, it can be said that I was the anchor within the seniors group. Additionally, the positive experience seniors had with the children as they worked with in prior Cycles of this research provided a different kind of anchor in keeping seniors engaged in the project. However, I would still recommend working alongside an anchor figure within both the children's and seniors' communities as an important and desired aspect in building an I-3S.

The hybrid design of the I-3S is also a consequence of working with communities at the margins. The mobility challenges that many seniors face limits their ability to move from where they live to designated learning spaces. Thus, having seniors collaborate online in the I-3S can overcome their mobility limitations. Similarly, children in economically-challenged areas have limited access to internet and technological devices at home, and so the physical space organised through the I-3S provides appropriate infrastructure in the same community where the children live and negates the limitations of technology access. The reason of

developing an I-3S was precisely to include communities who do not normally have access to these kinds of experiences.

Additionally, I have pointed out that research on IPs does not take a critical learning perspective, and thus the existing research overlooks the challenges that seniors and children face in accessing learning environments. This indicates that IP practitioners do not generally ask questions such as, who benefits from these programmes? Or how can we ensure that a wider range of people get included? These questions are not necessarily asked when these programmes are designed. However, from the sociocultural critical perspective taken in this research, these questions were very important in developing the I-3S. One of the fundamental theories of this space, critical-digital-literacy, argues that literacy should be linked to learners' digital cultures (Buckingham, 2007); another, third-space theory, argues for a non-hierarchical learning environment where everybody's knowledges count (Gutiérrez et al., 1995). Therefore, questions related to who the learners are, who is accessing these spaces, and what their learning context looks like, are necessary questions to answer.

I argue that a contribution of this research is in highlighting the need to ask critical questions and reflections around IPs before implementing these programmes with communities at the margins, particularly because not asking these types of questions reinforce social inequalities, and opportunities for improving literacy practices may be lost.

I close this subsection again stating that in the I-3S, supporting learners to overcome challenges to reach the learning space is not optional but necessary and must be addressed within the I-3S design. Furthermore, knowing learners and their sociocultural context is fundamental, not only to better support learners to overcome the challenges that prevent them from participating but also to design the activities that learners should perform. In other words, the practice must be situated, and, as indicated in the subsection, a community anchor is a valuable asset in supporting that work.

7.2.2 Conceptualising the I-3S as a place/space

In the I-3S, communication amongst seniors and children is mediated by technological devices. At the same time, those technological devices are present there to enable the intergenerational communication and to purposely intervene in the learning process. Human and nonhuman entities impact how the I-3S space develops, as well as how learning emerges within this space. Therefore, it is necessary to explain how it was through connecting different theories that the I-3S, as a place/space, started to be conceptualised. This is one of the original contributions of this research.

Mannion (2012) stated that to understand what emerges from the senior-children relation, such as intergenerational learning, it is necessary to look at the place where the relation was happening (see Section 3.4.1.2, Literature Review), including the objects, practices, and all other nonhuman entities that made up the place and impact the meaning making within it. Emphasis is placed on how all entities are enmeshed and reciprocally co-emerge (Mannion & Gilbert, 2015). Mannion's argument relates to the critical-digital-literacy field: there, to understand how critical-digital-literacy emerges, it is necessary to break with the human-centric account of literacy to consider the materials surrounding and embedding the human interaction (Burnett, Merchant, Pahl, & Rowsell, 2012; Gourlay & Oliver, 2013; Gourlay & Oliver, 2014; Burnett & Merchant, 2019; McDougall & Potter, 2019; Tuin, Freitas, & Freitas, 2020). The critical-digital-literacy field uses ideas from the sociomateriality field to account for the meaning making on digital literacy practices, where human and nonhuman entities are involved in the performance of literacy. Although Mannion's work do not use sociomateriality, connecting these two arguments became important. It supported the work to understand how seniors and children developed critical-digital-literacy in the I-3S, and understanding of this interaction will unfurl throughout this chapter. However, at the beginning of this research, these arguments were limited because

they could only make sense, or they could only be contextualised, once the learning space exists. When this research began, the I-3S as a place/space did not exist; seniors and children were not already interacting nor engaging with any critical-digital-literacy activity, and so it was not possible to apply those arguments.

My goal here is not to minimise, nor criticise, what these arguments state but to point out that, for me, they became essential and made deep sense once the learning environment was running. The approach to develop an I-3S would have been different if someone else had conducted this research. However, in the way that this research developed for me, the theories and the different connections between all the theories applied to this research came to light throughout the process, and also through my personal learning process of understanding the theories when applying them in a natural context. Within this frame, at the early stages of designing this learning environment, the two arguments stated above, only allowed me to be aware that the nonhuman entities surrounding and embedding the place/space where the human interaction happens should not be randomly chosen because they do impact learning. Thus, as the Cycles progressed, it became clear how the place/space design should take into account the human and nonhuman entities within the I-3S to understand how learning emerges from their relation, as explained later in Section 7.2.4.

Additionally, as discussed in the literature review (Section 3.4.1.1), an IP should be characterised by its aim to provoke reciprocity, which is understood as engagement – a relationship – amongst generations which works alongside other goals established by the programme (Jarrott, 2011; Mannion, 2012; Kump & Krasovec, 2014). In this spirit, the I-3S aimed to enable learners to develop reciprocity and critical-digital-literacy whilst interacting in a hybrid environment where the children were all together in the same physical space and the seniors collaborated through a videoconferencing system. Alongside these aims, there are two aspects that further characterise the I-3S. First, seniors and children have different

sociocultural contexts and, due to their generational gap, they also have different knowledges, experiences, communication forms, and ways of learning, among other generational differences. Second, the aim is that seniors and children develop critical digital-literacy together; it is not that one generation takes the role of teaching the other. These characteristics revealed the need to bring in third-space theory to support the construction of this learning space, in particular because this theory focuses on developing literacy within environments where the differences amongst learners' sociocultural backgrounds and knowledges is strong (Gutiérrez et al., 1999). Although third-space theory has not previously been applied in intergenerational environments, when it was linked with Mannion (2012) proposal of intergenerational learning, both theories offered guidance to theoretically conceptualise an I-3S, and particular guidance for designing the activities that learners performed.

As detailed before in the literature review chapter (Section 3.3), third-space theory stresses that in the classroom, what counts as knowledge is determined by the teacher's *script*, which represents the values, ideas and practices of the dominant culture. Thus, the local knowledges that students bring to the learning space either get displaced or students develop a *counterscript*, which is a form of resistance to adapt their local/cultural knowledge (Gutiérrez et al., 1995). In consequence, teachers' scripts and students' counterscripts remain parallel. However, at certain moments within the learning environment, when there are no hierarchical discourses (i.e., no cultural discourses/knowledges are secondary) and learners are encouraged to bring all their knowledges and differences as tools or resources available to one another, *scripts* and *counterscripts* intersect. The differences are challenged and create tension; thus, learners' ideas, actions, understandings, and beliefs are subjected to revision and re-adaptation, resulting in the creation of new knowledge (Dewey, 1929). Nevertheless, for this to happen, the communication in the learning space should be non-hierarchical, since

that communication lays the groundwork for an environment in which people feel invited to bring all of their differences in knowledges, be they generational or sociocultural, among others available (Gutiérrez et al., 1995). This resonates with how intergenerational learning emerges.

Intergenerational learning does not emerge just because seniors and children share a place or an activity. As detailed in Section 3.4.1.2, literature review, intergenerational learning is place-responsive and emerges in relation to the differences found in people, discourses, structures, time, and places (Mannion & Gilbert, 2015). In other words, when the generations respond to the differences they find amongst them and within the place, the generations engage in forms of making – making meanings, practices, and places – that are shared in common (Mannion & Adey, 2011). Although Mannion’s arguments do not explicitly refer to seniors and children differences in dominant forms of knowledges (power relations) as third-space theory does (Gutiérrez et al., 1995), both theories highlight that new learning emerges from the differences that learners bring to the learning space - in this case, all the differences that seniors and children bring to the I-3S. Moreover, for this to happen, Gutierrez’ third-space theory adds the importance of having a non-hierarchical communication among seniors and children. This is how intergenerational learning and third-space theoretical concepts were linked to conceptualise an I-3S.

Additionally, as learning environments, third-spaces are identified as ideal for critical-digital-literacy to emerge because critical-digital-literacy should be connected to the diverse digital practices in which people are already involved, including their specific uses of digital tools and media. In other words, critical-digital-literacy should be connected to people’s digital cultures (Buckingham, 2003). Thus, since the nature of third-spaces is to recognise and validate everybody’s knowledges, it is possible to theoretically conceptualise and frame an intergenerational third-space to build critical-digital-literacy from learners’

digital cultures. Thus, third-space theory was used to inform/unpack how the generational and sociocultural differences learners possess can be used to foster learning.

In sum, the activities that learners perform, and the overall environment, should encourage seniors and children to develop reciprocity and critical-digital-literacy from the differences they find and from the diversity of knowledges, digital cultures, and resources that each of them bring to the I-3S.

The theoretical connections between critical-digital-literacy, intergeneration learning and third-space theories, as described in this section are a strong starting point of a theoretical conceptualization of an I-3S, and were used to guide the overall design of the I-3S, as described next.

7.2.3 Setting up the I-3S

Once the I-3S is conceptualised, the framework is used to guide the design of this learning place/space and the activities performed within it. However, implementing the design was as important as engaging with theory to inform the design. The implementation stage brought to life claims made in literature, contextualising them; it also pointed out aspects that have gone unidentified in literature or unconsidered in the original design. Therefore, I will explain how to set up an I-3S based on my final design, which emerged after the three DBR Cycles. The overall setup covers three areas: infrastructure of the I-3S, reconceptualization of reciprocity and digital making in the I-3S activities design.

First, Section 7.2.3.1 provides the infrastructure of the I-3S, which enabled communication in the learning space. Then, Section 7.2.3.2 points out how the characteristics of the I-3S demonstrated that understandings of reciprocity and digital-making needed to be re-conceptualised. Therefore, with these new understandings, Section 7.2.3.3 explains how to design the activities that learners would perform in the I-3S.

7.2.3.1 Infrastructure of the I-3S

During the re-design phase of Cycle 2, I identified that the place/space (including the materials in it) were also part of the action within the group. As pointed out by Mannion and Gilbert (2015), the place/space and the materials in it provide the conditions for learning to happen or not. For instance, the way in which the internet was set up caused frequent disconnections, thus impeding intergenerational communication. Similarly, other aspects related to the nonhuman entities and their impact within the I-3S indicated the value of sociomaterial approaches to theoretically inform the setup of the place/space in the I-3S (see Section 5.3.1, Cycle 2). Moreover, the implementation phase in Cycle 2 demonstrated that the re-design of the place/space, along with reorganising how learners were grouped, worked as invisible infrastructure of the I-3S because both enabled communication to take place and impacted how the communication fluctuated (see Section 5.5.1, Cycle 2). Therefore, in fostering a fluid and non-hierarchical form of communication in the I-3S, the nonhuman entities within the I-3S played a key role enabling or disabling communication among the generations. Similarly, they impacted the learning design in such way that, rather than having direct repercussions in learning per se, they functioned as an invisible infrastructure that influenced how the communication flowed among all entities.

In this context, drawing from sociomateriality approaches and third-space theory, it was possible to identify three aspects that, when brought together, integrate the invisible infrastructure of the I-3S:

1. Seniors and children should be grouped in small working teams, such as one senior with one or two children, where everyone speaks the same language.
2. The physical place where children interact should be arranged in such a way that the internet is strong and steady, and each team has its own working space and materials.

3. The place – physical and virtual – where the intergenerational interaction occurs should be isolated from noise within the environment.

The first structural recommendation is that seniors and children should be grouped in teams. As the cycles progressed, I noticed that when the generations actively participated in activities that encourage them to exchange resources, as well as “thinking and doing” together as a team, the generations then had opportunities to more effectively interact to exchange knowledge and build relationships (Gutiérrez, Baquedano-López, & Turner, 1997; Cope & Kalantzis, 2015). The Cycles made evident that both generations had more engaged conversations when interacting one-on-one than when each senior was interacting with all children simultaneously, as happened in Cycle 1. Although it might be possible that seniors/children use technology, such as translation Apps, to communicate each other, the affordances of the apps and the technological devices might not break language barriers amongst the generations, as happened in Cycle 1 (see Section 5.3.1, Cycle 2). Consequently, it is suggested that even with the seniors and children living in different countries, they group in teams where everyone speaks the same language; this is a basic starting point in enabling communication amongst generations. Having different languages is one of too many challenges within the I-3S, mainly because the intergenerational interaction happens online and the technological devices available today do not respond to the needs of a learning space like the I-3S (see Section 4.5.1, Cycle 1).

To enable the communication among seniors and children, the second infrastructural aspect is important, namely that the place where the human interaction happens, along with all the tangible and intangible materials within the place, are entangled as a relation with the humans (Latour, 2005; Fenwick & Edwards, 2010; Leonardi, 2013; Fenwick, 2015). An entanglement of relations is constantly changing, and constantly enabling, disabling, and reconfiguring the communication changes within the I-3S; as a result, they regulate the forms

of participation (Latour & Stark, 1999). Hence, the physical arrangement of the materials – or the online arrangements of the intangible materials, such as software – enable, disable, and regulate the forms of participation in the I-3S, thus impacting how learning emerges (Fenwick & Edwards, 2010). Understanding this complexity helped me to propose an arrangement of the human and nonhuman to enable non-hierarchical form of communication.

In this context, I propose that the internet setup should be configured in a way that allows a strong and steady connection amongst seniors and children, since disconnections mean that seniors and children only get segments of the information being exchanged, resulting in a non-fluid communication. It might be seen as obvious that there must be an internet connection amongst seniors and children to enable the communication; however, it is easy to overlook how it should be set up to respond to the needs of the I-3S. In the context of this research, it meant preference for wired internet connections over wireless connections (tangible material) and the power to change the internal configuration of the router to create a private network to be used only within this learning environment (intangible material); in other words, I recommend a reconfiguration of the tangible/intangible materials.

The third infrastructural aspect denotes that the intergenerational communication takes place in an environment that is, as much as possible, free from outside noise. This is because technological devices such as iPads are designed to emphasize certain sound frequencies over others. Thus, when voices and outside sounds occur simultaneously, it is easy for devices to fail to identify human voice, and instead block them along with other noises, resulting in learners only receiving segments within the information exchange. Therefore, it is proposed that intergenerational communication happen in a space which is isolated as much as possible from additional environmental noise. This aspect is also necessary to help give access to the I-3S to seniors who may have some hearing loss.

It is also proposed that the physical space where children interact is arranged in such a way that learners understand the materials, technological devices, and other materials in the working space, as important elements of the learning process (Fenwick & Edwards, 2010; Fenwick, 2015). For this to happen, it is suggested that each team has its own work station and their own set of materials to work with. Moreover, having this physical arrangement grants each team control over their own equipment and allows them to organise themselves in considering when and how to use the equipment, thus providing them ownership in how they develop their digital-text (Cooper et al., 2013); this is a way in which seniors and children gain agency over their work.

All of the above-mentioned aspects are considered the invisible infrastructure (Star, 1999) of the I-3S because together, as a group, these aspects become the ‘harness’ enabling communication within the I-3S. As such, the performance of the invisible infrastructure can only be evaluated via its ability to support fluid, non-hierarchical communication and the development of reciprocity and critical-digital-literacy. However, as with any infrastructure, these three aspects cannot be evaluated by themselves but need to be considered through the performance of all the other I-3S components, both human and nonhuman (Star, 2002).

7.2.3.2 Reconceptualising reciprocity and the digital-making in the I-3S

The human and nonhuman entities, as an entanglement, impact how reciprocity and critical-digital-literacy develops in the I-3S. Therefore, how the entanglement is orchestrated should not be random but theoretically-informed. In this spirit, first, it is necessary to review how reciprocity and critical-digital-literacy can be fostered, considering the characteristics of the I-3S and the nonhuman entities involved ahead of designing the activities.

IP Literature suggests that reciprocity builds when seniors and children interact via activities that are meaningful (Kaplan, 2002; Kump & Krasovec, 2014; Smith et al., 2017), and critical-digital-literacy emerges through the making process of digital-texts

(Buckingham, 2006). Therefore, it might be logical to assume that if seniors and children work together (through videoconference) in the production of digital-texts, they can develop both reciprocity and critical-digital-literacy simultaneously. However, IP literature is based on face-to-face encounters, not with the intergenerational interaction occurring online, as in this research. Thus, I challenge the literature which supports this argument and demonstrate the need for a new understanding of reciprocity and a new approach to the roles that seniors and children play when producing a digital-text together.

Reciprocity is understood as building a reciprocal relationship between seniors and children (see Section 3.4.1.1, Literature Review). This definition implies that when seniors and children interact face-to-face through the activities proposed in the IP, they will naturally build a relationship. However, in this research, there is no face-to-face interaction among seniors and children and so the activities that learners perform whilst interacting online to develop critical-digital-literacy must also intentionally provoke a relationship amongst the generations. Therefore, reciprocity and the development of critical-digital-literacy were planned to occur simultaneously throughout the activities.

During this research, the traditional definition of reciprocity was extended to respond to the characteristics of the I-3S and to ensure that seniors and children were equally involved in opportunities to learn. Literature on IPs involving technology shows an unequal involvement amongst the generations because one generation will often take the role of teaching the other (Kaplan, Sánchez, Shelton, & Bradley, 2013; Moffatt, David, & Baecker, 2013; Cyber-Seniors, 2017). However, the I-3S has at its heart non-hierarchical relations and dialogue amongst learners; thus, placing one generation in the teacher role clashes with this aim. Therefore, connecting reciprocity with third-space theory means that seniors and children should be equally involved in opportunities to switch between the novice and expert roles. This is one way in which learners are encouraged to bring their knowledges and place

them as resources for one another. Moreover, switching between the novice and expert roles provides both sets of learners – seniors and children – with opportunities to expose, exchange, and contest their differences, and to build new learnings on from that, these exchanges framed by non-hierarchical communication.

In sum, this section argues that reciprocity and critical-digital-literacy develop simultaneously in the I-3S, with reciprocity understood as a) a reciprocal relationship among the generations; and b) the equal involvement of seniors and children in opportunities to switch between novice and expert roles. To reach this aim in practice, this research proposes drawing from IPs, critical pedagogy, digital-literacy theory, and multiliteracies pedagogy to design the activities within the I-3S.

7.2.3.3 Theoretically-informed framework to guide the activities design in the I-3S

The activities design is context-based, meaning that the activities vary depending on the context in which the I-3S is implemented. However, this research contributes a theoretically-informed framework that can be used to guide the design of activities that learners should perform in the I-3S. This framework not only considers human interaction, but it also engages with how nonhuman entities intervene within those activities. I first describe how the framework grows from critical-digital-literacy theory. Then, I build upon this theory to identify two important components of this framework: senior workshops and intergenerational activities.

Grounding on critical-digital-literacy

The activities design are grounded in David Buckingham's work (2003, 2006, 2007, 2010), which suggests that critical-digital-literacy develops through the making process in producing digital-texts, where learners are engaged in a reflective process guided by the critical-digital-literacy framework (see Section 3.5.1, Literature Review). Here, I will point out that Buckingham's work draws back to Freire's critical pedagogy because it offers

important insights to critical-digital-literacy even though Freire's research focuses on more traditional literacies (reading and writing). In this context, the making process should engage learners in developing technical skills to manipulate technology, but the emphasis is on developing the means to understand technology and digital media as resources to criticise and transform reality and as resources that seniors and children can use and produce despite their age or sociocultural context.

Further, use of a pedagogy of multiliteracies within the I-3S favours the development of critical-digital-literacy (Buckingham, 2003). Multiliteracies frame the possibility for connecting literacy activities with learners' sociocultural contexts, which is important because critical-digital-literacy recognises that literacy must be connected to learners' sociocultural contexts and be embedded in learners' digital cultures. One consequence is that people in different contexts with different digital cultures will develop different aspects of critical-digital-literacy. Multiliteracies also give learners space to bring their knowledges as resources to experiment with different approaches to face new learning situations (Cope & Kalantzis, 2015). Whilst experimenting, learners also have opportunities to acquire the metalanguages underlying their learning trajectories (Cope & Kalantzis, 2000). Moreover, multiliteracies look for a transformed practice, encouraging learners to use creativity and innovation to transform real world situations (Cope & Kalantzis, 2009). These aspects of multiliteracy are well suited to digital-text production because they can enable opportunities for the reflective process to occur, as well as provide moments for the development of technical skills. However, the reflective process does not happen spontaneously; it should be encouraged by the facilitator and/or by the activities designed by the facilitator (Buckingham, 2007), something already considered within this proposal for construction of an I-3S.

By understanding the work in the I-3S from this perspective, it is possible to identify two additional elements of the activities framework: a) workshops with the seniors are

needed before engaging them in activities within the I-3S; and b) the intergenerational activities need to follow a specific “making” process of the digital-text, as explained next.

Seniors’ workshops

To ensure seniors’ effective participation in the I-3S, all seniors should have one-on-one workshops with the facilitator before the intergenerational activities. These workshops have proved to be integral to the design because they aim to clarify seniors’ roles during the intervention, as well as support seniors to develop the basic digital skills they need to engage in the I-3S. These workshops play an important role in satisfying seniors’ needs for understanding their roles and they provide instruction for what they need to do in every session within the intervention (Generations-United, 2002). Thus, during the workshops, the facilitator should emphasise that the seniors’ role is to collaborate with the children and not to “teach” them. Also, the facilitator should give seniors the space to clarify any doubts around what they will do within the I-3S. This resonates with the importance of seeing the workshops not only as spaces for seniors to develop technical skills, but as spaces to bring up questions around power relations and reciprocity between generations, moving seniors towards a more critical engagement.

It is suggested that the workshops happen in the same physical space, and with the same equipment, that seniors will use during the intervention. This is a way to *situate the practice* (New-London-Group, 1996) because it allows the facilitator to understand seniors’ different skills, needs, and sociocultural contexts, and thus to identify the best way to support each senior – according to their personal needs – in developing the technical skills to establish a videoconference to reach the I-3S. This aspect is crucial because, for some seniors, it was essential for them to realise that they were capable of using technology to connect with others (Hill et al., 2015). Also, the facilitator can use the workshops to identify the type of software/hardware that seniors need to use during the activities in the I-3S. This

means that the chosen software needs to accommodate seniors' needs and digital cultures (Buckingham, 2006; Rowsell & Walsh, 2011). Additionally, close interactions with the seniors gives the facilitator opportunities to more deeply know each person and thus identify effective ways in which each senior could collaborate in the digital-making process. Here, I will underscore that, when conducting the workshops, the facilitator needs to modify the workshops' aims according to seniors' needs, carefully tailoring the workshops to adapt to seniors' personal characteristics (see Section 5.4.2.2, Cycle 2, page 142).

Working closely with the seniors also builds trust and rapport between the seniors and the facilitator; this relationship is key because it positively impacts the socio-emotional aspects of seniors' digital engagement (Haight et al., 2014). Moreover, having one-on-one in-person workshops with the seniors is a way to balance the fact that seniors will only experience the intergenerational interaction virtually. Thus, through this relationship, seniors build rapport with the facilitator and acquire the digital skills needed to connect virtually with the children, both of which give the seniors confidence to take part of the I-3S (Schreuers et al., 2017). On the other hand, as I have been pointing out throughout this section, seniors' inclusion in the I-3S has limitations because the seniors cannot get the same form of in-person support as children, since the facilitator moves to a different geographical location (to children's neighbourhood) when the intergenerational interactions start (*DigiCamp*). This raises questions about whether the I-3S would ideally involve a facilitator at both sites, working with the seniors as well as with the children. Although it is not possible to answer these questions within this study, as this would have required more resources and another facilitator. Nevertheless, I suggest that future research could address this point.

Intergenerational activities

With emphasis on "making" as key to develop critical-digital-literacy, the process of creating the digital-text is as important as the digital-text that is itself produced. Therefore,

this framework proposes that the digital-text production occurs with participants following a specific procedure which involves a critical reflective process and the physical/digital manipulation of technology. It is through this procedure that the human and nonhuman entities build relations within the I-3S and serve to produce the I-3S itself.

The act of making is traditionally related to the physical manipulation of materials, both tangible and intangible (Kajamaa & Kumpulainen, 2019; Keune & Pepler, 2019). However, in the I-3S, this understanding was impacted by the fact that seniors and children were at different geographical locations and that seniors did not have access to peer support at their locations. Thus, the *making* happened under specific characteristics: seniors and children were assigned different roles in the making process and thus everyone developed different aspects of critical-digital-literacy. However, data suggests that all of them contributed to the digital-text production and felt that they had made significant contributions to the digital text. Moreover, all of them developed some aspects of critical-digital-literacy. Thus, through the three Cycles, I identified an approach to the critical-digital-literacy activities which followed the theoretically-informed structure that is explained next.

The making process should involve a reflective process to develop critical consciousness which is embedded in a physical/digital making process (Buckingham, 2003). The reflective process has the intention of engaging learners in questioning aspects that they themselves recognise as negatively affecting their communities, and from here, to glimpse how they could use technology to overcome those challenges. Involving seniors and children into a deeper reflection of social challenges is a way of provoking the exchange of dialogue and, through this exchange, start to build reciprocity (Matthew Kaplan, 2002). By doing so, seniors and children can create meanings, practices, and places that they share in common (Mannion & Adey, 2011). For instance, when the “best friends” team concluded that bullying

at schools is correlated with the violence in their neighbourhood, thus, they developed a wearable technology to prevent bullying (see Section 6.6.4.1, Cycle 3, page 222).

Regardless of the digital-text that learners come up with to overcome the challenges identified in the community, it is important to establish a learning environment where seniors and children are implicitly guided to share/expose their experiences in such a way that they become aware of the contradictions they live (Freire & Macedo, 1987). It is important that the environment invites learners to be listened to, without imposing on them ideas of “the right thing to think/do”. Care must be taken to not impose pre-established ideas of what should be the “right answer”, but learners should be guided to come up with their own ideas to overcome the contradictions they identified, and to embed them in a digital-text. Being able to identify the contradictions experienced in their communities, as well as being able to develop the means to overcome these contradictions, are in line with critical pedagogy. Freire (1970) stated that critical literacy practices should move learners from psychological reflection around their oppression to praxis, which involves acting to transform society regardless of whether one is too old, too young or resides in an economically challenged area.

Once learners determine the digital-text they want to produce, organising the way in which they engage in the making process for that artefact is neither trivial nor obvious. The “hands-on” experience is key because human cognition is always grounded in real world experiences, where learners are exposed to unfamiliar learning situations that are connected to learners’ contexts, needs, and competences (Dewey, 1938; Rowsell & Walsh, 2011). This way, learners experience “the new” sufficiently close to their zone of intelligibility, allowing them to make meaning of “the new” using their own codes of expressions and representations (Cope & Kalantzis, 2009). This helped me to understand that, whilst it was vital that seniors and children should engage in the making process for the artefact, they should do this as per their digital cultures, needs, and competences, though not necessarily through performing the

same activities. The making process is also dependent on the support that is available, of course. Additionally, the making process allows an ongoing critical reflection on the way that digital media is not neutral, but it constructs certain meanings and understandings of the world. This is how learners develop *critical consciousness* around digital media (Buckingham, 2003).

In this online environment, where the seniors were working on their own, it is the children who were able to collaborate in the reflective process alongside the physical and digital making of the artefact and the physical building and/or manipulation of specialized software to digitally build the artefact. For instance, physical construction occurs when using electric components to build a technological prototype, or when manipulating a software to create/edit a podcast. Seniors, on the other hand, collaborated mainly in the reflective moments of the making process and, when possible, engaged in using specialized software to intervene in the digital building of the artefact. To an extent, this is because I was only physically with the children and not with the seniors. This suggests that if there can be someone physically with the seniors, then this could possibly have changed.

Involving only the children in the physical and digital making of the artefact responds to the fact that even though children would be exposed to new information or a new learning experience, all children are working together in the same physical space alongside the facilitator. Thus, children could get support from peers and the facilitator in getting closer to their zone of intelligibility. On the other hand, seniors did not have these kinds of support where they lived, and thus experiencing “the new” would be too far from their existing competences. This is a limitation in the I-3S because seniors missed the opportunity of being engaged in the physical/digital making of the artefact, and thus they missed the opportunity of developing certain instrumental technical skills and metalanguages inherent in digital media (Buckingham, 2007). Similarly, this is a limitation to reach *reciprocity* because this

action automatically offers seniors fewer learning opportunities than the children. Nevertheless, it is proposed that, as far as possible, some seniors can engage in using specialized software to intervene in the digital building of the artefact, for instance in using a software/tool like Google Docs to write texts simultaneously with the children. This software/tool provides a feasible possibility for the seniors' engagement, at least among those seniors with prior experience manipulating technology and whose digital culture connects with learning to use this software/tool. In other words, the learning available with using this software/tool connects with the technological practice that seniors already have.

Nonetheless, because the emphasis in this framework is on the critical aspect of digital-literacy, seniors and children should and can be equally involved in the reflective process of the making, allowing them to gain critical digital literacies as they work together. The reflective process can occur, for instance, when discussing the social challenges that each of them identify in their communities, or when proposing a digital-text to overcome those challenges. The reflective process engages learners in understanding and/or critiquing their sociocultural context, whilst encouraging learners to understand how digital media operates, its connection with digital media represented in the world, and its connection with other spheres of society (Buckingham, 2003). Moreover, when seniors and children come up with a digital-text embedding their ideas/reflections, both generations experience how digital media can be critically produced to impact or transform society (see Section 3.5.1, Literature Review). Therefore, even though seniors and children do not always engage in the same activities during the production of the digital-text, both generations have equal opportunities to engage in developing critical-digital-literacy. Here I stress that, in this research, despite both generations talked about the social challenges faced in their communities, all teams decided to address the social challenges proposed by the children instead of those proposed by the seniors. For instance, this video shows Jacob sharing with the children that sometimes

seniors experience discrimination due to their age ([Click here for evidence](#)), however, this team chose to tackle the pollution challenge that children proposed.

Alongside having equal opportunities for learning, seniors and children should have opportunities to build a relationship with each other; these two aspects are understood as building *reciprocity* within the I-3S. Thus, to encourage a relationship among seniors and children, the making process can be enriched with activities where the generations could get to know each other better (Matthew Kaplan, 2002), which involves dedicating some intergenerational sessions or moments within intergenerational sessions where seniors and children could talk about who they are and exchange information about their personal interests. These specific activities support the intergenerational connection and thus aid in building a relationship. Additionally, it is proposed that children are encouraged to build reciprocity within their own age group; that reciprocity can be fostered by having recreational sessions where children can just play and be friends. However, having something similar for the seniors was not possible because each senior lived in different locations.

To close the activities within the I-3S, it is proposed that children showcase the digital-texts they produced amongst the people in their neighbourhood. This sort of showcase is related to the development of critical-digital-literacy because it is an activity that gives children an opportunity to share with a real-world audience. Also, because children feel proud of sharing their work with people they care about, motivating to do high-quality work. Moreover, children enjoyed and highly valued the showcase activity.

It is suggested that only the children participate in the showcase, which also demonstrates a limitation within this learning environment, because the technological infrastructure used in this research could not provide connection between the seniors and group environments, and could not provide a quiet environment, relating back to the supposition that all online intergenerational interactions should be isolated from noise, as

explained earlier in Section 1.1.3.1. Nevertheless, if it was possible to have a better technological infrastructure, the showcase experience would be richer because the digital-text was produced by both generations and both could participate in its exhibition.

In sum, this section exposed different elements from the theoretically-informed framework to guide the activities design in the I-3S. Therefore, I will now address what emerges within this learning space.

7.2.4 What emerges within the I-3S?

The final design of the I-3S informs and guides how the human and nonhuman entities can be entangled in such way that encourages the development of reciprocity and critical-digital-literacy. Within this organisation, the human entities not only “use” the materials, but the humans and the materials, in a specific environment, are brought into use in synergy; humans-materials-place are inherent within the activity itself (Ingold, 2000). Therefore, to identify and understand what seniors-children-place-facilitator (including the tangible and intangible materials within that place) have produced together as a relation (Mannion & Gilbert, 2015), I propose to use Burnett and Merchant (2019)’s sociomateriality framework to explore digital-literacy practices.

This framework guided the understanding of what happens inside the I-3S, mainly by identifying first, who is making what, with whom, and with what? Second, what are the ethics of production, including what is made? Who and what else is implicated? Whose interests are served? and finally, how do the different layers of making interface? This framework was not used to provide a straightforward answer the questions, but it rather as guidance to understand what emerged within the I-3S. Understanding that the outcomes will be diverse depending on the particular entanglement of humans-nonhumans-materials (tangible/intangible), the design of the space and the activities intra-acting with each other.

In this context, the following section, Section 7.2.4.1, explains how human and nonhuman entities come together as a relation; Sections 7.2.4.2, 7.2.4.2 and 7.2.4.3 point out the different roles that human and nonhuman entities played. Later, Section 7.2.5 explains what human and nonhuman entities produced together as a relation (Mannion & Gilbert, 2015).

7.2.4.1 Human and nonhuman entities come together as a relation

I first looked at who is making what, with whom, and with what. The relations within the I-3S are intentionally impacted by how the activities were designed, which, in this case, were meant to foster a reciprocal relationship between seniors and children, along with giving each generation equal learning opportunities (see Section 5.4.1, Cycle 2); this meant that seniors and children should have opportunities to contribute in the digital-text production and equal opportunities to swap between novice and expert roles. Therefore, both generations contributed to making the digital-text and they both had opportunities to develop critical-digital-literacy. Seniors mainly collaborated in the reflective process of critical-digital-literacy whilst children engaged in both the reflective process and the physical/digital building of the artefact. Similarly, to set the ground for the development of reciprocity and critical-digital-literacy, the activities looked for fluid and non-hierarchical communication amongst the generations, as well as within the seniors-children-facilitator relation. Therefore, authentic interaction and communication among all human entities was implicitly encouraged throughout the making process (Gutiérrez et al., 1997).

Within this frame, it must be acknowledged that the roles that seniors, children, and the facilitator take within the I-3S are, to some extent, related to how the activities were designed. However, this research found that although all teams engaged in the same process of developing a digital-text, where children were in charge of the physical/digital making of the digital-text, seniors and children decided on their own to play different roles within their

teams. They established their own ways of being in intergenerational learning, taking on one or more of the three main roles: the facilitator role, switching from a novice to an expert role or vice versa, and peer counsellor. That is, not all seniors, nor all children, engaged in all these roles but everyone decided their role, as explained next.

7.2.4.2 Facilitator role

Most seniors adopted a role that was like a facilitator role. These seniors focused on structuring the group-work task to keep the learning focused and moving forward. For instance, this role might have involved keeping track of the team's working progress to reach the expected goals and deadlines. Similarly, they influenced the interaction within the team, such as making sure that all team members equally participated in discussions and provided opinions, and making sure that these opinions were considered. Additionally, the seniors who adopted the facilitator role promoted collaborative dialogue within the team, continuously using scaffolding as a mediational means (Swain & Watanabe, 2012) by making questions to children to scaffold their thinking or guiding them to explore other possibilities that children had not considered. Seniors took this role during the reflective moments as well as when children were physically/digitally creating the digital text. In the reflective spaces, this approach allowed seniors to engage children in deeper discussions around the social challenges, moving beyond just describing the challenge to more deeply reflect on the social consequences (see an example in Cycle 3, section 6.6.4.1). Moreover, seniors themselves were involved within the collaborative dialogue: working closely with the children, they created and tested ideas or possible solutions to all of the challenges that the team encountered during the making process.

The activities did not assign seniors this role, but most of them took it perhaps due to their age and their experience and skill in organising teamwork. Moreover, as some prior experience as teachers, the facilitator role came somehow naturally to them. I stress that

seniors' taking the facilitator role is not considered good or bad. Teams where the senior took the facilitator role worked more independently, requiring less assistance from me, and working with more agency than the other teams. Although this is a positive aspect, teams where seniors did not take the facilitator role were also able to create their digital-texts and to develop reciprocity and critical-digital-literacy.

Not all seniors took the facilitator role. Some seniors, even if their background was also as teachers, appeared willing to adapt to the working pace and working style taken by the children. In these cases, as facilitator, I needed to support the teams by structuring their group-work tasks to keep the learning focused and moving, whilst also encouraging them to engage in collaborative dialogue through scaffolding their work and interactions. Nevertheless, the seniors who did not take the facilitator role, easily – and more naturally – engaged in a collaborative dialogue with children, and helped to deepen the discussion around social challenges. Moreover, these seniors also worked closely with the children, creating and testing ideas to overcome the challenges. These seniors tended to not to scaffold the interactions with the children through intentional questions, but instead engaged in natural collaborative dialogue within the children as peers. This point will be explained later in Section 7.2.4.3.

There is no data indicating why not all seniors took the facilitator role. However, the characteristic amongst the seniors who did not take the facilitator role might be related to their cognitive levels and the uncertainty they had regarding their role within the intervention. Although in this research I did not measure or test the seniors' cognitive levels, seniors with memory challenges and/or who constantly doubted what they needed to do did not take the facilitator role and were more dependent on my support as facilitator. This stresses that the I-3S is an inclusive intergenerational learning space – the I-3S adapted to seniors' needs and, up to a point, included them regardless of cognitive and other needs.

Seniors who did take on the facilitators role were key in how the planning and coordination happened throughout each team's making process. Moreover, to an extent, these seniors took responsibility for the children's learning process and constantly used scaffolding questions as a tool to support the children's thinking.

Additionally, all seniors, including those who did not take the facilitator role, played a key role in deepening the discussion during the reflective moments, involving children in considering aspects that children did not think of. However, seniors were not facilitating the interaction, rather they were thinking together with the children; seniors were not imposing ideas to the children but scaffolding children's thinking whilst constructing new ideas (e.g., Dorothy & Janis building a technological prototype, Section 6.6.2, Cycle 3, page 208). This way, all seniors participated in the construction of ideas, concepts, and meanings within the making process. This required a high degree of coordination from seniors and children, with both generations justifying their own ideas, and acknowledging and elaborating each other's knowledges (Webb, 2009).

The facilitator role was also taken by me as the actual facilitator of the intervention, and I was responsible for promoting collaborative dialogue amongst seniors and children. However, this support was to be given to each team depending on their needs and characteristics as a team and thus it required that the facilitator builds from her/his knowledge about the seniors' and children's characteristics to support everyone within their teams, in the way that each of them required it. At moments, this process involved supporting just the senior or just the children within the teams, providing support to seniors-children as a relation to move forward in their collaboration and interaction, and supporting all teams to overcome the logistical and/or technical challenges they might face.

7.2.4.3 Switching from novice-expert role

To foster reciprocity and digital-literacy, the I-3S involved seniors and children in equal opportunities of learning. Connecting this with third-space theory, it is understood that seniors and children should be equally involved in opportunities to switch from the roles within the novice-expert dichotomy whilst producing the digital-text. Within this frame, data from Cycle 2 and Cycle 3 showed that during the reflective process within the critical-digital-literacy and physical/digital building moments in the intervention, seniors and children constantly engaged in dialogues that made them switch from between novice and expert roles.

It is important to highlight that in Cycle 1, although seniors and children engaged in dialogue, they never engage in dialogues that made them switch from within the novice-expert dynamic. Their dialogue in Cycle 1 was always hierarchical, where seniors were always the experts teaching the children (see Section 4.7.3, Cycle 1), and thus, this aspect was re-designed from Cycle 1 to Cycle 2. Therefore, the final design was already engaging seniors and children in non-hierarchical communication, which set the ground for new knowledge to emerge, as explained next.

In their conversations with others, people elaborate on their thinking (Webb, 2009). Thus, in the I-3S when seniors and children were developing a task together, they engaged in dialogue and interactions where both generations, regardless of their abilities, used their own knowledges, words, symbols, and understandings to exchange information, thoughts, or ideas as resources made available to one another. The exchange encouraged them to elaborate on their thinking because seniors and children make new meanings and modify knowledges and experiences through their dialogue and interaction (Swain & Watanabe, 2012). The constant meaning-making and reshaping of knowledges and experiences through their collaboration (via speaking and writing) is connected to learning because it impacts cognition, an impact

which can be noticed when seniors and children talk through the meanings they have and make sense of them (Swain, 2006). This is how seniors and children make meanings that are shared in common (Mannion & Adey, 2011).

In this context, it can be said that within the continuous peer support, seniors and children, regardless of their abilities, were simultaneously experts and novices since they provided scaffolding to each other to advance their thoughts and ideas (e.g., Section 5.6.2, Cycle 2, page 155, where Edna/Marion/Ava write the podcast's storyline). Seniors and children were using their own resources as tools to participate in the I-3S and build new learning from that (Gutiérrez, 2008). However, both the tangible and intangible (such as software) materials also took part in the scaffolding process, impacting the switch between novice and expert roles.

Technological devices (software and hardware) not only mediated the collaboration between seniors and children but actively participated in the learning process because the affordances that software and hardware possess have the potential to scaffold both seniors' and children's thinking. Many times, when working with technology, seniors and children were not "taught" but instead were involved in an experiential activity where both generations were making sense of the metalanguages through the materials (Cope & Kalantzis, 2009). Thus, the material, such as technology, take an active role the learning process. For instance, in Cycle 3, each senior and children had their own Micro:bit where they individually experimented with coding in its editor. Seniors and children individually tried ideas/hypothesis of how to create an algorithm, receiving immediate feedback from the simulator confirming or rejecting their hypothesis of the correct use of coding syntaxes. This can be seen as a scaffolding process between seniors-technology, as well as children-technology. Moreover, when seniors and children engage in dialogue with each other around their individual experiences with the device and make changes together in their algorithms to

improve their digital text, receiving immediate feedback from the editor. This process can be seen as a scaffolding process between seniors-children-technology. Therefore, the novice-expert role happened amongst the seniors and children but it was also impacted by the technology and all the other materials within the I-3S, such as the electronic devices, cardboard, paper and all other materials used to build their artefacts.

Similarly, all the children within the I-3S and me, as the facilitator, also had an impact on the senior-children-materials learning process. To enable children to build reciprocity and ensure that they have opportunities to switch between novice and expert roles within the I-3S (Daniela K. DiGiacomo & Gutiérrez, 2015), the facilitator asked each child to explore by themselves (and master, to an extent) specific software/hardware features. For instance, in Cycle 2 each child explored different features of the software they were using to create the Podcast (see section 5.4.2.1). Later, children were called on to share that specific knowledge with everybody in the I-3S, in order to promote each child's learning through their explaining and sharing material with others (Webb, 2009). The task allowed the children to share knowledge and promote scaffolding with each other as peers, giving all children the opportunity to switch from novice to expert roles, which should happen in third-spaces (Gutiérrez et al., 1997). Children highly valued the experience of being able to "teach" others (e.g., the quotes in Section 5.6.6, Cycle 2, pages 171-172). Moreover, it became natural for children to help each other whenever they faced challenges in their making process (e.g., the video shown in Section 6.6.2, Cycle 3, page 214, when Janis brings two children to help her and Dorothy to turn the LED on).

As the facilitator, I also played an active role in scaffolding seniors' and children's thinking, both individually or as a team, through supporting them to become proficient in their strategies; I provided this support when other team members, or any other children within the I-3S, were unable to give support to overcome challenges. Additionally, the

facilitator scaffolds seniors' and children's thinking by creating moments where experts share metalanguages within the I-3S. For instance, in Cycle 2, children had a workshop with a professional writer who provided them with metalanguages to create a podcast script; the children then shared the metalanguages with the seniors when creating their Podcast.

As can be seen, seniors and children were simultaneously expert and novices, scaffolding each other to advance their thoughts and ideas, communicating and interacting in ways so that the generations created new meanings in common (Mannion & Gilbert, 2015). However, the tangible and intangible materials, the children, and the facilitator all had active roles in the scaffolding process, impacting the switch from novice to expert roles.

It should be acknowledged that the facilitator within the I-3S needs to support or encourage seniors and children to take the novice/expert role, since an aim is that both generations had opportunities to switch between roles. Thus, although many times seniors and children take the novice/expert role naturally, the facilitator should encourage it nevertheless.

7.2.4.4 Peer support

This role refers to the many moments throughout the activities performed in the I-3S where seniors and children emotionally supported each other. The support they gave each other not only emerged when the generations exposed the social challenges faced in their communities, but seniors and children also provided support to each other in personal matters. The mutual peer support spontaneously happened when the generations had conversations about what it means to be old, discussions around death, and family challenges. Here, I emphasize that both seniors and children took this role. They both supported each other as if they were friends in an equal relationship, as can be seen in how senior Heather and Isa talk to each other (see dialogues in Section 5.6.3, Cycle 2, pages 161-164). Moreover, there are moments in which the facilitator supports children and seniors when they need it.

For instance, this audio where Ava explains that being in the I-3S helped her to “not to feel sad” because she lost her grandpa a few weeks before Cycle 3 ([Click here for evidence](#)).

As it can be seen throughout this section, 7.2.4, seniors and children established their own ways of being in intergenerational learning, taking on one or more of the roles described here during the overall making process.

7.2.5 Potential outcomes from the I-3S

This section explains what seniors-children-place-facilitator (including the tangible and intangible materials within that place) have produced together as a relation (Mannion & Gilbert, 2015). To do this, I looked at what was made, who and what was implicated, whose interest were served, and how the different layers of making interfaced (Burnett & Merchant, 2019). From this review, it can be said that with the enmeshment of relations within the I-3S that I created, seniors and children built a reciprocal relationship – even a friendship – whilst developing different aspects of critical-digital-literacy. Moreover, it can be said that seniors and children walked together towards building aspirational future social imaginaries, embedding their voices within transformative actions, as discussed next.

7.2.5.1 Reciprocity developed through friendship

Both generations claimed that they enjoyed being with each other and referred to their intergenerational interaction as a meaningful experience, even though their full interaction happened through videoconference systems instead of face-to-face. Throughout the cycles, children never saw the online interaction as a barrier or as something that limited them in their engagement with the seniors. Children claimed that the experience was the same as if the senior were in the same physical space. On the other hand, some seniors said that the virtual interaction with the children limited the level of engagement they could have, a response which was particularly strong in Cycle 1. However, after seniors engaged in Cycle 3 and the I-3S re-design ended, all the seniors said that the feeling of reciprocity or friendship

was the same as having the children with them, sharing the physical space. There is no single aspect that explains the different experiences the generations had, but it could be seen throughout the cycles that children had more support during the intervention. For instance, when children were not interacting with the seniors, they were engaged in doing something related to their digital-text whilst being surrounded by all of the other children and the facilitator. Therefore, the children had a deeper and more diversified experience within the I-3S when compared with the experience of the seniors. Additionally, in the first cycle of the intervention, the I-3S infrastructure did not provided reliable or fluid communication amongst the generations. For instance, the set-up of the physical space and the quality of the internet meant that noises and disconnections impacted the seniors-children communication. It wasn't until Cycle 2 and Cycle 3 that the I-3S infrastructure started to allow for fluid communication among the generations. Therefore, it can be said that the overall re-design done in the I-3S enabled the communication and a type of engagement that helped seniors and children to overcome the challenges inherent in their videoconference encounters and make them feel as if they were interacting face-to-face in the same physical space. Moreover, even though the seniors and children did not know each other before the intervention and had never met face-to-face, both generations said that they enjoyed being together and felt that they fostered a reciprocal, positive relationship.

I clarify that what I am about to claim was the case for Cycle 2 (to some extent) and for Cycle 3 (to a greater extent); also, that it was not the same experience for everyone throughout all the cycles. However, the theoretical contribution I presented in this last chapter is the one that has the potential to provoke what I point out in this section.

Seniors and children took on different roles throughout the sessions, and, with the facilitator's support and technological affordances, both generations were often encouraged to mutually scaffold their knowledge and reciprocally share resources to move their work

forward. Their communication and collaboration was most of the time broadly fluid and non-hierarchical; thus, both generations claimed the feeling they were equally participating, meaning that both groups had the experience of sharing something with the other generation. Thus, despite their age differences, both generations recognised their contribution as equally necessary within the making process, and so the final product could not have been done without the involvement of the other generation – a sentiment that participants explicitly expressed. These aspects often experienced by seniors and children are important because, by definition, a third-space is a place where normative/established patterns of interaction intersect and give rise to a fertile space for non-hierarchical interaction and learning to emerge (Gutiérrez et al., 1997). Also, any third-space should validate learners' knowledges and learners should be encouraged to bring those knowledges into the learning process (Gutiérrez, 2008; Gutiérrez et al., 1997). Therefore, even though there is no prior research on third-spaces within an intergenerational context, the I-3S design proposed in this research potentially produces the same characteristics established by third-space theory.

Another aspect that was identified in the I-3S was that the reciprocal and positive relationship that generations grew was a key element to keep the learning going. Throughout the cycles, the seniors constantly received support from the children, particularly in relation to “how to use technology”. For instance, there were many times when seniors directly asked children for assistance on how to manipulate the software they were working with during the interaction, whilst at other times, children spontaneously advised the seniors when they noticed that the seniors were struggling. Either way, the friendly and assertive way in which children supported the other generation gave the seniors confidence to keep trying the technology instead of giving up. Moreover, those seniors who were more resistant to using technology expressed that some of the technical skills they developed, such as learning how to establish a videoconference, were learned because they were constantly trying it out; the

videoconference as, after all, the only way to connect with the children and that activity was something that the seniors looked forward to. This echoes with literature, which states that seniors can overcome barriers to adopting technology if they have motivation and are provided with a friendly space to get support and to use trial and error methods (Barnard, Bradley, Hodgson, & Lloyd, 2013; Hill et al., 2015; Vroman, Arthanat, & Lysack, 2015; Schreuers et al., 2017). Thus, it can be said that being engaged with children encouraged seniors to overcome some barriers that prevented or dissuaded them from using technology. Moreover, the overall experience within the I-3S kept the seniors from giving up on technology.

In the case of children, all of them recognised that the seniors were very helpful in proposing ideas to improve the work. The children indicated that the seniors were not giving them “answers” nor telling them what to do, but the seniors were instead supporting them to think about different perspectives. Also, they also indicated that, together as a team, they generated and complemented each other’s ideas in order to make their digital-text. Children also recognised that all of the other children in the I-3S helped them to scaffold their learning process, even when they were now in the same team. The latter can be explained by the multiliteracies pedagogy adopted in the I-3S; I encouraged the children to overcome their challenges by using the resources available within the I-3S, such as peers’ knowledge, instead of relying in the facilitator’s support. Moreover, in Cycle 2 and Cycle 3, children were encouraged to build reciprocity amongst themselves by switch between novice and expert roles whilst “teaching” each other how to manipulate new software. This experience was highly valued by children, and they felt proud to share what they know with others.

Within this context, seniors and children said they connected positively with each other and broke stereotypes about the other generation. In experiencing that both generations were not so different and both groups functioned as equally important members of the team,

they were able to mutually learn from each other. Their collaboration within the I-3S let both generations to share about their living context and cultural backgrounds, as well as to explore the aspects that they both had in common. Moreover, the seniors and children felt confident to engage in discussions about difficult and sometimes personal topics such as death, how it feels to get old, and the experience of losing memory. It was also through these spontaneous conversations that the generations equally exchanged thoughts, built friendships and improved their understanding of the other. As it can be seen throughout the research, the reciprocal and positive relationship that the generations built amongst the groups, and those built amongst all of the other children within the I-3S, was a key element to keep the learning going. The friendships that seniors and children built within the I-3S set the groundwork for both generations to engage in something meaningful. The model proposed in this research suggests that seniors and children bring a range of knowledge and expertise to the I-3S that is not just about learning digital skills but rather goes way beyond that.

7.2.5.2 Each person developed different aspects of critical-digital-literacy

To understand what was made and what was produced within the I-3S, in terms of critical-digital-literacy, it is important to remember that the critical-digital-literacy stance taken in the I-3S was focussed on the development of a “critical consciousness” through engaging learners in reflection on their own digital media practices and helping them to recognise how digital media relates to different spheres of society. With this, learners were encouraged to position themselves in a line of thought and action. It is from this perspective that I explored what was produced – and what was implicated – in the I-3S.

I anticipated that seniors and children might develop different aspects of critical-digital-literacy, since those literacies are closely related to learners’ existing digital culture and individual characteristics. However, the data showed that each learner from both the seniors and the children, developed technical digital skills according to their personal needs

and characteristics. This differs from many media stereotypes and representations of older and younger people, and also from some of the literature around intergenerational practice (see Section 3.4.2, Literature review). Even though all of them were involved in the same activities and produced similar digital-texts, each person developed something different. Their learnings did not depend on their generation but on who they were as persons. However, the data showed that learners who were more familiar with using technology developed more advanced skills in manipulating software, such as how to best use Google Docs when doing teamwork. On the other hand, learners with less experience using technology developed basic technical skills, such as how to type using a keyboard or how to establish a videoconference call.

The response was similar when all seniors and children were exposed to coding by using the Micro:bit. Even though the device and the concept of coding itself was something new for all of learners, those more experienced with technology acquired more coding skills (such as how to use more advanced coding syntaxes or how to write more efficient algorithms) than the less experienced learners. Overall, the technical digital-skills that seniors and children developed within the I-3S were very diverse, ranging from how to turn an iPad/computer off and on to assembling a t-shirt as a wearable technology. This result resonates with Buckingham (2007), who explained that the process of making a digital-text allows learners to explore the different affordances of technology, letting them acquire the technical skills that better respond to their needs.

Additionally, Buckingham (2007) stressed that it is also through the making process that learners understand how digital media is linked to the different spheres of society, and this is what opens the door for reflection on how to use and produce digital media as resources to transform society. In this regard, seniors and children within the I-3S were equally involved in reflective moments, which were not spontaneous but provoked within the

activities, where seniors played a key role in keeping the dialogue engaged and robust. It was from these reflective moments that learners envisioned a feasible way to use technology as a resource to potentially transform something that they identified as needing transformation. This way, seniors and children experienced how humans' understandings of the world are embedded in technology, implying social responsibility. Therefore, since all of the digital-texts emerged within this frame, it can be said that the produced digital-texts were (to an extent) learners' beliefs/intentions embedded in technology. However, these intentions were not pre-established moralistic beliefs imposed by the I-3S but came as a result of reflective moments that were individual or elicited with the other generation; in other words, the digital-texts embed the meanings that seniors-children created together.

Producing the digital-text made children feel very proud of what they did. First, they were proud because they recognised that what they produced was something with real potential to transform society (see Section 5.6.4, Cycle 2, pages 169-170). Second, because even when the making process for the digital-text was perceived as a new and very challenging experience (such as using coding to develop a technology prototype), they were capable of producing the digital-text. The children understood that they have the capacity to overcome the challenges and that capacity allowed them to feel very proud of themselves. However, children also recognised that being able to overcome the challenges happened not only because of their personal tenacity but was also due to the support they had from seniors, the facilitator, and all the other children within the I-3S. This suggest that children understood how everybody's knowledges are valuable, as well as how these knowledges can be exchanged and used as resources, that, when combined, result in tools to overcome challenges and producing new learning. Additionally, the activity of showcasing their digital-texts with their family and friends was something treasured by children, and something that impacted the children's empowerment; there, the children enjoyed "teaching" what they

know to their loved ones and in return, they received positive comments and praise. Thus, getting recognition from friends and family reinforced the children's feeling that they are capable of doing something challenging.

On the other hand, the seniors had a different experience. The seniors did not express feelings of empowerment due to the production of the digital-text, but they did express feeling proud of what they, as a team, produced together. The seniors were not proud of the digital-text itself, but rather they were proud of the experience of working closely with the children and being able to produce something together. Beyond seeing technology as a transformative tool, the seniors instead recognised the great potential that intergenerational interactions have for transformation. Further, all the seniors recognised that their participation in the I-3S changed some of their preconceived ideas and perspectives around technology.

The seniors who described themselves as not engaged with technology stressed that they now perceive technology as something that is friendly to use and as something that can be used to keep them connected with other people. The latter sentiment was emphasised by those seniors whose social connections were restricted since they lived in retirement homes. For them, technology could be seen as a resource to “go out” and keep in touch with people beyond those who live with them. From a different position, those seniors who already have contact with children (such as their grandchildren) recognised technology as something they could use to find common ground with the other generation. For instance, some seniors viewed the Micro:bit as a resource they could use to meaningfully and nonhierarchically communicate and interact with their grandchildren; it appeared as a resource that let both generations create meanings together whilst building a friendship. It can be concluded that seniors and children experienced technology as something they could use and produce – despite their age or social position – to impact their inner environment/circle; thus, technology was seen to have the potential to transform society.

7.3 Conclusion

In this study, I made methodological, theoretical and practical contributions to knowledge. First, using design-based research methodology to investigate and to create intergenerational learning environments. Second, connecting different research fields (critical-digital-literacy, intergenerational practices, and third-space) to theoretically conceptualise and to create an intergenerational third-space (I-3S). And third, designing and implementing an I-3S where seniors and children could develop critical-digital-literacy, alongside a reciprocal relationship and friendship. The final design of the I-3S informs and guides how the human and nonhuman entities can be entangled in such a way that encourages participants to develop critical-digital-literacy and reciprocity.

Within these contributions, other key aspects stressed in this study are: First, the need to enable communities at the margins to access learning spaces such as the one implemented in this study. We must ask ourselves: Who has access to intergenerational learning spaces? In literature in this area, it is not typically talked about helping participants access these spaces. As important as designing a learning space, we must support learners to overcome the challenges that hinder their participation. Second, the use of online intergenerational practices to break geographical and mobility challenges that seniors and children face was not a priority of researchers in this field. And third, in the field of digital literacy, a key aspect in this study is the importance of providing seniors with a meaningful reason to explore and use technology. This motivation becomes key in helping them overcome the challenges with using technology.

Alongside the above contributions, I would like to talk about what I learned while conducting this study. First, the contribution of community members in the development of I-3S is key, and it is an aspect that I did not foresee in the initial stages. When people see that activities will benefit their own communities, they help a little or a lot, each within their

means, but all playing an important role in developing fruitful non-formal learning spaces. Second, I realized that seniors and children have a clear understanding and perspective about the social challenges that have direct impact on their lives. These groups are not typically included in conversations in our families, schools, or communities. As such, there is a need for spaces where they can express what they think and feel, and to propose solutions about overcoming their own social challenges.

Finally, during this study all participants and I developed a friendship and an emotional connection that has continued to this day, almost two years after the last cycle of DigiCamp. We all have remained in touch through social media, videoconferencing, email and telephone. I consider this another impact that this study had on participants, on their communities, and on the researcher as well. This was best expressed by senior Heather while working with children in DigiCamp: working with children in DigiCamp is not about using technology, it is about connecting hearts.

8. Epilogue

8.1 The COVID-19 Pandemic

The current COVID-19 pandemic has affected us all, making us experience first-hand some the mobility challenges that participants in this study face every day, and we can see how important technology is in overcoming them. In a very short period of time, the entire world went online, all of us having to become IT specialists overnight. This rapid change exposed how big the digital divide is everywhere, particularly affecting seniors (Seifert, Cotten, & Xie, 2020; Xie et al., 2020) and children from economically challenged areas (Vivanco-Saraguro, 2020; Zamora Saenz, 2020). Not surprisingly, communities at the margins became some of the first casualties of this new reality, as they have limited access to technology. To help participants of DigiCamp and other children in her community, Carmen re-enabled the I-3S working space to share her internet so they could attend school online.

In this past year, we all have felt issues like what we encountered and overcame in DigiCamp: lack of access to proper technological devices, barriers using technology, spotty internet service, noisy working environments, etc. It also made evident that technology can help us stay connected because, as social beings, we need an emotional connection to others.

Due to the pandemic, several studies in the area of intergenerational practices have started, motivated by the experience of isolation faced by seniors. Results have been mixed, as seniors experience similar challenges as the participants of this study (Gould & Hantke, 2020; Thang & Engel, 2020; Cortellesi, Child, & Initiatives, 2020).

8.2 Participants of DigiCamp

In the retirement home where Litzy and Heather live, other residents have benefitted from the iPad donation we received for this research. The retirement home started to offer iPad classes. Although it was not planned for the I-3S to extend its impact beyond the participants, the I-3S had indirect impact within learners' communities.

Litzy told me that she is very grateful for having an iPad. Due to enhanced safety measures, residents of the retirement home must keep socially distant, a great challenge for them since most have hearing loss. She explained to me that now that she cannot go out due to health challenges and because of COVID-19, her iPad is what keeps her connected with people in the outside world, as she shares in this video ([Click here for evidence](#)).

The children who participated in the I-3S are using the equipment that was donated to them to continue their formal education, as this is the only equipment they have. Some children now have internet service at home, but those who do not, go to our working space whenever they need internet.

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Appendix A

Children's Diaries: Questions

1. What did you learn in today's session? Please write your answer in great detail. How was the experience of working with the senior today? (What did you like? What did you talk about the most and did you enjoy? What did you like the least?)
2. Did you feel that your opinions were taken into account by the members of your team? Why do you think this?
3. What did you enjoy the most about today's session and why?
4. Do you think there is something that we should change for the following sessions?
5. When you used the Micro: bit, what things were easy to do or understand?
6. When you used the Micro: bit, what things were difficult to do or understand?
7. Was there anything about when you used the micro: bit that you particularly liked or found particularly interesting?
8. Is there anything else you would like to tell me?

(Spanish)

1. Qué aprendiste en la sesión de hoy? Por favor escribe tu respuesta con mucho detalle. Cómo fue la experiencia de trabajar con el/la senior hoy? (qué te gustó? Qué fue lo que más platicar y disfrutaste? Qué fue lo que menos te gustó?)
2. Sentiste que tus opiniones fueron tomadas en cuenta por los integrantes de tu equipo? Por qué piensas esto?
3. Qué fue lo que más disfrutaste de la sesión de hoy y por qué?
4. Crees que hay algo que debemos cambiar para las siguientes sesiones?
5. Cuando usaste el Micro:bit, qué cosas fueron fáciles de hacer o entender?
6. Cuando usaste el Micro:bit, qué cosas fueron difíciles de hacer o de entender?
7. Hubo algo de cuando usaste el micro:bit que, en particular, te haya gustado más o que encuentres particularmente interesante?
8. Hay algo más que te gustaría decirme a mí?

Appendix B

All Nodes found in Diaries, interviews, and videos (grouped by colours)

1. Activities that participants already do with technology before DigiCamp
2. Advising young about how is to work with seniors
3. Anxiety. Part express anxiety due to something they did in DigiCamp
4. Audio coming from none-voice is difficult to share in the online environment
5. Auto-criticism. Participants talk about how they could improve
6. Behaviour- How do we suppose to behaviour in the learning environment
7. Blending technology and no-tech to execute an activity
8. capitalizing what happens in the immediate environment or context for learning purposes
9. Challenges are something positive-as expressed by participants
10. Challenges experienced in the Learning Environment
11. challenges to communicate or misunderstanding between seniors and young in the online environment
12. Challenges with Tech
13. challenges with Tech while interacting seniors and young
14. Challenging experiences with the other generation
15. Characteristics of the DIGICAMP SPACE according to young
16. Community. talks about building a community
17. DigiCamp is a safe space to be
18. Digital Literacy Learnings after DigiCamp that participants identify
19. Digital Literacy or technology part WISH TO HAVE
20. Empowerment
21. Empowerment-Seniors empowering kids
22. Encourage participants to think-decide-do things by themselves
23. Equity (or not) between generations-They believe themselves as equal, or not equal
24. Evidence that young share with parents or others what they are doing in the project
25. Exchange of generational references to explain each other what things or situations are
26. Expectations from DigiCamp
27. Expressions or Experiences about old populations
28. Family or Personal Matters
29. Food expressions
30. Forgetting things that happen
31. giving explanations in English to young, even if they speak only Spanish
32. Going out during DigiCamp
33. good example of senior and young working together to make their product

34. Hardware or software devices that participants use
35. Having fun while interacting seniors and young
36. how do children and senior respond to technical difficulties
37. How do children experience technology at home
38. how other seniors might experience this learning environment
39. How seniors experience technology at home
40. Language experiences
41. Learnings NOT related to Digital Literacy
42. looking to know more about technology (DigLiteracy)
43. Meeting the writer as an experience
44. Motivation to participate in this project
45. Online disconnections or other disruptions while interacting seniors and young
46. Online Experience-How part. felt the online environment
47. Others get desperate when trying to teach me technology
48. Participants are not contributing much to the team work
49. Participants need a closer advice on what to do
50. Positive Experience with the other generation
51. Positive feeling while being in the learning environment
52. Positive relation or experience with technology
53. Prior experiences with the other generation-Before DigiCamp
54. reflecting on how they worked as a team
55. reflecting on the reality in which we live
56. Researcher advice on how to manipulate hardware-software
57. Researcher encourages the interaction between participants
58. Researcher frustration
59. Researcher helps in the learning environment-according to participants
60. Researcher helps participants to identify common things among them
61. Researcher makes changes or adjustments to the plan in the moment is needed
62. Seniors and young are exposed to new things together or at the same time
63. Seniors and Young share digital literacy knowledge each other
64. seniors and young share personal information to know each other
65. seniors encourage young to think deeply or to contribute more
66. seniors feel empathy with young
67. Seniors help Young
68. Seniors implicitly teach the young
69. Seniors professional background
70. Seniors think tech could help them to communicate with the other generation
71. Seniors working overtime to help in the project
72. sharing or talking about their living environment
73. Shy- Young are shy to share or to speak while talking with the senior
74. signs of good connection between participants

75. Sounds from the environment disturb
76. Taking notes-Seniors and young take their own notes
77. Tech as something that keeps them in touch with people
78. Tech helps you to feel less isolated
79. Tech use has to be clearly linked to my own existing interests
80. TECHNOLOGYish participants identify as something they already know
81. They want to work together next year or in the future
82. Thoughts about Producing something with technology
83. Using tech is not intuitive nor obvious
84. Working non-digital -Seniors and young simulate what they will do with technology
85. young experience technology at school
86. young have difficulties to express themselves or don't know the vocabulary
87. Young Helping Each Other to solve issues
88. Young might be bored
89. young re-configure the fiscal space to better work with the senior
90. Young talk to the senior with more familiarity
91. young tend to agree or to like what senior suggests-without questioning

Appendix C

Cycle 2 DigiCamp 2017 – Full schedule

Date	Time	Activity
		<p>Interview children in advance about the kind of technology they use and how they use it. Also about their background.</p>
<p>Monday 31st July Session 1</p>	<p>10:00 – 12:00</p>	<ul style="list-style-type: none"> • Discussion about the research project: what it is, what we will do, diaries, interviews. To discuss why they will work with seniors and how we will do it. <ul style="list-style-type: none"> ○ Children who already participated in this project will explain to the new children how was their work last year. How they worked with the senior. From here I will introduce some information about working with seniors, such as being patient and speaking loud and clear. ○ To speak with children about taking advantage of everybody's knowledge, regardless of being children/senior. ○ To discuss with them about their experience of being able to give their opinions or thoughts about what is happening in the world. Is it important for them? ○ Do they know ways to 'make their voices heard'? <ul style="list-style-type: none"> ▪ To link this to online platforms. • To discuss about the impact we could have when participating online <ul style="list-style-type: none"> ○ Malala/ change.org/gofundme.com ○ Cyber Bulling • Discussion about personal data in online environments <ul style="list-style-type: none"> ○ Children will select pseudonyms ○ How are we going to manage our identity when posting online ○ Responsibility we have when posting online content • Discussion about working with seniors <ul style="list-style-type: none"> ○ Teams will think about what they would like to share with their new friend. They will prepare some questions to interview the senior. Young can take a cellphone with them to take pictures of what they want to share with the senior. ○ Young will write their first diary. We'll do this at the end of the session (15'), I will guide them to reflect on what they did and what they will enter in the diary.
<p>Tuesday 1st Session 2</p>	<p>9:00 – 1:00</p>	<p>9:00 – 9:45 María/Ava (Edna)</p> <p>10:00 – 10:45 Janis (Litzy)</p>

		<p>11:00 – 11:45 Isa (Heather)</p> <p>12:00 – 1:00 Oscar/Liam (Jacob)</p> <ul style="list-style-type: none"> • Getting to Know You Activity Senior/young • As homework Young/Senior will think about a something they believe is necessary to change in: the world, they country, their city or immediate environment. • Young only come when they have the meeting with Senior
Wednesday 2 nd Session 3	<p>9:30 – 12:00</p> <p>*Edna (9:30-10:30)</p> <p>*Jacob (12:00-1:00)</p>	<p>Marion/Ava: will meet the Senior and will discuss about the ideas they have, and will choose the issue they would like to address and why it is important. (9:30-10:30 am)</p> <p>Oscar/Liam: Will meet the Senior and will discuss about the ideas they have, and will choose the issue they would like to address and why it is important. (11-12 am)</p> <ul style="list-style-type: none"> • All other children will arrive at 10:00 am. All of them will have a task to complete. They need to look for What it is & how can we create (some tools) a Radionovela or radio Podcast (informative). They will share this information to the other children (Maybe during meal) <ul style="list-style-type: none"> ○ What is a podcast? • Fill out the diaries.
Thursday 3 rd Session 4	<p>9:30 – 12:00</p> <p>*Heather (9:30-10:30)</p> <p>*Litzzy (11:00-12:00)</p>	<p>Janis: will meet the Senior and will discuss about the ideas they have, the issue they would like to address and why it is important. (9:30-10:30 am)</p> <p>Isa: Will meet the Senior and will discuss about the ideas they have, the issue they would like to address and why it is important. (11-12 am)</p> <ul style="list-style-type: none"> • Children will learn by themselves how to use Audacity, will look for free music and sounds that they could use (we could talk about why free music?). They will share this information with the others. • Fill out the diaries
Friday 4 th Session 5		<p>Going out! (working with Roberto Castillo about how to write their own story).</p>
Monday 7 th Session 6		<p>9:00 – 9:45 Marion/Ava</p> <p>10:00 – 10:45 Oscar/Liam</p> <p>11:00 – 11:45 Janis</p>

		<p>12:00 – 1:00 Isa</p> <ul style="list-style-type: none"> • Young/Senior will plan and start working, as a team, on their media product. • Young only come when they have the meeting with Senior
Tuesday 8 th Session 7	<p>9:30 – 12:00</p> <p>*Edna (9:30-10:30)</p> <p>*Jacob (11:00-12:00)</p>	<p>Marion/Ava: will continue working on their media product. (9:30-10:30 am)</p> <p>Oscar/Liam: Will continue working on their media product (11-12 am)</p> <ul style="list-style-type: none"> • All other children will arrive at 10:00 am. <p>Fill out the diaries.</p>
Wednesday 9 th Session 8	<p>9:30 – 12:00</p> <p>*Heather (9:30-10:30)</p> <p>*Litzzy (11:00-12:00)</p>	<p>Janis: will continue working on their media product (9:30-10:30 am)</p> <p>Isa: Will continue working on their media product (11-12 am)</p> <ul style="list-style-type: none"> • All other children will arrive at 10:00 am. • Fill out the diaries.
Thursday 10 th Session 9		*Final touch to their project (children only)
Friday 11 th Session 10	Final Activity Special Event	<p>*Upload it online and share it with seniors and the world.</p> <p>Edna - 9:00 – 9:45</p> <p>Jacob - 10:00 – 10:45</p> <p>Heather - 11:00 – 11:45</p> <p>Litzzy - 12:00 – 1:00</p> <p>*We'll have a going out activity to close the project</p>

Appendix D

Detailed schedule that seniors received in Cycle 2

DigiCamp August 2017 – Planning

Tuesday 1st

9:00 – 9:45 am (Edna) Marion/Ava

10:00 – 10:45 am (Litzzy) Janis

11:00 – 11:45 am (Heather) Isa

12:00 – 1:00 pm (Jacob) Oscar/Liam

- Getting to Know You Activity Senior/young
- As homework Young/Senior will think about a something they believe is necessary to change in: the world, they country, their city or immediate environment

Wednesday 2nd

*Edna (9:30-10:30 am) -- Marion/Ava/ Senior will discuss about the ideas they have. They will agree on a topic they would like to address and will discuss why it is important.

*Jacob (12:00 am -1:00 pm) -- Oscar/Liam/Senior will discuss about the ideas they have. They will agree on a topic they would like to address and why it is important.

Thursday 3rd

*Heather (9:30-10:30 am) – Isa/ Senior will discuss about the ideas they have. They will agree on a topic they would like to address and will discuss why it is important.

*Litzzy (11:00 am-12:00 pm) Janis/ Senior will discuss about the ideas they have. They will agree on a topic they would like to address and will discuss why it is important.

Monday 7th

Dorothy - 9:00 – 9:45 Marion/Ava

Jacob - 10:00 – 10:45 Oscar/Liam

Heather - 11:00 – 11:45 Isa

Litzzy - 12:00 – 1:00 Janis

- Young/Senior will plan and start working, as a team, on their media product.

Tuesday 8th

*Edna (9:30-10:30) Marion/Ava: will continue working as a team on their media product.

*Jacob (12:00-1:00) Oscar/Liam: will continue working as a team on their media product.

Wednesday 9th

*Heather (9:30-10:30) Isa: will continue working as a team on their media product.

*Litzzy (11:00-12:00) Janis: will continue working as a team on their media product.

Thursday 10th

*Final touch to their project (young only)

Friday 11th

Final Activity with Seniors to share the project with everyone!

Edna - 9:00 – 9:45

Jacob - 10:00 – 10:45

Heather - 11:00 – 11:45

Litzzy - 12:00 – 1:00

Appendix E

Full schedule cycle 3

July/August 2018	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	30-July	31-July	1	2	3	4
	To work on 'what is an algorithm?'	To explore the micro:bit, basic functions	Workshop with Roberto Castillo (Literature and technology)	A catch-up session with the senior. Children will share with the senior what they did in the workshop. Then, children and senior will start discussing about the social problem they will tackle and why it is important.	To select the social issue, to select what kind of technology will be developed, as well as planning the work schedule. Each team will plan how they will be constructing their technological prototype.	
	Only Children will work	Only Children will work	Only Children will work	Children & Seniors	Children & Seniors	
				10:00 - 10:45 Marion/Ava/Brenda/Edna	9:00 - 9:45 Isa/Heather	
				11:00 - 11:45 Janis/Dorothy	10:00 - 10:45 Janis/Dorothy	
			All children will work on basic electric circuits in all the following sessions	1:00 Lunch	11:00 - 11:45 Oscar/Liam/Nora/ Jacob	
					1:00 Lunch	
	6	7	8	9	10	11
	working on the prototype following the schedule that each team planned	working on the prototype following the schedule that each team planned	working on the prototype following the schedule that each team planned	Finalizing the prototype	Saying good bye!!! and Film making	Digicamp ends with a presentation and a small party in their community.

Children & Seniors	Children & Seniors	Children & Seniors	Children & Seniors	Children & Seniors	Only Children
10:00 - 10:45 Marion/Ava/Brenda/Edna	10:00 - 10:45 Janis/Dorothy	10:00 - 10:45 Marion/Ava/Brenda/Edna	10:00 - 10:45 Janis/Dorothy	8:00 - 8:45 Marion/Ava/Brenda/Edna	
11:00 - 11:45 Isa/Heather		11:00 - 11:45 Isa/Heather		9:00 - 9:45 Isa/Heather	
12:00 - 12:45 Oscar/Liam/Nora/Jacob		12:00 - 12:45 Oscar/Liam/Nora/Jacob		10:00 - 10:45 Janis/Dorothy	
1:00 Lunch	1:00 Lunch	1:00 Lunch		11:00 - 11:45 Oscar/Liam/Nora/Jacob	
				1:00 Lunch	