Inclusive Digital Socialisation
Designs of Education and Computer Games in a Global Context

Thomas Westin

Academic dissertation for the Degree of Doctor of Philosophy in Computer and Systems Sciences at Stockholm University to be publicly defended on Monday 22 May 2017 at 09.00 in Lilla Hörsalen, NOD-huset, Borgarfjordsgatan 12.

Abstract
Digital socialisation is to learn the ways of living online, across national borders, local cultures and societies and has to be inclusive for equal participation. Conditions for this socialisation process are different due to both local and individual limitations. In a high-income country like Sweden, playing computer games are one of the most common practices for digital socialisation among youth online (digital youth), but rarely in school with teachers. Thus, there is limited institutionalised support taking responsibility for the socialisation process online of digital youth. As contrast, in a lower middle-income country like Sri Lanka, telecentres provide holistic community services with free access to computer hardware and sometimes also Internet to bridge an internal digital divide. However, there are still several barriers for inclusive digital socialisation, such as shortage of teachers, infrastructure, accessibility and a language barrier. The problem is that digital youth have to overcome barriers for inclusive digital socialisation, often with limited institutionalised support. Game oriented education (GOE) is a potential approach to bridge these barriers. Thematic questions were: How can environments for inclusive digital socialisation be designed for digital youth who: T1) are gamers that are excluded in school; T2) are living in underprivileged communities; and/or T3) have disabilities and play games? A related thematic main question is: T4) how can education about game accessibility be designed for game developers? Within a design science framework, ethnography showed that GOE with entertainment games enabled gamers excluded in Swedish schools to be included, but could not be sustained by the schools. GOE workshops about programming were a possible way to raise awareness about ICT opportunities at Sri Lankan telecentres. Furthermore, a game prototype for deaf versus blind was demonstrated in workshops within formal education settings in Sweden and Sri Lanka, exploring a design method. Finally, two international online surveys provided data for designing a game accessibility curriculum framework, based upon opinions from researchers and game developers. Conclusions are that GOE may be an environment for inclusive digital socialisation, if it is: 1) sustained in the educational social system; 2) enabled within limits of ICTD; and 3) accessible for digital youth with disabilities. The latter requires: 4) education for game developers. This thesis shows how these requirements may be fulfilled, enabling GOE as a design to achieve inclusive digital socialisation in a global context.

Keywords: computer games, education, socialisation, inclusion, exclusion, development, accessibility.

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To Michelle and Oscar
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Thank you!
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<td>Westin, T., Söderström, D., Karlsson, O. &amp; Peiris, R.</td>
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Author’s contributions to included papers

The author’s contributions to the included papers were estimated as follows and confirmed with the co-authors:

- **Paper I**: The idea of the paper came up in dialogue between authors. Furthermore, my contributions were writings regarding methods, disabled people, and parts of the discussion regarding open education resources, as well as critical readings. Approx. 30% of the paper.

- **Paper II**: My contributions were talking to users of the telecentres (youth) and documenting the technical conditions, in order to prepare for further follow-up studies (e.g. Paper III). Furthermore, I contributed to writing the discussion and conclusions of the paper. Approx. 40% of the paper.

- **Paper III**: My contributions were the idea for the study and designing and managing the game workshops. I also did most of the writing of the paper. My co-authors helped out with running the workshops, including translation and technical support, and commenting to improve the paper. Approx. 70% of the paper.

- **Paper IV**: I defined the study, did data collection, and wrote this journal paper with comments from co-authors. Approx. 90% of the paper.

- **Paper V**: I came up with the idea, problem and question, wrote the paper and did most of the data collection and analysis. Co-authors aided with comments on the text, support with the game development, and talking to gatekeepers. Approx. 80% of the paper.

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1 Introduction

This thesis argues that game oriented education is an approach to enable youth living online (digital youth) to overcome barriers of digital socialisation. Examples of barriers are lack of e-inclusion in education, games and underprivileged communities, with limited institutionalised support. This approach requires both educators and game developers to take responsibility for socialisation of digital youth, through inclusive designs for local and individual limitations. Thus, it is necessary to understand how to design environments for inclusive digital socialisation of youth online to achieve equal participation and keep societies together. This chapter presents a brief background followed by the main research problem, thematic questions and research goal. Furthermore, delimitations, intended audiences and structure of the thesis are presented.

1.1 Inclusive digital socialisation for digital youth

A background to the thesis is provided below, including explanations of core concepts to understand the research problem and questions.

1.1.1 Culture and inclusive socialisation

Culture “is the system of meanings shared by groups of people as encoded in their language, music, arts, and other expressive and representational forms and systems” (Danesi and Rocci, 2009 p.137). In digital culture, people share meanings by communicating both face-to-face and online. Socialisation is “the process whereby an individual learns to adjust to a group (or society) and behave in a manner approved by the group (or society)” (Encyclopædia Britannica, n.d.). Socialisation is necessary for all citizens in order to participate in society and keep society together. Thus, socialisation has to be inclusive. Socialisation can also be seen as to restrain social responsivity (the willingness to respond socially), which in pure form is free of the norms and behaviours favoured in a group (Asplund, 1987). I.e. to be socialised is to be normalised. Furthermore, social response and asocial non-response co-exist; as social response is directed toward something of interest it also implies being turned away from everything else (Asplund, 1987). Today, this
may be related to e.g. issues of exclusion in school for pupils diagnosed with attention deficit disorders. Inclusive socialisation is a self-contradiction if it requires the individual to be normalized. However, this may be resolved if the environment is normalized, as explained below.

1.1.2 Digital socialisation, digital youth and gamers

Digital socialisation is to socialise in digital culture, i.e. to learn the ways of living online, across national borders, local cultures and societies. This is especially relevant and problematic for youth, which can be illustrated by quoting the German sociologist and pedagogue Thomas Ziehe, preceding the wide Internet adoption of the 1990’s:

“Rarely has a society raised the abstract myth of "youthfulness" to such an ideal, and at the same time underestimated or even ignored the new problems associated with young people's life situation” (Ziehe, 1989 p.48) [auth.transl.]

The problems Ziehe relate to are consequences of modernity, such as the dissolution of generational boundaries and traditions; there is a greater need of motivation to learn something in-depth due to all available affordances (ibid), i.e. to turn away from other things (Asplund, 1987). Ziehe dissolves generational boundaries of youth by focusing on ability to handle communication alternatives rather than age (Norgaard, 2000); in other words to be socialised in digital culture. For instance, in a study based on a seven-year long survey of problematic online behaviour of adolescents in Korea, the authors conclude that “school-based digital socialization to prevent adolescents’ online delinquency is inevitable” (Kim, 2015 p.650). However, this also requires digital literacy among adults (ibid.).

The term digital native was coined in writing by Prensky in 2001, where he argued: “Our children today are being socialized in a way that is vastly different from their parents.” (Prensky, 2012 p.76). However, with reference to a class perspective brought up by Lee (2008), digital natives presupposes regular access to computers: “Socio-economic background still plays an important role in shaping young people’s access to and use of the internet, and this tends to disadvantage those from poorer families more.” (Lee, 2008 p.148). Given this class perspective, critique of digital natives (Almeida et al., 2011), and Ziehe’s (1989) view of youth as their ability to use communicative alternatives, digital youth may better represent those who are in the process of socialisation in digital culture. In other words, youth within the limitation of 43% of the world population who have “some form of regular access to the
Internet” (Broadband Commission for Digital Development, 2015 p.8). In Sweden, 98% of boys and 97% of girls aged 9-12 years play games (on personal computers, game consoles, and/or tablets) (Swedish Media Council, 2015b). Gamers are here digital youth whose main interest are games (on computers/consoles). Almost every other boy at the age of 13, and more than one third at age 18 play more than three hours per day in Sweden. Gamers among girls aged 13 represent ~5%, and at age 18 ~1%. (Swedish Media Council, 2015b) At lower age however, the gender difference is smaller; at age 9, 11% of boys and 7% of girls are gamers. Thus, people are not born as digital natives but learn (socialise) to be digital youth or gamers given opportunity, norms and interest (social responsivity).

1.1.3 Barriers for inclusive digital socialisation

The socialisation process in digital culture is a challenge for digital youth, who have to potentially acquire all local cultures of those participating on the Internet. The focus of this thesis is on digital youth in school age, due to the need of an inclusive digital socialisation and a digital gap between school and societies that are increasingly transformed by digital culture. School (formal education) needs to be relevant for society and digital youth who play games. However, despite the contra-factual nature of modernity (Giddens, 1997) and cultural release (Ziehe, 1989) where traditions are less meaningful, the so-called modern school has remained basically the same as when it was incepted in the 18th and 19th centuries with schoolbooks, schedules and classrooms. The institutional inertia is a barrier for change in school (Liedman, 1997, Liedman, 2011), necessary for making school relevant in digital society for digital youth.

School is a globalised, institutionalised phenomenon with different local issues (e.g. dropout rates, language barriers, and socio-economic gaps). Entertainment computer games is also a globalised phenomenon, but are rarely played with teachers in school. Thus, digital youth have limited institutionalised support for digital socialisation. Recent research show the potential of games for education e.g. (Shaffer et al., 2005, Clark et al., 2016) but there are different views of what constitutes games; educational games are usually not part of the game culture among digital youth, see e.g. (Swedish Media Council, 2015b). Another barrier related to education is that games can be inaccessible for people with disabilities (Yuan et al., 2011), to some extent due to lack of available knowledge but also awareness among game developers. Furthermore, within limits of international human development or ICTD (Chen, 2015), and the class issues and limited access to Internet described in the previous section, many games may be difficult to use due
to cultural, technical and economic barriers. (These issues are further elaborated upon in the Extended background).

1.1.4 E-inclusion through inclusive design

As discussed above, education, games, and accessibility are related. Thus, to overcome barriers for inclusive digital socialisation, environments must be normalized by design from the holistic perspective of e-inclusion:

"e-inclusion refers all efforts by the public and private sector; civil society and the technology community to ensure full participation of individuals and communities in today’s knowledge-based society by (1) addressing the various inequalities that occur at the level of access, motivation, skills and usage related to ICT; and by (2) establishing policies and programs that build upon the use of ICT to achieve wider inclusion objectives." (Bleumers et al., 2012 p.16)

Furthermore, Bleumers et al. (2012) concludes with four policy recommendations for the EU commission: stimulate research regarding 1) diversity of gamers and practices; 2) game development tools, 3) ecology of inclusion in games, and 4) living labs involving formal, non-formal and informal learning contexts. Related to diversity of gamers and practices, in the International Classification of Functioning, Disability and Health (ICF), the World Health Organization (WHO) combines social (society), psychological (individual) and biological (medical) models of disability into a unified framework (WHO, n.d.). The ICF framework means that disability and accessibility affects all, to varying degree throughout life, in different situations. The social model goes beyond the individual limited functioning to include how these relate to normality (Giddens, 2007). Related to the third policy recommendation of ecology, this means that disability is to some extent designed, here created by e.g. game developers and educators but also that disability can be reduced or removed with accessible design for e-inclusion. The fourth policy recommendation of learning contexts for e-inclusion can be related to the issue of motivation brought up by (Ziehe, 1989) as well as skills and usage of ICTs within limits of human development. One example is non-formal learning contexts at telecentres1, providing ICT services for local communities, of special relevance in underprivileged communities in rural areas, e.g. tea estates in Sri Lanka. Another example is game oriented education, where education rather than games is designed to include digital youth who play games.

1 www.telecentre.org (visited 2017-02-27)
Terms like inclusive design, universal design and design for all are often used interchangeably. Universal design literally means design for all, and has its roots in architecture of the built environment (Stephanidis and Salvendy, 1998), which often has to be designed for all (as far as possible). However, it is practically impossible to adapt all built environments to perfectly suit each individual. For example, a door opener has to be positioned so those most in need can reach the button to use it (e.g. a person using a wheelchair), which may be lower than optimal for most people. A digital environment however, can be individually adapted (or normalized). A computer is by its very core design a universal machine, where binary digits (bits) can represent virtually everything. One key to enable this potential is to design development tools for developers of applications (e.g. games) that ease the implementation of accessibility, i.e. the second policy recommendation. A tool can be an application in itself but can also be a method or a model. Game accessibility is a field of research that aims to include all who want to play games, regardless of disabilities or other limitations. This thesis addresses the four recommendations (diversity, tools, ecology, and learning contexts) based upon the potential of digital environments for e-inclusion, through inclusive designs with game oriented education but also game accessibility.

1.2 Problem

The problem is that digital youth have to overcome barriers of digital socialisation, such as lack of e-inclusion in education, games and underprivileged communities, often with limited institutionalised support. This problem is relevant, as all digital youth need to be socialised online by participating in practices in digital society, such as attending education and playing games. The significance of inclusive digital socialisation is from a social perspective to keep digital society together, and from an individual perspective to have equal opportunities of both education and games. Solving the problem is a challenge due to different local requirements (e.g. privileged / underprivileged communities), the digital barriers between school and digital society and inaccessible games for disabled people.

1.3 Thematic research questions

To solve a part of the initial, practical problem above, the following thematic questions (T#) are explored:
How can environments for inclusive digital socialisation be designed for digital youth who:

T1) are gamers that are excluded in school;
T2) are living in underprivileged communities; and/or
T3) have disabilities and play games?

A related thematic question is:

T4) how can education about game accessibility be designed for game developers?

These four thematic questions are decomposed into more specific questions (Q#) in the included papers, presented in Part 1 (game oriented education) and Part 2 (game accessibility) of this thesis.

1.4 Research goal

The research goal is to create a prescriptive model for how inclusive digital socialisation can be achieved for digital youth in a global context. To achieve the goal four different artefacts are investigated in four studies, each relating to the thematic questions T1-T4:

1. A dialogue based, game oriented education for excluded digital youth in Swedish schools (Paper IV)
2. Game oriented workshops at telecentres for digital youth in underprivileged communities of Sri Lanka (Papers I, II, III)
3. Accessible and balanced game interface design for blind versus deaf game play (Paper V)
4. A curriculum framework for student (and professional) game developers to learn about game accessibility (Papers VI, VII)

1.5 Delimitations

This thesis focuses on how to design environments for inclusive digital socialisation of excluded digital youth (in school, games and underprivileged communities). While the goal relates to a global context, studies 1-3 are limited to Sweden and Sri Lanka. Study 4 takes a wider scope including people from several countries within EU, as well as USA, Brazil, Australia and Korea. All studies involve education (formal and non-formal) but are limited to either Swedish schools, Sri Lankan schools for deaf and blind, Sri Lankan telecentres, and universities internationally. Still, there are forms of education that are not directly included, e.g. informal education. Regarding other forms of inclusion,
some related issues about gender are discussed in the included papers, which may be topics for future research. Furthermore, while there is a clear connection between accessibility, disabilities and ageing the thesis does not focus on elderly. Also, the thesis excludes more than half of the world population who do not have regular access to the Internet (Broadband Commission for Digital Development, 2015). Finally, the thesis presupposes an interest in games that excludes digital youth who do not fit this profile.

1.6 Intended audiences

The intended audiences of readers are related to the definition of e-inclusion above: “the public and private sector; civil society and the technology community to ensure full participation of individuals and communities in today’s knowledge-based society” (Bleumers et al., 2012 p.16). More specifically, the audiences are professionals within: 1) formal education (schools, universities); 2) non-formal education contexts (telecentres); and 3) students and potentially professionals in the game development industry. The third may achieve change of games as digital environments for inclusive socialisation, while the former two may achieve change for inclusive socialisation through games within their educational contexts.

1.7 Thesis structure

The remainder of the thesis is structured as follows. The extended background section provides related research of education and games from perspectives on inclusion, such as game accessibility research, human development research about telecentres, and a conceptual framework.

In the methodology section, overarching philosophical assumptions as well as a discussion about ethics and verification of data is presented. The thesis comprise four studies focusing on different activities in a design science framework: problem explication, requirements definition, development, demonstration and evaluation of artefacts (Johannesson and Perjons, 2012). The four studies are presented in two main parts, as described in Table 1.

Each study relates to thematic questions (T#), that in turn relate to more specific questions (Q#) in each included paper. The selection of methods are discussed and motivated for each study, and how they were applied to collect and analyse data. Furthermore, problem and requirements, artefact and evaluations are presented for each study where applicable. Finally, a concluding discussion relates the findings in all four
studies with concepts and theory in the extended background. At the end there are concluding discussion, summary in Swedish, appendices and references.

Table 1: Thesis parts, studies, papers, activities, and (thematic) questions

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<td>Evaluate</td>
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2 Extended background

This chapter presents related research, theories and concepts to position the studies and discuss the findings at the end of the thesis. First, a conceptual framework is presented, followed by the relations between games and education, telecentres, and accessibility.

2.1 Conceptual framework

The research questions in this thesis are qualitative that needs to be bounded and focused, as an anticipatory data reduction or preliminary analysis in a study based on tentative ideas (Miles and Huberman, 1994). The conceptual framework (Figure 1) of inclusive digital socialisation relates to social systems theory and systems as difference (Luhmann, 2013); the social system of society has gradually been decomposed into specialized subsystems, a functionally differentiated society.

For instance, social systems such as education, games, and telecentres are problem areas that require solutions and therefore require communication. Formal education systems are in focus as long as you choose to participate in communication (e.g. at a university) or are coerced to do so (in school). Game systems are usually in focus when you voluntary participate in playing a game. Telecentre systems are in focus when you either voluntarily participate to e.g. learn something, interact with someone online or play games, but visiting the telecentre can also be part of school curricula or work.

Digital socialisation presupposes communication online participating in different social systems. Communication includes information, utterance and understanding; without understanding communication the social system can not continue to exist (Luhmann, 2013). Furthermore, to be able to perceive information is critical for understanding; thus consciousness and the psychic system is critical for social systems. (Luhmann, 2013).
Social systems are open systems interacting with other systems, involving two or more individuals with a shared focus. In this thesis, examples of social systems are education, games and telecentres and the relations between these. Luhmann (2006) explains that there must be a difference between system and environment; the meaning exists in the difference, without which the system fades into the environment. In social systems communication is the only mode to reproduce this difference; in contrast to the mode of action that can occur without another person, e.g. brushing teeth. (Luhmann, 2006) In social systems there is interpenetration between system and environment, but only in the sense that the system prerequisites certain environmental conditions; the environment can not be included in communication. (Luhmann, 2013)

As social systems gain their meaning from being different from the environment (Luhmann, 2013), there is a demarcation line between the system and the environment – what is included in the system and what is not included. Digital youth, who live in the environment of digital culture, need to interact with social systems such as education, telecentres and games, and the demarcation line can be seen as the interface to each system. While ‘interface’ has a specific meaning as the connection between human and computer, in system theory interface is the connec-
tion between different systems. In digital culture, interaction between people can take place face-to-face and/or via computers. However, communication “lies beyond the mere use of language. Somebody must be there who can be reached and who is capable of hearing or reading.” (Luhmann, 2006 p.48). Thus, the consciousness of the psychic system means there is a need of an interface for perception and understanding of communication that has to be inclusive.

Social systems such as education or games have different barriers or differences related to the environment, requiring different interface solutions for digital youth. Depending on individual and local limitations in the environment, the interface has barriers for e-inclusion defined as the problem in this thesis: The problem is that digital youth have to overcome barriers of digital socialisation, such as lack of e-inclusion in education, games and underprivileged communities, often with limited institutionalised support. To overcome these barriers, the thematic questions are explored in four studies in this thesis (Figure 1). The following chapters elaborate on the social systems – education, telecentres, and games – and their relations from perspectives of e-inclusion.

2.2 E-inclusion through education and games

Formal education has potential to reach all youth in a given society, especially if education is free as in e.g. Sweden and Sri Lanka including university; although in Sri Lanka it is limited to the bachelor level (Liyanage, n.d.). However, about 1/3 of pupils (mostly male) quit (dropout) or fail to grade in Swedish secondary schools (Swedish Association of Local Authorities and Regions, 2012 ). Hence, it is obvious that school does not reach all.

In a high-income country like Sweden, it may seem strange that the institution of formal education (school) fails to include 1/3 of secondary school youths. However, the relevance of school (but not education) in Sweden can be questioned; the so-called modern school was designed to educate for the industrial society in the 19th century, but manufacturing industries have gradually moved to middle or low-income countries during the last three decades.¹ (Worldbank, n.d.). School has also been criticised by most western pedagogical visionaries in the 20th century; it is hard to find anyone who is positive to school (Andersson, 2001). Thus, what was once the ‘modern’ school is now better described as traditional school, at least in Sweden. As (Giddens, 1990) has ex-

² Industry % of GDP in Sweden; 1981: 32.1%; 2014: 26.0%. Difference: -6.1%
³ Industry % of GDP in Sri Lanka; 1981: 28.0%; 2014: 30.1%. Difference: +2.1%
plained, time-space is loosened in modern society. In school however, time-space is usually strictly controlled by the schedule. Thus, it may be necessary to go from school to other forms of education, rather than trying to improve the existing school system.

Digital literacy among Swedish youth is high regarding use of digital services (Swedish Media Council, 2013, Swedish Media Council, 2015b), several of which were originally developed by Swedish ICT and game companies. This means that using Internet services for learning may seem more relevant for many Swedish youth today than attending school. However, this also means that youth are left to socialise themselves online, i.e. acquiring all cultures on the Internet with limited institutionalised support. This includes those who do attend schools where teachers lack digital literacy. An exception is perhaps digital youth with digitally literate, highly engaged and privileged parents or families. Socio-economic factors such as income and education of the family is closely related to opportunities for digital socialisation (Almeida et al., 2011).

2.2.1 Playing games in educational contexts

A concise definition of playing games is provided by Suits (2005 p.55): “playing a game is the voluntary attempt to overcome unnecessary obstacles”, i.e. an activity driven by intrinsic motivation. Scholars have discussed the connection between games in general and education at least since Plato, as noted by (Malone, 1981). Here, some perspectives on games and play in education are presented. Both games and education are environments for socialisation. By playing games one may learn how to act in games (digital culture) and by attending formal education one may learn how to act in society, which is merging with digital culture. Thus, combining games and education seem natural and the etymological meaning of school is leisure (Huizinga, 1955). However, to achieve change it is necessary to go beyond utopian grand schemes; such projects “are often disconnected from social realities” (Schuler, 2001 p.161). This may explain why the traditional so-called ‘modern’ school persists, despite the vast critique of school (Andersson, 2001), the contra-factual nature of modernisation (Giddens, 1990) and the fact that society in many countries have changed profoundly since the inception of the modern school in the 18th to 19th century. Therefore, it is important to maintain a critical view on games in education instead of only creating educational games with focus on content: “Rather than advancing education, we risk turning back the clock on decades of critical pedagogy and social research to replace the sandbox of play with a

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4 Swedish Game Developer Index 2016: https://goo.gl/GXaKhm (accessed 2017-02-01)
2.2.2 Content, dialogue and understanding

The problem of content is that, it is not the content that makes a discipline but rather social practices (Gee, 2007) such as dialogue about the content. This reasoning is similar to Kant’s principle of question propagation, i.e. where answers (facts or knowledge) create new questions in a dialectic inquiry. Lockhart concludes in his lament on math in school:

“So let me leave you with the only practical advice I have to offer: just play! You don’t need a license to do math. You don’t need to take a class or read a book. Mathematical Reality is yours to enjoy for the rest of your life. It exists in your imagination and you can do whatever you want with it. Including nothing, of course.” (Lockhart, 2009 p.139)

Thus, from this perspective there is no need to create a math ‘game’. Games designed for entertainment can be used also for formal educational purposes (Wiklund and Ekenberg, 2009). Games can be played as such for education by having a dialogue (during and/or in-between game play sessions) e.g. about Lockhart’s “Mathematical Reality” related to scenarios in the game world. In ancient Greece, dialectics was seen as the most important skill in a university educated person, i.e. the ability to test arguments against each other to come up with the truth (Liedman, 1997). Furthermore, Erasmus complained about having to just follow instructions, and not ask critical questions (Huizinga, 1955). Luhmann’s social system theory also builds upon understanding; communication is a prerequisite for social systems to exist, and understanding what is communicated is necessary for communication (and the system) to continue. Schuler (2001) questions if it is possible to create a text purely for entertainment; thus, it can be questioned to what extent games is purely entertainment, even if that was the intent of the game designer. In other words, games may be played to combine dialogue-based education – which is informal in character – with a formal education system.

2.2.3 Forms of education with games

Computer games and learning has its roots in theories of intrinsic motivation, and one of the earliest work in this field was made by Malone (1981) and (Malone and Lepper, 1987). Today, there are three forms of game-related education identified in research: game based learning (GBL), game oriented education (GOE), and game education (GE),
which can all be informal, non-formal or formal. In a review of recent research, Boyle et al. (2016) identified 71 papers about commercial off-the-shelf (COTS) entertainment games, and 72 papers about games for education. The survey do not mention game oriented education to enable playing entertainment games; on the contrary the paper concludes that there “has been a move away from using COTS games for learning due to difficulties in integrating them into the curriculum and an acceptance that it can be more useful to develop games that address specific curricular objectives” (Boyle et al., 2016 p.188). However, given the vast critique of school (Andersson, 2001) there are well-grounded arguments to design a game oriented formal education, rather than trying to conform games to school curricula as suggested in (Boyle et al., 2016). Thus, this thesis focuses on GOE, mostly formal (alternative design of school) or non-formal (game workshops at telecentres). Within GE the focus in this thesis is on the specific topic of game accessibility to improve inclusion in games. First though, a brief critique of GBL is useful as contrast.

Game based learning usually consists of games made for educational purposes, i.e. educational games (a.k.a. serious games). Edutainment is a concept closely related to GBL. The problem with GBL (and edutainment) is that they are designed with extrinsic motivations of achieving educational goals external to the game. “As with gamification, there is a question of whether these school-approved games will actually engage children meaningfully in curricula and activities that hold no intrinsic value” (Nolan and McBride, 2014 p.596). Also, Caillois (2001) makes a difference between play and productivity; productive play is what he calls corrupted play.

So-called sandbox games such as Minecraft may have some potential to overcome this barrier, as it is a game played voluntarily outside of school by many digital youth, while also being easy to modify as construction is part of the core game play. Minecraft is closer to what Caillois (2001) calls paidia (free play), as opposed to ludus (controlled play). The latter is close to how Huizinga view rules of a game as absolutely binding (Huizinga, 1955). However, it is still a hard balancing act not to corrupt game play by focus on production or education; gameplay has to be intrinsically motivated, where education can be achieved through dialogue about the game and game play.

Sáez-López et al. (2015) found that Minecraft was appreciated by students but was considered a waste of time by parents, and moderately appreciated by teachers; these results reflect the digital gap between school and games, but also the parent’s conception of school. In contrast to Minecraft, simulators (like a flight or surgery simulator) have a clear extrinsic motivation and do not pretend to be a game, although there may be game-like features. The target group is usually profession-
als or students (e.g. pilots, surgeons), i.e. people with a special interest in the topic, which may explain part of the success of such simulators where the special interest in the topic provides intrinsic motivation.

Game oriented education (GOE) emerged as a critical pedagogical alternative to school for pupils who were gamers, some of which were disaffected and/or socially excluded. One example of this was conducted in Sweden between 2002-2006 (Wiklund and Ekenberg, 2009). It was called the Digital Room, created by Göran Lange at Stockholm University, followed up in a later study in one of the included papers (Paper IV). It is described in more detail later, so a brief description can suffice here; a dialogue-based formal education design based upon COTS entertainment games, unmodified for educational purposes.

Game education (GE) has grown from the needs of the expanding game industry, but also to enable game research (Zyda et al., 2008). Furthermore, many educational institutions also use the intrinsic motivation of games to attract students to more generic subjects in e.g. computer science. These may be some reasons why game education has become quite popular, among both university institutions and students. However, globalisation including access to ICTs and Internet is unequally spread across the world, which is discussed in the next section as prerequisites for games in education.

2.3 E-inclusion through education and telecentres

Development research can be defined as “research which is relevant for understanding the interlinkages and transition processes on global, regional and local levels and which can make an important contribution with this knowledge to poverty reduction, expansion of human rights and sustainable development.” (Research Council of Norway, 2007) To achieve inclusive digital socialisation – considering the global yet local nature of digital culture – it is necessary to discuss issues related to international development research, especially in terms of human development.

One key of human development is the socio-economic situation where “[o]ne third of the world’s population lives below the poverty line with limited access to ICT and are further marginalized based on gender, rural-urban and poor-rich gaps.” (Windsor and Royal, 2014 p.164). This requires a social responsibility among both organisations and individuals, to balance economic development, welfare and the environment (ibid.), closely related to e-inclusion. Heeks (2009) out-
lines good practices for successful ICT in development (ICTD)\(^5\) projects, in three main categories: 1) Actors and Governance (stakeholders and open, competitive environment); 2) Sustainable projects (financial and social sustainability, local ownership); and 3) Design techniques (local participation, appropriate technologies, local development goals, and project risks).

2.3.1 E-inclusion and telecentres

In a lower middle-income country like Sri Lanka\(^6\), school leavers are usually youth who have finished their ordinary or advanced levels\(^7\) (two or four years after nine years in compulsory school) but have to support their families by working instead of attending higher education. However, there are also issues of school dropouts or non-attendance in compulsory school (5-14 years of age). In a UNICEF report, the Sri Lankan Minister of Education says that the “survey has identified poverty, illiteracy of parents, distance to school and various disabilities as the main reasons for some children avoiding school” (UNICEF, 2013 p.iii). The tea estates had the highest percentages of 5-14 years who never attended school (2%) and dropouts (2.3%), compared to 1% and 0.8% respectively in the total age group (UNICEF, 2013 p.2).

Furthermore, people living in underprivileged communities such as tea estates of Sri Lanka, often have to rely on so-called telecentres to get online and access digital services beyond simple text messages and e-mail. A definition of telecentres is to “provide physical places for people to access and engage with new communication technology” (Schuler, 2001 p.176). However, the central role of telecentres in Sri Lanka has been offline services with e.g. courses in word- or image processing. Telecentres has potential to achieve e-inclusion, especially if combined with formal or non-formal education. Some of the first telecentres originated in the rural area of Vemdalen, Sweden in 1985 (Falch and Anyimadu, 2003, Shadrach, 2012). Simultaneously in the USA, Antonio Stone started the Playing2Win centre in Harlem (New York) during the 1980’ies (Shadrach, 2012) and is now spread across the world, e.g. Ghana (Falch and Anyimadu, 2003). Hence, all these countries have their own challenges regarding inclusive digital socialisation, i.e. enabling all to acquire digital culture, shared across national borders, local cultures and societies. Inclusion of rural areas has continued to be perhaps the strongest incentive for telecentres, especially in

\(^5\) A related term is ICT for development (ICT4D), but it can be argued that human development projects should be done with rather than for people.

\(^6\) http://data.worldbank.org/country/sri-lanka (Visited 2016-09-02)

\(^7\) Sri Lankan (O)rdinary level: ages 15-16, (A)dvanced level: ages 17-18
lower-income countries, e.g. in Sri Lanka (Mozelius, 2014, Hanna, 2008).

2.3.2 Educational interventions at telecentres

Based upon conclusions by Mozelius (2014) rural areas of Sri Lanka face a number of obstacles or barriers: 1) a shortage of teachers, sometimes no teachers at all; 2) a varied infrastructure around the island; 3) language barriers, especially in English. To address these barriers, Mozelius (ibid.) recommends a top-down-bottom-up concept, i.e. provide initial support for starting up decentralised Sri Lankan ICT4D hubs in rural areas, and let local actors address long-term goals. ICT4D hubs disseminates knowledge region-wide and are “meeting points for students, teachers, subject matter experts, instructional designers, content developers, technicians, support staff, content development and facilitation”. (Mozelius, 2014 p.44). Telecentres but also schools are examples of physical ICT4D Hubs, and online environments are virtual ditto (ibid).

ICT in development (ICTD) typically has to be considered to be low cost regarding both equipment and maintenance, work with low and unreliable infrastructure such as electrical supply and Internet, and be easy to use (Chen, 2015). Designers also have to consider the political and cultural context beyond an objective rationality agenda of modernisation to avoid failure; there are differences between rational design and political actuality (Heeks, 2002). For instance, different models of telecentres exist in Sri Lanka; some are government funded while others are run by e.g. worker unions, and interventions may be politically sensitive. Thus, it is important to get permission for studies at telecentres from the organizations.

In Sri Lanka, the increasing access to Internet (Telecommunications Regulatory Commission of Sri Lanka, n.d.), smartphones (GSMA, 2015) and Wi-Fi also enables more people to play games. Internet based multiplayer games has potential for educational purposes, as have been discussed in section 2.2 and subsections. Such games are limited by Internet connectivity, stability, bandwidth and ping time in ICTD contexts such as rural Sri Lanka, but may be possible in the future if digital infrastructure is further improved.
2.4 E-inclusion through education and game accessibility

Despite the potential for education, games are often inaccessible for disabled people (Yuan et al., 2011), beyond issues of lacking access to computers and the Internet in general. Legislation in the USA, i.e. the Communication and Video Accessibility Act or CVAA (FCC, n.d.), recognized the fact that games are a communicative means in 2015. This legislation had immediate international impact due to the global market of games; the two major game console companies (Microsoft in USA and Sony in Japan) made accessibility updates available in 2015. While legislation for game accessibility is an important recognition, there is a need both to learn more about how to design accessible games for e.g. cognition (Yuan et al., 2011) and how to design education of both game students and professionals in the game industry for such accessible game designs.

2.4.1 Accessibility in the field of games

Accessibility in the field of games can be divided in two sub-fields; game accessibility, and workplace accessibility for game developers. The focus on inclusive digital socialisation relates to both, to create games accessible not only for disabled but also by disabled people. I.e. the workplace for a game developer is dependent upon accessible games and tools for making games; for instance, the line between the game and game editing tools is sometimes blurred (in e.g. sandbox games). Thus, a common denominator of the two subfields is game accessibility, which is the main reason for focusing on this topic.

Game accessibility has been researched since the early days of the game industry (Hughes, 1981, Burnham, 2001), and has gained increased interest in the last decade with a significant amount of publications (presented below). Access to one of the most common forms of activities in digital culture – playing games – is a prerequisite to achieve inclusive digital socialisation. Due to the lack of standards in game engines (compared to the W3C web standards\(^8\) and accessibility\(^9\)), game accessibility is harder to achieve; each game engine or game developer has to develop solutions ad hoc. Standards are but one piece of the puzzle though; ultimately it is up to the developer to implement accessibility in their games, which require education, awareness of issues and know-how. Furthermore, understanding how games can be made more accessible also has relevance for several related fields, such as virtu-\(^{8}\) https://www.w3.org/standards/ (accessed 2017-02-01)
\(^{9}\) https://docs.webplatform.org/wiki/concepts/accessibility (accessed 2017-02-01)
al/augmented reality and generic multimedia platforms such as the canvas tag and WebGL support introduced with HTML5. One related issue is web accessibility for deaf-blind, where the author and colleagues explored a design of Morse-coded haptic feedback using a game controller (Norberg et al., 2016).

Article 31 of the United Nations (UN) Convention on the Rights of the Child, says: “States Parties shall respect and promote the right of the child to participate fully in cultural and artistic life and shall encourage the provision of appropriate and equal opportunities for cultural, artistic, recreational and leisure activity” (United Nations, 1989). Furthermore, article 30 in the UN Convention for Disabled adds both equal access and the school system: “To ensure that children with disabilities have equal access with other children to participation in play, recreation and leisure and sporting activities, including those activities in the school system” (United Nations, n.d.). UNICEF (2008 p.15) provides a further explanation of Article 30:

“People with disabilities have the same right as others to participate in and enjoy the arts, sports, games, films and other fun activities.”

It should be noted that UNICEF explicitly mention games, which is important to achieve inclusive digital socialisation. In EU with (currently) 28 member states and different legal systems, standardisation and recommendations is the common approach. With the Communications and Video Accessibility Act or CVAA (FCC, n.d.), USA has taken the first step for legislation regarding the treaty for disabled people related to games.

2.4.2 Models of disability and needs of accessibility

Over a billion people or about 15% of the world population have a disability, which “is conceptualised as a decrement in functioning above a chosen threshold” (World Health Organization, 2011 p.290). This means that disability affects all, more or less and in different ways. As previously mentioned, the International Classification of Functioning, Disability and Health (ICF) is a framework, which provides a conceptual basis for defining disability and health. It is used both in education and community services, in different countries and cultures. (World Health Organization, 2013) Thus, the ICF fits well with the concept of inclusive digital socialisation.

Functioning and disability are opposites; while functioning relates to body functions and structure, activities and participation, disability relates to impairments, limitations of activities and restrictions of participation. (ibid.) Functioning in the ICF can be compared with functioning
and capability by Sen (1993), where capability “represent the alternative combinations of things a person is able to do or be – the various ‘functionings’ he or she can achieve.” (p.30). While Sen’s capability approach (ibid.) assesses well-being, functioning and capability, the ICF assess health, functioning and disability:

"Considering the functioning characteristics and outcomes beyond the body (i.e., Activities and Participation) and the external influences on them (i.e., Environmental Factors), the biopsychosocial model of ICF holistically addresses functioning, disability and health of the individual.” (World Health Organization, 2013 p.43)

The social model means that disability is caused by design. It is not blindness that causes disability, neither is it the wheelchair or the white cane; it is barriers such as lack of accessibility – designed environment factors – that cause disability. Similarly, it is not ADHD/ADD or dyslexia that causes disability to participate in school; it may be caused by the design of traditional school (classrooms, schedules, text books). The positive view of this is that designs can be changed; through awareness, skills and understanding of issues, game developers and educators can make environments for socialisation (games, education) more accessible to avoid stigmatizing adaptations.

Approximately 11% of people in the US are estimated to have difficulty participating in games due to a disability, based on US census data and an interaction model for games (Yuan et al., 2011). However, eventually we are all disabled in some situations throughout life. Game accessibility concerns removing unnecessary barriers for participating in game play due to disabilities or other limitations. Lack of game accessibility is especially problematic when using games in educational contexts, as education is a universal human right (United Nations, n.d., UNICEF, 2008).

Computer games challenge cognition, sensory perception and motor skills (Grammenos et al. 2009). The problems of game accessibility can be broken down into three main areas: 1) Perceive and/or understand feedback (output); 2) Decision making; and 3) Correct input via available hardware. (Yuan et al. 2011). Many game developers are also themselves in need of accessibility, both to play the games they are developing and at the workplace:

“This year, 22% of respondents identified as having a disability … the largest disability listed was psychiatric and mental illness, which represented 9% of respondents. The next largest disability category was for visual impairment and represented 6%. The third most listed disability was physical in nature, with 4% of respondents identifying this way.” (IGDA, 2015 p.11)
Further, there are professional game developers who need to learn about game accessibility without attending a school or have temporary employments (Weststar, 2015) without access to workplace education.

2.4.3 Recent game accessibility research

Although game accessibility has been researched since at least 1981 (Hughes, 1981), it is not as established as accessibility in general. To address this, an overview of research about game accessibility from 2011-2015 follows. It is a follow-up of a review made in 2005-2010 (Westin et al., 2011), although neither claim to be a complete review of the field.

The main search criteria on Google Scholar were papers published from January 2011 to September 2015 with the term “game accessibility”. While this term may exclude some papers it rendered 282 results, with widely varied focus and quality. To further narrow the scope, criteria for omitting papers were: 1) non-scientific papers, theses, books, reports, workshops, works-in-progress, patents; 2) papers about pervasive games, virtual worlds or other applications that are not primarily games; and 3) papers in other languages than English, due to the author’s lack of language skills. This resulted in 22 papers that were read closely. The papers are sorted below into the main target groups of disability profiles, but also multiple disabilities and generic issues related to implementation.

Visual: Garcia and Neris (2013) present a set of guidelines specifically for audio games, in addition to other guidelines10 that are more generic. Kim and Ricaurte (2011) present a musical rhythm game with a GUI, text-to-speech (TTS) and haptics, to create a common mobile game experience for sighted and blind. Their study can be compared to e.g. AudioQuake (Atkinson et al., 2006), where the mainstream 3D game Quake was made accessible for blind. Simões and Cavaco (2014) present a solution for orientation in games with 3D audio, with head related transfer functions (HRTFs). HRTFs are especially useful for virtual reality games to perceive precise location of sounds, related to head movement.

Hearing: Collins and Taillon (2012) present SoundIcons using a symbol and an arrow pointing in the direction of the sound, like a compass. While they do not discuss the Visual Sound Radar (VSR) in the Doom3[CC] mod by Reid Kimball11 in 2006 the SoundIcons is a differ-

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10 E.g. bbc.co.uk/guidelines/futuremedia/accessibility/games.shtml, gameaccessibilityguidelines.com, and includification.com (all accessed 2017-02-02)
11 http://gamescc.rbkdesign.com (accessed 2017-02-02)
ent approach; the VSR showed all sounds within hearing range on a mini-map. Coutinho et al. (2011) makes a good analysis of how Half-life 2 closed-captioning system communicates game audio. The result is six strategies useful for designing accessible games for deaf, and comparisons with Doom3[CC]. Mangiron (2013) describes the ad-hoc approaches for subtitling games, and compares these with how subtitling is handled in more traditional media, suggesting a more detailed set of guidelines, very useful to improve captioning for deaf in games.

**Motor:** Hernandez et al. (2013) developed action-oriented exergames with children who had cerebral palsy. The result is seven design recommendations. In (Hernandez et al., 2014) they present eight design strategies related to group formation, player ability and play styles in networked games. Gerling et al. (2014) present strategies for balancing two-player motion-based games related to physical ability; they also discuss how this affects player experience and self-esteem. Scardovelli and Frère (2015) developed a system using a webcam with image processing software to enable easy adaptation of inputs for individual needs. The system may be especially useful in lower-income countries where custom-made physical controllers can be too expensive.

**Speech:** There was no paper found in this review related to the issues of speech disability, thus this could be a topic for future research. Using speech synthesis is one possible approach to participate in voice communication; however, writing text can be problematic when your hands are used to control the game and a synthetic voice may also cause a stigma and be hard to understand for others.

**Cognitive:** Torrente et al. (2012a) specifically address cognition and show that individual configurations related to identity, user interface, and goals in the game are important. The paper also provides a brief review of research in related areas such as rehabilitation and virtual reality. This work is especially important, as there is clearly a need of more research for people with cognitive disabilities regarding game accessibility. There are some developers making games specifically for cognition, but this needs to be better addressed in mainstream games.

**Multiple:** Gerling et al. (2012) conducted a study using Microsoft Kinect, to develop game design guidelines for multiple age-related impairments. The result is seven guidelines, useful for designing motion-based games for elderly and others with similar limitations. Gomez-Gurley et al. (2014) also focus on age and recommend initial rapid prototyping with abled-users simulating disabilities, to be followed-up by including ageing people with disabilities. This work can be related to the Veritas framework by Scott et al. (2015b) described below. Nordvall (2013) created an innovative version of the classic game Pong for deafblind using a consumer-level haptic arm.
Generic issues of implementation: Scott et al. (2015a) evaluated the Veritas framework, simulating impaired personas for graphical user interface (GUI) based games. This approach can identify game accessibility issues in pilot studies. Vallejo-Pinto et al. (2011) explains how sonification was implemented in the educational game engine eAdventure, which was also used for several other studies: Torrente et al. (2011) present accessibility layers; Torrente et al. (2012c) propose interfaces supporting navigation and overview; Torrente et al. (2015) evaluate a semi-automated adaptation of a user interface. These studies about accessibility in eAdventure are a good case for game engine developers to learn from. Torrente et al. (2012b), Torrente et al. (2014) argue that barriers related to cognitive disabilities need to be addressed manually. However, having a very broad range of difficulty levels may be a viable software-based approach, see e.g. (Bierre et al., 2005). Adapting content for difficulty levels may have to be done manually.

Garcia and Neris (2014) describes an approach for implementation of universally accessible (UA) games. Their data-driven approach is based on components and a factory pattern instead of inheritance to maximize flexibility necessary for UA-games. This paper can be useful as basis for an assignment in game programming education, perhaps integrating this with eAdventure. Morelli and Folmer (2014) present a way to make games accessible without modifying the source code, which they call “real-time sensory substitution”. This approach is useful for retrofitting inaccessible games without access to the source code. Ossman et al. (2012) created a development tool for varied input methods such as an on-screen keyboard, which can be used for virtually any platform. It was tested with a game console, which is relevant due to the closed system design of consoles. Gerling et al. (2013) developed a code library for Microsoft Kinect SDK, to make it easier for developers making motion based games for people using a wheelchair. A limitation of code libraries is that while they can be useful for different platforms and game engines, they are language specific.

From the overview in Table 2 (on the following page) it can be concluded that speech and cognition remain unexplored areas of game accessibility, as well as inclusive designs for both blind and deaf. There also seems to be little research about community-based approaches to game accessibility. The overview provides some guidance for creating open educational resources about game accessibility; e.g. the various instances of solutions may be used as examples or in hands-on sessions, while the references provide knowledge about how to make games more accessible. In Table 2, “type” is the more general category within the field of research to which the paper is related; “instance” is the more specific area or solution in the paper.


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3 Methodology

This chapter explains the design science framework and discuss philosophical assumptions, ethics, and data verification. Strategies and methods for data collection and analysis are presented per study in Part 1 and 2 after the Methodology section.

3.1 Philosophical assumptions

The research questions (T1-T4, Q1-Q7) were qualitative where the author’s world-view may have shaped the research. The world-view in turn required an explication of assumptions regarding: 1) ontological (what was studied); 2) epistemological (how it was known what was studied); 3) axiological (how values of the researcher affect the studies); and 4) methodological (how knowledge was acquired from the studies) (Creswell, 2013). From the ontological view, the studies involved digital youth in Sweden and Sri Lanka, as well as experts in the international field of game accessibility to better understand how to design environments for inclusive digital socialisation. The approaches to data collection were selected pragmatically, based on what works in the given situation (Creswell, 2013). Epistemologically, arguments (reasons and conclusions) for the design were based upon quotes, observations, documents and related research as basis for the Findings chapter. These arguments were largely based on interpretations, based upon empirical data and related research and theory. From the axiological perspective, the interests of the author (games, inclusion and a critical view of how education is performed) may have affected the thesis; the research questions of the thesis stem from this interest and the analysis may also have been coloured by personal experiences of e.g. school. The methodological assumptions are described in the following sections.
3.2 Design science and activities in studies

This thesis focuses on design of environments for inclusive digital socialisation, in four related studies. Design science (DS) is “the scientific study and creation of artefacts as they are developed and used by people with the goal of solving practical problems of general interest.” (Johannesson and Perjons, 2014 p.7). For instance, the four studies involved design of education (game oriented workshops, a curriculum framework), and methods for creating accessible games, including a digital artefact (game prototype). DS is a framework where different approaches and methods are used for answering the research questions and achieving the research goal, which was reflected in the mixed approaches in the four studies.

DS typically builds knowledge in iterations: “a design science project is always carried out in an iterative way, moving back and forth between all the activities of problem explication, requirements definition, development, and evaluation” (Johannesson and Perjons, 2014 p.76). DS projects may involve all five activities, but may also focus on a selection of them and move back and forth between them iteratively. (The focus of activities for each study is illustrated with Table 1 in Thesis structure on page 21). All activities were based upon related research with different research approaches and methods, depending upon the explicated problem. The process of activities can be outlined in four studies as follows:

1. The Digital Room study (Paper IV) focused on explicating the initial problem by getting the perspectives of digital youth, and more specifically gamers, who were excluded in school. This was done through ethnography of a three year, formal game oriented education (GOE), which had been tried once before and was now repeated in a different location. Based on this, the initial problem was explicated: To create environments for inclusive digital socialisation, there may be a need to move outside of school, at least in Sweden. (Paper IV)

2. Telecentres in the rural, underprivileged areas of tea estates in Sri Lanka was found to be a good case for digital socialisation outside of school, based upon a document study (Paper I). The next step was to find which telecentres could be feasible sites to collaborate with, and gain a better understanding of requirements by visiting several telecentres (Paper II). Game oriented workshops within limits of ICTD (Chen, 2015) were designed and demonstrated at two different telecentres (Paper III). Based upon findings in study 2, the problem was further explicated: disabled people did not attend telecentres, for several reasons;
working conditions in tea estates, varied physical infrastructure in rural areas and lack of accessibility.

3. To be an environment for inclusive digital socialisation, a general requirement is that games used in game oriented education (e.g. workshops) at telecentres have to be inclusive. More specifically, a problem is that games are often inaccessible for people with disabilities. To further explicate the problem, related research about game accessibility was reviewed (in the extended background). Requirements of a game for deaf versus blind was outlined, and then the game was designed, implemented, demonstrated and evaluated (Paper V).

4. The needs for inclusion in game oriented education (study 1-3) and a recent change in legislation regarding game accessibility in the US, motivated a study to educate game developers about accessibility. Requirements for a curriculum framework was outlined that was then designed and demonstrated (Paper VI) and evaluated (Paper VII).

3.3 Design science and design based research

The common term of design science in the field of education is design based research (DBR), originating in the work by Ann Brown (Anderson and Shattuck, 2012). DBR aims to combine relevance by developing for local practices with studies of learning to advance theory (ibid). In this endeavour, research use mixed methods and build on several disciplines, including sociology and learning science; designs learn from e.g. computer science and curriculum theory (Sandoval and Bell, 2010). Similar to the design science framework by Johannesson and Perjons (2012), DBR develops prototypes with iterative refinements through testing in authentic practices to solve real-world problems (Anderson and Shattuck, 2012). DBR has typically focused on “small-scale interventions and in the lives of individual teachers and schools” (Anderson and Shattuck, 2012 p.24) but it “is interesting to speculate if the methodology could and will be used by researchers to investigate today’s disruptive innovations” (ibid.). An example of disruptive innovation today is open educational resources (ibid.), discussed in study 4. Another example is the formal game oriented education presented in the first study of this thesis.
3.4 Alternative methodological approach

DBR and action research (AR) have pragmatism as a common denominator, but in AR the researcher usually works without support of a design team (Anderson and Shattuck, 2012). AR has also often been compared to design science (DS) in general and while there are clear similarities there are definitely differences (Iivari and Venable, 2009). The basic difference is that while action research is a strategy, DS is a framework where many different approaches (e.g. AR) can be used. AR often both aims to change a problematic situation and contribute to social science, while DS aims to push technology to the limits which can cause breakdowns and may even make a problematic situation worse. (ibid.) For instance, the solutions for game accessibility in study 3 pushed the limits of game audio to its edges. If the study had been attempting to do AR, to e.g. use the game in daily activities for increased socialisation, there would be apparent risk of putting the deaf and blind pupils in an awkward situation with a game that was not ready enough for daily use. Instead the study can be described as a quasi-experiment during workshops in a formal educational context, within a DS framework.

3.5 Verifying the data

Validity can be reduced to asking: -Have I got the right ‘thing’? However, Lincoln and Guba says that in qualitative research it is not possible to answer this question (Denscombe, 2010). The research questions of the thesis and included papers are all qualitative. Credibility (or trustworthiness) is the qualitative equivalent to validity (ibid.). For the same reasons, it is more accurate to discuss dependability of the researcher than reliability (-Have I got the ‘thing’ right?). Furthermore, transferability (to provide enough detail for comparing with other cases) is used in place of generalizability, and confirmability (researcher’s influence) instead of objectivity.

The credibility requires triangulation, a process that “involves corroborating evidence from different sources to shed light on a theme or perspective” (Creswell, 2013 p.251). Different sources are used in each study; e.g. participants, documents, related research and artefacts. For instance, in Study 2, Papers I-II investigate the context; socio-economic factors, the internal digital divide in Sri Lanka, views of parents, instructors, youth and managers. In Paper III a workshop intervention confirm some of the previous conclusions, e.g. regarding youth as the parent’s hope for getting the opportunities of ICTs. Furthermore, “prolonged engagement and persistent observation” (Creswell, 2013 p.250)
is clearly represented in Study 1 (Paper IV, a study of three years in total) and about game accessibility (Papers V-VII), a field in which the author has been involved for more than fifteen years, see e.g. (Westin, 2004).

Member checking (Creswell, 2013) was done to different extent, i.e. allowing the participants to comment on the interpretations to achieve dependability. In Papers II-III member checking was done by sending the papers to one of the telecentre managers who were interested in following up. Paper IV was not sent to the participants as it was written a couple of years after the study where e-mails were no longer available, but given the long process with continuous dialogue the author feels confident that their perspectives were properly represented. Paper V was sent to the principal of the school for deaf and blind, as the author had no e-mail addresses to the pupils. Paper VI was not sent to the participants of the survey, but the survey in Paper VII was based upon Paper VI where the same participants who agreed to participate in a follow-up study could express their views of the interpretation in Paper VI.

Finally, confirmability or clarifying bias from the outset (Denscombe 2010) enables (you) the reader to understand my position and assumptions (related to the axiological assumptions in section 3.1). Regarding education I admit that my personal school experience was not very good, although I was able to cope with the situation, i.e. I was socialised in school. However, upon reflection the somewhat problematic process was probably the main reason I became interested in pedagogy, socialisation and inclusion with a critical view. Regarding games, I grew up with home computer brands of the 1980’ies (Sinclair and Commodore) but also Mac and PCs. I continued to play games until adult age when I also developed games and now teach game development. Still, I was born in 1972 when computers were still confined to science labs, far from the ubiquitous computing many privileged digital youth have today almost as infants; 15% of 2 year old children in Sweden used Internet daily in 2014 (Swedish Media Council, 2015a). Thus I may make different assumptions both related to digital youth, as well as people who started using computers later in life.

3.6 Ethics
There are four basic principles of research ethics: 1) protect participants’ interests, by avoiding personal harm; 2) ensure voluntary participation, by proper information; 3) operate with scientific integrity, by honesty; and 4) comply with laws, e.g. copyright (Denscombe, 2010). To protect the interests of the variety of participants (pupils, telecentres visitors, disabled people and game accessibility experts), the four stud-
ies had different issues to consider, related to these four basic principles.

Pupils and telecentre visitors were youth that could be considered to be vulnerable groups as explained in (Denscombe, 2010). Thus, permission to enter the field was provided by the schools and the related telecentre organisations (ICTA and Thondaman foundation). Involving people in underprivileged communities such as the tea estates of Sri Lanka required ICTs that were low cost and easy to use; the outcome of interventions should be useful afterwards (Aluwihare-Samaranayake, 2012). For instance, free educational resources that do not require broadband connection and can be used on smartphones and telecentre computers. In contrast, the game accessibility experts (Study 4) were not a vulnerable group, but may have other considerations such as non-disclosure agreements (NDAs) in the game industry that restrict what they can say. To protect their interest, the survey questions did not ask for details in specific games, which could reveal company secrets and break NDAs.

A common practice to ensure voluntary participation is to have written consent (Iivari and Venable, 2009). However, the demand to have written consent from the outset is sometimes problematic: “Ethics committee requirements that the research relationship must be formalized through written consent at the outset also has implications for those trying to research hidden groups or those who are difficult to access (Renzetti and Lee, 1993).” (Miller and Bell, 2012 p.1). Regarding the study of game accessibility for deaf versus blind at a school in Sri Lanka (Paper V), the principal was informed both in writing (e-mail), orally (online and face-to-face) and by demonstration of the game before the game test session. Also at the introduction of the test session, the participants were informed orally – and with a Sri Lankan sign interpreter – that participation was voluntary and that they could stop playing at any time. From conversations with a peer researcher who is Sri Lankan, I learned that in Sri Lanka the principal decides. Furthermore, the game was very simple and not very violent. Another example is the study of excluded gamers in Swedish schools (Paper IV) where consent was also achieved orally, in addition to the permission from the school principal that was written via e-mail. Here, the reason for oral consent from the pupils was their previous experience of school, which had created an aversion against written text forms while having a dialogue worked well with all.
PART 1: Game oriented education

“There is no reason to truant; what should you do? Go home and play games when you have it in school?”

Pupil in the Digital Room – 2nd trial (Paper IV)
4 Study 1: Digital room – 2nd trial

4.1 Study introduction

This chapter describes a study of a three-year upper-secondary school trial-education called the Digital Room 2 (DR2), with focus on pupils’ perspectives related to the first thematic question:

T1: How can environments for inclusive digital socialisation be designed for digital youth who are gamers and excluded in school?

4.2 Problem and questions

Despite (or perhaps due to) being a high-income country, many pupils in Sweden fail to grade within the stipulated time or quit. The relevance of school (how education is performed) in Sweden can be questioned, but not of education. Previous studies showed the potential of games for education, and the gaming culture is strong in Sweden. A three-year game-oriented education (GOE) was first evaluated as highly appreciated by the pupils. However, in a move by the school administration after ~1.5 years, the GOE was gradually regressed to traditional schooling (Figure 3), which provided a unique opportunity of a quasi-experiment of comparing before and after this move. The research question in the related article (Paper IV) was:

Q1: How did the pupils act upon the consequences of the regression from game-oriented education to traditional schooling? How can these acts inform the design of education in digital culture?

Answering Q1 was necessary to further explicate the initial problem, and define requirements in the next study (Study 2).
4.3 Formal game oriented education design

This study explored a second trial of a formal GOE called the Digital Room (DR), conceived and managed by a colleague, Göran Låge. The basic structure of the DR was based on what was called ‘full workdays’, without a traditional schedule to enable gaming (as many advanced games have varied lengths of game play). There was also no traditional classroom, but there was a common physical room to also enable socialisation outside of game worlds. The educational material was based on interaction: dialogue in and about a common interest, i.e. the entertainment games that pupils and teachers agreed upon and played together. The dialogue was often related to curricula, for instance talking and writing in a specific language while playing, or playing a game that relate to history that could be discussed. The pupils were given full administrative rights to computers to enhance learning opportunities and minimize costs for technical support. Furthermore, the dialogue about games extended also to creation of game assets, such as audio, graphics and some visual scripting. The function of the DR could be described as an inclusive interface or bridge to formal education, designed for pupils who were excluded in school but highly socialised in games (Figure 2). The pupils formed a strong group through games, despite the pupils’ diverse religions, backgrounds and socio-economic backgrounds.

Figure 2: Two pupils at the Digital Room. Photo taken by another pupil.
A summary of the formal game oriented education design is provided in Table 3, related to the findings presented below in section 4.5.

*Table 3: Formal game oriented education (Study 1) and the context*

<table>
<thead>
<tr>
<th>Function</th>
<th>The Digital Room (DR) may bridge the gap between formal education and digital youth who are gamers but excluded in school.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment</td>
<td>Socio-economic challenged suburbs in a high-income country, where many digital youth are excluded in school for different reasons.</td>
</tr>
<tr>
<td>Construction</td>
<td>Built on common-interest in games among pupils and teachers, and dialogue to relate to curricula. Full workdays in adjacent rooms and trust of pupils, e.g. to administrate computers themselves for learning.</td>
</tr>
<tr>
<td>Intended practice</td>
<td>For digital youth in school age with a strong interest in games.</td>
</tr>
<tr>
<td>Other practices</td>
<td>DR may also be a possible approach for digital youth in more privileged areas, as well as those above school age with interest in games that needs to finish their studies in adult education.</td>
</tr>
<tr>
<td>Side effects</td>
<td>The regression from game oriented to traditional schooling (Paper IV) provided contrast that clarified both the opportunities of game oriented education, as well as the problems of school for digital youth.</td>
</tr>
</tbody>
</table>

4.4 Methods

4.4.1 Research strategy

The strategy for the first study was a pedagogic ethnography with quasi-experimental interjections of mandated breakdowns (Qvarsell, 1996). A mandated breakdown in education can be questions or assignments, which disrupts the everyday being in the world, with the purpose of gaining new perspectives. This could be giving an assignment to create a game in addition to the common activity of playing games. Ethnography is the study of culture-sharing groups (Creswell, 2013). This study was ethnography of gamers who were also pupils in the Swedish school system. “Ethnography is neither subjective nor objective. It is interpre-
tive, mediating two worlds through a third” (Agar, 1986 p.19). Thus, the author interpreted the pupils’ perspectives related to research and literature.

4.4.2 Data collection and analysis methods

Methods were selected pragmatically based upon the situation, in line with pedagogical ethnography (Qvarsell, 1996). A thick description was achieved through observations and interactions with the pupils – roughly one day per week during two years – combined with a continuous dialogue with the project manager (PM) on a daily basis. During the third year, data collection was made when events occurred and the situation allowed, as the school schedule controlled the daily life of the remaining students. Perspectives expressed by the pupils were presented as facts, which is aligned with ethnography to make the voices of participants heard (Creswell, 2013).

A logbook format in chronological order was used to take notes during the entire project. This logbook contributed to understanding how and why events occurred and their consequences. The facts and their chronological order were related into strips of data over time (Agar, 1986), to enable a better understanding of why an event occurred; what events happened before and after provided a context for interpretation. The ethnographic approach required an interpretative analysis of the shared culture (Creswell, 2013) among the pupils, who were both gamers and pupils with a problematic history of socialisation in school.

Ethnography may be viewed as non-analytic with stand-alone descriptions (Denscombe, 2010). A multi-site study may enable comparison of common data between sites (Bryman and Burgess, 1994). The DR provided several sites of study. First it was moved physically from one site (in a socio-economic challenged suburb) to another (downtown). Second, the DR had previously been moved from one school organization to another (located at the respective physical sites) while it still remained physically at the first site. Finally, the pupils compared the DR with their previous experiences of various schools. Thus, it can be argued that the ethnography may go beyond the anecdotal level for a more generic understanding of designing environments.

4.4.3 Method application

The data collection for Paper IV started after approx. 16 months, in the transition from the first location in a suburb to the second location downtown. The prior part of the project was documented in a previous paper (Westin and Lange, 2012) included in my licentiate thesis, and is further described as context in Paper IV. During the months during and
after the physical move, notes were taken about observations made of pupils’ social response to the new situation. Observations were participatory and unstructured; sometimes together with the PM. Dialogue was central to reach consensus about matters (Creswell, 2013) with the pupils, important for credibility of the study. The observations often confirmed the interviews but also as basis for follow-up questions in group interviews over time.

The author conducted less-structured group interviews with the pupils who were able to participate; the new situation afforded a different approach than previously (continuous observations and individual interviews), e.g. due to the introduction of a traditional school schedule, where pupils were spread in time and space. Group interviews may have a drawback as some participants can be shy, but at this point all pupils knew each other well and everyone expressed their views.

Quasi-experiments were used more during the first part of the project as mandated breakdowns to enhance learning, such as responding to a request from pupils to create their own basic music studio, or introducing clay modelling to prototype game character creation and game development with a professional level game engine. The latter activity continued a few months after the physical move, until the school administration decided to regress to traditional schooling. The quasi-experiments were not strict hypothesis testing as in a proper experiment; social experiments are problematic from an ethical point of view (Denscombe, 2010). The process oscillated between empirical data and hypothesis testing, or mandated breakdowns (Qvarsell, 1996). Interestingly, in addition to the mandated breakdowns, the occasioned breakdown of the physical move and the consequence of regression, afforded a quasi-experiment by itself.

4.5 Findings

The questions in Paper IV were:

**Q1:** How did the pupils act upon the consequences of the regression from game-oriented education to traditional school? How can these acts inform the design of education in digital culture?

To further explicate the problem, answering Q1 was highly relevant. Paper IV presents the game oriented formal education for gamers who had been excluded in school, and regression to traditional school.
4.5.1 Lessons learnt from regression to traditional school

From the pupils acts based upon the regression back to traditional school – and the consequences thereof – paper IV concludes:

1. An erroneous, anonymous notice to the Swedish schools inspectorate caused an occasioned breakdown, which in turn enabled a quasi-experiment to compare pupils’ acts are before and after the regression.

2. The resulting process following the notice consumed significant time from teaching and solving issues that was not part of the notice, such as recruiting more teachers; this made the erroneous notice into a self-fulfilling prophecy.

3. The regression caused half of the pupils to drop out, and others to truant or deprecate school again; an exception was three pupils who were not gamers but had been placed in the DR – they appreciated the regression as they were socialized in school, even though they had been unsuccessful in getting grades.

In other words, since the purpose of school is to educate youth for further studies, work and life in general (i.e. to be socialised), the regression was counter-productive (or irrational) as only three pupils appreciated the change, and half of the group (ten pupils) dropped out. Education needs to be designed based on the social responsivity of pupils who risk exclusion; the formal game oriented education design in the Digital room was clearly appreciated by the pupils. However, two schools in Study 1 were unable to sustain formal game-oriented education (GOE). Furthermore, while a similar trial between 2002-2006 (Wiklund and Ekenberg, 2009) did not regress to traditional education, it was also not sustained (continued) after the trial. Thus, after two trials within ten years at three different locations and schools, GOE in Swedish schools seemed to be a closed path, at least for the time being. The conclusion from this was to work-around school and focus on non-formal education environments where the institution is less controlled. Such environments could be telecentres where validation of knowledge is possible (which can be a problem with informal education). This was further explored in Study 2 (presented in the next chapter).
Figure 3: Regression from the Digital Room (left) to traditional school with a schedule, classrooms and textbooks (right).
5  Study 2: Game-oriented workshops

5.1  Study introduction

In the previous study, schools in Sweden were found unable to sustain formal game-oriented education (GOE) that was appreciated by pupils. Instead, non-formal education environments could be a possible way forward, such as telecentres. Thus, this chapter describes a study of telecentres in rural, underprivileged communities of Sri Lanka related to the second thematic question:

T2: How can environments for inclusive digital socialisation be designed for digital youth who are living in underprivileged communities?

5.2  Problem and questions

While telecentres originated in Sweden, they are now more common in lower-middle income countries such as Sri Lanka, where Study 2 was conducted. Based on previous studies, the problem is that there is an internal digital divide in Sri Lanka (Mozelius, 2014), and tea estates are especially important to address, as these are often underprivileged communities. More specifically, the research questions in the related articles (Paper I-III) were:

Q2: What are the manifestations of the digital divide in the Sri Lankan tea estate areas? How can these manifestations be addressed?

Q3: What kind of telecenters are there today in tea estate areas of Sri Lanka and how are they used by the local population?

Q4: How can awareness of the learning potential at telecentres beyond basic ICT skills be achieved through games?
The answer to Q2 and Q3 was necessary basis for problem explication and requirements in developing and demonstrating the game oriented workshops that in turn answered Q4.

5.3 Game oriented telecentre workshops design

These workshops were created to take the concept of game oriented education into a different context from formal education (school) in Sweden to non-formal education at telecentres in Sri Lanka. The development process started with considering the knowledge base that was examined in papers I and II as well as what was learnt from field studies in paper II. These first two papers helped to explicate the problem further, and define requirements for the game oriented workshops in Paper III.

The construction (or structure) resembled to some extent the Digital Room education (in Study 1). The workshops were full workdays, in this case two days at each telecentre. There was no schedule (i.e. with subjects and time slots) but a rough plan of the day was made in dialogue with the telecentre staff before the workshops. Within limits of ICTD (Chen, 2015) several other barriers had to be considered here (in contrast to Study 1). Due to the number of attendants and the limited room space, unstable Internet connectivity and only four to five computers, it was necessary to bring extra equipment (laptops, tablets, mobile Internet dongles and power strips). Due to the varied electricity supply, all equipment was on charge before, during and after each session. The selection of game had also to be done carefully; it must be useful also after the workshop for the telecentre visitors; free of charge, easy to download and run and get started with.

The interaction through dialogue was restrained by a language barrier, which included Swedish, English, Sinhala and Tamil languages. Through the use of existing open educational resources, more specifically a game to learn about basic programming in a visual and interactive way, part of the language barrier was removed. However, when questions raised and also during the introduction, the telecentre instructors were crucial as translators in addition to my Sri Lankan colleagues. The function of the game-based workshops for the youth (the main users of the telecentres) was to raise awareness about ICTs in general, and learn about basic programming, to enhance their opportunities in the future. A summary of the game oriented workshops design is provided in Table 4.
Table 4: Game oriented workshops at telecentres and the context

<table>
<thead>
<tr>
<th>Function</th>
<th>The game oriented workshops may help to bridge the internal digital divide, by raising awareness about ICT opportunities for learning at the telecentres.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment</td>
<td>Underprivileged communities in a lower-middle income country, where telecentres exist within reasonable distance (possible to visit within one day).</td>
</tr>
<tr>
<td>Construction</td>
<td>Local participation and design within limits of ICTD and existing telecentre resources. Similar equipment added during the workshops to enable larger groups. Full workdays. Telecentre staff for translation and collaborative design.</td>
</tr>
<tr>
<td>Intended practice</td>
<td>For digital youth for whom telecentres is an opportunity to learn more about ICTs, within limits of ICTD.</td>
</tr>
<tr>
<td>Other practices</td>
<td>For adults (e.g. parents and instructors) who also want to learn more about ICTs through games.</td>
</tr>
<tr>
<td>Side effects</td>
<td>A positive side effect was that the telecentre staff that translated during the workshops also learnt some basics of programming, an opportunity for more sustainable workshops.</td>
</tr>
</tbody>
</table>

5.4 Methods

5.4.1 Research strategy

As this study involved traveling from Sweden to Sri Lanka, it was necessary to know where to go by first gaining a pre-understanding by making educated guesses. Thus, the strategy was to start with a document study to know what part of the country to visit and which people to contact (Paper I). The next step (Paper II) involved traveling in the tea estate areas of the hill country, meeting with managers and staff of both tea factories and telecentres, as well as talking to youth who were visiting the telecentres. This exploratory case study provided both confirmations of the previous theoretical understanding but also new insights, which were not found in literature. The strategy of going from theory to practice, proved very useful in planning a study (Paper III)
aimed to help close the internal digital gap described in (Paper I), with three game-oriented workshops conducted at two selected telecentres.

5.4.2 Data collection and analysis methods

In Paper I data collection was made with a literature review method as a guide, meaning that it does not claim to be a complete review of research in the field but rather to describe the background for follow-up studies (Papers II and III). In addition to the etic (outside) perspective given by literature (research, books and documents), an emic (inside) perspective (Creswell, 2013) was also considered where the main author (Paper I) is a Sri Lankan citizen.

Paper II was a direct follow-up of Paper I, where an exploratory case study approach was chosen with different data collection methods in order to examine existing rural telecentres and how they were actually used by the people. Content analysis was conducted of existing documents and websites related to telecentres, to learn which were possible to visit. Managers of tea factories and district levels, and instructors at tea estate telecentres were interviewed. We also talked to youth visiting the telecentres and a few of their parents. This variety of methods and people provided a holistic view but also specific details about the telecentres, the visitors and the communities’ views.

Paper III took a more specific approach, restricted to two telecentres and three game oriented workshops to teach youth basic programming concepts, but also to raise their awareness about opportunities at telecentres in general. Open educational resources were used which was possible to run on the telecentres’ computers, but also on smartphones which is the growing platform among the population, yet still rare in tea estates (Paper II). Observations were made during the workshops with notes taken, followed by group discussions with all afterwards with the aid of telecentre instructors for translation between the three major languages in Sri Lanka; English, Sinhala and Tamil. Combined, the methods enabled an understanding of how game oriented education could be designed to achieve a more inclusive digital socialisation. In other words, how underprivileged digital youth in Sri Lanka could be included in the global development of digital culture.

5.4.3 Method application

The theoretical background for the study evolved for over a year, where discussions and readings of various sources lead to new findings in literature and online resources. One of the starting points was the PhD thesis of one co-author about education for all in Sri Lanka, where the internal digital divide was identified, both geographically between ur-
ban and rural areas and socio-economically between privileged and underprivileged citizens (Mozelius, 2014). The focus on tea estates was chosen in a dialogue with the first co-author of Paper I, who knew about the special situation among the Tamil population living and working in the tea estates. The document approach was further used in Paper II with content analysis conducted manually, by reading and making notes of policy documents and government as well as private actor’s websites. Selection was made with purposive sampling for this exploratory case study (Denscombe, 2010), to focus on the specific conditions for the vulnerable 4.4% of the Sri Lankan population who live in the tea estate areas (Paper I). Interviews were made with managers, instructors and coordinators. Non-participant observations were made of the technical conditions of each telecentre, regarding Internet, local networks, hardware, software and how the equipment was used.

The findings in Paper II was important for planning Paper III, where workshops were planned for several months including many Skype meetings with the telecentre managers; we needed to sort out what existing telecentre equipment to use and what to bring to enable a workshop with many children given the pre-knowledge in Papers I and II. Starting up the workshops, the whole group was briefed of the day and what to do before they were split into pairs or threes sharing a PC or tablet, following an online tutorial with instructors, my co-authors and myself helping out where things were unclear. Thus, participatory observations were made with notes written and photos taken. At the end of the workshops a debriefing was conducted and some refreshments was served, as thanks for their participation and wrapping up their thoughts about the two days per telecentre.
5.5 Findings

The following three subsections relate to Papers I-III, which are presented individually related to the main research question and problem.

![Image of tea plantations in the hill country of Sri Lanka.](image)

*Figure 4: Tea plantations in the hill country of Sri Lanka.*  
*Photo by the author.*

5.5.1 Internal digital divide in Sri Lanka

The questions in Paper 1 were:

**Q2: What are the manifestations of the digital divide in the Sri Lankan tea estate areas? How can these manifestations be addressed?**

The conclusions are five challenges in the tea estate areas (Figure 4) that were:

1. Lack of education
2. Lack of access to ICT
3. Lack of computer literacy
4. Lack of career opportunities
5. and a language barrier, although literacy rates are high in Sri Lanka. Furthermore, women and people with disabilities were at the greatest risk of the internal digital divide in the tea estates. Although the number of disabled does not seem to be higher than in Sri Lanka in general, the need to address the challenges was greater due to fewer career opportunities. For women, special focus should be on both accessing ICTs but also education, available at well-functioning telecentres (Figure 5). Due to the language barrier, developing education and other civil services in vernacular languages is vital, such as e-governance, e-health, e-learning and e-agriculture.

Figure 5: Equipment at a well-functioning telecentre in the tea estate areas.
Photo by the author.
5.5.2 Usage and types of telecentres in the tea estates

The questions in Paper II were:

Q3: What kind of telecentres are there today in tea estate areas of Sri Lanka and how are they used by the local population?

From the paper it can be concluded:

- One major TC actor is the government funded Nenasala, and the other is the Prajashakti telecenters funded by the Thondaman foundation
- Conditions between these differ (salaries, training, and competence development) which affect their possibility to achieve transformation, e.g. through education and other social services
- Communication and networking between TCs and stakeholders, combined with local knowledge and practices is important to address the future development of TCs.
- While smartphones are becoming increasingly common in Sri Lanka, they are still quite rare among in underprivileged communities of tea estates. Furthermore, smartphones also have technical limitations compared to personal computers at TCs, where there also are instructors and technical support staff available.

A surprising finding was that monkeys were part of the internal digital divide in Sri Lanka (Figure 6). One of the telecentre managers told us that a reason both satellite and ADSL Internet connections did not work well, was because of monkeys playing with the satellite dishes and telephone wires. A mobile connection solves this issue, but is in turn restricted by the mountains in the hill country of tea estates (Figure 4) blocking the signal. There is also a lack of cell phone towers in tea estates. Novel solutions such as Project Loon\(^\text{12}\) in Sri Lanka may be a possible solution.

Well-functioning telecentres (Figure 5) fill a central role also in the future, as a holistic community service to achieve inclusive digital socialisation for digital youth who are the most common TC visitors. This potential requires: 1) conditions to be improved for the TCs and staff so that services can be sustained; 2) communication and networking between TCs; 3) personal computers at TCs to complement mobiles, e.g. to learn programming. One possible approach based on these findings, is presented in the next section.

\(^{12}\) [https://x.company/loon/](https://x.company/loon/) (accessed 2017-02-09)
Figure 6. —Play to learn, right? Anonymous hill country monkey.  
Photo by the author.
5.5.3 Raising awareness of ICTs through game workshops

The question in Paper III was:

Q4: How can awareness of the learning potential at telecentres beyond basic ICT skills be achieved through games?

![Anonymised workshop participants at the Nenasala telecentre. Photo by the author](image)

In Paper III it was shown how a telecentre game workshop could be designed in order to include underprivileged digital youth in one of the most potent digital skills – basic programming:

- Using an open educational resource in form of a free, web-based game about programming\(^{13}\) was able to overcome some lack of computer literacy and the language barrier (identified in Paper I) and also to address part of the lack of awareness of ICTs.
- All participants were able to learn some basic skills in programming, and more importantly they all expressed motivation to learn more about programming and make games, although the latter may also be an expression of politeness.

\(^{13}\) [https://rode.org/starwars](https://rode.org/starwars) (accessed 2017-02-18)
• The language barrier afforded an unexpected opportunity for sustainability, as the instructors at the telecentres also learned the programming concepts while translating.
• It was concluded that the game-oriented workshop with the game-based learning application was a viable approach to raise awareness of the learning potential at telecentres.
• The web-based game (based on HTML5) made it possible to run the game on smartphones and small tablets, although a larger tablet or PC is recommended due to the drag and drop interface of the visual programming language used.

Still, there are issues to unlock the potential, some that was also identified in Papers I and II, such as competence development and funding including Internet access. Future work is to follow-up with participants so they can learn more about programming that has potential to enable development of local digital services and enable improved inclusive digital socialisation. At the time of this writing, this has started with the Nenasala telecentre (Figure 7). Another finding from this study was that disabled people don’t attend telecentres; e.g. blind and deaf adolescents are attending special schools in the urban areas, and adults with disabilities stay in their homes. To include people with disabilities at telecentres requires accessibility, and if games are used at telecentres game accessibility is required. This is addressed in the next section.
PART 2: Game accessibility

“whether people are disabled when playing the game is entirely up to the designers and developers involved”

Answer to survey about game accessibility education (Paper VI)
6  Study 3: Game for deaf versus blind

6.1 Study introduction
This chapter describes the study of development, demonstration and evaluation of a two-player game, for digital youth who are deaf versus blind, but also versus hearing and sighted. This is related to the third thematic question:

**T3:** How can environments for inclusive digital socialisation be designed for digital youth who have disabilities and play games?

6.2 Problem and questions
The problem of inclusion for disabled was explicated in Study 2, where disabled people did not visit telecentres. To make game oriented education a possible approach for inclusive digital socialisation, the games must be as accessible as possible. Previous research has demonstrated several approaches and solutions to game accessibility (chapter 2.4.3). To enable people who are blind or deaf to fully hearing and sighted people to play against each other in a fair, balanced way without changing the game rules for either group was found to be a relevant issue. The research question was:

**Q5:** How can a competitive player-versus-player game be better balanced for playing without seeing or hearing with the same game rules?

Answering Q5 was important to provide a bridge for socialisation between deaf and blind, which otherwise have limited means of communication between the groups. This is also highly relevant in game oriented education to achieve inclusive digital socialisation.
6.3 Accessible game for blind-versus-deaf

The game in this study was developed to bridge a gap of socialization between blind and deaf, and to explore a tentative method for balancing games based on sensory feedback. Based on previous research about universally accessible games with parallel game universes (PGUs) (Grammenos et al., 2009) and unified design method (Grammenos et al., 2007), this study aimed to achieve balance without modifying game rules (as in PGUs). This implies to enable blind and deaf to play in the same game universe but with different sensory feedback. This resulted in some difference in game mechanics (how the game is played, e.g. stealth as blind) but within the framework of same rules (e.g. speed, score) and input (keyboard) for both players. Design alternatives were considered using the unified design method suggested by Grammenos et al. (2007). For instance speech input was considered for blind, but was deemed inappropriate for navigation and not ideal for firing. As speech is also inappropriate for deaf, it was clear that keyboard was the best choice for input.

![Image of game prototype and keymapping](image.jpg)

*Figure 8: Game prototype and keymapping (image bottom is cropped)*

To enable a simple setup for tests the game was created as two-player on the same computer, with a shared keyboard requiring key-maps far apart for each player (Figure 8). In this game, the camera is fixed so there was no need of split screen setup common in two-player games on the same computer. (In games with different player perspectives, the different output modalities of audio and visuals for blind and deaf players respectively could accomplish the same thing).
### Table 5: Game accessibility method for balancing sensory feedback

<table>
<thead>
<tr>
<th>Function</th>
<th>The tentative method can be a point of departure in further studies for designing player-versus-player games to include deaf and blind.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment</td>
<td>Game development, education and research.</td>
</tr>
<tr>
<td>Construction</td>
<td>The method included game prototyping, initially built on related research and a unified design method for universal access. The prototype was iterated and tested in game workshops in formal and non-formal educational settings, involving users with different hearing or visual limitations. Game scores, observations and surveys were combined to collect data, analysed with standard deviation as well as thematic analysis.</td>
</tr>
<tr>
<td>Intended practice</td>
<td>Designers of accessible two-player (and possibly multiplayer) player-versus-player games may use the method.</td>
</tr>
<tr>
<td>Other practices</td>
<td>The game prototype may in a further refined version help bridge the socialisation gap between a continuum of hearing and visual limitations (from blind and deaf, to hearing and sighted).</td>
</tr>
<tr>
<td>Side effects</td>
<td>Awareness about game accessibility was raised among university game students participating in the study.</td>
</tr>
</tbody>
</table>

#### 6.4 Methods

**6.4.1 Research strategy**

The strategy was a mixed methods approach, to understand how environments for inclusive digital socialisation could be designed for digital youth with disabilities. A study involving the design of a game with an interface solution to balance the game experience for both blind and deaf gamers to play against each other was conducted, as a way to improve socialisation between the two groups (Paper V). This involved creating an artefact (the game prototype), observing digital youth at a school for deaf and blind, and redesigning the game according to findings before testing with a larger group of university game students. This represents a quasi-experimental approach, possible to use in non-formal
(e.g. telecentres) and formal living labs (e.g. schools) as was recommended by (Bleumers et al., 2012).

6.4.2 Data collection and analysis methods

Creating and testing a prototype enabled an interactive experience of the artefact, here with focus on refinement (Fullerton, 2008) as the game design was built on some basic elements in the classic game Asteroids and the follow-up Space duel, both by Atari in 1979-1980 (Burnham, 2001). This game design was chosen as it was found to be clearly unbalanced for blind versus deaf, based upon a unified design analysis method (Grammenos et al., 2007, Grammenos et al., 2009): 1) Abstract task decomposition, e.g. ‘move’, 2) Design alternatives (DA), e.g. ‘keyboard input’, 3) User attributes, e.g. ‘blind’, 4) Appropriateness analysis (which DA is appropriate or not for which user attributes), and 5) User profiles (which combinations of user attributes represent groups of users). Fullerton (2008) outlines four types of game prototypes, where this study focused on game mechanics related to game accessibility; how the game could be made more accessible by modifying sensory feedback, affording different game mechanics within the frame of the same game rules.

The methods included reading related research, as well as practical design and redesigns with observations, a group discussion and an online survey for demonstration and evaluation. The first test in the study was conducted in Sri Lanka, which made interviews difficult due to language barriers. The reason for doing the first test in Sri Lanka was that there were special schools for blind and deaf, while in Sweden they were usually integrated in regular schools. In other words, it was easier to reach the main target group this way.

As the language barriers in Sri Lanka made in-depth discussions with participants challenging, the analysis of collected data was interpretive with a “disability interpretive lens” (Creswell, 2013 p.34) by discussing the findings with related research. Another reason to avoid in-depth interviews was that the participants were youth at school and university; it was necessary to be careful not to interfere with their daily activities by spending too much of their time. With observations during game sessions and a group discussion, the test could be limited to a couple of hours in total.

Analysis of the qualitative, less-structured data from observation notes and a survey (with university students, appendix 10.1), required a thematic analysis, here based upon (Braun and Clarke, 2006). All data items were interpreted and considered equally, to avoid anecdotal themes. Themes were checked against each other, in an iterative process by the author as an active part. The game score system provided data for
game balance, based upon score differences of blind and deaf players. Standard deviation provided a clear understanding of how the score differences in each playtest session related to all playtest sessions. However, these playtest results can only be used for this particular game, with the participants involved in this quasi-experimental setup.

6.4.3 Method application
The game in Paper V was designed based upon functional and environmental requirements (Johannesson and Perjons, 2014) for deaf and blind to be able to play a time-critical, real-time game against each other on equal terms. Blind and deaf youth in school age were involved after developing a first prototype of a game. Involvement early in the research process is important to design with rather than for people with disabilities.

Non-participatory observations were made while a blind player challenged a deaf gamer where a simple score system provided clear feedback whether the game was balanced or not. The observations were followed by a retrospective group-interview immediately after the session to understand more of why and how. Notes were also taken for each session, which was compared with the score results to find whether the game was balanced for the two groups. The game was redesigned based upon feedback from blind and deaf players. A second test was conducted with one adult, Swedish blind technician. A third test was conducted with a group of 39 students (who were neither blind or deaf), conforming to the disability lens and human differences, where we are all more or less disabled; see also (WHO, n.d.). The collected data of score differences were analysed with standard deviations, and qualitative data from observations, notes, and a survey with university students were analysed with thematic analysis.

6.5 Findings
The following subsection presents findings based on paper V.

6.5.1 Balancing interface features for inclusive game play
The question in Paper V was:

Q5: How can a competitive player-versus-player game be better balanced for playing without seeing or hearing with the same game rules?
At the day of the first playtest (March 14, 2016) there was a major power outage in Sri Lanka, which is why the game was played on the authors’ laptop (Figure 9) that had batteries fully charged. The game was designed to run well on almost any PC and no networking required, in order to make it possible for the pupils to play the game also after the test.

In the first test (with 6 blind, 6 deaf pupils) it was found that the game was playable for blind but clearly unbalanced when competing against a deaf player. A major issue was a game design flaw where the deaf player used a strategy to fire continuously while rotating, eventually hitting the blind player. When told not to use this strategy, the game was found more balanced. However, that was based only the last (sixth) test session. To address this, ammunition was limited with a time for reload in addition to improved instructions. In a larger test of the second iteration, this time with 36 university students who were either blind-

![Figure 9: Playtest with deaf (left) and blind (right) pupils sharing the external keyboard (for better spacing), but use different output modalities (vision versus hearing). Photo by the author.](image)

folded or using earplugs, the game was still unbalanced but score differences were approximately half compared to the first test. While these quasi-experimental results cannot be generalised, the study demonstrates a possible, tentative method to achieve game balance based upon modification of sensory feedback to be further evaluated in future research.
7 Study 4: Game accessibility education

7.1 Study introduction
Moving from learning how to make games more accessible (in Study 3) to educating aspiring and professional game developers is important to realise research findings in practice. This in turn is a prerequisite to enable inclusive digital socialisation in games but also game oriented education (Studies 1 and 2). Thus, this chapter describes a study of development, demonstration and evaluation of a game accessibility curriculum framework for game students but also professional game developers. This is related to the fourth thematic question:

T4: How can education about game accessibility be designed for game developers?

7.2 Problem and questions
Game developers are key actors in achieving inclusion in digital culture and especially for people with disabilities. One reason is that games usually are proprietary and often runs on closed platforms such as game consoles, where modifications is harder than on PCs. Furthermore, all gamers are not able to make games accessible even if the environment would be more open for modification. While game accessibility support on consoles have improved since the change of CVAA legislation in 2015 (FCC, n.d.), the implementation of accessibility in games is still (so far) up to each game developer. Thus, education about game accessibility for both game students and professionals is important. However, all game educators are not experts in game accessibility, and game professionals may need more flexible or informal education, e.g. through open educational resources (OERs). Hence, there was a need for a curriculum framework outlining learning outcomes. The research questions were:
Q6: How could a curriculum framework for game accessibility be designed? How could OERs for game accessibility be created and shared based on the framework?

Q7: What are the opinions among educators and game developers regarding the TCF? How could the TCF be redesigned?

Answering Q6 was important to create a first tentative curriculum framework (TCF) based upon opinions from peer researchers and developers, which could then be confirmed in a second survey to answer Q7.

7.3 Game accessibility curriculum framework

The idea for the game accessibility curriculum framework originated in a request from mostly the blind gamer community, on raising awareness about game accessibility among game developers. (This request was found in an informal survey to mostly blind gamers, before a panel presentation at the Game Developers Conference in 2015 where the author participated as speaker).

Table 6: The game accessibility curriculum framework and context

<table>
<thead>
<tr>
<th>Function</th>
<th>The framework provides an organized plan of learning outcomes, to define content to be learnt regarding game accessibility.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment</td>
<td>In formal and non-formal game education</td>
</tr>
<tr>
<td>Construction</td>
<td>A table of six learning outcomes, differing designers and engineers as well as advanced and basic level learners. Depending on these different parameters learning outcomes are, either introduced, transitional or emphasized.</td>
</tr>
<tr>
<td>Intended practice</td>
<td>To be used in game education (non-formal, or formal), by educators and designers of open educational resources.</td>
</tr>
<tr>
<td>Other practices</td>
<td>The outcome may also be used for informal learning, e.g. by game development professionals.</td>
</tr>
<tr>
<td>Side effects</td>
<td>None found.</td>
</tr>
</tbody>
</table>

The reason to aim for a framework rather than a curriculum was to enable it to be useful in a range of contexts such as formal, non-formal and
 informal education. For instance, game students fall into the formal education category, while game professionals may need to learn in a more informal or non-formal way, when time permits. The relevance of the framework is further enhanced by the CVAA legislation in the US, which have had international impact since 2015.

7.4 Methods

7.4.1 Research strategy
To learn from experts in game accessibility, two international survey-based studies were conducted involving researchers and other experts in the field of how to design a curriculum framework about game accessibility (Papers VI and VII). This is a prerequisite to achieve inclusive digital socialisation.

7.4.2 Data collection and analysis methods
Papers VI-VII involved experts in game accessibility in an online survey, as it was the only feasible way of doing the study, given the international character of the study and the limited time as the CVAA had already been applied to some extent and further in 2017 (FCC, n.d.). The sampling was purposeful, i.e. targeted towards experts from both academia (peer researchers in game accessibility) and the game industry. Involving game accessibility experts enabled a better understanding of how to design education about game accessibility, which is necessary to both meet legislation but also to create game environments for inclusive digital socialisation. Qualitative data (from open questions) were analysed thematically. The quantitative data (from closed questions) were analysed with the median and frequency of the responses. The survey questions are available in Appendices 10.2 and 10.3.

7.4.3 Method application
Based upon related research identified in a review of 71 articles about game accessibility published between 2011-2015 (in the Extended background), e-mails to authors were extracted. An online survey designed based upon topics in the reviewed articles was sent via e-mail to authors of those papers, which resulted in Paper VI. The survey was also sent out via e.g. a mailing list about game accessibility. 30/49 respondents reported having an Academic position, and the remaining 19/49 respondents had Industrial, Association or Other positions. As the
analysis was made with an interpretation of the results, it was necessary to follow up the first survey with a second to confirm the interpretations, presented in Paper VII.

The development process can be described in a number of steps. 1) First, the literature review about game accessibility presented in this thesis was made (section 2.4.3). 2) Based upon this, a number of themes were defined and translated into survey questions, of what learning outcomes should be in the framework. 3) 110 e-mail addresses were extracted from 71 international research papers related to game accessibility between 2011-2015, enabling us to reach a fairly large part of peer researchers in the field, in addition to the IGDA Game Accessibility SIG mailing list14. 4) Based on the first survey, a tentative curriculum framework (TCF) was defined in a table with learning outcomes, and to what extent they were to be introduced, emphasized or transitional, for designers and engineers, and basic or advanced level students (Paper VI). 5) As the TCF was in part based upon interpretations of qualitative data, a second survey was conducted after a few months. It was sent to 23 responders in the first survey that agreed to be contacted again, plus 15 people who attended the IGDA Game Accessibility SIG roundtable at Game Developers Conference 2016, and two more who actively asked to be included, in total 40, where 16/40 responded to the second survey (Paper VII).

7.5 Findings

The following two subsections first present a tentative curriculum framework to raise awareness of game accessibility (Paper VI) and the second is a follow up with a revised framework (Paper VII) based upon feedback on the tentative version.

7.5.1 Education about game accessibility

The questions in Paper VI were:

**Q6:** How could a curriculum framework for game accessibility be designed? How could OERs for game accessibility be created and shared based on the framework?

In Paper VI 49 peer researchers and experts in game accessibility responded a survey to learn how to design education about game accessi-

14 [https://pairlist7.pair.net/mailman/listinfo/games_access](https://pairlist7.pair.net/mailman/listinfo/games_access) (accessed 2017-02-21)
bility (GA), presented as a tentative curriculum framework (TCF). The conclusions were:
- The TCF should 1) introduce GA by framing the problem, explaining user needs and stressing the change of attitudes; and 2) teach how games can be designed to be more accessible.
- Open Educational Resources may be created and shared with a Creative Commons (BY, NC, SA) license
- The OERs should be flexible and modular enough to be useful for both aspiring developers (students) as well as professionals in the game industry that must meet the recent CVAA legislation in the US, which has global impact due to the globalised game market.
- Involving all stakeholders (e.g. disability organisations, game students and professionals) is important for going forward, as well as following up with respondents of this first survey to ensure our interpretations of answers are correct.
- Developing criteria for graduation performance for what all game developers should know or be able to do is also necessary.

7.5.2 Revised curriculum framework for game accessibility

The questions in Paper VII were:

Q7: What are the opinions among educators and game developers regarding the TCF? How could the TCF be redesigned?

To verify the dependability of the interpretations in Paper VI, a follow-up survey was conducted and presented in Paper VII where 16 of 40 responded. The result was a revised framework and the conclusions were:
- The TCF in the first survey was in part confirmed, but also revised to be more flexible and concise with six learning outcomes instead of nine.
- The learning outcomes of legislation, history, and economy were integrated with knowing the needs of disabled and the scope of issues.
- To implement the framework, various existing and future resources need to be mapped to the learning outcomes to make them easy to find for educators and learners.
- Furthermore, formats and licenses to use for OERs that all stakeholders can accept need to be investigated, e.g. what formats provides best possible accessibility.
- An online deposit of use cases with corresponding interfaces need to be built to evaluate their usability, in close collaboration with all stakeholders in the game industry, academia and disability organisations.

The second iteration of the framework can thus be considered fairly grounded in the views of peer researchers, and also people in the game industry with interest in game accessibility.
8 Concluding discussion

This concluding discussion reflects on all four studies (with questions Q1-Q7) as a whole and the contributions related to the main research problem and thematic questions (T1-T4). Based upon this discussion, a model of Inclusive Digital Socialisation (IDS) is presented and explained, along with a suggested method for using the model. Furthermore, limitations of all four studies are identified from a holistic perspective, including the value and novelty of findings. This includes theoretical and practical significance, as well as social and ethical implications of the artefacts in each study and the IDS model. Finally, further research is discussed.

8.1 Answers to research questions

This thesis has explored two themes of inclusive digital socialisation, i.e. game oriented education (T1, T2) and game accessibility (T3, T4). These themes are closely related yet decidedly different; the first address barriers for education, the other barriers for playing games. Both relate to socialisation in digital culture, and both have origins in leisure (the etymologic meaning of ‘school’), although school has been transformed to obligation in the modern school system. The problem is that digital youth have to overcome barriers of digital socialisation, such as lack of e-inclusion in education, games and underprivileged communities, often with limited institutionalised support. To solve a part of this practical problem, the thesis has explored four thematic questions:

*How can environments for inclusive digital socialisation be designed for digital youth who:*  
T1) are gamers that are excluded in school;  
T2) are living in underprivileged communities; and/or  
T3) have disabilities and play games?

*A related thematic main question was:*  
T4) How can education about game accessibility be designed for game developers?
The thematic questions have been decomposed into more specific sub-questions (Q1-Q7) in the included papers I-VII. Taken together, these sub-questions contribute to answering T1-T4. Table 7 presents an overview of how the Findings chapters relate to the Extended background chapters, and how T1-T4 relate to Q1-Q7.

Table 7: Relations between questions, findings and extended background

<table>
<thead>
<tr>
<th>Findings</th>
<th>E-inclusion through Education and...</th>
<th>Games (ch. 2.2)</th>
<th>Telecentres (ch. 2.3)</th>
<th>Game Accessibility (ch. 2.4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1: Formal GOE (ch. 4.5)</td>
<td>Q1</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>T2: GOE workshops (ch. 5.5)</td>
<td>Q4</td>
<td>Q2,Q3,Q4</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>T3: GA method (ch. 6.5)</td>
<td>Q5</td>
<td>-</td>
<td>Q5</td>
<td></td>
</tr>
<tr>
<td>T4: GA curr. framework (ch. 7.5)</td>
<td>Q6,Q7</td>
<td>-</td>
<td>Q6,Q7</td>
<td></td>
</tr>
</tbody>
</table>

Below the specific sub-questions Q1-Q7 are discussed as how they contribute to answering T1-T4. A summary of the Extended background is provided first for convenience.
8.1.1 Summary of extended background

Table 8 summarises the main argument in each subchapter of the extended background, referred to in the discussion of designs below.

<table>
<thead>
<tr>
<th>Main arguments</th>
<th>Chapters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social systems have barriers for digital youth</td>
<td>2.1</td>
</tr>
<tr>
<td><strong>Games:</strong></td>
<td></td>
</tr>
<tr>
<td>Digital youth often have to socialise themselves online</td>
<td>2.2</td>
</tr>
<tr>
<td>Games in education should critically maintain voluntary play</td>
<td>2.2.1</td>
</tr>
<tr>
<td>Dialogue about games is more important than educational game content</td>
<td>2.2.2</td>
</tr>
<tr>
<td>Relate approaches to games and education with intrinsic motivation</td>
<td>2.2.3</td>
</tr>
<tr>
<td><strong>Telecentres:</strong></td>
<td></td>
</tr>
<tr>
<td>Consider local and individual socio-economic situations</td>
<td>2.3</td>
</tr>
<tr>
<td>Telecentres may bridge internal digital divides between urban/rural areas</td>
<td>2.3.1</td>
</tr>
<tr>
<td>Educational interventions at telecentres should be “top-down-bottom-up”</td>
<td>2.3.2</td>
</tr>
<tr>
<td><strong>Game Accessibility:</strong></td>
<td></td>
</tr>
<tr>
<td>Computer games have potential for education but is often inaccessible</td>
<td>2.4</td>
</tr>
<tr>
<td>Game accessibility can be a challenge but is also a right</td>
<td>2.4.1</td>
</tr>
<tr>
<td>Game accessibility affects all game players, at some point in life</td>
<td>2.4.2</td>
</tr>
<tr>
<td>More research about game accessibility is needed</td>
<td>2.4.3</td>
</tr>
</tbody>
</table>
8.1.2 Designs for gamers excluded in school

Study 1 focused on excluded pupils in Swedish schools, that also had a strong interest in games, with the following questions:

**Q1:** How did the pupils act upon the consequences of the regression from game-oriented education to traditional schooling? How can these acts inform the design of education in digital culture?

The pupils’ acts differed depending on their previous level of socialisation in school and in games. While the game-oriented formal education included all in the socialisation process, the regression caused half of the pupils to drop out. However, the three pupils who were socialised in school appreciated the regression. From this it could be concluded that the Swedish school system seems unable to sustain a design that included all pupils in the study who had previously been excluded in school.

**T1:** How can environments for inclusive digital socialisation be designed for digital youth who are gamers that are excluded in school?

Related to the issue of e-inclusion through education and games (ch. 2.2) the answer to Q1 means that the barrier of socialisation with limited institutionalised support for digital youth continues to exist. Games seem to be allowed in school only when they have specific educational content for a learning outcome, similar to a textbook. The dialogue-based game oriented education (ch. 2.2.2) before the regression (ch. 4.3) was highly appreciated by pupils but rejected by school. Educational games are often accepted in school (as they don’t require dialogue, similar to a schoolbook), but such applications are often not viewed as games by digital youth, and are thus usually not played voluntarily (ch. 2.2.1) with intrinsic motivation (ch. 2.2.3).

While it is necessary that the social system of education differ from the (online) environment where digital youth live (ch. 2.1), education has to be relevant for digital youth, otherwise communication and the system cannot continue. With a GOE approach as in study 1, it was possible to make education relevant again for the pupils. Education (and especially formal education) has a strong potential as environments for inclusive digital socialisation, if it is designed based upon social response or interest (Asplund, 1987) of digital youth. However, given the problems of school to sustain the game oriented education in Study 1, other environments for digital socialisation through game oriented education (formal, non-formal or informal) required further research, such as at telecentres in Study 2 (Q2-Q4).
8.1.3 Designs for underprivileged digital youth

Study 2 focused on digital youth in underprivileged communities, with the following questions:

**Q2:** What are the manifestations of the digital divide in the Sri Lankan tea estate areas? How can these manifestations be addressed?

Women and people with disabilities were most at risk for exclusion due to the internal digital divide, where the language barrier was the clearest issue to bridge the divide. Thus, education about ICTs in vernacular languages was concluded to be a possible way to address these issues, where telecentres play a central role.

**Q3:** What kind of telecenters are there today in tea estate areas of Sri Lanka and how are they used by the local population?

There are several forms of telecentres, but the government funded Ne-nasalas and the workers union Thondaman foundation e-kiosks are the major actors. Most visitors are youth in school age, and some in their twenties but there are also housewives. The telecentres provide a holistic community service and is thus relevant despite the increasing use of smartphones.

**Q4:** How can awareness of the learning potential at telecentres beyond basic ICT skills be achieved through games?

As youth were the most common telecentre visitors, designing game oriented workshops with educational games was found to be a way to teach about programming. This approach helped bridging both part of the language barrier and internal digital divide during two days per telecentre. Involving telecentre staff as translators was found as a way to make this a more sustainable approach as they also learned the content.

**T2:** How can environments for inclusive digital socialisation be designed for digital youth who are living in underprivileged communities?

While women and people with disabilities is at the greatest risk of exclusion, most visitors at telecentres are youth in school age and are seen as the families hope to learn more about ICTs. Thus, by designing game oriented workshops to teach digital youth about ICTs like programming, they may empower the community as they grow up. Telecentres provide non-formal education, which may counter part of the issue of socialisation online (ch. 2.2). Telecentres are visited after school or in weekends.
so games used in the game oriented workshops should build on intrinsic motivation (ch. 2.2.3), to voluntary play the game and learn the topic (ch. 2.2.1). A challenge going forward with more dialogue-based GOE (ch. 2.2.2) about e.g. programming of games requires local instructors with enough programming skills to teach without the support of a limited educational game.

Furthermore, while education in vernacular languages is important, involving telecentre instructors as translators may contribute to make the workshop design more sustainable over time (ch. 2.3), by continue teaching the content after the workshops, potentially in dialogue using vernacular language. This way, telecentres may bridge part of the internal divide between underprivileged communities and more urban areas (ch. 2.3.1). However, people with severe disabilities are often excluded at telecentres. Disabled youth in Sri Lanka are usually attending special schools in more urban areas (e.g. for deaf and blind), due to lack of local resources. Thus, to change this games used in workshops at telecentres have to be designed to be as accessible as possible (see next section about Study 3). Furthermore, most accessibility solutions is simply good design for all.

8.1.4 Designs for blind and deaf digital youth

Study 3 focused on blind and deaf digital youth, but also considering a continuum of disability including fully sighted and hearing, with the following questions:

Q5: How can a competitive player-versus-player game be better balanced for playing without seeing or hearing within the same game universe?

Enhancing or reducing the sensory feedback (audio and visual) for each player can make the game better balanced without changing the game rules, i.e. enabled playing in the same game universe. This opens up for more inclusive game play and may simplify integration of blind and deaf in multiplayer games.

T3: How can environments for inclusive digital socialisation be designed for digital youth who have disabilities and play games?

To enable blind and deaf digital youth to socialise online (2.2), with each other but also with fully sighted and hearing, game accessibility is required (2.4). While game accessibility can be a challenge to achieve
(2.4.1), available guidelines\textsuperscript{15} show that it is mostly a matter of making
good design for all who play games (2.4.2). Furthermore, it can also be
argued that game accessibility is a right (2.4.1). The relevance of game
accessibility is further enhanced when related to game oriented educa-
tion, as education is a universal human right and a key for socialisation.
Study 3 has shown how a real-time, player-versus-player game can be
better balanced for deaf and blind by only modifying visual and hearing
modalities. A challenge going forward is to find how this can be
achieved in other types of two-player or multiplayer games, and more
complex game audio scenarios. Promising audio technology for this
purpose has recently been released\textsuperscript{16}.

8.1.5 Designs for game students and developers

Study 4 focused on educating game students and potentially game pro-
essionals, about game accessibility, by asking the following questions:

**Q6:** How could a curriculum framework for game accessibility be de-
signed? How could OERs for game accessibility be created and shared
based on the framework?

In this tentative curriculum framework (TCF), nine learning outcomes
included to frame the problem – the lack of e-inclusion (accessibility) –
from the perspectives of disabled gamers as well as changing attitudes
among developers and teach how to make games more accessible. This
should be done with open educational resources, enable remixing for
different educational contexts (formal, non-formal and informal).

**Q7:** What are the opinions among educators and game developers re-
arding the TCF? How could the TCF be redesigned?

From the international survey feedback, the framework was made more
focused by integrating three learning outcomes into the remaining six.
Needs to map existing and future resources to learning outcomes, as
well as what formats and licences to be used in an online deposit for
open educational resources were discussed.

**T4:** How can education about game accessibility be designed for game
developers?

\textsuperscript{15} \url{http://gameaccessibilityguidelines.com/} (accessed 2017-02-10)
\textsuperscript{16} \url{https://valvesoftware.github.io/steam-audio/} (accessed 2017-02-27)
With a curriculum framework it is possible to address a range of educational contexts and situations. The game accessibility curriculum framework is now fairly grounded in the views of game accessibility experts, both in academia and game industry. Thus, it can work as an organized plan of learning outcomes, to define content to be learnt regarding game accessibility.

The framework can be used by educators to design courses, but may also be a guide for informal learning by professional game developers in the game industry. Also, in these educational settings, the framework can be used as basis for a dialogue about games regarding inclusion (2.2.2). Through education based on the framework, games may be more accessible for disabled people (2.4) and thus also more useful in game oriented education. Future work is to implement the framework in practice and further evaluated in iterative, collaborative efforts with all stakeholders.

8.2 A model of Inclusive Digital Socialisation

Based on the four studies in this thesis, a model for inclusive digital socialisation (IDS) can be outlined. Starting at the top left in Figure 10 all digital youth need to be socialised in digital culture. For this purpose, game oriented education design is a possible approach, in turn requiring accessible game designs and education about game accessibility designs. These are broken down into subcomponents that maps to the four studies: 1) Digital Room 2; 2) Telecentre Game Workshops; 3) Visual and Hearing adaptations in games; and 4) a Game Accessibility Curriculum Framework.

Starting at the lower right in Figure 10, open educational resources enable (aspiring) game developers (also in lower income countries) to make games accessible that in turn enable inclusive formal education to be game oriented. In addition, each example of designs have dispositions that must be considered, for instance game oriented education designs in Sweden (Digital Room) and Sri Lanka (telecentres) have different conditions, regarding technology, culture, and socio-economy. This affects e.g. how games can be made accessible, what games can be selected, and what platforms to be used for gaming.

Conclusions are that GOE may be an environment for inclusive digital socialisation, if it is: 1) sustained in the educational social system; 2) enabled within limits of ICTD; and 3) accessible for people with disabilities. The latter requires: 4) education for game developers. This thesis shows how these requirements may be fulfilled, enabling GOE as a design to achieve inclusive digital socialisation in a global context.
Figure 10: A model of inclusive digital socialisation

To use the IDS model, the unified design method (Grammenos et al., 2007) used in Paper V is suggested as a potential tool. Based on this, a five-step process for applying the unified design method is outlined in Figure 10: 1) Abstract task decomposition, 2) Design alternatives (DA), 3) User attributes (local and individual requirements), 4) Appropriateness analysis (which DA is appropriate or not for which user attributes), and 5) User profiles (which combinations of user attributes represent groups of users/participants).

The use of the model may be at different levels, for instance in a holistic approach all four studies could be viewed as design alternatives. A more specific approach would be to focus on improving accessibility in a game. Depending on the approach, the abstract tasks would be different; see e.g. Paper V for a specific approach of designing better game accessibility. Another specific use could be to co-design workshops with the participants in an action research study; here abstract tasks could be to learn about ICT opportunities (with sub-tasks of finding, selecting, reviewing educational resources). The resources are then design alternatives, analysed for appropriateness related to user attributes, and finally user profiles can be defined.
8.3 Limitations

As mentioned in the introduction, Bleumers et al. (2012) concludes with four policy recommendations of e-inclusion for the EU commission: stimulate research regarding 1) diversity of gamers and practices; 2) development tools, 3) ecology, and 4) living labs involving formal, non-formal and informal learning contexts.

This thesis has addressed the first recommendation, with focus on disabilities but also gamers in different socio-economic contexts, such as differences between Sweden and Sri Lanka, as well as urban and underprivileged communities. However, the thesis does not address gender issues clearly. Also, the game and method in Paper V need to be further refined, e.g. with co-design at the school for deaf and blind, and as a network game with multiple players and more participants. The second recommendation of development tools is not directly addressed other than showing related research in the field of game accessibility. However, in a wider sense, methods and a curriculum framework for game accessibility, as well as game-oriented education can also be tools to achieve e-inclusion. Ecology (the third recommendation) has been addressed through the systems theory approach to understanding social systems related to the environment. However, an environment for IDS may look different for elderly and requires further research; e.g. how digital youth can learn from elderly and vice versa. The fourth recommendation of using formal and non-formal learning contexts as forms of living labs, has been addressed with schools and telecentres. Informal education has been discussed but not investigated further. Also, a more prolonged field study of game oriented education at telecentres is necessary to evaluate this effort.

Taken together, the findings about e-inclusion, game-oriented education and game accessibility in a global, human development context, should be a novel contribution, to the best of the author’s knowledge. An ethical issue of the findings is to consider and reflect upon game oriented education (GOE) for digital youth who are not gamers or not interested in games at all. Thus, it is important to stress that GOE is not meant as a quick fix for including everyone (that would repeat the mistake of traditional schooling); it is meant as an approach to include digital youth who are interested in games, with regards to local and individual limitations, and focus on social responsivity. To what extent the model for inclusive digital socialisation is useful in general need to be explored in further research, where the individual studies opens up several possible paths, discussed in the next section.
8.4 Further research

Continued efforts are illustrated in Figure 11 as boxes (solid lines), while possible new paths that were outside the scope of this thesis are boxes with dotted lines. For instance gender (e.g. inclusion of women at telecentres) and ageing (lifelong learning and ageing gamers). A longer-term plan (dashed lines) of revisiting formal education is also included.

![Diagram](image)

*Figure 11: Possible paths for continued and future research of IDS*

Continuing the efforts of Study 2 at telecentres to bridge the internal digital divide for people in tea estates is important; e.g. deepening knowledge about programming (Paper III) in a game-oriented workshop approach together with local staff and telecentre visitors. Perhaps in a future situation where digital youth have governance roles in formal education in Sweden, the formal GOE approach of the Digital Room (Study 1) may be revisited. However, for the near future non-formal contexts can be the recommended setting.

Furthermore, to include more people with disabilities at telecentres is important, through accessibility in general but also in games. Related to this, bridging the gap of socialisation between sight-disabled and deaf people, balanced game interfaces (Paper V) need to be further explored. Also, to change norms and attitudes toward game accessibility among game developers by implementing game education based upon the framework in Study 4 is important, as game developers are key players in designing environment for inclusive digital socialisation. It would be interesting to learn more how game developers could learn about game accessibility with an autodidact approach, with support from the framework in study 4 and open educational resources (OERs).

The unified design method (that was suggested above for using the IDS model) needs to be further investigated. Originally the method was
developed for human-computer interfaces for all (such as games and described in Study 3 and Paper V), but here it would have a wider application for interfaces to other social systems too, such as education.

Finally, the focus on games may be exchanged with some other interest in future studies – the basic idea is to enable an inclusive digital socialisation process by focusing on the interest of digital youth, for social response. If this interest shifts to some other phenomena in the future, so must the efforts for inclusion to not create new barriers for progress of digital socialisation due to similar institutionalised inertia as in school today.
9 Summary in Swedish

uppfyllas, och möjliggöra spelorienterad utbildning som en design för att uppnå inkluderande digital socialisation i en global kontext.
10 Appendices

Survey forms from paper V, VI and VII are presented in the following pages. The first (paper V) was conducted locally in Sweden only, hence the survey question in Swedish. It reads: “Discuss the experience of how it was to play without seeing or hearing: Was anything hard and if so, what? In what way? How did you get around the problems? Suggestions for improvements?”
10.1 Survey form for Paper V

**Uppföljning av speltest**
Speltest 3 av A11ynslo. 3 November 2016

1. Diskutera upplevelsen av hur det var att speela spellet utan att se respektive höra: Var det något som var snart och i så fall, vad? På vilket sätt? Hur tog ni er runt problemen? Förslag på förbättringar?


https://docs.google.com/forms/d/e/1FAIpQLScYpFbPByXJHk5oN7v1TcyGd_5mWHsLQBuXo0XVfaU/edit
10.2 Survey form for Paper VI

Game Accessibility Education survey
This survey is conducted by Thomas Westin (Stockholm University, Sweden) and Jérôme Dupré (CNAM, France). It is sent to people who we believe have an interest in Game Accessibility judging from published research and other work. If you have any questions, please contact thomas@dav.su.se or jerome.dupre@cnam.fr.

The purpose of this survey is to evaluate what a curriculum for Game Accessibility should include and focus on. The survey consists of mostly closed questions and a couple of open questions and should not take more than 15 minutes to finish. It is voluntary to respond. Data will be anonymised before publication in the academic press and disseminated via other media.

This survey closes on January 28, 2016.

*Required

For a curriculum about Game Accessibility, how would you rate the importance of the following topics?
Please consider that while awareness of all topics is important, only a few topics can be understood within time frames of a curriculum.

1. Basic concepts of impairments, disabilities and accessibility related to games *
   Mark only one oval
   1 2 3 4 5
   Not important □ □ □ □ □ Important

2. History of game accessibility *
   Mark only one oval
   1 2 3 4 5
   Not important □ □ □ □ □ Important

3. Game Accessibility Guidelines *
   (and similar best practices)
   Mark only one oval
   1 2 3 4 5
   Not important □ □ □ □ □ Important

4. Statistics related to game accessibility *
   (current data, industry reports etc)
   Mark only one oval
   1 2 3 4 5
   Not important □ □ □ □ □ Important
5. Law & Legislation for game accessibility
   (e.g., the Communications and Video Accessibility Act in the USA)
   Mark only one oval.
   1 2 3 4 5
   Not important □ □ □ □ □ Important

6. Funding available for game accessibility
   (e.g., Creative Europe in the EU, and Film Victoria in Australia)
   Mark only one oval.
   1 2 3 4 5
   Not important □ □ □ □ □ Important

7. Programming strategies for game accessibility
   (patterns, code libraries etc.)
   Mark only one oval.
   1 2 3 4 5
   Not important □ □ □ □ □ Important

8. Accessible Hardware Solutions for game accessibility
   Mark only one oval.
   1 2 3 4 5
   Not important □ □ □ □ □ Important

9. Design methods for game accessibility
   Mark only one oval.
   1 2 3 4 5
   Not important □ □ □ □ □ Important

10. Simulations for accessible design
    (e.g., color-blind simulation)
    Mark only one oval.
    1 2 3 4 5
    Not important □ □ □ □ □ Important

11. Current research and literature about game accessibility
    Mark only one oval.
    1 2 3 4 5
    Not important □ □ □ □ □ Important
12. Biographies "
(detailed description of an actual person’s life)
Mark only one oval:

1 2 3 4 5
Not Important

13. Personas "
(an imaginary representation of a user role)
Mark only one oval:

1 2 3 4 5
Not Important

Motivations

14. Please motivate your most important choices. A few sentences is enough. "


Your profile and teaching habits

15. How old are you? "

16. In which country are you mainly working? "

17. What is your position? "
Mark only one oval:

☐ Academic
☐ Industrial
☐ Association
☐ Other

18. In which context are you teaching? "
e.g. Computer Science, Marketing, Psychology, etc OR not applicable (if you don’t teach)
19. How do you rate your skills in the game accessibility field? *
Mark only one oval.

None  1  2  3  4  5  Expert

20. How often do you teach about game accessibility on a semester time basis? *
In any way, e.g. lectures, workshops, seminars, talks, etc.
Mark only one oval.

never  once  once a month  once a week  more than once a week

21. Optional: Your name
If you want to be invited to participate in educational efforts with IFIP and IODA

22. Optional: Your e-mail
If you want to be invited to participate in educational efforts with IFIP and IODA

Powered by Google Forms
10.3 Survey form for Paper VII

Game Accessibility Curriculum Framework – Follow-up Survey

This research is conducted by Thomas Waelin (Stockholm University, Sweden) and Jérôme Dupire (CNAM, France). This is a follow-up survey to the first one in February 2016, and it is sent to people who have expressed an interest in this follow-up study. If you have any questions, please contact thomas@cbis.su.se or j Jerome.dupire@cnam.fr

The purpose of this survey is to confirm our conclusions from the first survey regarding what a curriculum for Game Accessibility should include and focus on. The survey consists of mostly closed questions and a couple of open questions and should not take more than 15 minutes to finish. It is voluntary to respond. Data will be anonymised before publication in the academic press and disseminated via other media.

*Required

1. Your name *

2. Your e-mail *

3. Did you reply to the first survey? *
   - Yes
   - No

For DESIGNERS at BASIC LEVEL

LEARNING OUTCOMES (explained):
- INTRODUCED: The outcome is not the focus of the course but elements may be provided to achieve the outcome.
- TRANSITIONAL: Knowledge, skills, and/or attitudes (two of the three) to achieve the outcome may be the focus.
- EMPHASIZED: At least one element of the course focuses specifically on the complex integration of knowledge, skills and attitudes necessary to achieve the outcome.

*** For DESIGNERS at the BASIC LEVEL, the LEARNING OUTCOMES should be as follows ***

4. Introduced *
   - Agree
   - Disagree
   - Don’t know

Awareness of the history
Awareness of the scope of issues
Awareness of legislation
Awareness of funding
Experience of disabilities

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1/1
5. Transitional
   Mark only one oval per row.
   Agree | Disagree | Don't know
   -----------
   Know how of solutions

6. Emphasized
   Mark only one oval per row.
   Agree | Disagree | Don't know
   -----------
   Understand basic concepts
   Know the needs of disabled
   Able to apply design methods

7. Please add any comment about your choices:

For ENGINEERS at BASIC LEVEL

LEARNING OUTCOMES (same explanation as on previous page)
- INTRODUCED: The outcome is not the focus of the course but elements may be provided to achieve the outcome.
- TRANSITIONAL: Knowledge, skills, and/or attitudes (at least two of the three) to achieve the outcome may be the focus.
- EMPHASIZED: At least one element of the course focuses specifically on the complex integration of knowledge, skills, and attitudes necessary to achieve the outcome.

*** For ENGINEERS, at the BASIC LEVEL, the LEARNING OUTCOMES should be as follows ***

8. Introduced
   Mark only one oval per row.
   Agree | Disagree | Don't know
   -----------
   Awareness of the history
   Know the scope of issues
   Awareness of legislation
   Awareness of funding
   Experience of disabilities

9. Transitional
   Mark only one oval per row.
   Agree | Disagree | Don't know
   -----------
   Able to apply design methods
10. Emphasized
Mark only one oval per row.

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11. Please add any comment about your choices

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13. Emphasized
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14. Please add any comment about your choices

THANK YOU SO MUCH FOR YOUR TIME!

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Please add any comment you want to share with us about this work.
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