Modern Portable Technology in Environmental Education as part of Formal Curriculum Teaching

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Abstract

This thesis deals with increased use of mobile screen technology in freetime and schools, as well as people's alienation from the natural environment and its effect on learning and human development. The aim of this research was to explore technology integration in formal teaching and its affordances for environmental education. By qualitative research methods, the study focused on Finnish and Australian teachers' and educators' viewpoints of technology integration into teaching.

The findings underline that the issue is not only the use of mobile technology, but to know *how* to use the devices for better education. Both students and teachers have positive attitude towards screen technology in schools and it increases student's motivation in learning and engagement in the subject. Technology integrative learning activities result to student-centred, collaborative and self-initiative learning. The results declare that the mobile technology hold a large unused potential for effective learning and provides a tool for connecting students with nature, but also emphasize the teachers need for more education to use the technology for learning.

Keywords: environmental education, technology, teaching

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Chapter I: Introduction

Overview of the Topic

In the modern fast-paced lifestyle, technology seems to be the answer for everything. Lately, the popularity of technology in people's everyday lives has increased dramatically. For instance the ownership of smartphones and tablet computers among the Finnish people has increased rapidly during the last few years. According to the TNS Gallup in 2012, 44% used their own smartphone and only 6% tablet computer, while the equivalent numbers in 2014 (TNS) was 70% for smartphones, and 35% for tablets. Also, in 2014, OECD (2014) reported Finland having the most wireless internet connections in the OECD countries with its 132 broadband subscriptions per 100 inhabitants. The number of subscription has almost doubled within four years. The rise is remarkable and the influence of the constant presence of technology has had an impact on various matters. As the numbers of portable technology owners has increased, educators has been encouraged to integrate new, innovative technology use into their curriculum (Solomon & Schrum, 2007).

Meanwhile life in western societies is focusing on technological devices in one's everyday life, more authors and outdoor educators express their concern of children and adults not being engaged with natural environments. A well-known American writer, Richard Louv (2008), has written about children suffering from "nature-deficit disorder". That is to say humans are experiencing less primary experiences due to the lack of touch with nature. Consequently, the lack of time spent in nature has been linked to decreased wellbeing, overall happiness and "eco-literacy" (Capra, 2009). In addition to improving mental issues, it cannot be excluded the physical and cognitive health benefits that nature time can offer, such as attention capacity and memory (Hartig et al., 2003), as well as help with obesity and ADHD symptoms (McCurdy et al., 2010). Similar discussion has been raised in Finland, as Nyholm (2014), Sjöblom (2012), and Puhakka (2014b) suggest Finnish children alienating from nature.

As the world is changing, schools of the 21st century are living through a great transition. Meanwhile the world around the schools is globalising and technologizing, the schools has to follow the progress to respond modern labour market demands. Traditionally education has focused on the importance of the content knowledge and the subject but it is suggested that nowadays the schools should emphasize on developing students' capacity for transferable skills alongside of the content (Garner, 2015; Noteborn, Dailey-Hebert, Carbonell & Gijselaers, 2014; The Educational

Department of Helsinki, 2015). In many cases (Cheng, Lou, Kuo & Shih, 2013; Ruchter, Klar & Geiger, 2010; Welshe & France, 2012; Palmárová & Lovászová, 2012) this is suggested to be done by introducing digital teaching tools to the children to engage the learner to the topic and to increase the learning motivation.

On the other hand it is suggested that schools should focus more on environmental awareness and real experiences in nature (Louv, 2008; Nyholm, 2014; Ruchter et al., 2010; Puhakka, 2014a). The latest innovations that the schools have been adopting into their everyday use in western countries consider using tablets, smartphones, and other portable technological devices for teaching purposes. Portable technological devices are often suggested to be used inside the classroom to replace the original textbooks (Kelly, 2013), but also to expand the possibilities for teaching outdoors (Uzunboylu, Cavus, Ercag, 2009; Kamarainen et al., 2013; Welsh & France, 2012). Namely, the potential that the devices hold for teaching, for example problem solving, location-based and student-centred practices, is enormous (Palmárová & Lovászová, 2012).

Purpose of the Study and Significance

As introduced above, the study had a three-dimensional approach to the late development of the western society. The three dimensions were the rise of technology in people's everyday lives, the lack of time spent in nature, and finally the discourse of these in the context of formal school curriculum. This research focuses on exploring the possibilities and challenges of using modern portable technology in environmental education outside of classroom as part of formal curricula. By researching different methods and perspectives, the dissertation searched arguments for current discussion about technology usage in schools. These arguments, collected by the qualitative research and literature review, bring together the three dimensions from the modern world and to elaborate separately and comparatively with the theories. The effect of technology in children's relation to nature was also examined.

The aim of the study is to contribute to an incomplete body of literature in how technology should be used effectively in teaching. This study offers an insight into primary school teachers and educators attitudes of their understanding and innovative use of the technology. Therefore, the study results may offer teacher educators and teachers important knowledge about how to improve their technology integration strategies.

Research Questions and Hypothesis

As the aim of the study is to bring together issues from technology, the lack of touch with nature, and formal curriculum teaching, the research questions follow the themes. Likewise, the data collection questionnaire and the theories used in the literature review will be built on the following research questions.

1. Can the technological devices be used at school to enrich the learning experience outside the classroom and increase pupil's engagement in the subject?
2. Can the technological devices be used at school to enable children to spend more time in nature and make children more curious about the outdoors and natural phenomena?
3. Ascertain how the technological devices have to be used to reach the best outcome.

Finally the hypothesis is drawn from the issues introduced above. Researcher's prior assumption is that the use of modern technology increases students' engagement to the topic of the lesson but will not support the development of children-nature relationship because of the distracting nature of the device. The issues that the hypothesis state was also debated and partly agreed by academics in a panel discussion in Education for Sustainable Development –conference (Kenk et al. 2015). The hypothesis is developed further as following:

1. Many children are more used to touch the screen than to feel, smell, hear and see the natural attractions and therefore the technological devices are distracting children from experiencing nature.
2. Pupils are used to use technological devices and therefore hold positive attitudes towards using them officially in school situation, but it will not increase pupils' connection to nature.

The topic of this thesis is actual in the public educational discussion. The teachers in pre-, primary-, and secondary schools in Finland need more education to learn how to exploit the modern technology to effectively support their teaching. Therefore a partial aim of the study is to answer the problem of technology integration into teaching outside the classroom.

Definition of Terms

Portable Technological Devices

Basically every modern device in any field is technological in a way or another. While Mayben (2010) is using the term "emerging technology" to cover all the new hardware and software that has potential for strengthening the teaching and learning process, this paper must narrow down to the

portable devices as the focus of the study is in practices outside the classroom. Also, the popularity of portable technological devices, such as tablets and smartphones, in Finnish schools has increased rapidly during the last years (Storås, 2014). In fact, a great number of primary school students (3 to 6 graders) carry their own smartphone to the school every day, and therefore this category of portable technological devices is the most valuable target group for the study. Additionally, the political discussion in the Finnish government emphasize the use of such portable technology in education and supports the idea of studying the most recent and used devices in formal curriculum teaching (Kelly, 2013).

Environmental Education

It is not at any intention of this thesis to make any new and strict definitions of such a big topic as environmental education. Yet, to support the study, the teaching should take place outdoors with the aim being linked to natural environment. In his book Modern methods of teaching environmental education (2000), Vijadra Kumar offers one definition of environmental education. Drawing from NCC (1990) he mention that environmental education can deal with three components: 1st education *about* the environment (for knowledge), 2nd education *for* the environment (for values, attitudes, and positive action), and 3rd education *in or through* the environment (nature as a resource). Similarly Bogner (1998) and Leeming et al. (1993) suggest the promotion of responsible environmental behaviour being considered as the ultimate goal of environmental education activities. These components offer a solid base to reflect the practices upon, whether the pupils gain connection with the natural environment or not.

Formal School Curriculum

The study focuses on formal curriculum teaching. This is to say that all teaching under observation will take place during official school hours. Not after school clubs or youth centres, not scouts or any other youth work organizations. The only practices that matters for this study are the lessons taught by the teachers for the normal pupils during their normal school day. There might be another environmental educator present in the situation to help the regular teacher, and so offer the teacher a possibility to control and observe the pupils in action. Also, all lessons in this study should have a target to reach during the class and this should be somehow related to natural environment for example water, forest, or undergrowth.

Cross-Cultural Setting

Due to the results of PISA studies and innovative teaching methods, Finland is often considered as the pioneer in education (Kupiainen, Hautamäki & Karjalainen, 2009). Therefore the thesis elaborates much from a Finnish perspective and so will Finnish publishers have a central role in the literature review of the thesis. Especially theories behind technology use in teaching are a contemporary topic in the educational papers. Nonetheless, the study will be written from a transcultural perspective due to the nature of TEOS study programme and all the multicultural experiences the author has gained.

Another cross-cultural aspect in this study appears from the data collected. As the chapter Research Methodology point out, the data was collected both from Finnish and Australian teachers and educators to enable to create a comparative position. The intention was not to compare the cultures or education systems of the countries, but to observe and analyse as many different practices and activities the individual cases were doing.

Structure of the Study

The paper will start with exploring the current level of research and academic discussion about technology use in environmental education. Yet, the number of authors publishing papers and research summaries is limited due to the contemporary nature of the topic. Hence, the aspect of environmental education will be broadened into teaching outside the classroom with technology but not necessarily with environmental objectives. The other main components in the literature review are technology integration in teaching mainly outside the classroom, pupils' engagement to the subject, and associative learning theories for technology use in teaching. A range of previous research will also be indicated.

Secondly, the Research Methodology of the study will be introduced. Research methods, questions, and participants are examined. Finally, the results of the research will be presented in Discussion where the literature, theories, research questions, and the data of the research will be put together and analysed extensively.

Chapter II: Review of the Literature

Building up the framework

This chapter will provide a short insight into the background themes of this thesis. The aim of the chapter is to develop an understanding for the reader about the trends in modern behaviour, education, and perception of nature. Also, the relevance of the topic in modern western world will be signified.

Children-nature relationship

The concern of young people alienating from nature is an increasing topic in the discussion of well-being of children and adolescents (Louv, 2008; Laaksoharju & Rappe, 2010; Natural England, 2015; Nyholm, 2014; Sjöblom, 2012). Many researchers from different parts of the world argue that children in the 21st century spend remarkably less time in the outdoors than only a few decades ago (Verboom, van Kralingen & Meier, 2004; Clements, 2004; Hoffert & Sandberg, 2001; Sjöblom, 2012; Puhakka, 2014b). However, perhaps the most known contributor in the field is Richard Louv and his ideas of children suffering from nature-deficit disorder (2008). According to Louv, the phenomenon of children de-connecting from nature is a result from policy making that began to restrict the use of the natural environments for playful purposes in the late 1980s. Ever since, both parents' and policy makers' attitudes have influenced the issues to have immersed, and more mental, social, and physical problems have appeared in young people's lives.

The discourse of the issues that causes children's decreased attachment to the environment is currently aiming to suggest causes and responses for the matter. Often repeated problem is summarized by Robin Moore (1997, p. 203) when he reports that "either indoor spaces have become more attractive, or outdoor spaces have become less attractive – or both." This can be linked to many more recent arguments which often consider the role of technology in children's everyday life (Louv, 2008; Laaksoharju & Rappe, 2010; Skår & Krogh, 2009). Nyholm (2014) and Skår & Krogh (2009) mention parents letting their children use most of their free time indoors playing games and using portable devices instead of going to nature to experience the outdoors. Also the increased popularity of organized sport hobbies is considered to decrease children's free time in nature (Laaksoharju & Rappe, 2010; Skår & Krogh, 2009).

The wide-ranging effects of nature time in human development have been researched by many authors and the results demonstrate much the same benefits. Traditionally nature has been seen as a place for a primary experience where one can learn scientific knowledge and use their senses in an aesthetical way (Becker, 2015; Louv, 2008). In addition to Becker's suggested sensory development, nature-time can offer children a place to use their natural curiosity by exploring the environment (Skår & Krogh, 2009), improve child's attention and memory capabilities (Hartig et al., 2003; Kaplan, 1995) and gain improvement in pupils' achievements such as math, reading and sciences (Bartosh, Tudor, Fergusson & Taylor, 2006). Additionally, Louv (2008) suggest that the children who has created a connection with nature in their childhood, are more likely to preserve the environment from natural disasters in their adulthood. Though, it is impossible to summarize all the positive benefits nature has for human development, de Groot, Berg & Steg (2012) and McCurdy et al. (2010) conclude natural environment being conducive for holistic healthy living.

The transition in modern educational aims

As the world is changing, all the structural factors in social order must develop along. Education is one of them. As everything else in the society, education has been shaped by the ever developing technology: the pen and paper, the blackboard, the overhead projector, and for the latest inspiration, smartphones and tablet computers. All these evolutionary steps have shaped the way knowledge was developed and disseminated. After all this have formed the practices used for studying and learning during the decades. (Holford, Jarvis, Milana, Waller & Webb, 2014)

Traditionally, education has focused on transferring scientific content knowledge passively from teacher to pupil inside the classroom (Becker, 2015; Noteborn et al., 2014). Nevertheless, the current transition in educational discourse speaks of the importance of the modern learning skills (Holford et al., 2014; The Education Department of Helsinki, 2015; Kamarainen et al., 2014, Sitra, 2015), or as Noteborn et al. (2014) defines, procedural knowledge. The learning is to take place in a multidisciplinary setting where many subjects are to be studied simultaneously (The Education Department of Helsinki, 2015; Noteborn et al., 2014). Even more increasingly ICT (information and communications technology) skills are emphasized to provide children the abilities already during their early years to success in the modern technology driven world (Pirhonen & Häkkinen, 2014). Similarly, The National Research Council (2011 p. 2) of the United States have summarized the critical educational aims in the 21st century as: "(1) to reflect the importance of understanding the human-built world" and "(2) to recognise the value of better integrating the teaching and learning of science, engineering and technology".

In addition to teaching subjects in crosscutting units, Becker (2015) argues for the importance of social, sensual and aesthetic learning experience that the schools should offer. To make the teaching to support students' holistic well-being, teaching methods should be more student-centred, learning environments should vary indoors and outdoors, and the demands of different learners should be noticed. These elements support the German educational ideology of *Bildung*[1] which is to create the core for German education. (Becker, 2015)

All factors mentioned above are playing a central role in the current reform in the Finnish education system. In other words, the aim of Finnish schools is to prepare students to apply better for industry and modern society. This is to be done by removing much of the subject-specific lessons, and replacing them by teaching phenomena or teaching by topic. For example some pupils might study cross-subject topics such as the European Union – which would combine elements of economics, history of the countries involved, languages and geography. Another major change in the Finnish education is that learning is becoming more like a social event, where pupils work together in a social environment using the most suitable platforms, and no longer teacher oriented lessons are held in the same extent. (The Education Department of Helsinki, 2015; Garner, 2015; Sitra, 2015)

The increasing trend of technology teaching

In many occasions, technology has been proposed to enrich the learning environment and learning experience in schools (Kamarainen et al., 2013; Uzunboylu et al., 2009; Pirhonen & Häkkinen, 2014; Cheng et al., 2013; Ruchter et al., 2010; The Education Department of Helsinki, 2015). Especially handheld devices, like smartphones and tablet computers, have been widely introduced for teaching purposes. During the past few years, the newsfeed in Finland has been breaking news repeatedly that cities and municipalities has purchased tens of thousands of tablet computers for schools in order to update their whole teaching methodology (Vantaan Sanomat, 2014; Yle, 2015; MTV, 2012). The same tendency seems to exist in the United Kingdom (BBC, 2014) and in another highly rated unit in the PISA tests, Shanghai (Ministry of Education and Culture of Finland, 2013). This suggests the development being rapid, and the aim is to rely more and more on technology, which supports the reform in the Finnish curriculum in 2016. But, what do the portable technological devices have to offer for the teachers? The benefits and downsides of technology use

[1] The ideology of Bildung is hardly translatable into other languages. In short, in the most authentic sense, Bildung refers to the process, where the harmonization of mind, heart, selfhood and identity is achieved through personal transformation. For the developer of Bildung, Wilhelm von Humboldt (1767-1835), the concept of education became a process of holistic development rather than learning external knowledge and skills. (Kakkori & Huttunen 2014) This learning is intended to be gained through solving the routine breaking challenges, and thus creating new knowledge and skills. (Becker 2015).

in teaching will be explored in depth in the following chapter, Affordances and challenges of technology for teaching.

Affordances and challenges of technology for teaching

This chapter will examine the previous research in the field of formal education. The current public discussion about the use of technology in schools reflects to the studies implemented in the area of education, which can be proved by the years that the studies have been published (i.e. references). Despite the topicality of the subject, there are not many studies that unite environmental education and the use of technology with formal teaching. Due to the lack of exact literal academic work, the references of this chapter must be adapted and the researches will be collected from other educational discourse as well. Simultaneously, this issue emphasizes the necessity and the significance of this thesis for the future school development.

Nowadays, younger and younger children learn to use mobile devices which create a great potential for teaching (Welshe & France, 2012). That is to say that with only a little extra effort in supporting pupils' technology skills, the teachers could adopt technology in the learning situation (Chen et al., 2008; Uzunboylu et al., 2009). With the features that the devices hold, for instance wireless Internet connection, notebook, camera and other media recorders, GPS receiver, and other applications that have been conceived for special teaching purposes, the teachers are able to expand their handbook of learning practices (Kamarainen et al., 2013). Lai et al. (2007) proposed the students using cameras in an environmental education practice outperforming the students without the device in knowledge creation. Nevertheless, they highlight technology using students losing their interest in the topic sooner than the others due to "the convenience and quickness of photo taking [that] may distract students from the results of their observation" (p. 333).

Student motivation

According to many authors, students hold positive attitudes towards the use of handheld technology in the learning activities (Chen et al., 2008; Cheng et al., 2013; Ruchter et al., 2010; Uzunboylu et al., 2009; Mayben, 2010; Kamarainen et al., 2013). For instance, Chen et al. (2008) reported more than 75% of the participating students attending with increased learning motivation and learning content knowledge better with the devices than without. Lai et al. (2007) also support this by stating the children using mobile computers being more motivated, having enhanced awareness of learning in context, and better enriching their conceptualization of knowledge through experience, than their counterparts using paper-based workbooks on a field trip. Additionally, Mayben (2010)

offers three main factors that represent student perception of the activity: fun, altered perception of learning, and motivation.

In their Ambient Wood project, Rogers et al. (2004) argues mobile technologies supporting self-initiated exploration in nature, increasing peer and facilitator communication, and enhancing children to build and test hypothesis in the natural environment. Such independent activities support the idea of promoting children-nature relationship, and improving students' collaboration skills. Likewise, Kamarainen et al. (2013) reported technology to promote children interaction with natural elements and classmates, and thus enriching the learning experience. Studying water quality in a local pond, children were reported demonstrating a deeper understanding of the learning objectives and that "students had expanded opportunities to engage in activities that resemble scientific practice" (p. 545).

Student engagement

Another positive impact in learning with technology is learner's increased engagement to the subject. Especially Chen et al. (2008) mention students' development in their critical thinking about the topic. For example they mention students reflecting their previous knowledge about the environment while collecting data with portable computers. Their study also show that by actively processing the data, students were reported constructing the new knowledge in a self-reflecting way. This does not correspond to the findings of Ruchter et al. (2010) and Costabile et al. (2008) whose studies could not identify any significant difference in learning engagement between students using mobile phones or paper-based guide book in environmental education program.

Cheng et al. (2013) pointed out that those students who used mobile technology participated with significantly increased interest to the subject. In addition to increased engagement, students' learning effectiveness improves. This was a result of a digital game based activity that was designed to enrich the learning content, to be easy to use, and to increase students' learning motivation. Kamarainen et al. (2013) stresses student-centred facilitation being beneficial for the students as they experienced a different sense of ownership over the task. Technology integrative teaching can "encourage active processing thus helping students to develop deeper understanding, discover gaps in their understanding, and realize the potential for transfer in similar contexts" (p. 554).

Rogers et al. (2004) pointed out students experiencing a certain amount of distraction from the topic that was caused by challenges with operating the devices outdoors. The distraction appeared when the students had to switch between tasks that required intensive concentration. They also suspected that carrying technological devices outdoors might be problematic for practical reasons. Simply,

children's hands get full when carrying a device, and they are no longer able to touch and feel nature. Therefore Rogers et al. suggested students working in groups when the operating person can be changed. In turn, Ruchter et al. (2010) observed that even though students might have been distracted from exploring nature, they did not experience it as isolation. They also stressed modern children being able to utilize mobile devices and engage in other experiences simultaneously.

Environmental awareness

Some authors argue the mobility of the handheld devices as one of the greatest benefits for learning (Chen et al., 2008; Uzunboylu et al., 2009; Lai et al., 2007). Sharples, Taylor & Vavoula (2005) offer another aspect by suggesting not to focus on mobile technology, but on the learners being mobile. With the ability to move around, take quick interactive field notes, and gather data independently and collaboratively, the classrooms are no more needed in the same extent (Chen et al, 2008; Lai et al., 2007; Kamarainen et al., 2013). By taking the studying outside the classroom teacher is able to reconceptualise "learning as personal, situational, collaborative, and lifelong" (Uzunboylu et al., 2009, p. 382).

The possibility to experience real life phenomena outside the classroom by using handheld devices enables children to create personal connections to the natural environment which on the other hand is suggested to influence learner's attitudes towards nature (Uzuboylu et al., 2009; Kamarainen et al., 2013). Teaching environmental subjects with technology outdoors made students to observe nature more carefully and thus increase their environmental awareness (Uzunboylu et al., 2009), improve their environmental knowledge and attitudes (Ruchter et al., 2010), and to "overcome one of today´s fundamental challenges for environmental education, namely, learners' alienation from nature" (Cheng et al., 2013, p. 105). Additionally, Palmárová & Lovászová (2012) believes computer mediated outdoor activities in schools to contribute to a healthy lifestyle. Even so, Ruchter et al. (2010) underlines the importance of continuity. To make change in learners' environmental attitudes, they emphasize that the learning situations must be repeated regularly.

Teachers' point of view

As described above, the affordances of technology to enrich pupil's learning process are various. From teacher's perspective, the issue is *how* to use the devices to support their teaching and what kind of challenges they are confronted with. Many argue teaching with portable devices being more student-centred and enhancing active learning situations (Palmárová & Lovászová, 2012; Kamarainen et al., 2013; Rogers et al., 2004; Chen et al. 2008). To change teaching methods in a more student-centred way, educators are required to shift their role from teacher to mentor or expert

(Noteborn et al., 2014). Graeff (2010) suggest that teachers should aim their teaching results to reach beyond textbooks.

To increase students' learning motivation, the activities should be well designed. Palmárová and Lovászová (2012) suggest adventurous and competitive activities resulting in high intrinsic motivation and great learning outcome. Furthermore, they offer not to make the learning activities too trivial or difficult, in order to offer a suitable amount of intellectual challenge. Also, the teachers should take the weather into account, namely, rainy weather during the class might not only lower participants´ motivation but also damage the hardware and so ruin the joyful learning experience. Similarly, Cheng et al. (2013) emphasize usefulness and ease-of-use being key determinants when planning the learning session.

According to Kamarainen et al. (2013), teachers who facilitated outdoor learning experiences with smartphones being unable to prepare the class ahead of time if working alone. This resulted from a lack of resources and education available. As a conclusion, Ruchter et al. (2010) summarizes that novel technology-mediated education offer a great potential for environmental education. Since the students are already advanced users of the devices, they feel natural to participate in direct experiences with a portable computer in nature. This supports to answer to the aggravate problem of nature-deficit disorder in increasingly urbanized societies. However, the aim of this thesis is to find out if technology can actually enhance human-nature connectedness, or does the device disturb student from experiencing nature. These contradictory issues will be debated in Discussion.

Perspectives in learning theories and models

This chapter will summarize the different learning theories that technology use in education can be based on. When teachers' pedagogical approach changes from teacher to facilitator, the way they plan, implement, and review their teaching changes as well. In current educational discussion the learner is often considered as an active and collaborative unit, who is not taught to learn only content, but to learn how to learn in sustained situations (The Education Department of Helsinki, 2015).

Speaking of current changes in education for sustainable development, Daniella Tilbury (2015) emphasize six factors in the reformation of educational praxis. She states that teaching should empower the student (empowerment pedagogy), face to the future (futures pedagogy), and be flexible for place, mode and time (flexible pedagogy). Additionally, teaching should support learner's transformative capabilities (transformative pedagogy), be crossing boundaries (non-boundary pedagogy), and take place in social situation (social learning pedagogy). All the mentioned factors are highly influenced by the future of technology integration for teaching and support the use of outdoors.

In the 21st century, many have aimed their attention towards technology supportive learning theories. Likewise Tilbury, social constructivist theory is often mentioned to form the base for the use of mobile devices (Uzunboylu et al., 2009; Chen et al., 2008; Palmárová & Lovászová, 2012 Kamarainen et al., 2013). Palmárová & Lovászová argue activities implemented with technology being student-centred, problem-based, and collaborative, which all are closely connected to Jean Piaget's theory of constructivism. Discussing the roots of constructivism, Ackermann (2010) suggest collaboration with peers accelerating learner's progress and fostering their communication, social, and learning competencies, which again are factors that are often highlighted when teaching with mobile technology.

Considering different pedagogical approaches for technology use in education, Salmia, Michelson, Nuuttila, Siivola and Venho (2013) offer several models to base the practices on. Mobile pedagogy affords learning to take place in authentic situations, for example on learner's free time and in nature. Next, two models of mobile pedagogy will be presented, starting with AEFIRIP-model, and continuing with mobile inquiry learning. More models are available in their publication: Mobile guide 2: With mobile – naturally! (Salmia et al., 2013, in Finnish).

Figure 1. AEFIRIP -model (Silander, 2012. In Salmia et al., 2013)

The AEFIRIP-model, introduced by Pasi Silander (2012), is intended to help teachers to apply mobile technology in their teaching and to create situations where the learner interacts with fellow students and the environment. As pictured, authentic situations always play central role for learning. The learning process starts with activating learner's prior knowledge by asking reflective questions about the subject. Next, the teacher helps learners to become aware of their knowledge and preconceptions, and the learner visualizes this by writing them down (externalization). Prior knowledge reflections from all students can be gathered and shared in a mobile learning blog to enliven discussions. Now students start to focus their learning in an authentic environment (e.g. nature) by collecting data from the subject. Mobile devices (photos, videos, text etc.) can be used for data collection. Teacher is supposed to support the learning to aim to the essential subject with small questions and tasks. (Salmia et al., 2013)

In interpretation, the learner is guided to visualize one's key findings and reflect upon them. The aim is to identify situational factors and their relationships to the subject or phenomenon. The findings can also be merged to relevant theories and literature, and since learners might have different interpretations, fruitful reflective discussions can be facilitated within the class. This allows learners' to mirror different aspects, and make the learning meaningful in individual and communal level. In reflection students are guided to continue processing their knowledge with

literature and others perspectives, and so become aware of their own personal learning process. Finally, the students continue exploring the topic in depth by making questions in a knowledge construction process where the gathered content is central. In information processing, mobile inquiry learning model can be adopted. (Salmia et al., 2013)

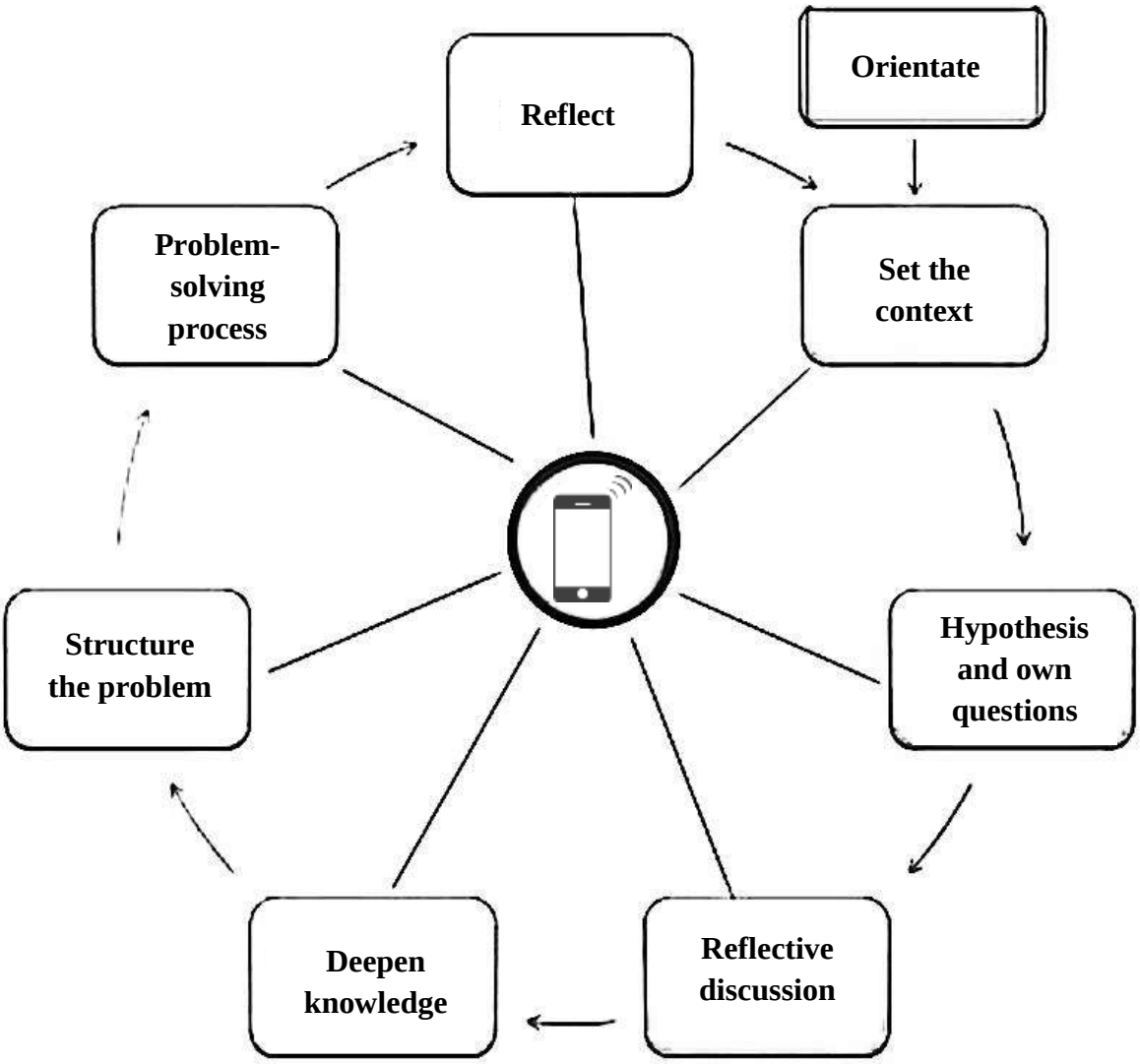

Figure 2 Mobile inquiry learning (Silander, 2012. In Salmia et al., 2013. Translated.)

Also developed by Pasi Silander (2012), mobile inquiry learning model is based on the idea of inquiry learning (Hakkarainen et al., 1999). Mobile inquiry learning model aims to activate learners to process their knowledge and interests in a goal-directed way. The model builds on an idea, where learners are developing new knowledge collaboratively based on the question or their own hypothesis. According to the model, the learners are supposed to share their knowledge and opinions with classmates, and reflect in ever deepening knowledge creation process. Mobile technology offers students various ways to implement the sharing process in different forms where everyone can access the same files and complete with their own ideas. Inquiry learning starts with

orientation, where the teacher set the context for learning and motivates the students to link the topic to real, authentic situations. Based on the learning context, learners will start developing own questions and problems that they will start processing. It is important that every student will link the topic to their personal preconceptions and prior knowledge, or they will not be able to progress in their understanding of the subject. (Salmia et al., 2013)

Critical evaluation of prior knowledge is crucial for deeper understanding over the subject. Learners assess independently or collaboratively how well their hypotheses correspond to the existing problem and decide for the need of further investigation. Simultaneously the learners compare their own ideas to others' and review their knowledge critically. Through reflective discussions, the learners aim to deepen their understanding of the subject. The main questions are often divided into smaller pieces to ease the problem-solving process. While working around the problem, the learners can collect information using different sources preferably in co-operation with peers. Finally, mobile inquiry learning practices aim not only to create new knowledge but also to achieve conceptual change in learners thinking. A change in one's conceptual thinking is often in central role when transferring the learning into practice. (Salmia et al., 2013)

In Figure 2, Silander has set mobile technology in the centre of the learning cycle that pictures the practices. Despite of that, Silander does not emphasize the use of the devices in the inquiry learning activities but speaks much of students being active, curious and collaborative. Therefore it could be deduced, that the device is used as a tool in many phases of the practice, but it does not necessarily form the core of the cycle since the active students should keep that position. As mentioned above, mobile inquiry learning model is elaborated from inquiry learning (Hakkarainen et al., 1999) but to use mobile technology in learning as an individual model, it should be explained in more detailed way, how to exploit the devices in practice.

National Research Council (2011) supports similar ideology of teaching than introduced above. Science should be learned in authentic situations, "which take place in context and communities that are meaningful to students and provides connections to their own experiences" (in Kamarainen et al., 2013, p. 545). By giving the student a possibility to work in a self-initiated method gives students the feeling of having control over how they access the information and shifts the learning responsibility towards the student (Rogers et al., 2004). That way student will get more motivated and engaged to the topic, and the learning becomes more efficient.

Introduced learning models by Silander (2012) are basically elaborated versions based on well-known educational contributor, David Kolb's (1984), four stage learning cycle: concrete

experience, reflective observation, abstract conceptualization, and active experimentation. The additional factor that Silander offer in his models is the creative use of technology. By activating the students to use their own thinking and to use such working methods as they wish, the students are expected to enjoy the learning process and develop both conceptual and procedural knowledge.

From the pedagogical point of view it must be concluded, that the technological devices can, and are recommended to be used in teaching, but the emphasis must be kept in the student and the subject rather than the device (Cheng et al. 2008). Similarly Lai et al. (2007) support technology oriented environmental education by mentioning that, "it was not the technology itself but interplay between technology and pedagogical practice that affords possibilities for better experiential learning" (p. 335).

Chapter III: Research Methodology

Research Design

The structure of this thesis is designed to answer to the research problem and questions as holistically as possible. The three research questions presented in Introduction define the core for this study and everything will be built over these questions. For example the variety of themes processed in the literature review follows strictly the framework set by the research questions. Similarly the open ended questions in the questionnaire have been developed to support each research question separately. These questionnaire-research question relations will be explained in the following chapters.

Research Problem and Hypothesis

It must be admitted, that mobile devices have come to schools to stay and the usage of technology in teaching will only increase from now on. However, not always are the teachers able to use the new devices by themselves or know how to teach with them. Even so, research has shown that the majority of the students have a positive attitude towards the use of technology in school (Mayben 2010; Cheng, Lou, Kuo & Shih 2013; Ruchter, Klar & Geiger 2010; Palmárová & Lovászová 2012). This research aims to offer insights to the teachers' perspectives and what kind of support the teachers consider necessary. The lack in teachers' capability to use the devices offers a possibility that tablets and other portable devices are purchased without adequate knowledge and research about how to use them effectively. This might lead to an assumption, that portable technological devices act as an intrinsic value and therefore has a wrong starting point for the educational practices.

The hypothesis of this research can be seen as a continuum for the problem mentioned above. It is based on researcher's personal concern on two issues in the modern western lifestyle where children use more time with screen technology and are less connected to nature. As presented in Introduction, the hypothesis is summarized in two, slightly sceptical issues:

1. *Many children are more used to touch the screen than to feel, smell, hear and see the natural attractions and therefore the technological devices are distracting children from experiencing nature.*

2. *Pupils are used to use technological devices and therefore hold positive attitudes towards using them officially in school situation, but it will not increase pupils' connection to nature.*

Finally, the research aims to explore these issues with the support of the research questions. The main question is if technological devices can be used to enhance children's interest in the natural environment. If so; how, when, and where the devices should be used in environmental education. The research aims to hold a neutral position for the hypothesis and aims to provide data to suggest supporting or refuting it.

Instrumentation

To examine the realized outdoor use of technology as part of formal teaching, the qualitative research method (Denzin & Lincoln, 2000) was applied. By using qualitative research method the aim is to explore in depth the increasing phenomena of technology integration in teaching and its affordances for environmental education. To study the learning activity comprehensively, data were collected from three different aspects: teachers who taught the class, educators from local educational institutes who helped the teachers and planned sessions, and through non-participative observations by the researcher who participated several sessions where handheld devices were used in outdoor situations.

The research was approved through the University of Cumbria ethics approval process (see Appendix 1). The participating teachers and educators were invited to answer a questionnaire that included five multiple choice, and seven open ended questions (see Appendix 2). The participants received a link in their e-mail that guided them through the questionnaire. In one case (Ecovan), the link was sent by the researcher himself to the teachers and one practitioner, whereas in two other cases (Mobilely to the World & BUEEC) the link was forwarded to the participating teachers by the main educator of the institute. Before answering the questionnaire, the participants were introduced to the topic by reading a short summary about the perspectives of the research but the exact research questions were not presented. The participants were asked to give as holistic and multidisciplinary answers as possible. To answer the questionnaire took approximately 15 minutes. The questionnaire was translated into Finnish and English to enable similar setting in the examined two countries.

Researcher took the role of an observer in five classes in Lahti and five classes in Brisbane. The length of the sessions varied from two hours to six hours. The events differed from each other by the educational objectives and methods but shared the use of technology in outdoor situation as part of formal curriculum teaching. Tablets, smartphones, cameras, and digital microscopes were used

during the classes which were all supported by an educator from another institute than the school itself. These observations were aimed to offer practical insights to the activities implemented in teaching and to recognize students' reactions towards the used devices. The data was documented by field notes by the researcher.

To deepen the understanding of the benefits and issues that the teachers are experiencing, semi structured interviews (Biggam, 2008) were also applied. One Finnish teacher and one educator, as well as one Australian teacher and two educators from other institute were interviewed. Interviews followed the same themes as the questionnaire. The researcher kept the interviews open but led the discussion with exact questions. The interviews took place after environmentally oriented classes where educators integrated handheld technology in teaching. Thus, all the interviewees had an example of technology implementation in their minds, and the purpose of the device as well as the realized learning objectives was analysed. The interviews were recorded and the teachers were given similar introduction to the perspectives of the thesis as in the participants answering the questionnaire. Partial aim of the interviews was to open the cultural context for education in the two countries.

Research Questions

As the research questions were first introduced in chapter I, now the questions will be presented in relation to the open ended questions in the questionnaire.

1. *Can the technological devices be used at school to enrich the learning experience outside the classroom and increase pupil's engagement in the subject?*

The first research question has strongly educational and theoretical aspects, and focuses on the current change in teaching methods. As the questionnaire is aimed straight to the teachers and other educators who work hands-on with children, this question is dealing with opinions and perspectives of the practitioners. The data for the first research question is collected through the following questions in the questionnaire:

- How do you think about the use of technology as part of formal curriculum teaching?
- Think about the pros and cons of using technology outside the classroom (e.g. in nature)
- Why did/would you choose to use technological devices as part of your teaching?
- How does the use of technology affect pupil's learning?

2. *Can the technological devices be used at school to enable children to spend more time in nature and make children more curious about the outdoors and natural phenomena?*

The second question widens the educational perspective into environmental education and children-nature relationship. However, the context is still in the formal school teaching even though the aim is to find ways to urge the students to spend more time in green environment in their free time as well. Therefore the data collected with the following questions can be examined together with the first research question school context as well as combined to Richard Louv's ideas of nature-deficit disorder in the context of nature. The data for more environmental aspect is collected by following questions:

- How do you think about the use of technology as part of formal curriculum teaching:
- Think about the pros and cons of using technology outside the classroom (e.g. in nature)
- How does the use of natural environment affect pupil's learning?
- What kind of challenges do you find in using modern technology in environmental education as part of teaching outside of classroom?

3. *Ascertain how the technological devices have to be used to reach the best outcome.*

The third research question is more about the practical issues the teachers and educators are experiencing in their everyday work. As the aim of this thesis is also to offer practical examples of technology use in environmental education, the following questions play a central role for this research:

- Think about the pros and cons of using technology outside the classroom (e.g. in nature)
- Describe an example of a practice you have done with the pupils when you have used technology in your teaching in the outdoors
- What kind of challenges do you find in using modern technology in environmental education as part of teaching outside of classroom?

Sample

For data collection, a purposive sampling method (Patton, 2002) was adopted. Being purposeful for small samples with particular characters in the field of study, purposive sampling enables this exploratory, qualitative research an access into the phenomenon under focus. In this research the

main goal of purposive sampling is to focus on certain characteristics of teachers and educators, which allows best the participants to answer the research questions. Due to the limited resources available for the study, critical case sampling technique was implemented to find out if any notable outcomes can be drawn. It is typical for critical case sample to research if the representative cases can be decisive in explaining the phenomenon of interest. The three cases will be introduced below.

In total, the aim was to gather data from approximately 20 teachers in primary schools and educators from other educational projects. The participative teachers and educators was mixed genders and in different ages, all between 26 and 65. The common factor that all teachers share is that they all teach a class in primary school for grades 3-6 (age 9-12), and they have an interest of using modern technology in their teaching outside the classroom. The teachers were not necessarily experts in using technology in their own teaching but they all shared the interest of doing so. On the other hand the educators from other institutes can be seen as experts in technology teaching. The educators were leading technology supportive environmental education projects and therefore working closely with primary school teachers and pupils. All participants were engaged in a project that helps the teachers to take the pupils to learn outside the classroom using technology. The technology oriented mind-set that the participants had enables the data being rich in content but on the other hand limit the capabilities to generalize the research results into bigger context.

The participants for the study were recruited through three organizations of which two was located in Finland and one in Australia. The joint factor between these projects was the shared interest in introducing technological devices to be used in outdoor teaching. The cross-cultural aspect aims to offer this research a wide perspective to analyse the results. Anyway, the nature of this study is not to compare two educational cultures because of the three individual organizations do not represent cultural perspectives. Instead, by having the chance to observe the practices in two countries and discuss with local practitioners, the researcher will gain a rich overall understanding and knowledge to share in the future. Next, the three partner institutes of the research will be introduced.

Case Ekopaku (Eng. Ecovan)

Ekopaku is a van that is aimed to enhance teachers to use their school's local environment for educational purposes. The van carries technical devices (e.g. digital microscopes, tablets and a big screen) as well as traditional environmental education material (e.g. binoculars, snowshoes and books). The Ecovan can be driven to the school where the teachers can keep classes outdoors using the material inside the van. The use of the van is free of charge for the schools and the deep

intention is to build bridges from school curriculum, including biology, chemistry, mathematics, and many others into ones everyday life. The van is used in the city of Lahti in Finland.

Case Mobiilisti Maailmaan (Eng. With Mobiles to the World)

The project has developed mobile tools to take the playful research-based learning activities and inclusive pedagogy approach in education in the primary school surroundings and in nature. In the project, mobile technology, social media and cloud platforms has been widely used. Also, location-based applications like Grafitee and Action Track has been introduced for educational purposes. The aim of the project was to develop technology integrative models to be used in education. Mobiilisti Maailmaan –project takes place in the schools of Helsinki, in Finland. (Mobiilisti Maailmaan, 2013)

Case Brisbane Urban Environmental Education Centre (BUEEC)

The Brisbane Urban Environmental Education Centre is committed to supporting schools in implementing the Australian National Curriculum. The design of the programs is based on the 'Teaching the 21st Century Learner' model which in practice means students learning with digital handheld devices. In their courses the Centre emphasize real world contexts, active participation, and aims to integrate information and communication technologies into learning. The real world contexts often include field trips to city and suburban locations to learn about the local environment, and natural systems and resources. The BUEEC aims to develop deeper understanding for students about sustainability and the modern environmental challenges the society is facing in the future. The Centre is located in Brisbane, Australia. (The BUEEC, 2015)

Data Analysis

The qualitative data from the questionnaires, interviews and field notes will be analysed by using a content analysis method (Hsieh & Shannon, 2005). The data will be stated with using a directed approach where the analysis and discussion consider the theory and previous research findings together with the data. With this method the discussion seeks for relations, to express commonalities and disparities between this research and the previous researches. A summative content analysis approach will also be used to emphasize the most often repeated viewpoints. Simultaneously the Finnish and Australian perspectives will be explored together and comparatively even though the focus will be kept in individual activities (see Limitations). The demographic data will be used for picturing the sample and how frequent is the participant's use of technological devices outside the classroom. This sought to describe how experienced and active

the participants were in the current educational development and to value their expertise in the topic.

Limitations

The limitations of this study correspond to the topicality of the subject. That is, as the research area is rather new, the number of teachers implementing such activities is relatively low. Hence, the purposive sampling method was implemented. Therefore any statistical generalizations can hardly be made and the suggestions must be drawn from the individual cases represented in this paper. On the other hand this offers a great opportunity for this research to develop new ideology for teachers, practitioners and decision makers. As stated in the hypothesis, some practitioners and nature education advocates still carry a reserved mind set for technology integration in environmental education. Of course, another issue that limits the possibilities to create any generalizations is the biased sample in this study. Namely, even though all participants were not technology or outdoor education experts, they were all interested to combine those elements, which is not always the case in schools.

The cross-cultural setting brings this research a wider perspective of practices but due to the concise sample in both countries, no strong culturally justified arguments can be stated. Also the research method focusing on teachers and other practitioners limits the perspective of the results. If a more objective perception was desired, children and their parents should be included for the sample and wider range of methodology implemented.

Finally, there is always a problem with a questionnaire including open ended questions. To collect qualitative data, the questionnaire does not reach the level of semi structured interview in the depth of the content. Therefore, the questionnaire data is completed with five semi structured interviews with teachers and educators to gather a deeper understanding of the topic.

Summary

This chapter has presented in depth the research problems, the methods applied for data collection, sample of the study, and possible limitations for the research. The choice of methodology and methods has been chosen according to what I consider the most appropriate methods to explore, gain the richest insights and seek possible answers to the research questions I have within the limits of time, resources, and situational framework available for me. Due to the pragmatic nature of the

issues presented in the study I have tried to create as little limiting factors for the participants either answering the questionnaire or being interviewed. Therefore some of the questions in the questionnaire have a very open approach (e.g. Describe an example of a practice…) meanwhile other questions are more straightforward (e.g. How does the technology affect pupil's learning?). These both types of questions are necessary to achieve as honest and holistic results as possible.

Chapter IV: Findings, Discussion and Recommendations

This chapter will demonstrate, analyse and discuss the survey findings in relation to the literature review. The aim is to reinforce the existing knowledge gap in the current educational discussion and offer the reader comprehensive data content based on the research implemented. Firstly, general observations of the research process will be concluded. Secondly, the demographic findings will be articulated in total and separating the responses from the two countries. Thirdly, the survey findings will be linked together with the research questions. Relations with the findings and the previous research will also be examined. The content analysis of the research will focus on commonly repeated opinions of the participants. Finally, limitations of this study and recommendations for further study will be made. In this chapter I will occasionally separate answers from the participating teachers and the answers from the educators from other institutes. To keep the separation clear, the primary school teachers will be called as 'teachers' and the other institute educators will be called as 'educators' or 'practitioners'.

My experience of the research project was that both questionnaire and interviews produced well-structured data and good insights into the issues the thesis is dealing with. The data collection process was relatively fluent except the problems that the Australian participants faced with using Google Forms. The researcher was informed by several participants that the link to the study was blocked by their web browser. Therefore the questionnaire was converted into Microsoft Word™ and re-sent to the teachers, but due to the end of the semester, the amount of replies was less than expected.

While observing the technology integrative outdoor activities in both countries, the teachers indicated great interest in the research topic and also often shared the concern pointed out in the hypothesis. This noticeable interest in the teachers and educators talk corresponds to the active public discussion in the media (e.g. BBC, 2014; Yle, 2015; Vantaan Sanomat, 2014 & Kelly, 2013). While discussing with the teachers in an informal setting, they shared some interesting insights into how the profession has been changing during the last years and will be changing even more rapidly in the upcoming years. These changes, issues and wishes for the future will be widely discoursed below.

Demographic Findings

In total, 18 responses to the questionnaire and five interviews were made. From those questionnaire responses, 12 were from Finland and 6 from Australia. Two of the interviews were made with Finnish teachers, two with Australian teachers and one with Australian educator. 80% of all teachers and 83% of all participants were females, which make the sample highly biased, but also picture the teachers' gender situation in schools.

From the Finnish teachers and educators from other institutes, 12 responses to the questionnaire were gathered. Of these, half was answered by teachers and half by other practitioners. As mentioned, these answers were highly biased by gender, namely 83 % of the teachers and educators were females. This corresponds to the teacher situation in Finland in 2013, where 74 % of the primary school teachers were females (Kumpulainen, 2014). From the Finnish participants, three fourths were under 45 years, and all of them used technology as part of their teaching either inside or outside the classroom. Three thirds of the Finnish respondents use technology in their teaching at least once in two weeks and the rest at least once in a semester.

All of the Australian respondents were between 36 and 55 years old. Five of the six participants were females and used technology in school, both indoors and outdoors. One school teacher used technology only indoors. The Australian sample uses much more technological devices than the Finnish, since all the respondents mentioned using the devices at least once a week which makes the participants more experienced than the Finnish sample. Due to the modest number of Australian questionnaire responses, these are not very well comparable to the Finnish corresponding.

Findings and Discussion

Research Question 1

The first research question was to find out if technological devices could be used at school to enrich the learning experience outside the classroom and increase student engagement in the subject. As the previous research has shown, students often hold a positive attitude towards the use of technology in schools (Mayben 2010; Cheng, Lou, Kuo & Shih 2013; Ruchter, Klar & Geiger 2010; Palmárová & Lovászová 2012). Likewise, the sample of this research releases similar attitudes by the participating teachers and educators of which over 90 % was able to find positive elements from technology in educational purposes. The positive elements were mainly linked to students' learning experiences, but also teacher's expanded toolbox for new teaching methods was

emphasized. The possibility "for teachers to cater a wider variety of learning styles than traditional methods" (Australian female educator) allows better learning opportunities for different learners.

There were many upcoming opinions about why the devices should be integrated into teaching. To some extent, the reasons followed the same trends as introduced above in the literature review. The sample highlights the importance of the mobile technology in teaching and emphasizes technology increasing students' motivation, engagement, and enthusiasm for the subject. Namely, in addition to the all five interviewees, 83% of the Finnish and all of the Australian respondents mention increased engagement and motivation being the main element that improves when the devices are utilized. The improved engagement originates from students' everyday lives, because they often relate the devices into leisure time and having fun. Also, it was often mentioned that the activities done with mobile technology does not even feel like studying.

> *"One student said that this [studying outdoors with technology] is much better than studying, meaning that this was unheard-of for her."*
> *- Finnish female teacher*

> *"Information and communication technologies are engaging and highly valuable teaching learning tools. Students find the use of ICTs engaging, motivating and fun. ICTs also offer learning opportunities not possible without the use of ICTs."*
> *- Australian female teacher*

The previous quotes highlight the effect that mobile technology can make for learning motivation. An Australian educator explained the lately increased use of mobile devices in their courses by saying students speaking digital language and therefore they feel natural to use the devices in school situations. Even so, he argued that the teachers should be educated into higher level in technology skills to be encouraged to use the devices even more. The interviewed teachers highlighted especially the opportunities that mobile technology can offer for new teaching methods but no very exact ways of implementing new methods was explained in detail. A few of the teachers have participated a separate course for technology use in schools, but mostly the use of the devices was based on teacher's own initiative and interest. The teachers recognized the pros and cons that technology can offer, but deeper understanding of the models presented for example in the literature review was lacking.

Similarly, as presented in the literature review (Palmárová & Lovászová, 2012; Kamarainen et al., 2013; Rogers et al., 2004; Chen et al. 2008) the sample described the use of technology encouraging the active student and student centred learning situations. By enabling the use of technology at school, the teachers feel like passing part of the learning responsibility for the students. This empowers the students to work on their own initiative: to actively seek for accurate knowledge from the internet regardless of the place, report and share findings they have made, and work collaboratively in small groups. Also the creativity was reported as increased. When using novel teaching methods the teachers can enliven the learning experience, differentiate the learning content according to the student's skills, and motivate even the most unmotivated students to do the tasks.

The previous indicates the findings being closely related to constructivist learning theory which has been mentioned to create the base for technology use in education (Tilbury, 2015; Uzunboylu et al., 2009; Kamarainen et al., 2013). Indeed, student-centred and collaborative working method where peers accelerate the learner's progress supports the theory by Piaget. Technology use in teaching was also reported fostering the communicational and social competences, which again, can be seen as reaching the holistic educational competencies to gain better life. Namely, Noteborn et al. (2010), mentioned the ultimate aim for schools being to teach both conceptual and procedural knowledge. The same constructivist elements in education are presented by Sitra's developmental research (2015) to create the base for the whole education in the future in Finland.

By keeping the learning objectives to follow the curriculum, but widening the teaching methods, the students can use the learning methods that fits them the best whether it is creating a video, Power Point slideshow or in written form. In other words, all kinds of learners can access the curriculum in different ways. Being responsible for their own learning and working actively around the subject, the students feel more motivated to go to school. This internal motivation makes the school more interesting and helps the students to enjoy their school time.

> *"It [technological device] engages the learners and provides them with greater detail and illustrative examples of what we, as teachers, are telling them."*
> *- Australian male teacher*

While the review of the previous literature (e.g. Chen et al. 2008; Lai et al. 2007) suggested similar, mostly positive, results as presented above, the sample offered an additional point of view.

Reflecting to Rogers et al. (2004), many respondents had experienced the devices distracting some students from the topic. The respondents did not mention it as a problem, but something to take into consideration in teaching and setting clear boundaries what to do with the device.

Some participants also held a slightly more reserved position than the others for the use of tablet computers, and they had their reasons. A frequently repeated condition for the efficient use of mobile devices states that the device should be used as a tool to deliver the curriculum content instead of using technology for technology's sake. As it was often mentioned issue, the respondents seemed to acknowledge the pros and cons of the devices very well. It repeals the statement offered in the hypothesis, where the handheld devices were assumed to act as an intrinsic value for the activity when the teachers do not have the necessary skills. Due to the modest number of participants, this result cannot be generalized into bigger national contexts, but gives an interesting insight into the mindsets that the teachers with positive attitude towards technology hold for novel teaching tools.

Research Question 2

As underlined in the hypothesis by the researcher and environmental education academics, the issues dealing with the second research question divides the sample the most. To integrate technological devices into environmental education and to use the devices to enhance children to get more curious about nature shared the opinions both in Finland and in Australia. In general, it could be mentioned that the Australian sample held slightly more supportive position for using the devices outdoors than the Finnish equivalent.

All the interviewees recognized children's alienation from nature in their local environments. To teach in the natural environment was highly supported by the respondents. The dominant opinion emphasized the importance to maintain the relationship between children and nature. To sustain this bond for future generations, the teachers and educators mentioned broadly that children need real first hand experiences where they can use their senses diversely in the natural environment.

> *"The students already sit too much in front of the screen technology. When the devices are brought outdoors, the basic environmental education is in danger to be disadvantaged. The use of all the senses: smelling, tasting, and feeling, are more efficient when the child is in straight contact with the natural elements without the screen in between.*

I think that the most important thing is to strengthen child's relationship with nature. Many children can be so estranged from nature that with a technological device, such as a tablet computer, nature appears in a whole new way than through direct experience. The device might also inspire the students to explore nature when the use of technology is justified."
- Finnish female educator

This quote expresses the confusion that many participants had for technology. In many responses, both positive and negative affects was articulated. Anyway, the previous quote links together with Peter Becker's (2014) statements where children and adolescents should gain more primary experiences in nature. He argues that the use of tablet computers immediately changes the perspective of the experience from primary to secondary due to the effect of the device. When things are perceived through the device, the observed element alters by size, shape and colour and so changes the details of the object. To gain holistic learning, young people should get into primary contact with nature using their sight, hear, taste and feel senses.

According to the literature review, questionnaire responses and the interviews, mobile technology can support environmental education activities in schools. Likewise Becker (2014), many respondents emphasized that without feeling, touching, smelling and hearing nature with personal senses, it is not possible to enhance children nature relationship. Technology itself can enrich the learning experience, but it cannot replace the real touch of nature. In fact, all the participants of this research held a positive attitude towards integrating technology in environmental education, but many added that the device should not be an intrinsic value for the activity. Even so, a few Finnish respondents emphasized technology skills being a necessity for the children who work naturally with technology and therefore the skills should be taught as well. To learn in early ages how to utilize the devices purposefully in different projects was mentioned necessary to success in the modern labour market.

In addition to the possibility to enrich the nature experience, technology can be used to target learner's attention according to personal interest or educational aims. The results of this curiosity can easily be recorded by using different methods which will be presented in detail in the next chapter. Nature is also reported to reassure the lively and to excite more quiet students, and to deepen the holistic and meaningful learning experience in authentic surroundings.

In such urbanized environment as Brisbane where a lot of historical places have disappeared, the children lack of opportunities to experience pure natural and historical elements to learn from. The use of mobile technology allows new methods that bring students back in time through video clips, 3D pictures and interactive applications. On the courses of BUEEC the focus is always on environmental sustainability, which aims to create understanding about "how human behaviour has affected and is affecting on our environment and to empower students to make right choices in their own future" (Australian male educator). Drawing from the interviews and observations of the classes, the aim of BUEEC courses became clear. Meanwhile the learning objectives follow the curriculum, the aim to build up nature connectedness was also strongly visible. The learning activities clearly aimed to teach knowledge about the environment; values, attitudes and positive actions for the environment; and different ways to use the environment as a resource. The educational practice dealt with both historical changes and the latest issues such as flooding and shore erosion.

> *"Geography, History and Science can be a little 'dry' in the classroom and being out in the field helps the subject to come alive. Our aim is to help students develop a sense of stewardship for their environment and provide therewith the knowledge and skills they require to become responsible global citizens."*
> *- Australian male teacher*

Clearly, these educational objectives of BUEEC reflect to NCC's (1990) definition of environmental education. To strengthen children's environmental awareness the teaching should include education *about* the environment, *for* the environment, and *in or through* the environment. Also Bogner's (1998) and Leeming et al.'s (1993) suggestion to promote responsible environmental behaviour comes true on the excursions.

Similarly the Finnish projects had their environmental objectives. According to the observations and interviews the aims were not as well structured as the Australian ones. The focus on Finnish courses was mainly to learn about certain natural objects, enhance students to explore nature and take photos according to their interests and to work collaboratively in small groups. Then again, the Finnish students had more freedom to work on their own initiative rather than teacher centred activities which made the learning situations very lively and enjoyable for the students.

For many respondents technology was not only a positive additional tool for experiencing nature, but also a distracting element that should be, if not avoided, at least carefully considered how to be utilized. As the first research question discussed about the distracting element of technology use from the engagement point of view, half of the respondents were more concerned about children not experiencing the real nature through the screen. The often repeated question was if technology is coming between the child and nature, when it is integrated into environmental education. Similarly Becker (2014) questions that with technology children might be bodily present in the learning situation, but then, where are they in their minds.

> *"The challenge I think is in balancing the two and finding the right blend between the technological devices adding to learning experiences, whilst still encouraging the deep, meaningful learning that comes from teaching outside the classroom.*
> *- Australian female educator*

Also the portability of the devices divides the sample into two. Partly the mobility is said to open up possibilities since all the necessary tools are in one gadget. On the other hand the device is said to limit children's working positions, spontaneous movements and supplant multisensory experiences and therefore the devices need to be turned off occasionally. All organizations in the sample proved to have solved this problem by ensuring students spending time in nature also without the device.

Research Question 3

As stated in the analysis of the first two research questions, the teachers and educators support the idea of integrating technological devices into teaching to better reach the environmental objectives. This supports mainly the issues pointed out in the literature review. However, the third research question emphasizes the most important practical matters of the activities: what are the main characteristics of well-planned and directed practices that include handheld technology?

It appeared that the participating teachers have a massive knowledge gap in this particular issue. Even though the participants are more experienced technology users than average teachers, the teachers from the two sample countries mentioned themselves lacking education of using technological devices in teaching. This is alarming especially from Finland's viewpoint where the curriculum reform in 2016 aims to increase the exploitation of technology in schools. However, the questionnaire responses, interviews and the observations released three categories where the

activities shared similar elements. Firstly, the simple features of the gadgets were reported to be used for data gathering purposes. The second category activities were based on GPS (Global Positioning System) and the compelling nature of games. Thirdly, the organizations had developed specific applications and interactive online books for certain educational purposes.

> *"The Baltic Sea Day: We take pictures of the Baltic Sea with two themes [1]I am worried about, [2] the lovely Baltic Sea. Everyone takes one picture of each theme. Together we look at the pictures from a big screen and discuss about the problems and the uniqueness of the Baltic Sea."*
> *- Finnish female educator*

As mentioned above, one remarkable benefit that repeatedly appeared from the sample considered the widened opportunities to gather data with mobile devices regardless of the place and time. Half of the Australian and 58% of the Finnish questionnaire respondents mentioned the mobile devices increasing the opportunities to gather all sorts of data regardless of the time and place. Simple features like camera for taking photos and videos, notebook for making notes and sound recorder to capture sounds of nature enables simple practices with students. Additionally, the best is when these notes can be accessed again inside the classroom, processed with more information and shared with others. This opportunity demanded that notes taken outdoors can be saved in hard discs or cloud services since none of the teachers had their own tablet computers for their class.

Introduced working method allows the teaching to be more project based where students work either individually or in groups in the same project. To take pictures and make notes outdoors enables the students to reflect their ideas and thoughts together. The possibility to reflect upon the pictures helps students to connect their own thoughts into bigger context and thus make the learning experience meaningful. This kind of utilization of technology is simple for the teachers to implement and the only limitation is teachers' imagination.

The second frequent activity rest on the excitement of games that were based on GPS receiver of the gadget. Often the games that are based on GPS demand a certain application to be downloaded to the device (e.g. Action Track or Grafetee). To plan and realize the game takes plenty of time and experience from the teacher and therefore these activities were only run with the help of an educator. However, when the game is well planned, the results confirms Lovászová's and

Palmárová's (2012) findings that game based activities leads to high intrinsic motivation and great learning outcome. The activities were also reported as very rewarding both for the students and the teacher.

At its simplest form, the game can be orienteering using the navigation app downloaded for a tablet computer. The game often starts with a story that naturally develops along the way and hooks the students to learn more. Following the clues from the screen, the groups move from checkpoint to another. At each checkpoint there is a problem to solve which can be related to any subject (e.g. the signs of springtime). To solve the problems, students need to for example take pictures, create a video or search more information online. By solving these problems the groups proceed towards the goal and eventually they will reach the final completion. When the learning activity was based on games the students naturally enjoy and want to challenge the other groups. This makes the learning inconspicuous and even addictive for the learner. The more the teacher or educator uses time and imagination to plan the session, the better the result becomes.

The planning of the session always starts with the learning objectives often set by the school curriculum. Since the observed activities were environmentally oriented, the activities took place in a zoo or a fortress island in front of Helsinki. Hence, the aim of the activities was to enhance students' thinking about the endangered animals in the zoo and to study place based history while exploring the fortress island. The well-developed storyline played a central role in the activities.

The third way to deliver the educational content was mostly used in the courses of Brisbane Urban Environmental Education Centre, which means that all the classes was run by an educator with the help of the teacher. This added extra value and quality to the lesson since the educators had developed the content of the lesson to follow the curricular aims. The main part of the excursions run by BUEEC used a program on Apple™ iPad called the iBook. This application allowed the educators to create an interactive slide show where text, pictures, internet links and video clips enriches the learning experience.

The main idea of the application was that groups followed the directions from the screen and performed the given tasks independently in small groups. Different means to deliver the educational content was aimed to serve all kinds of learners. The lessons included a lot of discussions first in small groups and afterwards reflecting the results of the discussion together with the educator and the teacher.

The well-directed technology use on BUEEC courses resulted to follow the AEFIRIP-model presented in the literature review. As the ultimate aim for AEFIRIP is to "create a communal mobile learning situation where the learner is in active interaction with other students and the environment" (Salmia et al., 2013), the BUEEC courses represented technology integrative environmental education as its best. Indeed, the learning process started with activating the students to discuss about the location according to their prior knowledge. When the one-day excursion progressed, the students had to interpret, reflect and process their prior knowledge and new knowledge offered by the iBook application or the educator. On the excursion the students were asked to focus on certain issues and to take pictures of and make notes about them. Afterwards this collected data was reflected with the teacher and processed inside the classroom into a personal photo journal.

As the BUEEC excursions reached the educational objectives well, and engaged the students to work independently, it can be concluded that the educators of the organization used AEFIRIP-model exemplarily without knowing it. Likewise in the model, the mobile device was used to gather and process data, but the active student and the authentic learning situation created the core of the session. Simultaneously the teacher of the class expressed a wish that all students could have their own tablets so they would not have to change the devices continuously.

An example of bad use of mobile device in educational situation is when a teacher gives a tablet computer to a student as a reward after completing all the given tasks. This is the best to show the incompetence of the teacher and not understanding the true educational value of the device. Similarly, students might find the entertaining qualities of the device dominating, but when the technology comes in frequent use in schools, both teachers and students will learn how to gain the best benefit.

Challenges from the teachers

Some challenges for the use of technology outdoors were often repeated in the questionnaires and by the interviewed teachers. All of the stated challenges were something to consider when planning and implementing the session instead of cancelling the activity. The first major issue, naturally arising from the Finnish respondents, is the always changing weather. One third of the Finnish responses mentioned the risk of the devices breaking in the rain or due to students' incautious handling. Surely, the long and cold winter limits the opportunities for the technology use since the battery life of the devices drops dramatically in cold. This was also considered as a factor that is limiting the use of mobile devices outdoors.

Even though the majority of the respondents carried a positive attitude towards technology, the teachers felt the need for more education about how to use the gadgets for educational purposes. This is a major issue both in Finland and Australia that the teacher education training will need to consider in the near future. There is a generational difference in the technology skills among the teachers and the students since many teachers mentioned the students being more skilful with the gadgets than the teachers. A few Finnish teachers had taken the chance and changed the roles of the class upside down when asking the students to teach the teachers about how to use the device. This is an excellent example of how to teach children not content knowledge, but different roles people have in life and so advance the students in their thinking.

Resulting from the lack of education, the Finnish teachers expressed the difficulties of using the applications, cloud service data storages and different ways to share information online. It was mentioned that the practical issues of the devices should be well planned and the functions of the gadgets should function trustworthily. Namely, when the devices are out of order, it takes valuable time out of learning itself. For example the teachers mentioned GPS receivers and inoperative WLAN connections affecting troubles in class.

Another concern in technology integration into schools considered equal rights for students in Finland. Mainly the teachers in Finland shared the worry that even though the Finnish government is updating the national curriculum in 2016 and simultaneously schools are investing in mobile technology, the inequality in Finnish schools will increase. The main reason for this is the varied amount of money that schools and municipalities are able to invest for new devices to even become able to deliver the curriculum objectives. The Finnish participants agreed that the government should ensure equal opportunities for learning through the country, but simultaneously recognize the cost of investment and furthermore the maintain expenses of the devices.

Finally, the change in teaching methods varies the way of evaluation that the teachers have to make. While before, teachers could assess students' learning outcomes simply by exams, the new, portfolio and project based learning methods demand the teachers to assess the whole learning process more holistically. This relates to the change in teacher's role as the teacher is not continuously in the lead of the lesson but students work more individually. This set the teachers who have used the same teaching methods for decades in a new situation and definitely in need for further education to adapt the new condition.

Limitations and Recommendations for Future Research

The fact that all the responsive teachers and practitioners used technology in their teaching either inside or outside the classroom indicates two issues. Firstly, it proves the rise of technology use in schools during the 21st century. The two countries selected in the research are both relatively highly ranked in educational issues (OECD, 2012), and in the top three countries in the OECD (2014) countries in the number of wireless broadband subscriptions. Then, because the countries and the sample were chosen according to the interest in technology and environmental education, it makes the sample highly biased. This emphasis on the sample results to the fact that content is not well generalised into other countries that might not be as technology oriented. For further study, it might be beneficial to collect more examples from different technology integrative environmental education activities implemented in other, not so technology oriented countries.

Secondly, the sample was weighed for a reason. To receive elaborative and valuable data from different perspectives, it demands some experience about the topic from the respondents. Therefore, this research acts as a starting point for further studies and discussion. As a multidisciplinary and even futuristic field of study, it is important to recognize the need for further teacher education and to create a common understanding of how the devices should be utilized in practice. Also, for further research, it would be fruitful to find out if the teachers with no prior experience or interest about teaching with technology would offer different points of views.

However, the most limiting factor of this research is the modest number of participants. The issue resulted from the fact that the amount of teachers and organizations, that completed the demands of the research, was very limited. The two Finnish visionary projects and the Australian environmental education centre fulfilled excellently all the three dimensions that the research had. Even so, the teachers co-operating with the three organizations could have been more active to answer the questionnaire. Admittedly, the small sample population size makes it difficult to draw any broad conclusions but does provide a good foundation on which the future research may be built.

Chapter V: Conclusion

This research was based on three issues that concerns changes in modern lifestyle in western cultures, which were the rise of technology use in people's everyday lives, the lack of time spent in the natural environment and finally the discourse of the two in the context of formal school curriculum. The research highlights in particular children's alienation from nature, increased use of screen technology and the modern educational development in the two technologically oriented countries, Finland and Australia (OECD, 2014). This section will revisit the research objectives below, summarize the findings of this research work and offer conclusions based on the findings.

The overall aim of this research was to explore the possibilities and challenges of using modern portable technology, such as tablet computers and smartphones, in environmetal education, particularly as part of formal curricula teaching outside the classroom. By researching different methods, the dissertation sought arguments to complete the current discussion about technology in schools. The specific research objectives were, within the context of formal education, to answer the following research questions:

1. Can the technological devices be used at school to enrich the learning experience outside the classroom and increase pupil's engagement in the subject?
2. Can the technological devices be used at school to enable children to spend more time in nature and make children more curious about the outdoors and natural phenomena?
3. Ascertain how the technological devices have to be used to reach the best outcome.

The results of the study were various. Firstly, this research confirmed that in addition to students (Mayben 2010; Cheng, Lou, Kuo & Shih 2013; Ruchter, Klar & Geiger 2010; Palmárová & Lovászová 2012), also teachers hold a positive attitude for technology use in schools. Secondly, the participants highlighted the increased motivation and engagement into the subject being the most valuable outcomes of technology use. This result considered both teaching indoors, but more importantly using tablet computers and smartphones effectively to increase student's awareness of the environment. To facilitate education with environmental objectives, technological devices can support the activities, but cannot replace the sensory contact to gain real touch with nature.

The research reports learning with mobile computers advancing student-centred, collaborative and self-initiative learning methods which are available regardless of the time and place. The cases

presented in the Discussion follow the ideas of Jean Piaget's constructivist learning theory where the learning is most efficient in peer interaction that technological devices are excellent to facilitate.

According to the observed practices, the technology integrative educational activities were divided into three categories. Firstly, the simple features, such as camera, notebook and voice recorder, were used to collect data from the outdoors. The possibility to re-access the gathered data enables the class to discuss the content and reflect upon the experience. The second way for efficient utilization was based on GPS connection. By using the GPS receiver, the educators were able to build a learning game to excite the students to learn. Thirdly, teachers and educators can create an interactive slideshow to guide the students through the content of the class, and therefore provide learning opportunities with greater detail and illustrative examples.

The participants did not mention only positive effects of the technology integration in schools. The devices were proved occasionally to distract the students from the subject. The teachers also expressed the need for further education of how to utilize mobile technology effectively in teaching. Overall the teachers and educators stated the challenge in technology integrative teaching being to find the right balance between screen time and first hand experiences, especially with natural elements.

Although this research has achieved its overall aim of reinforcing the existing knowledge gap in current educational discussion about the affordances of mobile technology in schools, one also has to acknowledge the limitations of this work. The research suffered from a modest number of participants and therefore no statistic generalizations can be made. The three represented case studies offer very limited amount of perspectives. Indeed, parents and teachers with no prior interest in technology could offer more insights into the topic. Even so, this research provides a good foundation for educational discussion and further research about a very current topic.

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Appendix

Appendix 1: University of Cumbria Ethical Approval Form

Research Ethics Application

for Taught Degree (Bachelors & Masters) students

Application for study involving Human Participants

NB: This form should be submitted to your Dissertation supervisor and Dissertation Module Leader once reviewed and signed by your supervisor. The form is designed as a discussion document as well as a record of ethical approval

All fields will expand as required.

1. Title of Project: Modern Technology in Environmental Education as part of Formal Curriculum Teaching
2. As this a student project, please indicate type of course you are on by ticking the relevant box: □ BSc □ BA □ MSc X MA □ PgC □ PgD
3. Type of study X Involves direct involvement by human subjects ☐ Involves existing documents/anonymised data only.

Applicant information
4. Name of applicant (student): Paavo Heinonen
5. Project supervisor(s) Name(s): Dr Heather Prince E-mail(s): heather.prince@cumbria.ac.uk

This completed document must be discussed with your supervisor.

The Project **NOTE:** In addition to completing this form you must submit all supporting materials such as participant information sheet (PIS) and consent form.
6. Overall purpose of the research in 3-4 sentences (maximum length 150 words).

The aim of the study is to map different possibilities and challenges that modern technology provides for environmental education outside of classroom as part of formal curriculum. By critical questioning of the practices and questionnaires in written form with school teachers, the aim is to survey the potential modern technology has for teaching outside the classroom.
7. Anticipated project dates Start date: 23rd February 2015 End date: 31st July 2015
8. Please describe the sample of participants to be studied (including number, age, gender): The aim is to gather data from c. 15 teachers in primary schools. The participative teachers will be mixed genders and in different ages, all between 28 and 63. The common factor that all teachers share is that they all teach a class in primary school for grades 4-6 and they are somehow engaged with modern technology in their teaching outside the classroom. The participants are already engaged in a project that helps the teachers to take the pupils to learn outside the classroom. The participants may be from any nationality.
9. How will participants be recruited and from where? Be as specific as possible. The data collection will be made in cooperation with three organizations, two in Finland and one in Australia to gain a comparative perspective. The Finnish teachers are already engaged in local projects, the first being called the "Eco van" which is run by the Finnish nature and environmental school organization. The Eco van will be driven to the schoolyard where the teacher teaches a lesson together with an environmental educator who is driving the van. The teachers come from separate schools all around the city of Lahti in Southern Finland and they are all participating in the project in voluntary basis. The participative teachers have known from the beginning that there will be a master thesis research about technology around the project and that they will have an opportunity to participate in the survey if they like. The second participative project is called "Mobilely to the World" and it is run in Helsinki. In this project the teachers are creating location-based games that will engage the pupils in research-based learning activities. The participative teachers will be contacted by the project manager of the project. The third target group is located in Brisbane, Australia, and the organization is called Brisbane Urban Environmental Education Centre. The practices done in Brisbane have similar elements and aims with the Finnish organizations so it creates an opportunity to compare three local operators from the two sides of the world. The biggest differences between the projects is that while in Lahti the van is driven to the schools, in Brisbane the classes will travel to the centre.

Stage 1 – Please complete all sections by ringing the appropriate answer.

1. RISKS

Do any aspects of the study pose a possible risk to participants' physical well-being (e.g. use of substances such as alcohol or extreme situations such as sleep deprivation)?	YES	NO
Are there any aspects of the study that participants might find embarrassing or be emotionally upsetting?	YES	NO
Are there likely to be culturally sensitive issues (e.g. age, gender,	YES	NO

ethnicity etc)?		
Does the study require access to confidential sources of information (e.g. medical, criminal, educational records etc.)?	YES	NO
Might conducting the study expose the researcher to any risks (e.g. collecting data in potentially dangerous environments)?	YES	NO
Does the intended research involve vulnerable groups (e.g. prisoners, children, older or disabled people, victims of crime etc.)	YES	NO

2. DISCLOSURE

Does the study involve covert methods?	YES	NO
Please confirm that the study does not involve the use of deception, either in the form of withholding essential information about the study or intentionally misinforming participants about aspects of the study.	YES deception is involved	NO deception is not involved

3. DEBRIEFING

Do the planned procedures include an opportunity for participants to ask questions and/or obtain general feedback about the study after they have concluded their part in it?	YES	NO	NA

4. INFORMED PARTICIPATION/CONSENT

Will participants in the study be given accessible information outlining: a) the general purpose of the study, b) what participants will be expected to do c) individuals' right to refuse or withdraw at any time?	YES	NO	NA
Will participants have an opportunity to ask questions prior to agreeing to participate?	YES	NO	NA
Have appropriate authorities given their permission for participants to be recruited from or data collected on their premises (e.g. shop managers, head teachers, classroom lecturers)?	YES	NO	NA

5. ANONYMITY AND CONFIDENTIALITY

Is participation in the study anonymous?	YES	NO	

If anonymity has been promised, do the general procedures ensure that individuals cannot be identified indirectly (e.g. via other information that is taken)?	YES	NO	NA
Have participants been promised confidentiality?	YES	NO	NA
If confidentiality has been promised, do the procedures ensure that the information collected is truly confidential (e.g. that it will not be quoted verbatim)?	YES	NO	NA
Will data be stored in a secure place which is inaccessible to people other than the researcher?	YES	NO	NA
If participants' identities are being recorded, will the data be coded (to disguise identity) before computer data entry?	YES	NO	NA

6. SUMMARY OF ETHICAL CONCERNS

If any of the boxes below require ticks, you should complete the relevant sections in the Stage 2 below. If none of the boxes require ticks, then it is reasonable to expect approval, after discussion with your supervisor.

If you have answered 'YES' to any of the questions in Section 1 (risks), please tick the box	X
If you have answered 'YES' to any of the questions in Section 2 (Disclosure/covert methods), please tick the box	
If you have answered 'NO' to any of the questions in Section 3 (debriefing), please tick the box	
If you have answered 'NO' to any of the questions in Section 4 (consent), please tick the box	
If you have answered 'NO' to any of the questions in Section 5 (confidentiality), please tick the box	

Stage 2: Ethical Considerations
If you have ticked any of the boxes above please give details below of how you will address each issue in your research
Section 1 - Risks The pupils of the interviewed teachers will not be part of the research in first hand. However, the pupils are in indirect connection with the research because the teachers

are using their knowledge of their pupils when answering the questions. As researcher, I will make sure that the answers will be in general classroom level rather than individualizing each pupil.
Section 2 – Disclosure/covert methods
Section 3 – Debriefing
Section 4 – Consent
Section 5 - Confidentiality

Supportive Materials Checklist

Please attach all necessary supportive materials and indicate in the checklist below.

Please tick as appropriate

Participant Information Sheet	X
Consent Form	X
Letter of invitation	X
Other (please state, and explain)	

Approval: Yes

Student signature:  **Date: 3rd March 2015**

Project supervisor: Heather Prince Date: 15 March 2015

Comments: Participant Information Sheet and Consent Form now received.

Programme Team/Module Leader: Chris Loynes Date: 16 March 2015

Comments:

Appendix 2: Questionnaire (inc. information sheet & consent form)

Participant Information Sheet

Dear teacher/educator,

Thank you for your interest to develop our schools a better place to learn. The topic of the study combines formal curriculum teaching with the natural environment and modern technology. The aim of the study is to map different possibilities and challenges what modern technology carries along for environmental education outside of classroom as part of formal curriculum teaching. This research is part of my MA Transcultural European Outdoor Studies (TEOS) final thesis.

You are invited to answer the questionnaire using your own expertise about education. In the open ended questions, holistic, multidisciplinary, and critical thinking is desirable. Be sure that you do not need to be an expert on using technology to answer the questionnaire, but first and foremost active to try and develop new teaching methods. The research has two core perspectives under examination:

1. Nowadays many children, adolescents and adults are spending more and more passive time in front of screen technology which is suggested to affect even human evolution and increasing mental disorders. Therefore the first perspective of the study consider the increased use of screen technology to enhance school teaching. The tendency in many schools around the world is to integrate handheld gadgets into their teaching. So, the aim of this research is to examine how the gadgets should be used in schools to achieve the best learning outcome.
2. Secondly, children alienating from nature is considered an incresed concern in western countries. Richard Louv (2005) launched the term "nature-deficit disorder" to describe the effects when children are not gaining first hand nature experiences during their childhood. Less parents and schools offer children possibilities to explore their natural environment through experiences.

Some questions you may have about the research project:

Why have you asked me to take part and what will I be required to do?

As a teacher, you have an up-to-date and a wide perspective about current educational issues and teaching methods. Therefore I find your opinions and ideas extremely valuable. To participate in this research, you are invited to answer to the questions in the questionnaire attached.

What if I do not wish to take part or change my mind during the study?

Your participation in the study is entirely voluntary. You are free to withdraw from the study at any time without having to provide a reason for doing so.

What happens to the research data?

This research will be made with qualitative methods. The data will be analysed anonymously and no personal details will be collected from the participants. Only the researcher will be able to access the data.

How will the research be reported?

The data will be used mainly for this master thesis purposes. If there is an opportunity and increased interest in the topic, there is a possibility to publish an academic article written by the researcher. The anonymity of the participant will be promised in any case.

How can I find out more information?

Please contact the researcher directly. You may also contact the first supervisor of the project, Dr Heather Prince in the University of Cumbria. For contact information see below.

What if I want to complain about the research?

Initially you should contact the researcher directly. However, if you are not satisfied or wish to make a more formal complaint you should contact Diane Cox, Director of Research Office, University of Cumbria, Bowerham Road, Lancaster, LA1 3JD. diane.cox@cumbria.ac.uk

Paavo Heinonen

Email: pjhheinonen@gmail.com

p: +358-456709906

Dr Heather Prince

Email: heather.prince@cumbria.ac.uk

Participant Consent Form

Have I read and understood the information sheet about this study?
Yes
No

Have you been able to ask questions and had enough information?
Yes
No

Do you understand that you are able to withdraw from this study at any time, and without having to give a reason for withdrawal?
Yes
No

Your responses will be anonymised. Do you give permission for members of the research team to analyse and quote your anonymous responses?
Yes
No

Date (dd.mm.yyyy)

Questionnaire Start

1. **I am:**
   School teacher
   Educator/facilitator of another institute

2. **Male / female**

3. **Age**
   <25 / 26-35 / 36-45 / 46-55 / 56-65 / >66

4. **Are you using technology in your teaching (multiple answers possible):**
   Inside the classroom
   Outdoors
   Not using but I am interested of the topic

5. **How often / many times have you used technological devices as part of your teaching:**
   Just tried a couple of times
   At least once a week
   Once in two weeks
   Once a month
   A few times per semester or less often

6. **How do you think about the use of technology as part of formal curriculum teaching:**
   1
   2
   3

7. **Think about the pros and cons of using technology outside the classroom (e.g. in nature):**
   +
   +
   +
   +
   +
   -
   -
   -
   -
   -

8. **Why did/would you choose to use technological devices as part of your teaching?**

9. **Describe an example about a practice you have done with the students when you have used technology in your teaching in the outdoors:**

10. **How does the use of technology affect pupil's learning?**

11. **How does the use of natural environment affect pupil's learning?**

12. **What kind of challenges do you find in using modern technology in environmental education as part of teaching outside of classroom?**

Thank you very much for your time and effort! Please save the form and send it to the researcher:

pjhheinonen@gmail.com

Kiitos!