DEPARTMENT OF EDUCATION, COMMUNICATION & LEARNING

UNIVERSITY OF GOTHENBURG

Learning animal welfare and conservation at the zoo: Using a mobile application

Fikru Ayalkibet Zeberga

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Abstract

Purpose: The aim of this research is to explore theories of learning animal welfare and conservation at the zoo using digital media. Hence, theories mainly focusing on animal welfare and conservation and learning will be discussed in order to suggest a possible prototype for a mobile app that could be used to teach animal welfare and conservation at the zoo.

Theory: Connectivism theory and theory of affordance are used for this capstone project.

Method: This capstone project is divided in three parts: A systematic literature review, project design and project evaluation. The data collection was conducted in the form of zoo visit observation, documents acquired from Norderns Ark zoo and interviews with students and teachers.

Results: The result of this project gives an insight on how users interact with a mobile app without the presence of a zoo guide around. The students were clicking on the different tabs to get more information about the specific animal.

Using digital media may not be as interactive as face to face communication between the teacher and pupil. However, carefully designed mobile apps can be efficiently used to teach animal welfare and conservation at the zoo. Consequently, making the teaching and learning process collaborative and engaging experience might be effective to teach animal welfare and conservation at the zoo.

Though there was also a plan to do the prototype test with multiple students, as a result of the COVID 19 pandemic, finally it is decided to do it with two students only. Therefore, the results are inconclusive and they are not reliable enough to improve the proposed mobile app prototype.

Foreword

Table of content

1. Introduction

According to World Tourism Organization 2014 report, tourism accounts for 9% of global GDP and comprises 1.1 billion tourist arrivals per annum and this number could double by the year 2030. Visits to zoos may account for 20–40% of global tourism, but only few studies have focused on zoos' impacts on the conservation status and welfare of animals (Moorhouse et al., 2015).

Scientists and legislators now use animal welfare as a term that is a scientific concept describing a potentially measurable quality of a living animal at a particular time (Broom 2011). The World Organization for Animal Health (OIE) provided the following definition for "animal welfare" in 2008: "An animal is in a good state of welfare if it is healthy, comfortable, well-nourished, safe, able to express innate [natural] behavior, and if it is not suffering from unpleasant states such as pain, fear and distress"(The World Organization for Animal Health (OIE) website, 2020). Wildlife conservation is an activity in which humans make conscious efforts to protect plants and other animal species and their habitats (Tidball, 2014). Wildlife conservation is very important because wildlife and wilderness play an important role in maintaining the ecological balance and contribute to human quality of life (Tidball, 2014).

Educating the public about wildlife and conservation has long been a core component of many zoos' mission statements (Patrick et al., 2007). Conservation biology and animal welfare science are conspicuous and distinctive among scientific disciplines for explicitly embracing ethics (Soulé, 1985). However, Fraser (2008) suggests that animal welfare should be discussed in terms of values, and he advocates for a closer association between animal welfare and animal ethics, which can be defined as the human concern for animal welfare measured by attitudes to different types of animal uses (Fraser, 1999).The implicit moral premise is that protection of non-human life and ecological processes that depend on such life are good and right (Soulé, 1985; Vucetich & Nelson, 2007) and this premise gives legitimacy to keeping wild animals in zoos.

Zoos educate their visitors on conservation by exhibiting live animals – zoos act not only as reservoirs of endangered animals but they also claim to make visitors more "conservation-minded" after

their zoo experience (Fennell, 2015; Fernandez et al., 2009). Education is something many zoos focus on, especially when it comes to the conservation perspective (Patrick et al., 2007). When visitors arrive at zoos, they all enter with previously gained knowledge and experiences as well as a personal interest and motivation for visiting (Falk & Dierking, 2010).

According to (Nill & Scott, 2011), zoos have historically been defined as sites for the entertainment of the general public and continue to be dependent on the revenue raised through visitor receipts. Maynard (2018) claims that animals can have decreased welfare in confinement and that confinement can even affect their conservation and that visitors are critical to close confinements. The contemporary justification for zoos is based on their ability to act as sites of wildlife conservation (Neil & Scott, 2011). Consequently; they argue that; zoos are, today, identified as sites of conservation, research, education, and entertainment.

Researchers suggest that students learn more about animal welfare and conservation while visiting zoos than in schools (White and Jacobson, 1994). They also found that students learned more about conservation issues during their zoo visit if their teachers were trained in a workshop about these issues before the visit (White and Jacobson, 1994).

In addition, exhibits with interactive displays could be more successful at holding visitors' attention and consequently enhance the educational functions (Fallon and Kriwoken, 2002). Technologies like smartphones that many visitors bring with them into museums offer a wide range of features for creating and sharing media such as text, images and video (Pierroux, Krange, & Sem, 2010). Hence, the question 'How could we teach animal welfare and conservation at the zoo using digital technology?' comes to mind.

Students showed a strong desire for social interaction during zoo field trips (Davidson et al., 2009) and they prefer to work and talk with peers and not to complete worksheets individually (Griffin & Symington, 1997). Though interactive designs, zoo visitors move from passively reading text on interpretive signs to manipulating interactives that require some mental as well as physical involvement effecting more active participation in their learning (McManus, 1987). So, on which premises should we teach animal welfare and conservation at the zoo using digital technology?

This study is done on Nordens Ark zoo which is situated on Åby manor in Bohus county. The zoo is a private non-profit foundation that works to ensure endangered animals have a future. It is engaged in conservation, rearing, research and training, as well as doing what we can to increase public awareness of biological diversity.

In addition, the zoo has an active online presence thorough its official website and social media (Facebook and Instagram). Based on the data collected by the zoo on April 2020, they have 19,000 followers on Facebook, of which 69% are between 25-54 years (72% are women and 27% are male and 1% didn't give information about their gender). According to the zoo, 77% of Facebook followers are from Sweden, 11% from Norway, then the United States, Germany, the UK and Denmark, in descending order of about 1% each. They also have 9900 Instagram followers where 71% are between 25-54 years (72% are women and 28% are male). The majority, 84% of these Instagram followers are from Sweden, 7% from Norway and 1% from Germany.

According to Nordens Ark's webpage (see more on https://nordensark.se), children and young people learn to appreciate the value and beauty of biological diversity, as well as how people can take responsibility protecting it for future generations. They have educational activities about animal welfare and conservation at all levels, from primary school to college. Nordens Ark offers lectures, short courses and full courses in conservation biology, biological diversity and ethology (see more on https://nordensark.se). For the purpose of this study, we are only going to focus on a short course which is designed for comprehensive school students between the age of 10 – 14 (grade 4 to 8). To enhance the zoo learning activities, mobile learning could be added as a complementary means of learning about the animals of the zoo. Based on the data collected from Nordens Ark zoo we will propose a prototype of a mobile app that could possibly be helpful while teaching animal welfare and conservation at the zoo for comprehensive school students (students between the age of 10 - 14).

1.1 Aim and Research Question

The aim of this research is to explore theories of learning animal welfare and conservation at the zoo using digital media in order to develop a mobile app prototype. Hence, theories mainly focusing on animal welfare and conservation and learning will be discussed in order to suggest a possible prototype for a mobile app that could be used to teach animal welfare and conservation at the zoo.

Navigating through these theories, I will try to answer questions:

1. How could we teach animal welfare and conservation at the zoo using digital technology?

2. On which premises do we build these ideas?

2. Literature review

A systematic literature review was conducted initially using Scopus, Web of science and Super databases. Scopus and web of science are used because both are multidisciplinary databases covering scientific, medical, social sciences, arts & humanities and technical literature. Finally, Super search is used in order to include other data bases with possible relevant articles.

2.1 Search Terms used

After my first search, I have noticed that some of the research is discussing both welfare and conservation. In addition, even if I included both 'welfare' and 'conservation' in to my discussion, my main areas of interest are 'learning' and 'digital media'. As a result, I have decided to do a search on both 'learning' and 'digital media'. I have used the term 'digital media' instead of 'digital technologies' because the term 'digital technology' is a very broad term and some of the results I found from this search are very technical (meaning, some are even about animal breeding and genetics technologies …). With 'digital media' search I have found results about different digital media (social media, mobile Apps, the internet, phones …), which are 'digital technologies', that are tested or are currently being used for the purpose of teaching/learning at the zoo.

- Animal welfare* learning at the zoo; Animal conservation* learning at the zoo (for Web of science)

- "Animal welfare" AND "learning" AND "zoo" (for Scopus)

- "learning animal welfare and conservation at the zoo using digital media" (for Super search)

2.2 Inclusion and exclusion criteria

In order to identify articles, I have used different inclusion and exclusion criteria. Though, using technology for learning; inside and outside the school environment; is not a recent phenomenon, we have witnessed an increasing interest in the subject matter the last couple of years (Raja & Nagasubramani, 2018). As a result, I have only searched for articles that are published after the year 2010. In addition, articles that are peer reviewed and written in the English language are included. Finally, to narrow my search, after reading the abstracts and titles, I have excluded book chapters and other publications (news and editorials) and literatures that are not directly related to the subject matter.

2.3 The result of the literature review

From my initial search, I have Identified 513 hits that discuss at least the two or more ideas of my interest all together ('animal welfare and conservation', 'learning/teaching at the zoo' and 'digital media'). Since, 321 of my initial search results are written before the year 2010 and 96 are not peer-reviewed a total of 417 records did not meet my inclusion criteria.

After reading the titles and abstracts, from the remaining 96 hits, 54 articles are screened out from the list because they are not relevant for the study. Of the 42 hits, 28 more are excluded for reasons like being book chapters (6), editorial (3) and articles (8), written in other than English language (3), research not directly related to the subject (7) and duplicate (1). As a result, out of the 513 hits discovered at the initial search I will be focusing on the 14 results on the literature review part of this paper (see fig 1).
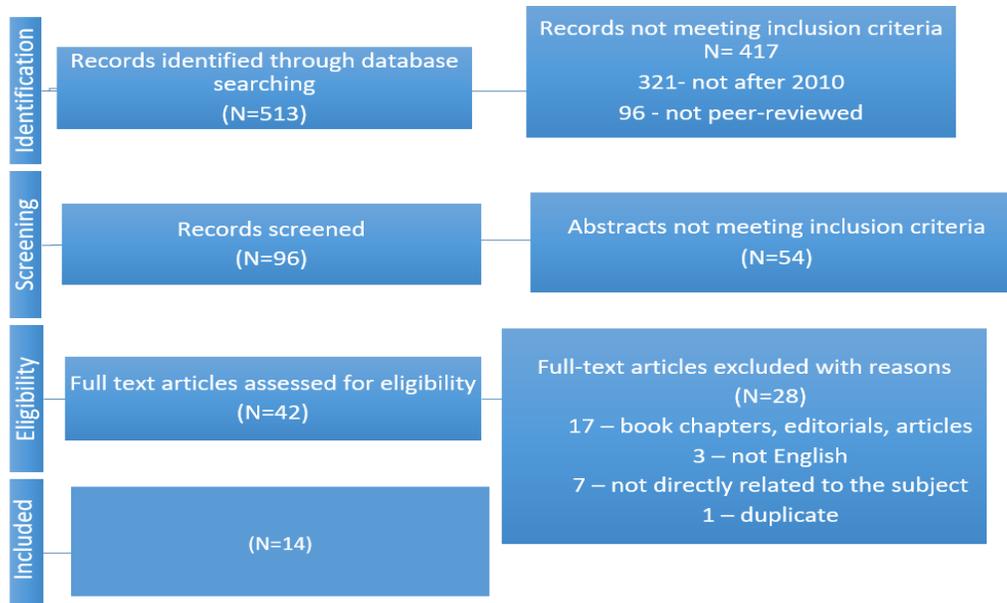
Fig. 1. Flowchart of literature selection process.

2.4 Review of the literature

In this sub section I will be discussing about learning animal welfare and conservation at the zoo and previous research that focused on learning animal welfare and conservation at the zoo using digital technology. The 14 hits from my literature search are included in the next three sub sections (See Appendix IV).

2.4.1 Learning animal welfare and conservation at the zoo

These days zoos are identified as sites of conservation, research, education, and entertainment (Neil & Scott, 2011). In recognition of this, Niel and Scott (2011) have tried to analyze the image that zoos are currently portraying to the general public, to see how the different roles are advertised and how they sit alongside one another. They have gathered data from contents and semiotic analysis of the websites of 54 zoos around the world. Their findings indicate that the image zoos present to the public whilst incorporating

a strong conservation message lacks depth (Neil & Scott, 2011). They also found out that most zoos websites put more emphasis on entertainment than education.

Neil & Scott (2011) suggested that zoos need to present their conservation credentials in more detail and ensure the entertainment message does not adversely affect transmission of the conservation or education one whilst at the same time continuing to attract sufficient visitors to ensure the economic viability of zoos. In addition, it is recognized that changing public perceptions of zoos requires these institutions to act together rather than independently when determining the overarching theme of the zoo (Neil & Scott, 2011).

The above paragraph raises one question, are zoo visitors there to see animals or learn? A mixed-methods study by Katie & Andrew (2015) examined visitor learning from both zoos' and visitors' perspectives using qualitative and quantitative data. Five hundred and forty zoo visitor interviews from nine case studies provide insight into visitor intentions, which indicate that the majority of visitors (72%) arrive at zoos with a learning agenda (Katie & Andrew, 2015). Over 170 zoos across 48 countries also report, via an online questionnaire, that the majority of their visitors come to learn (Katie & Andrew, 2015).

This study can be a very good example for how sometimes it is difficult to understand zoo visitors' learning agenda. These zoos use primary informal measures (such as casual feedback, observations and anecdotes) and primary formal measures (surveys and interviews) to assess their visitor's learning performance. The authors found that, on average, more than half of the zoos (58%) used primarily informal measures, 41% of zoos used primarily formal strategies and approximately 15% of the zoos used both informal and formal measures (Katie & Andrew, 2015). Based on Katie & Andrew (2015) findings, zoos' reliance on informal measures of visitor intentions appears to provide them with a less than accurate picture of their visitors' learning agendas.

Inspiring conservation action is a complex task directed at various behavioral outcomes (Smith, 2009) that typically derive from efforts in two different learning domains: the cognitive domain (increasing awareness, understanding, or knowledge about environmental issues and conservation actions), and the affective domain (promoting emotional/affective connections to animals and/or the natural world).

Underlying these learning goals is also the need to meet visitors' expectations for enjoyment and fun (Carr and Cohen, 2011).

Recent studies in zoos and aquaria have examined various discrete factors that can influence conservation learning such as engaging visitors' emotions or connecting with visitors' prior knowledge and experiences (Ballantyne et al., 2007). Still, visitor studies are only beginning to understand the key elements and strategies that will achieve mission outcomes concerning conservation education (Ogden and Heimlich, 2009). Thus, zoos will face a challenge when it comes to teaching about animal welfare and conversation while entertaining visitors.

2.4.2 Previous Research: Learning at the zoo using technology

Greater emphasis is now placed on encouraging learning through zoo exhibits that are designed to educate while still remaining fun (Packer & Ballantyne, 2004). Zoos and aquaria can more effectively use the media and their stakeholders to communicate their projects and organizational roles, educate the public, and better influence their conservation goals (Kusiak, 2015). A study by Conkey & Challoo (2015) examined the effects of two augmented-reality iPad apps the 1st an inquiry-based app and the 2nd an information-based app on adult patron learning about the Komodo dragon and the Hippopotamus at a moderately sized zoo in South Texas. Interestingly, the participants gave high ratings to their learning experience (Conkey & Challoo, 2015).

Miller (2010, p.120) argues "an ubiquitous access to technology has led to a shift in science learning from individuals needing to store a mental warehouse of information on scientific topics to a 'just-in-time (JIT)' system in which individuals are able to access needed scientific information almost instantaneously and on an as needed basis (e.g. accessing medical information, weather information, and scientific facts online)". Miller (2010) suggests that if informal science education venues, including zoos, are to stay relevant they must acknowledge and embrace this new style of information access.

Mobile or cell phone technology represents a viable and increasingly inexpensive (Nickerson, 2005) means for museums and zoos to deliver JIT content to visitors (McNeal and van't Hooft 2006). Recent studies have explored and somewhat supported the notion that technology is capable of enhancing more formal science learning experiences (Chen et al. 2005; Ogata et al. 2008) and less structured outdoor learning experiences (Chen, Kao, and Sheu 2003; Chen et al. 2004; Liu et al., 2007). Liu and colleagues (2009) report findings suggesting mobile learning activities had a positive effect on supporting student observation and manipulation during natural science learning focused scientific inquiry activities.

In order to use mobile technology learning successfully, it is important to understand how these techniques influence visitor learning and experience at the zoo (Perdue et al.,2012). Perdue et al., (2012) have collected stay time data for 582 visitors, and administered survey to 180 visitors. Visitors spent significantly more time at the exhibit when a video or live presentation occurred and scored significantly better on knowledge questions than those who were not there during a presentation, even though all information was available on signs throughout the exhibit (Perdue et al., 2012). Finally, the results suggest that technological additions, such as educational video presentations, have the potential to positively influence visitor behavior and knowledge gained at the zoo.

On the other hand, Paul, et al., (2018) tried to show how social media plays a huge role when it comes to animal welfare and conservation learning. A good example is (Facebook®) by the British and Irish Association of Zoos and Aquariums (BIAZA) accredited zoos, when putting together content to share with an online audience. Paul, et al., (2018) calculated the average percentage of mammals, birds, reptiles, amphibians, fish and invertebrates constituting the collections of nine UK zoos. Results show a bias towards mammals, not only in the number of posts but also in engagement (likes and shares) with such posts (Paul et al., 2018). Zoos also announce births and hatchings via social media more than expected, which could be a useful way of engaging an online audience with important welfare and conservation issues and rationalizing why species are housed in captivity (Paul et al., 2018). Posts overtly conservation-or education-based were limited in number, and attracted little following. There was a significant relationship between the number of likes received by a post and the number of times it was shared (Paul et al., 2018). If

zoos diversified the range of subjects in their Facebook posts to highlight key aspects of biology and ecology of their living collections, it is possible that more engagement with key aims of the modern zoo would arise within an online audience (Paul et al., 2018).

2. 5. Learning Theories and Mobile learning

Mobile learning (or m-learning) as a concept and theory has evolved rapidly, and it is no longer considered just a technocentric trend, attractive for those interested in devices and technologies (Khaddage et al., 2016). Digital technology, as a potential for transforming education, has been a major theme of research and development work for a long time (Säljö, 2010). These technological advancements changed how we learn and how we understand the term learning. With the digital technologies we see an increasing capacity to externalize human cognitive functions, and this development will have implications for learning and for the institutional definitions of learning (Säljö, 2010).

The most recent discussions tend to assert there has been a shift from defining mobile learning as based on the devices used (Soloway et al., 2001) towards the inclusion of context (Sharples, Taylor, & Vavoula, 2007, p. 4). Mobile learning is accepted to represent a technological advance, enabling rich, distributed and contextualized approaches to learning (Crompton, 2014). Moreover, it is accepted that m-learning is about the learner's mobility, and how we as educators can engage students and in learning activities without them being restricted to a physical location (Khaddage et al., 2016). With increased popular access to information and knowledge anywhere, anytime, the role of education, perhaps especially formal education, is challenged and the relationships between education, society, and technology are now more dynamic than ever (Traxler, 2007).

From the perspective of connectivism, internet technologies including mobile technologies have created new opportunities for people to learn and share. Learners develop knowledge through peer networks and share this knowledge online (Ozan & Kesim, 2013). Connectivism is a conceptual framework which

views learning as a network phenomenon influenced by technology and socialization (Siemens, 2006). It is claimed to have roots in principles explored by chaos, network and complexity and self-organization theories (Siemens, 2005). Downes (2012) asserts it is also supported by connectionism, associationism and graph theory. According to Siemens (2005), the notion of connectivism has implications in all aspects of life including design of learning environments. The principles of connectivism, after Siemens (2005) are:

- Learning and knowledge rest in diversity of opinion.

- Learning is a process of connecting specialized nodes or information sources.

- Learning may reside in non-human appliances.

- Capacity to know is more critical than what is currently known.

- Nurturing and maintaining connections is needed to facilitate continual learning.

- Ability to see connections between fields, ideas, and concepts is a core skill.

- Accurate, up-to-date knowledge (currency) is the aim of all connectivist learning activities.

- Decision-making is a learning process in itself.

The portable nature of mobile technology enables students to move between and interact with indoor and outdoor environments see for example Chen, Kao, and Sheu (2003), Roschelle (2003), Seppälä and Alamäki (2003). In addition to the portability of the device, mobile learning also provides the opportunity for connection and communication between other learners. What we have been witnessing so far is that the current zeal around mobile application solutions sometimes distracts schools from the meaningful purpose of mobile integration; that is being portable, interactive, engaging, on demand, collaborative etc. (Benham et al., 2014).

Connectivism, collaborative learning, and experiential learning are good examples of learning theories that have been identified which particularly lend themselves to the specific affordances of mobile learning. Norman (1999) refers affordance to the possibilities of action communicated by the environment and perceived by the actor. Parsons, Thomas and Wishart (2016) identify five specific mobile affordances

which differentiate eLearning from mobile learning, namely portability, evidence and data gathering, communication, interaction with the interface, and outdoor environment.

On the other hand, Sharples, Taylor & Vavoula (2010) suggest that a theory of mobile learning must be tested against the following criteria: does it account for the mobility of learners? does it cover both formal and informal learning? does it theorize learning as a constructive and social process? does it analyze learning as a personal and situated activity mediated by technology?

Sharples (2009) also suggests that mobile learning instructional design should: Support learners to reach personal understanding through conversation and exploration; Support learners' collaboration in order to construct common knowledge; Use technology to enrich learners' collaborative knowledge building with other learners and teachers; and Support learners' transitions across learning contexts.

3. Description of the project

In general, this is a prototype design for a mobile learning app that could be used to teach animal welfare and conservation at the zoo. The idea is not to completely replace teachers at the zoo, rather to support learning activities by providing a mobile and instant access to animal welfare and conservation courses that are available the Nordens Ark zoo. In this part I will describe the data collection and interview process. In addition, I will explain how the original prototype looks like and the process involved in the prototype design.

3.1 Interviews and data collection

Consecutive interviews in person and over Skype were done with two students, one educator and two employees of Nordens Ark to collect data on the course offered to comprehensive school students that are focused on animal welfare and conservation. After our first meeting mid-February, the education director of Nordens Ark zoo and I had three 30 to 45 minutes long meetings over Skype (two meetings before the design of the prototype and one after testing the prototype) and one face-to-face interview at the zoo. I also had the chance to include the communication director of the zoo in the Skype interviews.

The first meeting and visit at Nordens Ark zoo are conducted in an attempt to collect first-hand information that will be helpful for the design of the project. During this time, presented the project to the education director of Nordens Ark zoo. Animal conservation and welfare work that have been done and that are currently going on and future work planned on the specific subject matter were discussed. I addition, we have discussed about how Nordens Ark zoo teach animal welfare and conservation at the zoo and its future plans. This first-time meeting is concluded with a four-hour-long visit at the zoo. The visit helped me see animals and witness what the actual animal welfare and conservation work looks like at the zoo. This zoo visit was quite helpful during the design of the prototype and photos and videos documented at this visit were used while testing the prototype with students.

We had three Skype interviews between the education director, communication director of Nordens Ark zoo and I. As the zoo has an active online presence (through website, Facebook, Instagram and a mobile app), it is decided that to include the communication director in these meetings. The first two Skype meetings are focused on getting necessary information and supporting documents for this project. As a result, how they teach animal conservation and welfare, their students, the courses that they are using, experience with online and/or mobile learning and website, social media and mobile app use (see appendix III). The third Skype interview is done to present the prototype and its test results for education director and communication directors.

With the consent of their parents, I also interviewed two students. The first interview is before the design of the prototype and since I have a very limited time with them, I interviewed the students at the same time. During this interview, I have collected information to create a persona for students. This interview is done to create a profile and understand students' expectation from the mobile app prototype (see appendix II).

The second interview with the students, took place right after testing the prototype. After a phone call conversation with their respective parents, it was decided to have the prototype testing and the interview at the home of one the student while both parents are present. This second interview was short and brief and was done in order to understand the students take of the prototype. I will be discussing this more later in evaluation of project parts (under Students reaction after the test).

I have also used emails as a major tool to communicate and to collect important data from the education and communication directors of the zoo. Since the zoo is 175 from Borås, where I am currently living, emails were our major form of communication (to arrange Skype meetings, share documents and present progress report of the prototype).

From a document acquired from the zoo via email, three different lessons that are designed for young children, between the age of 10-12 years (grades 4,5and 6), and one lesson for 8th grade students are sampled for this study (see fig 2). These lessons are divided in to three parts as post visit (includes the preparations for the visit and background knowledge expected from students and teacher before their visit),

during visit (activities and lessons) and after visit (tasks that will be performed by the students after their

visits).

Åk 8   Biologisk mångfald

Bokning:	Lektionen bokas i början av januari
Tidpunkt:	Mars (i första hand vecka 12).
Buss:	Bokas av ansvarig lärare på skolan
Plats:	Samling vid Hotell Nordens Ark klockan 9.00, därefter en kort promenad till en sal där den första halvan av lektionen genomförs. Den andra halvan sker utomhus i den vilda delen av parken. Lektionen avslutas ca 11.00.

Innan besöket:

För att eleverna ska få rätt behållning av lektionen är det bra om läraren har gått igenom vissa begrepp innan besöket i parken. Följande begrepp gäller: ekosystem, ekosystemtjänster,

Under besöket:

En av Nordens Arks utbildare tar hand om en klass på ca 25 elever. Första delen av lektionen hålls i en sal och baseras på en powerpointpresentation med ett mentometersystem.

Mentometersystemet ger eleverna möjlighet att svara på frågor. Resultatet visas på gruppnivå som grafer i presentationen och diskuteras efteråt. Det finns stora pedagogiska vinster i att alla får ta ställning och på så vis bli engagerade i lektionen.

Efter besöket:

Arbeta vidare med biologisk mångfald, mångfaldens värden och hoten mot biologisk mångfald. Frågor som rör hållbar utveckling och elevernas möjlighet att själva göra bra val för miljön.

Eleverna fick göra en bedömningsuppgift på skolan som tog upp spridning av miljögifter i näringskedja och resonemang kring bränslen till bil i form av el eller biodiesel från palmolja. Här fick eleverna möjlighet att visa vad de hade lärt sig om hur den biologiska mångfalden kan hotas/gynnas.

Fig.2 course sample for 8th grade students (see the English translation on Appendix V and full

Swedish version on appendix VI)

3.2 Design

This stage of the design process work is done by answering five major questions; based on

Norman's (2013) four different activities in the human-centered design process; including who the users

are, what their needs are, what are the possible solutions for their needs, what the solutions looks like and

testing the proposed solutions. In this subsection the development processes of the prototype are outlined and discussed. I will also use Dirksen's (2016) methods for learning about our Learners. Dirksen suggests understanding our learners' interest is important. "…You want to consider the question of what your learners want from a few different angles. Think about why they are there, what they want to get out of the experience, what they don't want, and what they like" (Dirksen, 2016, p.43).

3.2.1 Empathize: Who are the users?

"…You want to know about your learners—not just about their demographics, but about their motivation, likes and dislikes, skill level, and ways of understanding the world" (Dirksen, 2016, p.78). According to Dirksen the best way to understand and know about our users is talk to them. "… I'm not going to get into a lot of detail about this, but here are a few key practices that I believe are crucial for good audience analysis: talk to your learners, follow your learners around and try stuff out with your learners" (Dirksen, 2016, p.75).

Based on the information collected from the two students, teaching materials collected from Norderns Ark zoo, interview with Norderns Ark employees and zoo visit I conducted, I have created a possible user persona for the prototype (see fig 3 and 4). The students interviewed expect to learn about animal welfare and conservation while visiting the zoo and interact with friends while using the app. As I understand from the interviews, students think zoo visits are fun because they get to be with friends while seeing animals. Not only do they think zoo visits are fun but they also understand these visits will help them investigate more about wild and domestic animals that they are interested in.

Technically, both students and teachers are users of this mobile application. Though, students between grade 4 and 8 were the targets at the beginning of the project, for different reasons that are included in the limitation part of this paper, it is decided to focus only 8th grade students.

3.2.2 Define: What do your users need?

Greater emphasis is now placed on encouraging learning through zoo exhibits that are designed to educate while still remaining fun (Packer & Ballantyne, 2004). Zoos and aquaria can more effectively use the media and their stakeholders to communicate their projects and organizational roles, educate the public, and better influence their conservation goals (Kusiak, 2015). According to the few students interviewed (as a result of the pandemic), zoos are places to have fun with as well as learn about wild and domestic animals (see fig 3 student persona). The students' reasons for visiting zoos are to have fun watching animals, hang out with friends and learn about animals and the environment in the process. Furthermore, their expectations from the prototype are to learn about animal welfare and conservation using a mobile app while visiting the zoo, easy to use app and to interact with fellow students while using the app.

During Skype interviews and email exchanges, teachers, have also expressed their own expectations and requirements from the prototype design. Their expectation is to teach about animal welfare and conservation using a mobile app. Though, they are concerned about time limitation (as a result of the pandemic), they expect an easy to use and self-instructive mobile app. In addition, their current materials are in two languages, the teachers asked both English and Swedish languages to be included in this app (see fig. 4 "teacher persona").
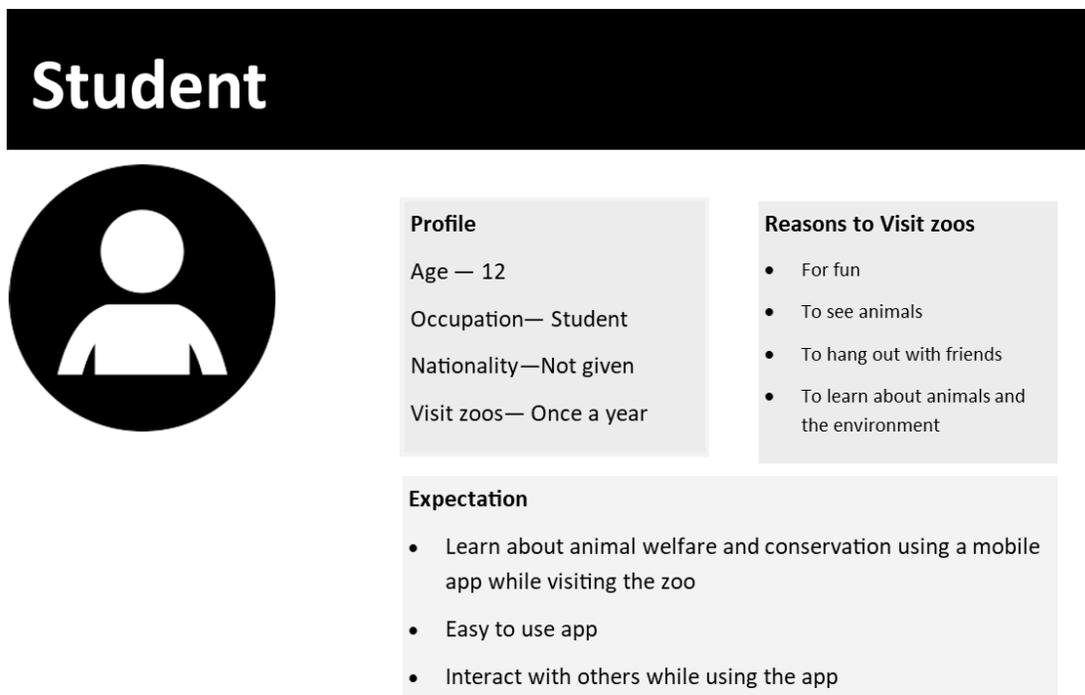
Student

Profile

Age — 12

Occupation— Student

Nationality—Not given

Visit zoos— Once a year

Reasons to Visit zoos

- For fun
- To see animals
- To hang out with friends
- To learn about animals and the environment

Expectation

- Learn about animal welfare and conservation using a mobile app while visiting the zoo
- Easy to use app
- Interact with others while using the app

Figure 3. Student persona

Teacher

Profile

Age — 30

Occupation— Teacher

Nationality—Not given

Visit zoos— 5 days in a week

Requirements

- it should be easy
- and self-instructive.
- It should be Swedish and English
- Concerns— Time limit

Expectation

- Teach about animal welfare and conservation using a mobile app while visiting the zoo
- Easy to use app
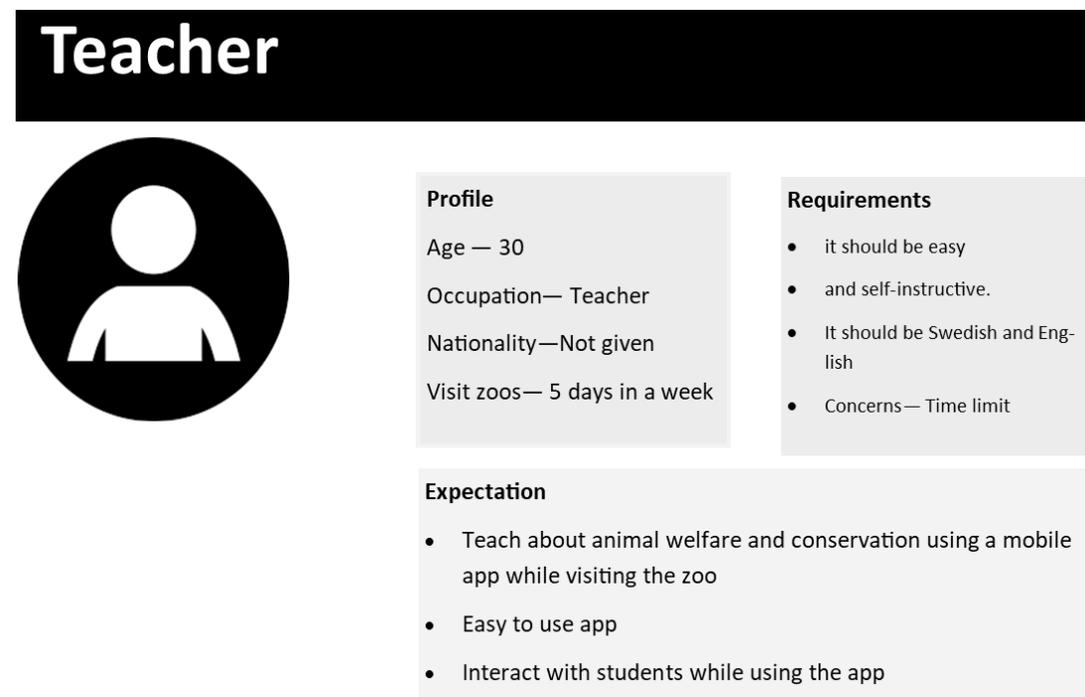- Interact with students while using the app

Fig. 4. Teacher persona.

3.2.3 Ideate and Prototype: What solutions are there? and what does the solution look like?

According to (Norman, 2013) once the design requirements are determined, the next step for a design team is to generate potential solutions. This process is called idea generation, or ideation. "There are many ways of generating ideas: many of these methods fall under the heading of "brainstorming." Whatever the method used, two major rules are usually followed: to generate numerous ideas and to be creative without regard for constraints" (Norman, 2013, p.226). Rather than adding random fancy features I have tried to stay in line with the information I have gathered from the participants and formulated these features.

Design and sketch of the prototype is done using a prototype designing website (moqups.com) and then each individual sketch is moved to a mobile app simulator software on a local drive (Mockupplus). Using this software, I designed the simulation of the mobile app and later the prototype is transferred to my tablet through a shared account for students during testing.

The first page users see after launching the mobile app is a "login" page. Here users can login or create an account using an existing email or a social media account. Once they created an account and logged in, they can choose courses that are designed by teachers. The courses are designed for students from 4th to 8th grade. As a result, student can choose their current grade level and access their age and grade appropriate courses (see fig 5. User design chart).

The other most important section of the prototype is "Setting" part. Under "settings" there are three different sections: personal information, preference and sign-out options. Personal information refers to some information that is may be visible to other people using the mobile app. This might include user name, profile picture and email address provided by users during signing up. Under the European personal data law (European union website, 2020) "Personal data" is any information that relates to an identified or identifiable living individual. It includes different pieces of information like a name and surname, a home

address, an email address such as name.surname@company.com, an identification card number, location data (for example the location data function on a mobile phone), an Internet Protocol (IP) address and a cookie ID*; when collected together may identify a particular person. Though, this is just a prototype, if it is decided to work on developing the actual mobile app, personal data protection will be a thing to take in to consideration.

A "Preference" section under settings was not included in the original design but added after testing the prototype based on feedback from students and teachers, which will be discussed later. "Preference" helps students to select their preferred language for the app. Two languages; English and Swedish are included under this section. The last option under settings is a sign out tab.

As stated at the beginning of the project description, all courses for all grade level are divided in to three major parts. The first part, "Before visit" is where school teachers and teachers from the zoo converse and decide on the preparation for an upcoming visit. This include issues like the background knowledge the students need to have before the visit so that they could easily understand the lessons, appropriate dress code for the current weather condition and teaching aid materials used by the school teachers.
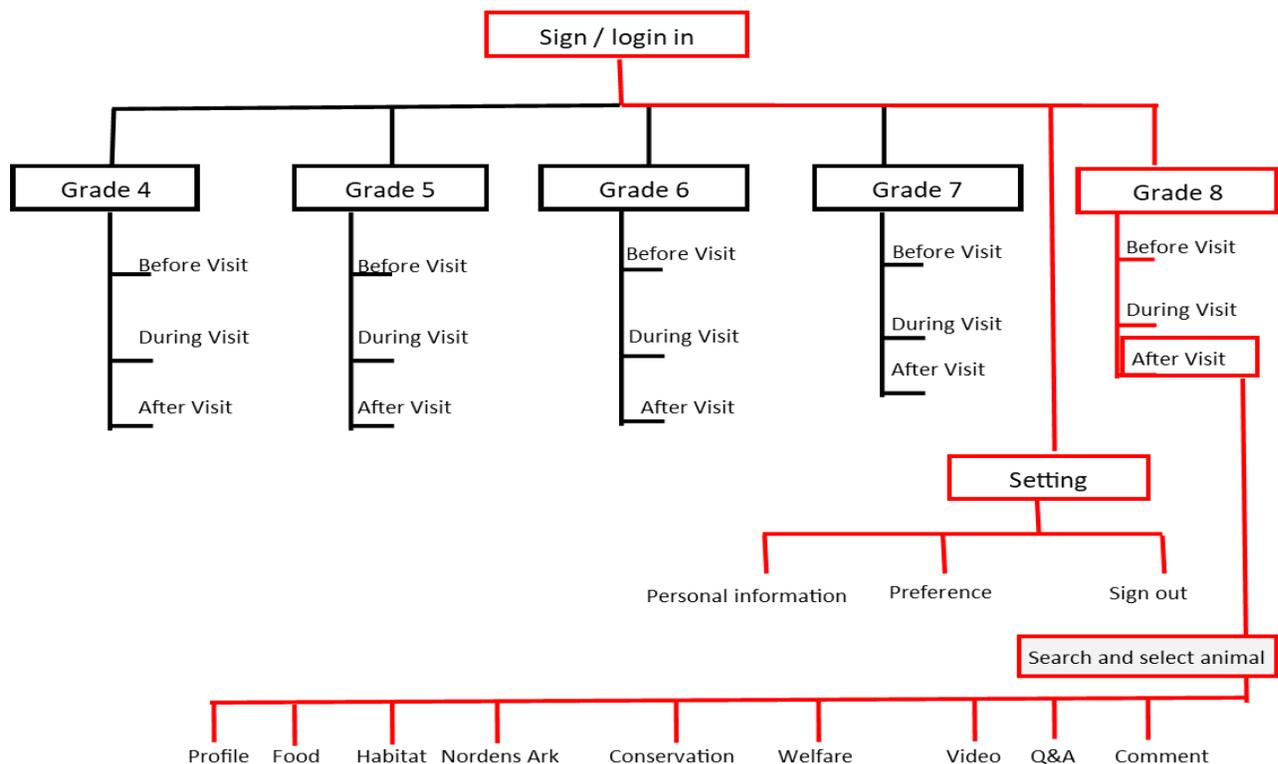
Fig. 5. User design chart (this prototype is only designed for 8th grade students)

"During visit", the second part of the course, is where the students and school and zoo teachers meet and the actual lesson for the day began. They meet either in a meeting room or by the entrance of the zoo for a brief introduction. They usually use mini lectures, power point presentation and videos lessons. Then, the actual zoo visit will begin.

After visiting and finishing the lesson for the day (these lessons only last for half a day and usually in the morning), they will have a lunch break. After lunch, "After visit" starts. During this time students will get the chance to visit the zoo without the zoo teachers. This is where the proposed mobile app came in handy. Note that, (as stated earlier under "design" section "Empathize: Who are the users?" section) it is a very big and time-consuming project, therefore this prototype is only designed for 8th grade students.

As users select "After visit" tab, long list of animals will appear on the screen. Here, users can select animal of their interest and accesses more information about them. If the animal they are particularly interested is not on the list, they can also search for it using the search button from the top of the list.

Dirksen (2016) suggests that whenever possible you should show, do not tell, and promote engagement by using structured goals and real accomplishments. Traditionally, during zoo visits, there is a zoo guide who would walk around with visitors and explain the exhibits. Here, the proposed prototype will create an opportunity to show visitors the actual animal welfare and conservation work by promoting engagement with the exhibit. Once users select a specific animal, they will get a page with six different tabs including Profile, Food, Habitat, Nordens Ark, Conservation, Welfare, Media, Q&A and Comment (Fig 6).

There are also additional buttons and tabs with different affordances added in to this design. Including:

- **Profile:** Includes general information about a specific animal. (appendix I, Pic 9 profile page)

- **Food:** Information related to the type of food they prefer to eat and their prey are included here. (appendix I, Pic 10 food page)

- **Habitat:** specific environment, vegetation, landscape, country of origin (in that animal is endemic) and other related issues will be discussed here. (appendix I, Pic 11 habitat page)

- **Nordens Ark:** Under this tab, students can see statistics of the animal they have selected. Including, how many, number of males, number of females, new born (if any) and their living condition at the zoo. (appendix I, Pic 12 Nordens ark page)

- **Conservation:** Here users can read and learn about the work that is going on for the specific animal at the zoo. Practice by the zoo to protect wild species and their habitats in order to prevent species from going extinct will be presented here. All the lesson materials will be prepared by teachers at the zoo. (appendix I, Pic 13 conservation page)

- **Welfare:** Same as "Conservation" students will get information welfare of the animal. In this section of the app, students will learn how an animal is coping with the conditions in which it lives. Questions related to animal welfare like: is the animal healthy, comfortable, well-nourished, safe, able to express innate behavior, and if it is not suffering from unpleasant states such as pain, fear, and distress will be answered. Here they will get all the lessons that are given by the zoo regarding the welfare work of the specific animal. Length of the lessons and materials for both conservation and welfare sections will be decided and designed by teachers. (appendix I, Pic 14 animal welfare page)
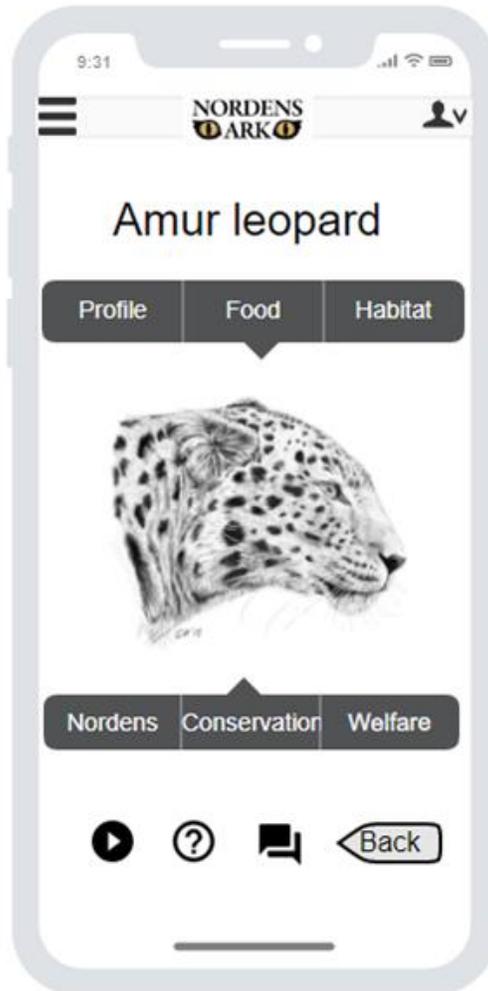
Fig 6. User page of the prototype

At the bottom left of this page there is a tab "Media" where multimedia materials including pictures and videos that would complement the above six tabs will be presented. Next to the "Media" tab there is a "Q&A" tab where users can send their questions for teacher at the zoo. Norman, (2013) also suggests that learning experiences should be two-way interactions, so you know when learners understand correctly and when they do not. Since, users attach their email with their question, teachers at the zoo will have a chance to reply directly to the user. In addition, using "Comment" tab from this section users can share their view about the animal that they are currently visiting (see appendix picture 7 – 18).

4. Development project evaluation

This part of the project includes testing the proposed prototype and making the necessary modifications based on the results. Studies, by Cooper (1998, 1999) show that a test and evaluation phase that is customer oriented is the critical factor - whether it is done and how well it is executed - is significantly correlated with the new product success. "Like prototyping, testing is done in the problem specification phase to ensure that the problem is well understood, then done again in the problem solution phase to ensure that the new design meets the needs and abilities of those who will use it" (Norman, 2013 p.229).

4.1 Test: How well does the solutions work?

"Test your learning on a few users ahead of time so you can smooth out the rough edges before it goes out to your entire population" (Dirksen, 2016, p.327). As a result of the current COVID-19 pandemic, traveling to Nordens Ark and testing the prototype with users at the zoo became a health risk. Therefore, I have compiled all videos and pictures I have documented from my visit at Nordens Ark at the beginning of March, when I planned the study.

From the long list of domestic and wild animals at the zoo, I have selected part of the prototype that is designed for amur leopard. This is decided based on the multimedia material (Videos and photos). From these materials, after editing them all together, I have created a 15-minute-long video about the amur leopard. The idea was to play this video on a big screen for students as if they looking at the leopard in captivity at the zoo and use the prototype at the same time (see fig.7).

Both students who participated in this test are the same students who participated at the design of student's persona at the beginning of this project. As they have prior knowledge of the product, they were given a very short explanation about the prototype and why we are testing it. Following this, all essential parts of the prototype are moved to a tablet and given to the students to test.
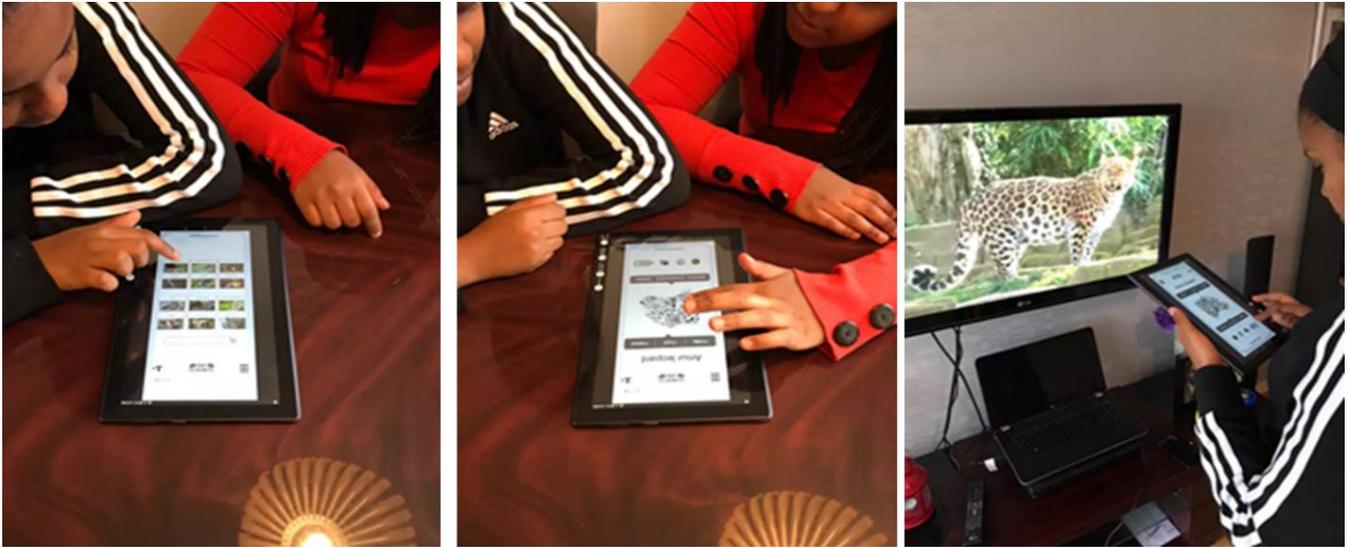
Fig 7. Students trying the prototype

At the beginning, both students took more time looking at the animal on the video rather than using the prototype. After a couple of minutes since there is no one to give them information about the animal they started to use the prototype. Even after the video has ended, one of the students continued to use the prototype and asked if I could play the video again, so I did. From this test, I notice that, even under this circumstance, the students are trying to learn more about amur leopards using the prototype.

4.1.2 Students reaction after the test

After testing the prototype, I have asked the students what they think about the prototype, what they like about it and what needs improvement. This interview is done and right after the test and I asked both students at the same time. Their responses are summarized as follows:

> Student 1 – *this is my first time trying this kind of thing and it is cool. I love reading about animals. The prototype I have tried is all in black and white even picture of*

the animal. I think you can add more colors to it and make it more interesting.

Can you?

Student 2 – *I like it. I have never seen amur leopard before. I can't wait until I go to the zoo*

and see the animal in real life. You have already told us that this is just a

prototype and it is not online yet. I want to see how I could interact with other

students using this app.

4.1.3 Teachers reaction to the prototype and to the test

After the design and testing of the prototype it is decided to set up a Skype meeting with the teacher and education director of Nordens Ark zoo. During this 30-minute-long meeting design of the proposed prototype and results of the test was presented. After the presentation, I asked the education director for her response and about the possibility of doing more work on the prototype and if there is a possibility of making an actual learning app based on this project. Her response is:

Teacher – *This is very interesting. This could be something we can use for education purpose*

here and also for ordinary visitors who are interested to know more about our

animal welfare and conservations works. We have planned not to give so much

information on paper, so this kind of technology is more efficient for us. We have

tried to give this kind of information on paper and people carry it around the zoo

and would end up throwing it on the ground. As most children these days carry

around their mobile phones, this will be a perfect solution. This is a flexible

solution to give a timely information for our students and ordinary visitors in

general. Collaborating and developing the mobile app in the future will be

something we are going to discuss with you and different departments of the zoo.

The upside of this prototype is that it gave an insight on how users interact with a mobile app without the presence of a zoo guide around. The students were clicking on the different tabs to get more information about the specific animal.

Parsons, Thomas and Wishart (2016) identify five specific mobile affordances as portability, evidence and data gathering, communication, interaction with the interface, and outdoor environment. Judging from the test result and from interviews with students and the teacher the prototype gave users the ability to move around the learning material (mobility), to gather information while doing so and communicate with each other.

Looking back to mobile learning theories, Sharples, Taylor & Vavoula (2010) suggest that a theory of mobile learning must be tested against four criteria: First, Does it account for the mobility of learners? From the result of the test we see that having the prototype gave students to be mobile. This is also noticed by the teacher. As a result, during our discussion she replied "As most children these days carry around their mobile phones, this will be a perfect solution. This is a flexible solution to give a timely information for our students and ordinary visitors in general".

The second criterion is, Does it cover both formal and informal learning? I have also noticed a positive result when it comes to covering both formal and informal learning. The lessons on the prototype are going to be designed by teachers mimicking the formal learning and the zoo visit (in this case the animal presented on a big screen) is an informal learning.

Third, Does it, theorize learning as a constructive and social process? I would say that it certainly does. Most of the affordances (tabs like messaging, sending question and sharing options) that are added to the prototype are intended to enable users to be involved in a contractive and social process. This is also reflected when one student asked "…You have already told us that this is just a prototype and it is not online yet. I want to see how I could interact with other students using this app…".

According to, Sharples, Taylor & Vavoula (2010) the last criterion is, Does it analyze learning as a personal and situated activity mediated by technology? Here the technologies mediating the personal and situated learning activity are mobile phone and the app (the proposed prototype in this case).

The above quote by the teacher "As most children these days carry around their mobile phones, this will be a perfect solution. This is a flexible solution to give a timely information for our students and ordinary visitors in general" also supports connectivism approach which views learning as a network phenomenon influenced by technology and socialization (Siemens, 2006). As most students have mobile phones, instead of preparing learning materials on paper, the zoo has planned to use mobile apps for both students and ordinary visitors who are interested to know about animal welfare and conservation.

Dirksen (2016, p. 40) "we need to consider interests, motivations and attitudes of our learners". As the prototype is in English, participants were struggling to understand some of the words. Teachers at the zoo have also the same concerns, so they suggested to include the Swedish language in the prototype so that students could easily understand the lessons. As a result, I included a "change language" option under settings (See appendix 18).

The other concern for teachers at zoo is getting an interactive mobile app to make students engaged in the lessons presented. As this is just a protype and most of the materials included are static, it will be difficult to fully test its functionality, success and failure at this stage.

4.2 Limitation and suggestion for further studies

This project was a pilot study with numerous limitations. Effect of time limitation is reflected during the design and testing phases of this paper. In the beginning, the plan was to create a prototype for students from grade 4 to grade 8 students. But later it is decided to focus on 8th grade students only. There was also a plan to do the prototype test with multiple students but finally it is decided to do it with two students only. Therefore, the results are inconclusive and they are not enough to improve the system.

The current pandemic is another limitation. Because of it, planned zoo visits are canceled and most of the communication between teachers at the zoo and the researcher are limited to Skype and email communications. As a result, prototype testing is done with two students outside the zoo. If the test is done

inside the actual zoo, we might get more results that could give us insights to our question how to teach animal welfare and conservation at the zoo and on which premise we could shape this idea. So, one can say that the downside of this test is that it is not done at an actual zoo.

Different studies are being done to understand the best ways to use mobile technologies for education purpose. There is always room for improvement. Further studies on using mobile application to teach animal welfare and conservation at the zoo should focus on the technology and how it affects visitors learning experience.

In order to understand how to use mobile technology learning successfully, it is important to understand how these techniques influence visitor learning and experience at the zoo (Perdue et al.,2012). The next step would be a larger-scale study in order to investigate the validity of future enhancement ideas.

5. Conclusions and recommendations

Based on previous studies and from the results of this prototype test one can conclude that an interactive mobile apps can be helpful to teach animal welfare and conservation at the zoo. One of the recommendations to achieve this is, "…to apply we have to have an iterative design process'' (Norman, 2013, p.222) and do more tests at the zoo and improve the prototype based on the new findings.

After the first test, I have noticed how students can be easily engaged in learning activities using the prototype. Thought they may not be as interactive as face to face communication between the teacher and pupil, carefully designed mobile apps can be efficiently used to teach animal welfare and conservation at the zoo. Consequently, making the teaching and learning process collaborative and engaging experience might be effective.

Technological advancements in general and improvements in mobile technologies in specific are creating new opportunities and creative ways to connect with others so that we can learn from others and share what we know at the same time. Technology and socialization are probably things that we need to study more so that we can exploit design of learning environments from the connectivism point of view.

Yet again, the best way to know more about our learner's motivations and attitudes is to design a prototype, do continues tests and make appropriate modifications based on our new findings. In an iterative design process, in order to identify the learners' motivation and attitudes, we have to know who the users are, study what their needs are, generate possible solutions for their needs, design a prototype for possible solutions and test the proposed solutions. Repeat until satisfied. As a result, it is recommendable to make more tests inside an actual zoo in order to understand and utilize the proposed mobile app prototype for learning purposes effectively.

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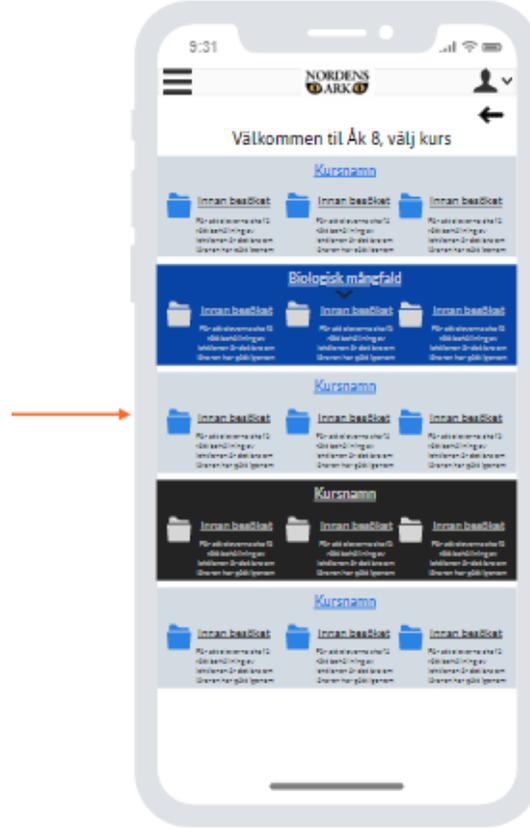## Appendix I
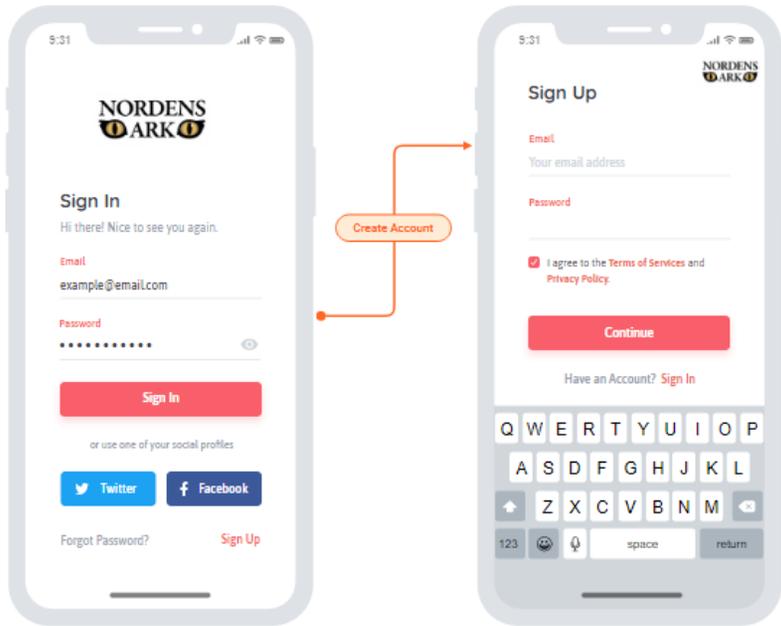
pic 1 and 2 – sign in page
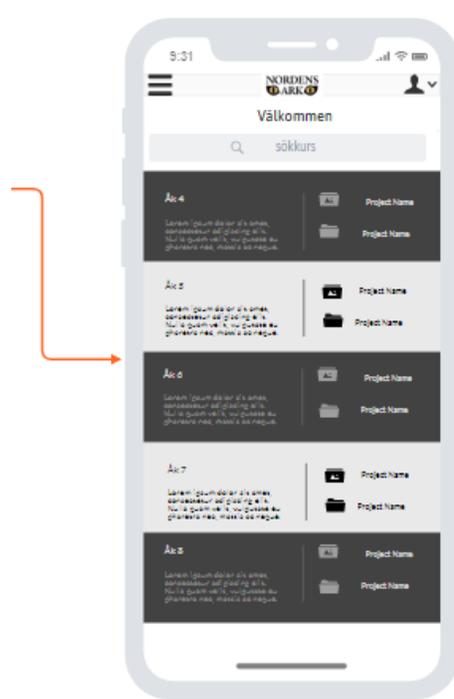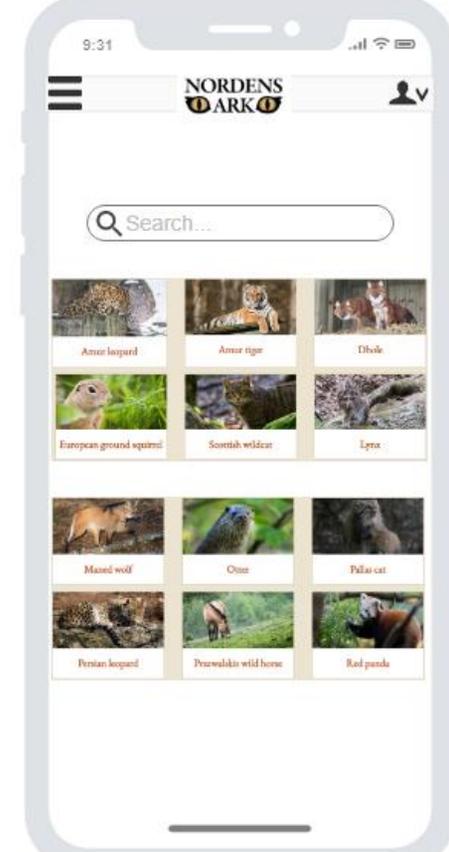

Pic 3 – first page
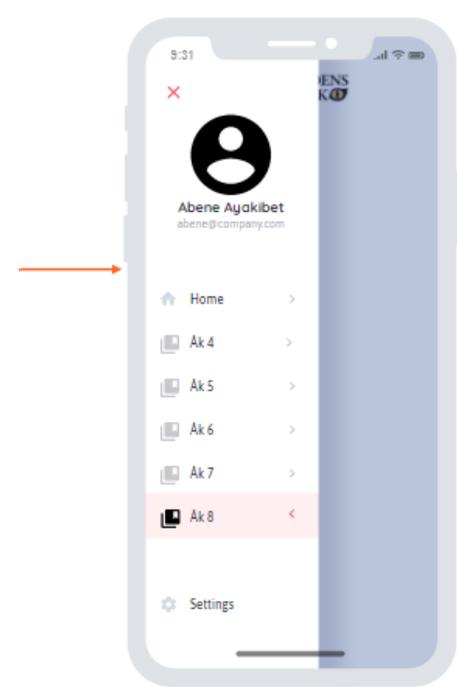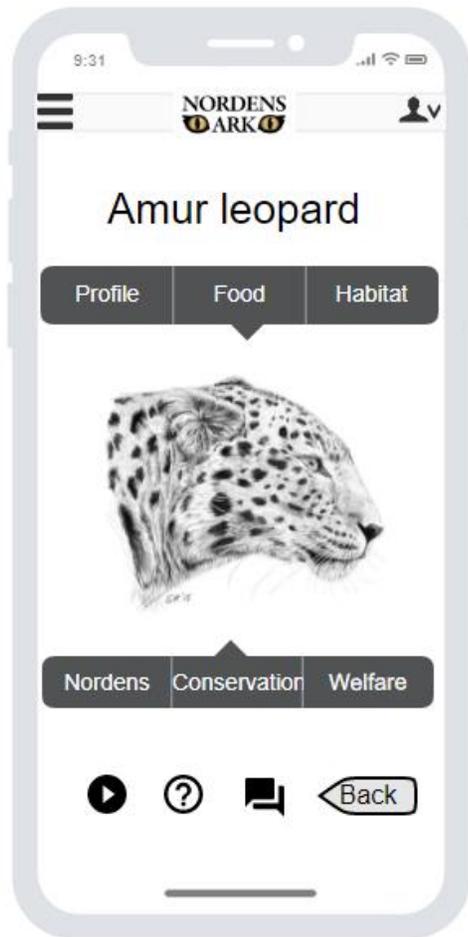

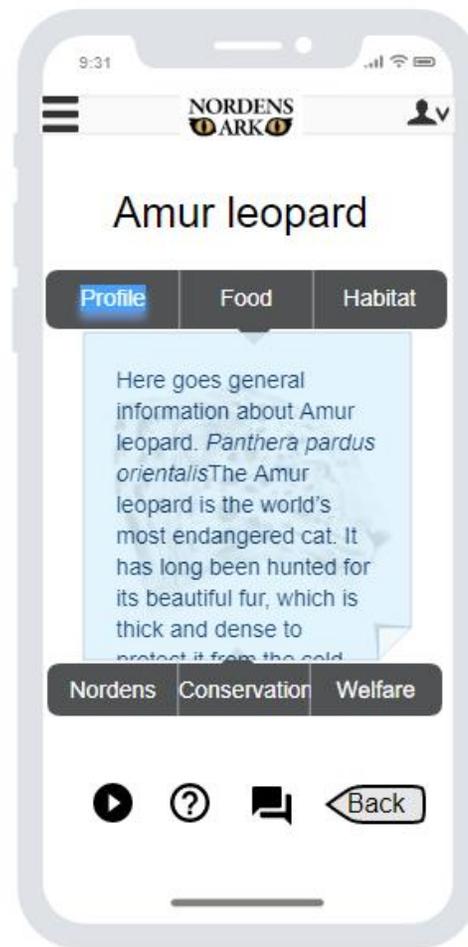Pic 4 – setting and profile page

Pic 5 list of courses

Pic 6 lists of selected courses

Pic 7 – list of animals from the 3rd part of the course

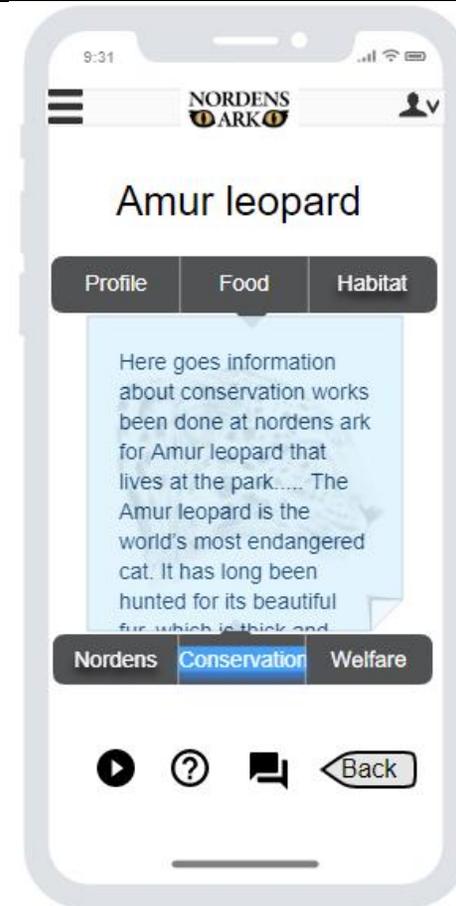Pic 8 selected animal front page

Pic 9 profile page
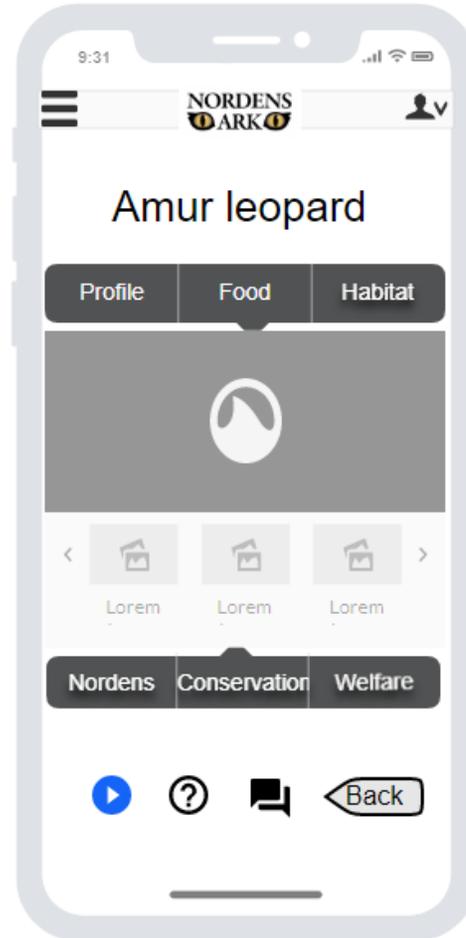

Pic 10 food page

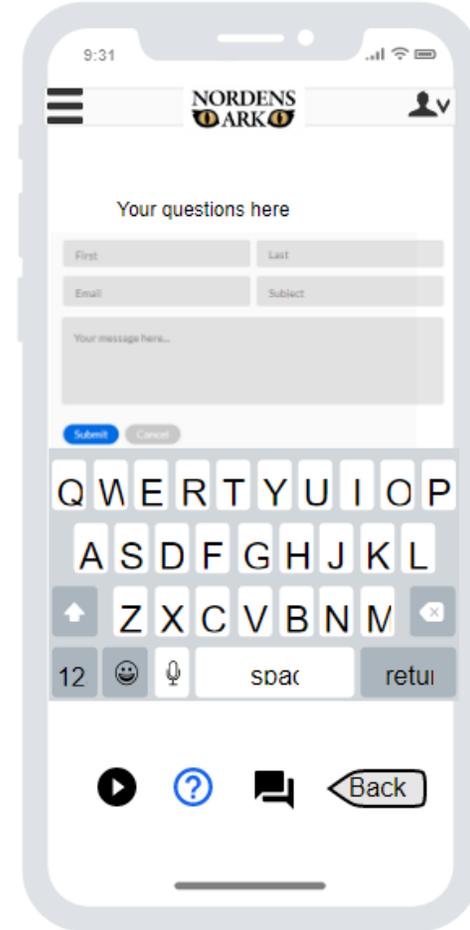Pic 11 habitat page

Pic 12 Nordens ark page

Pic 13 conservation page

Pic 14 animal welfare page

Pic 15 multimedia page

Pic 16 questions page
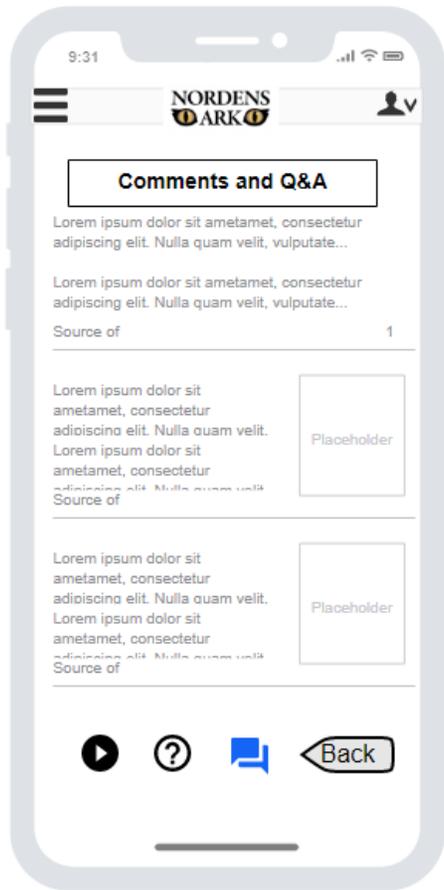
Pic 17 comments, questions and answers page
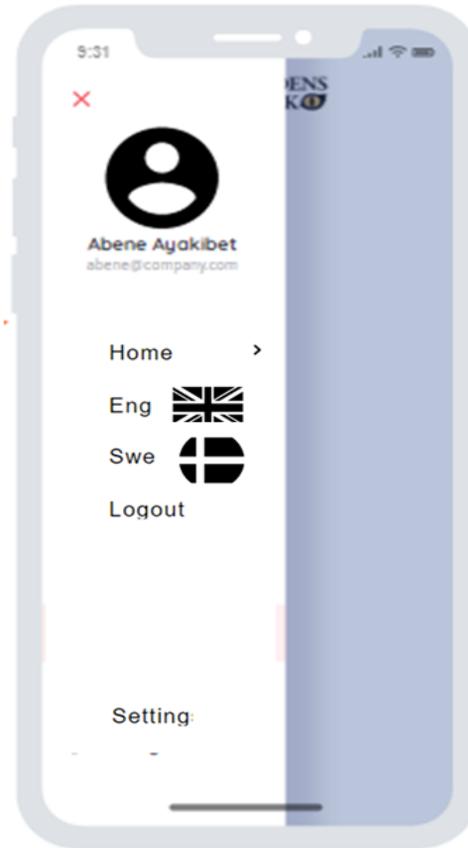
Pic 18 language page

Appendix II – questions for prototype

Interview form for students and teachers

Student

Profile

Age —

Occupation—

Nationality—

Visit zoos—

Reasons to Visit zoos

•

Expectation for the new mobile app

•

Teacher

Profile

Age —

Occupation—

Nationality—

Visit zoos—

Requirements

•

Expectation

•

Appendix III – questions for Skype interviews

1, Are there any courses that are dedicated to teach animal conservation and welfare at your zoo?

2, What does these courses look like? How about the zoo visits? Are they part of the courses?

3, Who are your students? Where do they usually came from?

4, How do students book this classes? Are these courses available online?

5, Hare are the problems that you have been facing so far? What is done as a solution?

6, What is your experience when it comes to online and/or mobile app learning? Both as a teacher and a student?

7, Are there any efforts done to teach your current animal conservation and welfare courses online and /or mobile app?

8, How do you use the zoo's official website, social media and mobile app to promote your animal conservation and welfare works?

9, What are the advantages and disadvantages of teaching aid materials that are currently being used?

10, Are there any researches done that are related to the specific issue?

Appendix IV – The result of the systematic literature review

No	Publication date	Autor/s name	Title
1	2010	Jon D. Miller	Adult Science Learning in the Internet Era
2	2010	Säljö, R.	Digital tools and challenges to institutional traditions of learning: Technologies, social memory and the performative nature of learning
3	2011	Yocco, Victor, Elizabeth H Danter, Joseph E Heimlich, Betty A Dunckel, and Chris Myers	Exploring Use of New Media in Environmental Education Contexts: Introducing Visitors' Technology Use in Zoos Model
4	2011	Carr, N., & Cohen, S	The Public Face of Zoos: Images of Entertainment, Education and Conservation.
5	2012	Perdue, B., Stoinski, T., & Maple, T	Using Technology to Educate Zoo Visitors About Conservation. Visitor Studies
6	2013	Luebke, J. F. and Matiasek, J.	An exploratory study of zoo visitors' exhibit experiences and reactions. Zoo Biology
7	2014	Crompton, H.	A Diachronic overview of technology contributing to mobile learning: A Shift towards student-centred pedagogies. In M. Ally & A. Tsinakos (Eds.), Increasing Access through Mobile Learning
8	2015	Sarah Webber	Design and evaluation of interactive technology for human-animal encounters at the zoo. In Proceedings of the 12th International Conference on Advances in Computer Entertainment Technology
9	2015	Katie R. & Andrew M.	Do zoo visitors come to learn? An internationally comparative, mixed-methods study, Environmental Education Research
10	2015	Green, M., Conkey, A., & Challoo, L.	Cybersafari: The effects of inquiry and information apps on visitor learning and satisfaction at zoos. Journal of Interactive Learning Research, 26(2), 147-168.
11	2015	Moorhouse TP, Dahlsjö CAL, Baker SE, D'Cruze NC, Macdonald DW	The Customer Isn't Always Right—Conservation and Animal Welfare Implications of the Increasing Demand for Wildlife Tourism.
12	2016	Khaddage, F., Müller, W., & Flintoff, K.	Advancing Mobile Learning in Formal and Informal Settings via Mobile App Technology: Where to from Here, and How? Educational Technology & Society
13	2018	Mucha Mkono and AfiyaHolder	The future of animals in tourism recreation: Social media as spaces of collective moral reflexivity.
14	2018	Paul, R., Kerry A., & Lisa M	Animals in an online world: an evaluation of how zoological collections use social media.

Appendix V – Course sample for 8th grade students (English translation) ; translated using Google Translate

NORDENS ARK

Year 8 Biodiversity

Booking: The lesson is booked in early January

Time: March (primarily week 12).

Bus: Booked by the responsible teacher at the school

Location: We meet at Hotel Nordens Ark at 9.00, then a short one walk to a hall where the first half of the lesson is conducted. The other half takes place outdoors in the wild part of the park. The lesson ends approximately 11.00.

Before the visit:

In order for the students to get a proper reading of the lesson, it is good if the teacher has gone through some concepts before the visit to the park. The following concepts apply: ecosystems, ecosystem services, biodiversity, threats to biodiversity and its benefits.

Prepare students to be outdoors in the park parts of the day and to wear durable clothing and shoes. Rainwear if needed. It is good if students are informed about the lesson scheduled so that they have the right expectations when they come.

During the visit:

One of the Nordic Ark's trainers takes care of a class of about 25 students. The first part of the lesson is held in a hall and is based on a PowerPoint presentation with a mentometer system.

The mentometer system gives students the opportunity to answer questions. The results are displayed at group level as graphs in the presentation and discussed afterwards. There are great educational benefits in allowing everyone to take a stand and thus become involved in the lesson.

The lesson covers topics and concepts such as biodiversity, the values of diversity - ecosystem services, the situation in the world and what causes biodiversity to decrease. Some deal with how humans value species.

It includes, among other things, a discussion on the question "What do we benefit from zoology?"

The second part consists of a guided tour of the wild park. The threats to biodiversity that the students have learned about before are concretized with examples of problems different species at the Nordic Ark encounter in nature. The purpose is to give students real perspectives on what favors and threatens biodiversity…

After the visit:

Continue to work with biodiversity, the values of diversity and the threats to biodiversity. Issues related to sustainable development and the students' opportunity to make good choices for the environment themselves. The students had to do an assessment task at the school that addressed the distribution of environmental toxins in the food chain and ….

• Biodiversity and what favors and threatens it. Social discussions about biodiversity, for example in connection with forestry and hunting.

• Local ecosystems and how they can be investigated based on ecological issues. The relationships between populations and available resources in ecosystems. The local ecosystems in comparison with regional or global ecosystems.

• Current social issues related to biology…

Appendix VI – Course sample for 8th grade students (Swedish Full)

NORDENS ARK

Åk 8 Biologisk mångfald

Bokning:	Lektionen bokas i början av januari
Tidpunkt:	Mars (i första hand vecka 12).
Buss:	Bokas av ansvarig lärare på skolan
Plats:	Samling vid Hotell Nordens Ark klockan 9.00, därefter en kort promenad till en sal där den första halvan av lektionen genomförs. Den andra halvan sker utomhus i den vilda delen av parken. Lektionen avslutas ca 11.00.

Innan besöket:

För att eleverna ska få rätt behållning av lektionen är det bra om läraren har gått igenom vissa begrepp innan besöket i parken. Följande begrepp gäller: ekosystem, ekosystemtjänster, biologisk mångfald, hot mot den biologiska mångfalden och vad som gynnar den.

Förbered eleverna på att de ska vara utomhus i parken delar av dagen och att de ska ha tåliga kläder och skor på sig. Regnkläder om det behövs. Det är bra om eleverna informeras om att det är en lektion som står på schemat så att de har rätt förväntningar när de kommer.

Under besöket:

En av Nordens Arks utbildare tar hand om en klass på ca 25 elever. Första delen av lektionen hålls i en sal och baseras på en powerpointpresentation med ett mentometersystem.

Mentometersystemet ger eleverna möjlighet att svara på frågor. Resultatet visas på gruppnivå som grafer i presentationen och diskuteras efteråt. Det finns stora pedagogiska vinster i att alla får ta ställning och på så vis bli engagerade i lektionen.

Lektionen täcker ämnen och begrepp som biologisk mångfald, mångfaldens värden - ekosystemtjänster, situationen i världen och vad som orsakar att den biologiska mångfalden minskar. En del behandlar hur människor värderar arter.

Den innehåller bland annat en diskussion kring frågan "Vad har vi för nytta av fästingar?" Andra delen utgörs av en guidad tur i vilda parken. De hot mot biologisk mångfald som eleverna fått lära sig om tidigare konkretiseras med exempel på problem olika arter på Nordens Ark möter i naturen. Syftet är att ge eleverna verkliga perspektiv på vad som gynnar respektive hotar den biologiska mångfalden.

Under lektionen informeras även om alla yrkeskompetenser som krävs för att driva en anläggning som Nordens Ark. Vi förväntar oss att eleverna deltar aktivt under lektionen. Nordens Arks utbildare håller lektionen så medföljande lärare/mentorer kan hålla sig i bakgrunden. Det ger er möjlighet att lära känna eleverna och se hur de tar sig an uppgifterna de ställs inför. Skulle någon elev inte delta, utan istället störa lektionen, förväntar vi oss att lärare/mentorer tar hand om eleven om vi ber om det.

Efter lektionen finns det möjlighet att äta medhavd lunch på Nordens Ark. Efter lunchen är ni välkomna att stanna kvar resten av dagen och utforska parken på egen hand om ni vill. Lunchen kan ätas på olika ställen beroende på hur länge klassen stannar kvar på Nordens Ark. Har klassen gott om tid kan den ätas i Varghuset om det inte är upptaget med något annat arrangemang. Alternativt kan den ätas någonstans närmre entrén t.ex. i Stora ladan eller på lekplatsen. Den guidade turen och därmed lektionen avslutas där vi kommit överens om att äta lunchen.

Efter besöket:

Arbeta vidare med biologisk mångfald, mångfaldens värden och hoten mot biologisk mångfald. Frågor som rör hållbar utveckling och elevernas möjlighet att själva göra bra val för miljön. Eleverna fick göra en bedömningsuppgift på skolan som tog upp spridning av miljögifter i näringskedja och resonemang kring bränslen till bil i form av el eller biodiesel från palmolja.

Här fick eleverna möjlighet att visa vad de hade lärt sig om hur den biologiska mångfalden kan hotas/gynnas.

Kursplanen i Biologi:

Lektionen syftar till att behandla de gulmarkerade kunskapskraven och/eller skapa förutsättningar för att arbeta med dem före/efter besöket på Nordens Ark.

Natur och samhälle Årskurs 7–9

•Människans påverkan på naturen lokalt och globalt. Möjligheter att som konsument och samhällsmedborgare bidra till en hållbar utveckling.

•Ekosystems energiflöde och kretslopp av materia. Fotosyntes, förbränning och andra ekosystemtjänster.

•Biologisk mångfald och vad som gynnar respektive hotar den. Samhällsdiskussioner om biologisk mångfald, till exempel i samband med skogsbruk och jakt.

•Lokala ekosystem och hur de kan undersökas utifrån ekologiska frågeställningar. Sambanden mellan populationer och tillgängliga resurser i ekosystem. De lokala ekosystemen i jämförelse med regionala eller globala ekosystem.

•Aktuella samhällsfrågor som rör biologi.