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**HOW TO INCLUDE THE MEMBERS OF
REMOTE ETHNIC COMMUNITIES INTO
THE DESIGN PROCESS OF THE
ENDANGERED LANGUAGE LEARNING
APPLICATION**

A case study with Nganasan community

ABSTRACT

Mariia Nukala: How to include the members of remote ethnic communities into the design process of the endangered language learning application

A case study with Nganasan community

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More and more indigenous languages nowadays are getting endangered, which makes people lose the diversity of their cultural values. Previous studies and professional literature suggest that digital language learning can be used to address this issue and contribute to language and culture revitalization. Participatory design became a trendy method to create interactive digital products together with the users. However, the concept of endangered language learning is not still fully studied in the field of Human-Computer Interaction, and there is not enough knowledge of how co-creation can be used to engage people from ethnic minorities in order to motivate them to use the application for learning their native language.

This thesis work presents remote experimental research and contributes to the knowledge in the participatory research field, presenting the study in which children in the role of co-creators designed the materials for Nganasan language learning application. This study aims to understand how a digital language learning application called NganasanMe, will be used by remote community members, whose experience with the technology is limited, and how it will affect users' motivation while using the application outside the educational environment. This research was conducted involving indigenous members of the Nganasan community, living in different parts of the Taymyr Peninsula. The research was divided into two parts, depending on the quality of the Internet connection in the homes of the participants. First, the offline study was conducted to explore how Nganasans would use the NganasanMe application and measure their motivation. The feedback from Nganasans was collected by using the questionnaire and interview. Then the participatory design sessions were facilitated with two Nganasan families. As a result, Nganasan kids produced the drawings as an asset for future application development.

The results of the research demonstrate the potential of applying participatory design to increase motivation and help Nganasans to learn their indigenous language, feeling empowered. The study investigated how language learning application might boost communication in the Nganasan in informal environments. According to the interview and questionnaire answers, Nganasans found the concept of digital language learning engaging and useful. However, only a minor part of the Nganasan community members is ready to participate in such studies, due to undeveloped conditions of life, socio-economic reasons, and people's cultural attitudes. The study also reports the challenges faced by the researchers while designing an application for endangered language learning in a remote community. Yet, one of the results shows that engaging indigenous people in the design process helps to get and produce more qualitative design outcomes and support the cultural values.

Keywords: Nganasan, Language Revitalization, Participatory Design, Remote Community, Child-Computer Interaction

The originality of this thesis has been checked using the Turnitin OriginalityCheck service.

PREFACE

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LIST OF SYMBOLS AND ABBREVIATIONS

CCI	Children-Computer Interaction
DLG	Digital Learning Games
DGBLL	Digital Game-Based Language Learning
HCI	Human-Computer Interaction
LL	Language Learning
PD	Participatory Design
RQ	Research question
TAUCHI	Tampere Unit for Computer-Human Interaction
UCD	User-Centered Design

1. INTRODUCTION

This chapter presents the background of this thesis research and the motivation behind exploring the idea of how the technological solution for endangered language learning could affect the motivation of people from ethnic minorities towards learning their native endangered language. It also outlines the purpose and objectives of the thesis, rises research questions, and presents the structure of the thesis.

1.1 Background and Motivation

There is no doubt that nowadays a lot of languages all over the world are getting endangered. Previous research in HCI (Human-Computer Interaction) contributed to understanding digital language learning (LL) as a way for language and, correspondingly, culture revitalization. It is well known that indigenous language loss, as well as language revitalization, are not new areas in academic work, but according to Hermes & King (2013, p.125), they are a new direction in the field of “community activism”. In recent years, the ways that the new digital technology can support the intention to teach and renew endangered languages have attracted increased attention of researchers worldwide (Hermes & King, 2013). However, much of the previous research about technology inclusion for indigenous language learning has been focused mostly on adults, rather than children (Coronel-Molina, 2005). It is not much known about how technology might be used in learning indigenous languages among children and their families in an unofficial context, for example at home or the meetings of cultural representatives.

To address these shortcomings, this research will explore how digital language learning application might be used by diverse members with low technology adoption of the Nganasan community in various contexts, especially informal (e.g., their homes). Furthermore, due to the situation with the SARS-CoV-2 pandemic all over the world, the research in this thesis was conducted remotely via the What’s app application. Originally, participatory design (PD) was planned to be conducted also remotely with a group of children in an educational environment (e.g., cultural Nganasan club or school). But because of the deteriorating situation with SARS-CoV-2 in Taymyr, all children’s studies were held from the distance, mostly from home. However, the participatory design was conducted in both ways: one session was carried out from participant’s homes and the

other one with a group of children in the cultural Nganasan club, since in few months after the research has started, kids again continued their studies in schools.

Nganasan community is a small-numbered ethnic minority, settled on the Taymyr Peninsula, Russian Federation (Figure 1).

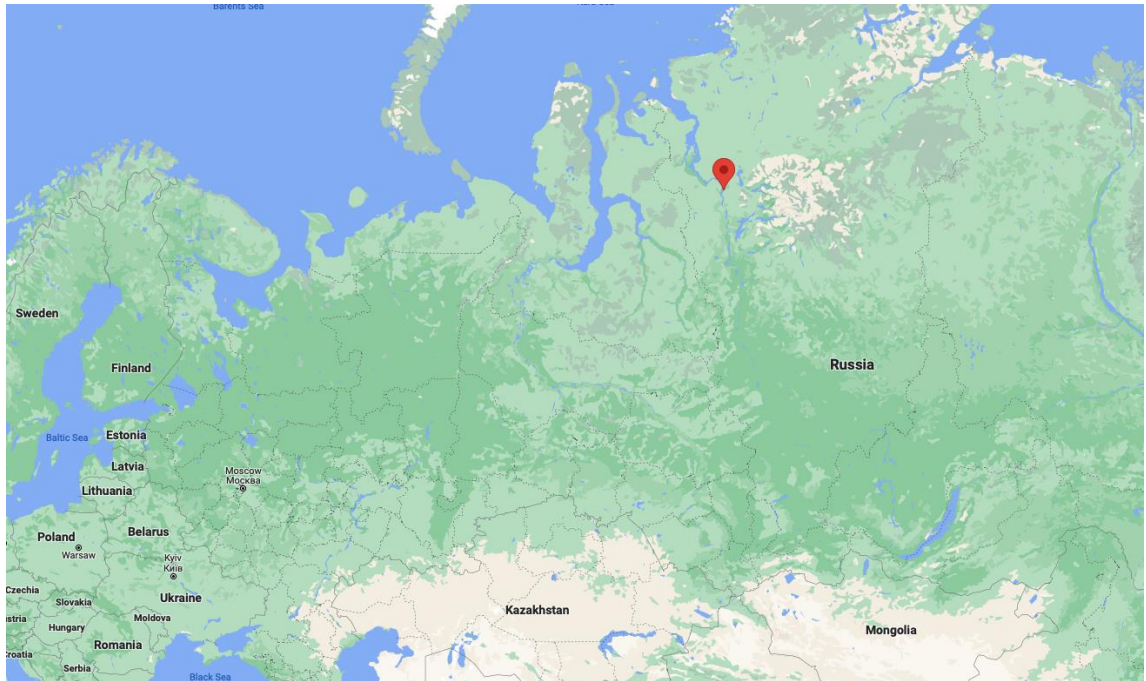


Figure 1. Map illustrating the location of the Taymyr Peninsula (Google Maps, 2021)

Nganasan language being a part of a Samoyedic-Uralic language family is considered to be seriously endangered (Leisiö, 2019). Nowadays, Russian is the only official language in the society. Over the years, the younger generation of Nganasans living far from their families has lost traditional ways of living (Reznikova et al., 2018), and respectively, are not any more tightly connected to their culture. They do not have the motivation to speak the language of their ancestors (Suihkonen, 2002), which is one of the reasons why language has become endangered.

According to Smoking (1999), it is possible to preserve the culture by preserving the language, because the culture of ethnic minorities is defined by their language identity. Considering the case with Nganasans and analogous small-numbered communities (e.g. Hermes & King, 2013), one of the ways of language revitalization is to spark interest toward the culture of their ancestors and engage the younger generation to start learning their native language. Fun and engaging methods are advised as appropriate ways for teaching. According to Inkpen (1997) as cited by Sim et al. (2015), fun is considered as a part of user experience as well as one of the main motivating factors for children, when

they interact with the technology. If technology does not provide a positive user experience, children are unlikely to interact with it or accept it. Moreover, fun is related to enjoyment and motivates players of any age to keep playing (Sweetser & Wyeth, 2005). Hence, the right approach to address endangered language learning might be digital learning solutions. Moreover, it would also bring technological progress into community life, encouraging people to gain skills advantageous for modern life. At the same time, cultural aspects and technology adoption level should be respected while designing the digital solution. This will make the perception of technology more positive.

In late 2019, a group of TAUCHI (Tampere Unit for Computer-Human Interaction) researchers from Tampere University in collaboration with a linguist created an application for Nganasan language learning, called NganasanMe. The goal of the application was to affect children's motivation towards their native culture and language learning to potentially support culture revitalization. The application is one of the parts of the Digikieli project, and the first version was created for tablets only. NganasanMe application provides young users with an entertaining, interactive language learning experience, which could be easily accessed outside a classroom environment. The application was designed to be used in mobile devices, where users act as self-guided. When the application was ready, three tablets with the application were sent to the Volochnanka village and tested in a school environment with local children aged from 7 to 12 (Burova et al., 2021). As was said previously, there is lack of information about how people use similar software in an unofficial context and its' potential impact on Nganasan language use. The author of this thesis joined the research team with the intention to continue work on this application. In contrast to the previous study, where the application was tested in a school environment and the application usage was supervised by the teachers, this thesis work focused on bringing new ideas for its' further development and exploring how the application can be used outside the school environment. As one of the results, new ideas for further application development will be presented. They were created with the involvement of the end-users: family with children. More detailed research goals will be described later in the Research goals and questions chapter.

Users' contribution to product development is a widely studied topic in Human-Technology Interaction (HTI). Numerous researches explored how people can be involved in the creation of a new service for themselves. Participatory design is a popular method used in the HCI field addressing to create interactive products together with the stakeholders (Bjerknes et al., 1987). For example, in this case study the children in the role of co-creators are expected to contribute to the design process by suggesting their ideas to the designers about what they value, find entertaining, motivating, or distracting (Gennari

et al., 2017). Participatory design nature is considered as collaborative and social, which leads to improving motivation of the end-users and, respectively, engage people for co-creation especially in case of endangered language learning. Moreover, Pitkänen-Huhta & Pietikäinen (2014) conclude that the participatory approach highlights the interaction between the learner and the broader community. Thus, this research also contributes to an understanding of children's empowerment, investigating how the "empowerment of learners may be encouraging in the learners' awareness of their own capacity and their ability to create new knowledge and thereby make use of their knowledge in society" (Pitkänen-Huhta & Pietikäinen, 2014, p.3). However, currently, there is a very limited number of studies exist focused on how to implement PD practice online in isolated communities, like in the Taymyr Peninsula. This thesis contributes to the knowledge in the participatory research field by reporting the online study, in which children from an ethnic minority, as the co-creators, designed content for LL application.

1.2 Research goal and questions

The objective of the study was to provide a better understanding of the ways in which technology can be used as a tool for endangered language revitalization. The research goal is to understand how a digital language learning application will be used by remote community members, whose experience with the technology is limited, and how it will affect users' motivation while using the application outside the educational environment. Furthermore, another research goal is to explore the ways in which participatory design can be applied to the Nganasan ethnic minority aiming to boost the learning of indigenous language. This thesis was focused on two following questions:

RQ 1: What are the outcomes and design artifacts of the remote explorative co-creation process with the Nganasan ethnic minority on language revitalization?

Since this research was carried out in the remote Nganasan community with its own cultural behavior, this question relates to the challenges and the benefits of including people of ethnic minorities in the remote design process and investigates what outcomes of the co-creation process with members of the ethnic community will it bring.

RQ 2: How to design content for endangered language learning application based on the obtained insights from participatory design?

The second research question is pointing the scenarios of implementing collected design artifacts from participatory design workshops.

To find the answers to these questions, experimental remote research was conducted combining knowledge and using methods of the HCI, cultural characteristics of the remote communities, and digital language learning design. The study tries to contribute to future research on the subject demonstrating the post-study design artifacts implementation and the experience of remote work with an ethnic minority.

1.3 Structure of the thesis

This thesis is organized as follows: after the introduction, the second chapter presents an overview of the remote Nganasan community and the current literature about digital language learning and the specific conditions of the design with children, which have to be taken into account before the beginning of the research. Section 3 describes the background of NganasanMe application development and its main features. Next, Section 4 introduces the methods and design approach of this research. Also, the section describes in the details how the study was prepared and conducted, including offline user study and participatory design workshops. Section 5 discusses the findings of the research, presenting challenges and opportunities of developing apps for remote communities. This section further demonstrates the possible implications of the design artifacts received during the PD sessions with kids and provides recommendations for future work. The Conclusion section summarizes the main findings of the study and concludes the thesis.

2. THEORETICAL BACKGROUND

This chapter presents an overview of the Nganasan remote community and focuses on the existing related work used for the thesis. This chapter aims to present the overall picture of the research subject. The concept of learning languages in digital format and design for children will be described in order to demonstrate the previous experience in this field.

2.1 Nganasan remote community

The Nganasans are people considered as the residents of the indigenous ethnic minority from the Taymyr Peninsula, northern Siberia, Russian Federation. The population census states that in 1989 there were only 1226 Nganasans, but suddenly in 2010 this amount decreased to 862. The Nganasan is a language of the Samoyedic-Uralic language family and is considered to be seriously endangered (Leisiö, 2019). Nganasan speakers are geographically dispersed mostly across the settlements of Ust-Avam and Volochanka, whereas a population with a smaller number of residents locates in Dudinka and Novaya village (Kosterkina et.al., 2001). Figure 2 illustrates Nganasan ethnic minority, demonstrating their national clothes and classroom with Nganasan children.



Figure 2. Nganasan people (private collection of one of the Nganasan community members)

The majority of people, who are native speakers of the Nganasan language, are middle-aged or even older (Janhunen & Gruzdeva, 2020). Nganasan language estimates only 125 speakers across the Taymyr Autonomous Okrug. The teaching of the Nganasan language in primary schools of Taymyr has started recently at the initiative of Nganasan people, but the lack of native-speaking teachers, literacy sources, and study materials

often make this teaching complicated. Historically, the Nganasan language was the primary language among Nganasans, but the situation has been changed, and nowadays the main language, which is used and learned is Russian.

Traditional Nganasan culture and the language, as a part of it, are closely connected to nature. Historically, lifestyle also played a big role in culture formation. The everyday chores: hunting, fishing, reindeer herding, and old-style craft - were the activities, in which people have learned Nganasan. Moreover, it is a spoken language, which does not have a written form. Helimski, 1997 stated that, due to incisive influence linked with economic and social reconstruction, Nganasans could not continue their traditional lifestyle. That is why the majority of local people moved to the cities and left their historical place of living and ancestral lifestyle (István Endrédi et al., 2010).

Unfortunately, the technology adaptation is progressing slowly in the Nganasan community. This happens because of the lack of digital solutions, poor access to the Internet, low support provided by the government, and people's cultural attitudes. Lack of access to digital technologies and, as a result, the lack of digital literacy skills prevents remote community members from participating in contemporary society (Carew et al., 2015).

2.2 Digital language learning

Over the past few decades, application inclusion to the education has raised a big interest among educators as a language learning tool. Nowadays digital language learning is considered as an effective and popular approach for people who learn the languages (Ramirez et al., 2018). Moreover, in a combination with gamification features the digital solutions make the learning more attractive for the students and improve their productivity. There are various types of digital educational tools, which might be applied for language learning, and one of them is digital learning games (DLG). "Games for learning is the production of a specially implemented application for the purposes of learning, teaching a particular subject of promoting engagement" (Hainey et al., 2016, p. 203). Acquah & Katz (2020) state that if the digital games are applied in the right context, they can be used to enhance motivation and learning outcomes (Peterson, 2010; Squire, 2002, 2008), but the existing literature related to digital game-based language learning (DGBLL) is still limited (Hung, Yang, Hwang, Chu, & Wang, 2018; Peterson, 2016). The context of use or, in other words, educational environments for learning games can be different: "formal educational environments (schools and universities online or off), places of informal learning (e.g. museums), or self-learners interested [in] acquiring new knowledge or understanding" (Klopfer, Osterweil & Salen, 2009, p. 21).

Roschelle et.al. (2000) defines that the purpose for using DLGs rather than alternative teaching methods is that they result in other types of positive outcomes and are often better matched to how children learn today. Additionally, learning is most effective when it involves active engagement, group participation, frequent interaction, presence of feedback, and connections to real-world contexts.

Also, Acquah & Katz (2020) have investigated that the popularization of DLGs is explained by fact that learners have changed. They propose that the students in the 21st century grow up with modern technology and thus are digital natives. This means that the students experience the freedom and enjoy it while playing digital games, as opposed to the traditional learning environment at school where teachers often need to make an effort to keep the students engaged. Moreover, it is considered that learners should start between 10 and 12 years old to reach native-level proficiency (Hartshorne, Tenenbaum, & Pinker, 2018).

The study by Acquah & Katz (2020) examined the empirical evidence for the effectiveness of digital games. According to their analysis, they revealed six key game features highlighted within the studies that influenced the outcomes: ease-of-use, challenge (at one's zone of proximal development), rewards and feedback, control or autonomy, goal-orientation, and interactivity. Furthermore, in addition to the game features, there were also explored that the conducted studies within an official educational environment, with or without the participation of a teacher, resulted in mostly positive language acquisition results, meaning DLGs can be implemented successfully within schools. Thus, DLGs are considered an effective tool for education.

Games are not the only way, in which digital learning can be applied. On the other hand, game elements in technology raise the engagement and motivation of the users and become more popular every day. Nowadays, there is a huge amount of language learning applications, positively affecting users' learning outcomes and learning experience in general. For example, based on the rating of App Store and Google Play online markets, the Duolingo LL application is one of the popular applications for learning new languages. It consists of 35+ languages and allows users to build solid speaking, reading, listening, and writing skills in a fun way. Another example of a similar LL app is WordDive, promising a user fast results from language learning experts. Memrise app stands out by providing learning materials in video and audio clips format from native speakers, which are used in everyday life. In general, these applications affect the learning experience positively in a context, which can be useful for a user-connecting with friends and family via various video software, travel, boosting the career level, or learning during free time.

2.2.1 Endangered language learning

Today mobile technology dramatically rises its' potential, which might be beneficial considering endangered language learning. By utilizing personal devices as a learning tool, families can easily become a part of language revitalization. In recent years, increased attention was paid to the new ways, which potentially can minimize indigenous language loss and support its' revitalization. Previously, the focus of the majority of work with indigenous languages and technology has been directed at adults rather than children or families. Only limited information exists about how technology might improve Indigenous language learning among children and families in informal environments. Being interested in this topic, Hermes & King (2013) rise in their studies a question about the appropriate role of technology in indigenous language revitalization. They tried to find an answer for the question of "How can community members effectively use technology in their efforts to revitalize a language?". Their main goal was to examine how urban Ojibwe participants utilized computer-based language learning technology with their families at home. Findings suggest that technology-based language learning helped to provide a starting point for learning and language use in an informal study environment, like home. In another study, the native speakers from Australian ethnic minorities were involved in a participatory process to develop ideas for LL application (Carew et al., 2015). Apps, for example, have the potential to contribute to indigenous language revitalization making the learning process flexible and attractive way for both youth and adults. For instance, Ramirez et al. (2018) explored whether apps can boost learning of indigenous language among children of elementary school age. They demonstrated that the apps may benefit when utilized by teachers, as a tool for LL, or it used outside the school environment when an educator is not available.

This thesis work addresses the facilitation of supporting language revitalization among children, as the main end-users. Hence, the following information on endangered language learning is presented partly describing how to improve the efficiency of children's studies in an informal environment. Children from ethnic minorities usually get the language knowledge from their family members. The approach of how language is taught plays important role in successful language perception. It needs to be acknowledged that for children there may be a balance between the inclusion of pedagogically useful content and the implementation of components that ensure the game is fun (Sim et al., 2015).

In past times and also nowadays, it is well seen that the successful language revitalization efforts are rooted in community initiative, investment, and commitment (Fishman, 2001). Children learn any language most effectively when surrounded by, and engaged

in, meaningful conversations with people, who also speak target language. These conversations, which provide rich incentives and opportunities for language learning and use, take place at home with family (Philp, Oliver, & Mackey, 2008). According to Hermes & King (2013), it means to ensure a success in language revitalization efforts and transmission across generations, the language should be instructed not only in formal or school domains, but also its' use should be promoted in informal contexts such as the home and family.

2.3 Design for children

In recent years there has been growing interest in studies with children, as users (Druin, 2002; Shahid & Kramer, 2009; Sim et al., 2015). According to Berman (1977) as cited by Druin (2002, p.1), “young people considered as entirely different user population with their own culture, norms, and complexities”. Therefore, special attention should be paid to design and user studies arrangements with the children. This section presents the previous work on how to design for children and how to conduct user studies with them.

The interest in Child-Computer Interaction (CCI) field is getting more popular, because nowadays computers play a ubiquitous role in everyday life, including the life of the younger generation. “Child-Computer interaction is the field that studies how to design interactive technology for children, and how children may make the most out of it in order to have the most positive impact on their development” (Hourcade, 2015). The exploring of the design of computer systems for children started in the 1960s when the group of researchers was focused on developing accessible computer programming for children. Children of the 21st century more frequently use interactive computer devices for different purposes including learning.

Moreover, there is a large volume of published studies describing the role of user studies with the participation of children. For instance, articles of Sim et.al. (2015), Shahid & Kramer (2009) state that participatory approaches with children can be beneficial in different stages of design, from the start to the evaluation phase. Considering participatory design as a very effective user-centered design methodology, and in particular with children, it will be discussed further in this chapter.

Druin (2002) described four main roles that children can play in the design of new technologies: user, tester, informant, and design partner. In the role of design partner, children at the same time play the role of equal stakeholders throughout the whole timeline of new technology design, equally contributing in any ways that are appropriate for chil-

dren and the design process (Druin, 2002). Being in any of identified design roles, children may feel empowered through the design process, which means potential growing interest towards interaction with technology. Also, another benefit of using any of the design roles is that children can be better understood by adults. Adults and the younger generation work together in order to invent new learning technology for children and find answers to defined research questions. Children's participation in the research studies may affect the way of how technology is used for learning.

However, work with children requires a specific approach. According to Inkpen et al. (1997), fun is one aspect of user experience and one of the major motivations for children to interact with technology, which is important to consider especially in the context of children's games. Carroll (2004) as cited by Sim et al. (2015, p.268) suggested that things are defined as fun when they "attract, capture, and hold our attention by provoking new or unusual emotions in contexts that typically arouse none". Following this statement, it means that if technology or software does not provide a positive experience, there is a probability that children will not interact or accept it.

Not only a positive experience but also possible challenges should be considered while designing technology with children. One of the main challenges of facilitating participatory design sessions with children is that sometimes participants do not understand where their efforts will be later used in the design. Sim et al. (2015) state that often, children, involving in the design process, invest a huge amount of effort and imagination. In the end, they often fail to see the final result, since the designs from a participatory process are rarely evaluated with end-users. As an example, in the study by Suleman and Krahmer (2009), in which participatory design techniques were used to design a game with children in Pakistan, it was unclear whether their ideas were taken forward into an actual game. Another challenges, which proposed Druin (2002) in his study, relate with attitudes between adult researcher and a child. He claimed that children are very honest creatures, and they have little patience for what they do not like, letting adults know only one side of their opinion. That might hurt a researcher, especially if the technology took years to create. The second potential challenge might arise when researchers do not know the right time to bring children into the process of design technology. Since children have used to follow adults' instructions, and adults, on the other side used to be responsible, it might be challenging to discuss team design decisions in terms of negotiation.

Moreover, little information is known about how much researchers can trust the data they collect with children. Discussing the survey, as one of the evaluation methods in HTI, Horton & Read (2008) as cited by Sim et al (2015) states that it is difficult to identify how

valid and reliable can be children's responses. Furthermore, as was said before, children are very honest in their feedback about technology, but much of what they say may be in their actions and therefore, needs to be interpreted within the context of concrete experiences (Druin 1999, 2002).

2.3.1 Participatory design

Participatory design is the hot topic today when conducting a user study with children. Furthermore, the participation of end-users in the technology design and evaluation has been long an important principle in HCI (Sim et al., 2015). According to Sim et al. (2015), the participatory design means that stakeholders are directly involved in the design process so that they can "explicitly influence values, norms, and ethical considerations that are embedded into designed artifacts". Sim et al. (2015) also point out that groups of users in PD sessions usually work in a collaborative way and influence decisions for the design.

Standard participatory design sessions are facilitated with end-users. Working in pairs with the designers they try to achieve HCI goals, like to propose and create potential design ideas for specific products. An example of such product can be, for instance, interactive games for museums designed by children (Dindler, Iversen, Smith, & Veerawamy, 2010). However, end-users' ideas might bring different effects to the final design, based on how the participatory session was organized. Contributing directly to the design is especially important so that the participants are aware of why and how they are involved in the process and understand the artifact nature they are designing (Sim et al., 2015).

Nowadays there is no general agreement on the effectiveness level of PD methods in learning application design. Those research works, which contributed to this area, were focused mostly on fun and cognitive aspects of the designed game, where learning designers also have been employed to improve and work on these aspects (Druin, 2002).

As was mentioned above, the results of the final design are depending on how the participatory design session was set up and what goals the designers want to achieve. Various works are demonstrating the potential of utilizing the participatory design method in the learning context. A great example of using a participatory design approach is presented in the study of Pitkänen-Huhta & Pietikäinen (2014), where they created little multimodal and multilingual picture books with a help of a group of Sámi school children. Nowadays there are no monolingual Sámi speakers left, and all Sámi languages are

related to endangered. The books were made during the participatory literacy task given by designers to the children in the context of endangered indigenous Sámi languages.

Another example from the academy (Shahid & Kramer, 2009) demonstrates the usage of participatory design workshops for promoting basic reading and writing skills in Pakistan illiterate children mostly living in less-developed areas. In this case study, the purpose was to develop an early version of an educational game to support assistance in learning local languages for illiterate children and also to understand better the everyday socio-economic problems faced by these children, obstructing their education. However, the result they presented was focused more on methodological outcomes and challenges faced by researchers while designing educational aids for children. Because of social and cultural constraints, it is not always possible to use in the standard way existing standard research methods in this community, and they need to be altered depending on the situational context.

The study by Sim et al. (2015) explored how participatory design methods can be used with children to design a serious game for a surrogate community. In this study, fifty children from the UK primary school were designing a serious game for children from Uganda. The results show and confirm that children in one country could effectively design fun games for a surrogate user group from another country.

Naturally, children have a creative mind and are eager to share their, sometimes unconventional viewpoints (Melonio, 2016). Therefore, in different stages of participatory design, potential users of a product move from the role of design informant to design participant or partner. Researchers embark on a design “journey” or “experience” with potential users and create a shared language, so as to understand the product from different viewpoints (Gennari et al., 2017).

2.3.2 Offline user studies in isolated locations

Even though most countries nowadays are well developed, there are still those locations, where progress is delayed. Sometimes designers are forced to work in such societies, which brings different difficulties in the research realization. According to Shahid & Kramer (2009), in developing countries with illiterate participants, regular PD practices cannot be straightforwardly applied. Possible challenges, like different cultural and social norms, levels of education, power structures, children-parent relationships, and local government policies, might occur while facilitating PD sessions in these conditions (Shahid & Kramer, 2009).

Kam et al. (2006) state that, when the user study is carried out in isolated locations, it is crucial to have a person being in the role of the local intermediary connecting research group and community stakeholders. A cultural guide can help the workshop to proceed smoothly, maintaining good relationships with both sides. For example, the local intermediary can explain to the research group how to deal with and understand rural people's mindset, at the same time trying to declare the importance of community stakeholders' presence for the research. Likewise, Kam et al.'s (2006) research team argues this point of view, stating that organizers of a PD workshop could build a more equal design partnership with rural school children by displaying honest interest to learn more about the local culture and language.

2.3.3 Cross-cultural design

It is well known that each country has its' own specific cultural characteristics. Professor Geert Hofstede, who was the author of popular studies on cross-cultural groups and creator of six dimensions of national culture, defined culture as: "*The programming of the human mind by which one group of people distinguishes itself from another group*" (Hofstede Insights, 2020). Developing a new digital product, designers need to keep in mind this significant statement, since for the different cultures the design will also differ. Highlighting the importance of applying cultural aspects to User-Centered Design (UCD) for mobile learning applications, Kam et al. (2006) define the need to understand the users, their cultural milieu, bonding with the users, and the relationship between users and their community.

The most comprehensive studies about cultural differences were conducted by Hofstede's research group between the 1967s and 1973s. In this research more than 70 countries were involved. As a result, the research team provided six dimensions of the national culture. According to Hofstede Insights (2020) the Dimensions of national culture consists of six dimensions:

- Power Distance Index
- Individualism versus Collectivism
- Masculinity Versus Femininity
- Uncertainty Avoidance Index
- Long Term Orientation versus Short Term Normative Orientation

- Indulgence versus Restraint

This thesis is based on the research, which is made for the Nganasan community, living in Russia. If to explore Russia through the six Dimensions model, it is visible that the specific cultural features will be included in the three most rated dimensions: Power Distance, Uncertainty Avoidance, and Long Term Orientation. Power Distance determines the fact that all people in societies are not equal. Furthermore, Individualism means that people mostly look after themselves and their families only. The third dimension Long Term Orientation, inherent for Russia, means that people take a more pragmatic approach, encouraging thrift and efforts in present as a way to prepare for the future.

Despite Nganasans live on Russian territory, Nganasan people indicate their nationality as Nganasans than the Russians. For this reason, and also because of Russian and Nganasan noticeable cultural contrast, design for Nganasan culture will require alternative design decisions. However, Nganasan culture nowadays is very little known, making it difficult to say what design principles are better to apply during the design process. To get more design insights, the author of this thesis discovers them during the conducted user studies. Implementing cultural aspects into user-centered development might potentially motivate and persuade users to use an application efficiently.

2.4 Design and empowerment

It is traditionally accepted in our life that an adult has power over a child, whereas the young generation is dependent on everything from their parents and teachers. However, this brings a large amount of personal experience about children and may not be enough to support today's young people. Deciding what technologies should be used in schools or at home, children might have difficulties raising their opinions due to "all-knowing" adult attitudes (Druin, 2002).

Empowerment is a trending topic due to giving a voice to whom it is needed. Nowadays there is a variety of definitions of empowerment. However, in the case of work with children in digital technology design, researchers take the concept of 'empowerment' as self-evident and prefer not to define what they mean by it (Kinnula et al. 2018).

A part of the NordiCHI Workshop (2020) has presented a comprehensive explanation of empowerment, reviewing existing types of it:

- Mainstream - motivating people through increased decision-making power, e.g., powerful giving some power of decision to the power-weak.

- Functional - improving life conditions of people while maintaining the status quo, e.g., through the development of better tools for people use.
- Democratic - people have the ability to affect decisions concerning them.
- Learning and competence - giving people skills and competencies for their future to enable them to flourish in their full potential, participate fully in society, and to control their destinies.
- Critical - challenging the conditions of status quo, questioning the power dynamics, and gaining more power of decision.

Special groups of people, for example, underserved communities, individuals with disabilities, and children from low socio-economic backgrounds need to be empowered with more attention. Social hierarchies, as a phenomenon of empowerment, appear when one group has power over another. For instance, the government has more power over citizens, regulating the availability of technology infrastructure; designers are more powerful over users, deciding what kind of technology is available for use; and a parent usually controlling children's access to the Internet and amount of time mobile phone is used. Answering the question of why empowerment is needed for children, the author of NordiCHI Workshop (2020) underlines that "what people learn young, will serve them in the future", as well as "courage and capability to question existing and future solution should be learned early".

Kinnula et al. (2018) explored empowerment in relation understanding what empowerment means in digital technology design context. She claims that one of the ways to empower children of different ages, as well as considered in the CCI community, is to participate in digital technology design, offering them different technology design skills. Participatory work with children is considered as a way of giving them a voice, empowering them as co-creators. Fulton's Report to the President on the Use of Technology to Strengthen K-12 Education in the United States (1997) claims the importance of children as users stating that: "they are fast becoming tomorrow's power-users of everything from the Internet to multimedia authoring tools" (cited in Druin, 2002, p.2). Children can be actively involved to design projects if an appropriate framework will be applied. Improving the usability and user experience of the designed products, this approach also makes sure that the design is understandable for children and compatible with their desires (Sim et al., 2015).

3. NGANASANME APPLICATION

The focus of this thesis is remote participatory experimental research. This chapter provides a short summary of the idea of the NganasanMe application aiming to introduce background information of the application.

The NganasanMe application allows learners to study the Nganasan language in an interactive way on portable devices only. NganasanMe mobile application provides users with various types of interactive lessons for language learning. Choosing a character suggested by the application in the beginning, a user immediately immerse into the language learning process. The application has been designed focusing more on learning, even though it has gamification elements for entertaining. Figure 3 demonstrates two different tasks from the NganasanMe application.

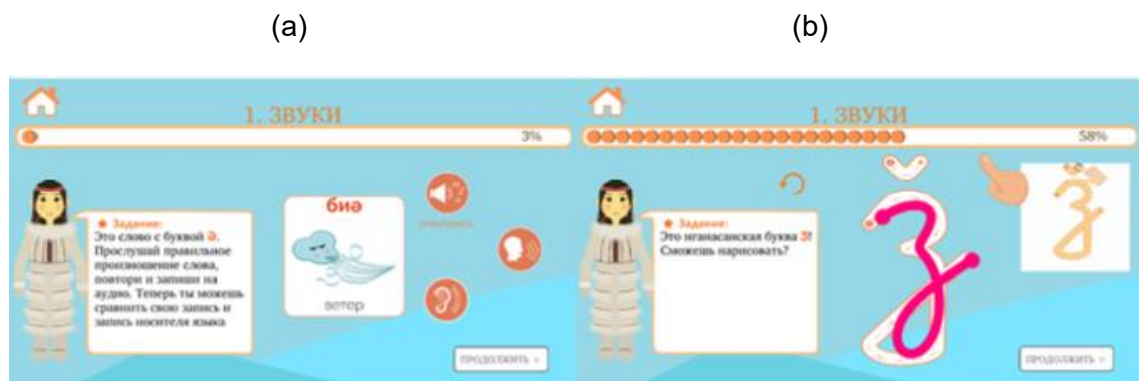


Figure 3. Screenshot with two examples of different NganasanMe application tasks: (a) listen-record-listen task and (b) draw a letter task

Since the application has been made for portable devices, the utilization of digital learning application outside a classroom environment, in comparison to being guided by a teacher, beneficially influence the involvement of a user in a study process due to the increased feeling of responsibility and the development of own learning strategies (XB Chen & Kessler, 2013).

The application is not available at any digital distribution platforms (App Store or Google Play), for this reason, it can be sent for a request asked from the author of this thesis. The first version of the application was developed only for Android tablets, but after evaluating the answers from background user information (in Google questionnaire format), it was clear that the users mostly have only mobile phones, as portable devices, at their

homes. Also, due to the situation with the SARS-CoV-2 pandemic, it was especially important to understand which way of using portable devices for users is the most accessible. Further usability evaluation allowed to transform the NganasanMe application to format compatible with Android mobile phones. Since the application is not responsive, it may work differently on different mobile screen sizes.

3.1 Design and Development

The concept of the application was created in the previous stage of the DigiKieli project mainly by a researcher from Tampere Unit for Computer-Human Interaction (TAUCHI), Alissa Burova (Burova et al., 2021). In a collaboration with a cultural mentor of this project Larisa Leisiö, who is a professor from Oulu University faculty of Information Technology and Communication Sciences, the needs and requirements of the application were identified mostly concentrated on the use of technology through a native language learning application for the classroom environment. In general, design and development were performed according to the UCD approach, as the fundamental principle in this project.

Despite the design was produced only by two researchers, more than one person contributed to the development process. John Mäkelä is a developer, who was responsible for backend/frontend, and one postdoctoral researcher, Sumita Sharma, was responsible for guidance into the CCI field and further ideation for the application development. The design, implementation, and evaluation processes were ready in autumn 2019. However, it was not still clear how the app would be used outside the school environment. Hence, it was agreed to continue it for further application development, which became a master's thesis of Mariia Nukala. The author of this thesis was responsible for exploring and applying the concept of participatory design, as well as, based on the results of participatory design session, contributed to creating and implementing new lessons for the NganasanMe application. In other words, planning and performing the participatory workshop made it possible to open new horizons towards new ideas for application development. Also, cultural aspects in the application design were created by Alissa Burova, but it was further upgraded and improved by the author of this thesis, based on the results gained through the research. The research studies were planned together with Alissa Burova, but due to the SARS-CoV-2 pandemic, and, therefore, when challenges appeared in organization studies from the distance, it was postponed. After the research has been done, all design solutions have been considered, improved, if it was needed and accepted by a leading project supervisor (Tampere University professor of Information Technology and Communication Sciences) and a cultural mentor: Markku Turunen and Larisa Leisiö. In this thesis, the author describes the process of application

development from a design thinking perspective and content development relying on co-creation results from participatory design.

3.1.1 Usability evaluation

Since the first version of the NganasanMe application was developed only for tablets, which were sent to Volochanka school for testing with children in spring 2019, usability evaluation was needed to make target users be able to use the application outside the formal educational environment. In practice, it means learning language by using the application on their own devices, the majority of which were parents' mobile phones. Also, the main goal was to get aware that the application will work correctly on all Android mobile phones, which were taken part in further research (application testing and getting feedback from the users). The usability evaluation process took few days in order to recognize as many program bugs as possible. Five different models of Android mobile phones were taken to test the application on them. Surprisingly, in general the application worked correctly on different mobile phones, even though it was developed for tablet format. But still, it was investigated that the mobile app was not responsive enough to fit into mobile phones with different screen formats and sizes. For instance, some mobile phones did not show the upper part of the application screen, others had problems with accuracy while interacting with the tasks in the application.

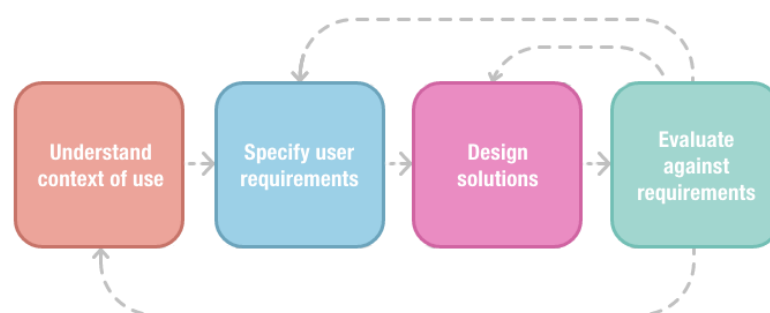
After potential interface issues were examined, John Mäkelä, who was responsible for the backend and frontend of the application, developed a new version of the NganasanMe application to make it operate properly on every Android mobile phone. Considering the context of use and targeting users, where the greatest part is children, the application should simplify the use and be quickly accessible. Thus, not only the functional part, but also interaction and logical content mistakes were elaborated by the research team. Next times, when the application was tested on the same mobile phones, which were taken in the beginning, there were not discovered any issues with the application functionality and logic. Moreover, the interaction with the application became easier and thus less irritating. The final version of the application was ready for research with the participants in January 2020.

4. METHODOLOGY

This section describes the research methods, which were used to test the application prototype design and facilitate participatory design workshops. Also, this section presents the description of the research study in the details. The research was conducted as experimental remote research divided into two parts: offline user studies and online participatory design workshops in the Nganasan community. Methodology, participants, procedure, and results are presented in such order to be easily perceived by a reader of this thesis. In the Discussion chapter, further discussion of the results can be found. Also, supplementary data for the research is presented in the Appendixes at the end of the thesis.

4.1 Design process and implementation

Addressing the goals and research questions and focusing on the users and their needs in every design stage, the research of this thesis is based on a User-Centered Design (UCD) iterative design process. The basis of many UCD methodologies is considered the international standard ISO 9241-210:2010 Ergonomics of human-system interaction¹. Being a part of the bigger standard, UCD involves users in the design process to be able to create an accessible and valuable product for them, utilizing various design practices. The UCD approach contains four stages, which were created to understand the users and their values, as well as the context of use in every design and development step. With close user collaboration as part of the UCD design approach, a sense of empathy appears and intensively getting stronger, while the products begin to fulfill the requirements of the users and their expectation (Interaction Design Foundation, 2015). Figure 4 represents the UCD framework with four key phases.



¹ <https://www.iso.org/standard/52075.html>

Figure 4. User-Centered Design diagram (Interaction Design Foundation, 2015)

One of the goals of the thesis is to include children of the remote community in the design process in line with UCD. To address the study goal, experimental remote research was designed. It includes a participatory design method, aiming to promote and engage people for language learning considered endangered. The author of this thesis has not been involved in the creation of the original application. Its' concept and goals identification were discovered before the project has started, so this means that the beginning stage will be considered as stage 0 and exploited as a base for the participatory design research. This thesis work starts with the preparation stage, where the Context of use and User requirements were explored. Below, Figure 5 illustrates the schema of the research.



Figure 5. Research workflow

Furthermore, the first stage of the research includes recruitment of the participants, discovering their background, and thereby trying to understand the context of the remote community better. Because of the SARS-CoV-2 pandemic situation, the recruitment of the participants was delayed for two months. The literature review, focusing mostly on digital language learning and design for children, was done in order to get more insights about the context of use and previously performed research work. Also, previous research examples allow to understand deeply what approaches make research flow efficient and what, on the other hand, obstruct getting qualitative results. The next step in this stage was to evaluate the usability of the application to adapt it for mobile devices and ensure that the application is error-free before sending it to the participants. When the application was fixed and tested, it was ready to be executed in the next stage for the user study. Then the user study was conducted consisted of two parts: Offline user study and Participatory design session. The first part of the research was carried out offline, where participants tested the application and responded with the answers to the questionnaire and interview questions. The second part was participatory design, which was carried out via What's app call. The last stage of the research process is Design solutions creation. After the user study has been finished, researchers have received the data and materials from the participants. They were analyzed and then utilized as content for new lessons and further development.

4.2 Research study preparations

Both user study methods were chosen according to the project goals and the context of the application use. On the way of identifying what methods should be used in this study, the research team has faced few challenges related to the location of the Nganasan population and SARS-CoV-2 pandemic restrictions. First of all, Nganasans live far on the Russian North, thus the remoteness of users made it impossible to arrange any face-to-face contacts. Secondly, low technology adoption and limited technology infrastructure in this area prevented some families from joining the experiment. After short ideation on how to overcome the challenges of the research, it was decided to conduct it via available technologies for Nganasans. According to the background questionnaire, which was sent at the beginning of the research, the most common communication way in the Nganasan community is What's app messenger.

These the most obvious and other limiting factors, related to the context, divide the research into two parts: offline user study with those people, who do not have access to a strong Internet connection, and online participatory design session with those people, who have better Internet accessibility. Both methods were targeted to increase user engagement and improve user experience.

The first try to reach a representative from the cultural Nganasan club in Dudinka (the biggest city in Taymyr) was undertaken on 1 September 2020. Only after few attempts in two months to get the contacts of potential research participants from representatives of the cultural Nganasan club, the research team has gotten contact information of a woman, who works in the Taymyr regional museum in Dudinka, Lidia. During these two months, it was created a background information questionnaire to examine the background information of the participants, including their demographic data, information about available and most used devices, and their awareness about national Nganasan fairy tales. Also, the consent form was prepared.

What's app call with Lidia was held on 13 November 2020, where she shared more information about the history of the Nganasan language, told a short story about life in North and finally granted access to What's app Nganasan community group, where indigenous Nganasans are only included. She was very happy to narrate her stories, and it was clear that she cherishes her destiny and is proud that she is a native resident of the ancient Nganasan community. After this call, it was decided to include into this thesis more information about the Nganasan people, thereby empowering them, since even in Russia people have not heard much about the Nganasan community.

In few days after the call, research members were invited to the What's app group with Nganasan members. However, after the project and request to be a part of the research were announced, people shared their skeptical attitudes about the research and even expressed aggression. Further, when Lydia joined the discussion, she explained that the research group will not teach them the Nganasan language, but kids will test and play with the application independently. The opinion of a person to whom Nganasans trust has influenced people, and they immediately decided that the project could be useful for them in language learning. After, all potential participants, who wished to participate in the studies, contacted the research group, and further, a conversation in What's app was created only for the volunteers of this study. The aim of this group was to create a private conversation to be able to contact Nganasans easily, sent them all needed information about the research process, and share other materials. Additionally, if participants had any questions, they shared them to general chat or asked the members of the research group directly in a private message.

4.3 Offline user studies

The first part of the research was an offline user study. In other words, no need for a continuous Internet connection was required for the testing. It was decided to use this approach because of the difficulties with the Internet access in the Taymyr Peninsula and also because of the SARS-CoV-2 pandemic situation, making people avoid social places, even the schools. Because the potential end-users live in different parts of the Taymyr Peninsula, even in small villages, where the situation with technological conditions is complicated, the recruitment of the participants was challenging for the research team.

The general idea of the offline study was to test and use the application in a non-official context by Nganasan families. Despite the testing has been once conducted in the school environment in Volochanka village with Nganasan kids, the study in this thesis is aiming to measure user experience in the whole family. Also, in this experimental research adult family members played important role in trying to define the answer on a crucial question: how to engage indigenous community members to learn their endangered language?

Offline user study was performed to find the opportunities to improve and further develop already existed application. Collecting feedback from the users allows to evaluate the usability and functionality of the application. Then the other goal was to find participants for the participatory design session, being the second part of the research.

The study was conducted remotely. The whole research team was located in Tampere, while the participants were taking part from their homes. During the study, the communication between participants and the research team was in Russian. The time difference between the Taymyr Peninsula and Finland is approximately 5 hours (depends on the season).

First of all, to collect data about members of Nganasan families a background questionnaire in the format of Google Forms with the questions about participants was sent on 16 November 2020. The purpose was described earlier in this chapter. Filling the form, users gave consent to be a participant of the research. Next, after the usability evaluation of the application was finished, on 22 of November 2020 the detailed description of the test procedure in PDF format was sent to the participants via What's app group to make sure they understand their future steps. The instructions also included the interview questions in the end. Questions were created in order to analyze the viewpoint of the participants, find potential pain points, and have the opportunity to improve the application according to users' feedback. Also, the questions included a topic about life in Taymyr to better understand living conditions in this area, where the research was done. Together with the instructions, a file with the NganasanMe application and video tutorial about how to upload the application file to a mobile phone were sent to the same group. To collect quantitative data, a questionnaire was selected as a method for analyzing users' opinion about the use of the application. The average emotional statistic was analyzed further in chapter Results.

When all required data was collected, the interviews were transcribed and translated into English. More user study details and its' procedure will be presented further in this chapter.

4.3.1 Methodology

To collect numerical data and gain user insights, both qualitative (questionnaire) and quantitative (interviews) methods were applied in this study. The first step was to send to potential participants an online pre-questionnaire (Appendix A) created in Google forms. The aim of the questionnaire was to collect background information about parents and their kids, and to understand what technologies are available in different Nganasan families. The pre-questionnaire consists of 24 questions, including an agreement to participate. Potential participants were asked their names, gender, and age. The rest of the questions asked from the participants were about how well their family knows the Nganasan language, what gadgets do they use and how often, and what fairytales do they know.

Next, a post-questionnaire (Appendix A) made of two parts was sent to the families, when they have already interacted with the application. First, a USE questionnaire with a Smileyometer scale was used consisting of seven statements. The aim of the questionnaire is to measure usefulness, satisfaction, and ease of use of the application by rating participants' agreement with presented statements (1=Strongly Disagree, 5=Strongly Agree). Then the participants had to choose the most appropriate face reaction expressing their opinions on a nine-statement 5-point Likert questionnaire (Appendix A) using a Smileyometer scale (1=Extremely Negative, 5=Extremely positive). Moreover, it was decided to use the questionnaire in a form of images with a limited number of rows, because in this case, the participants can answer the questionnaire without extra Internet workload, which might be a problem especially for Nganasans from far and small villages. The tool requires no writing, minimizes time, and makes it easy to complete the questionnaire, first of all, for kids.

A semi-structured interview (Appendix C) was used for qualitative data collection, consisting of 7 questions. First three questions are aiming to get a better insight about the application from kids and their parents, and further about possible application modifications and alternative solutions. Additionally, according to a strong interest to plunge deeper to know the role of Nganasan language in Nganasan society nowadays, the author of the thesis prepared four questions for the participants about personal feelings towards the future of Nganasan language.

4.3.2 Participants

The data in this section is based on the participants' responses for the background questionnaire (Appendix 1). The participants were 18 adults and their kids, who responded in Nganasan What's app group. As was mentioned previously, it was created special conversation only for volunteers, who wanted to participate in the research. The adults (15 females, 3 males) were 28 to 53 years old, and kids' age was varying between 4 to 17. All of them are native Nganasans, who speak the Russian language. According to the background questionnaire, all participants use smartphones every day to have access mostly to social networks and messengers: What's app, VKontakte (Russian social network), Facebook, and Instagram; while laptops are used usually few times a week for working or kids' studying. Depending how well adults know the Nganasan language, ten of the participants have a good vocabulary, but cannot speak, three participants are native speakers, three participants normally can speak Nganasan language, and three do not know the language and cannot communicate in it. The majority of kids (10) do not

know the Nganasan language, six kids know many words, but cannot speak in the language, and only two kids know the Nganasan language well and can speak. However, the situation with a sufficiently low level of language proficiency could be improved with help of participants and other Nganasans, who are interested in language support. For example, most of the responders attract their children to cultural club activities, such as singing national songs, dancing old Nganasan dances, playing traditional games, influencing children's awareness about Nganasan culture. Also, according to answers given to the questionnaire, children know many Nganasan fairy tales. All these facts tell that the adults strive to preserve the language with help of next generation, their kids. Likewise, in response to a question about the reason for participating in the study, the majority of those who responded felt that this experiment will be interesting for them and their children, because children can learn the native language and get more insights about their culture. In turn, almost all adult responders, have high expectations of the new learning application. Participants' consent was obtained in the end.

4.3.3 Procedure

The first part of the research was carried out from the distance (participants were in Taymyr, the research team was in Finland). Detailed video and text instructions (Appendix B) prepared in advance. Each family of participants has gotten all needed materials for the experiment via a specially made What's app group conversation. The materials, which were sent are as follows: research agenda and instructions, questionnaire, interview questions, video tutorial about using the app, and file with the NganasanMe application. The experiment began with an introduction to the agenda of the research, including goals and further tasks, which was sent first. The documents were sent to the participants in PDF files. Prepared in advance video was sent separately to the conversation, where Alisa recorded audio and video instructions on how to use the application. After the participants received the questionnaire in a format of separate images, they were suggested to use the built-in markup feature in the What's app for giving the answers to avoid possible troubles with the Internet connection. Interview questions were included in the file with the instructions. Prior to using the application, participants had to familiarize themselves with all the materials, mentioned above. It was decided to send the application in 15 minutes after all the instructions were sent to the conversation. The materials and the app were sent in the evening according to Taymyr's time zone. The time frames given to the participants for sending their results back were defined as 2 weeks

from the date they have gotten the materials for the experiment. What is more, the participants had the opportunity to clarify the uncertainties and ask questions by contacting at any time either the author of the thesis or the second researcher, Alisa.

4.4 Participatory design

Participatory design was organized orienting on the circumstances and the context of the research. The goal was to engage children for co-creation and thereby motivate them to use NganasanMe language learning application in the future. The sessions were held also remotely via What's app calls. Before continuing with the second part of the research, the participants were asked to finish first part to get experience about the application usage.

The recruitment of the participants was shorter and easier than in previous offline studies. When the research team and Lidia have knew each other closer, Lidia informed that she has two granddaughters and one daughter, and further they agreed to participate in PD session together. Next Nganasan family for PD workshop has been found by Lidia's recommendation. The family consists of four members: mother, father, daughter, and son; but only father and kids joined the workshop. The two families live in Dudinka, where the Internet connection is fast enough to have a What's app call. Even the attempt to call by video was made, but however connection was still interrupting.

Since the kids in both families had different age range, and they do not have good command of the Nganasan language, it was decided to ask them to draw the illustrations with different subjects to use them in the future as a content for language learning lessons. Kids' engagement in this task is considered very natural, since drawing is a commonly used task in schools. Trying to create interesting and useful subject for children, in the beginning of the conversation, family members shared some ideas what lessons they would like to learn in the application. Based on this opinion and after ideation inside the research team, it has been chosen two topics for the future lessons: Nganasan fairy tale and one of the traditional activities - fishing. Kids were asked to feel free and use any tools for drawing they want in addition to the paper.

4.4.1 Methodology

PD session was carried out remotely via What's app calls. Considering the age variety of children from volunteering families, it was planned by the research team and by parents to ask younger children to draw well-known characters from the fairy tales using

cultural attributes, whereas teenagers' task was to draw traditional activity of Nganasans-fishing.

Drawing is an attractive activity for kids, also it is considered in this project as an asset to utilize them in the NganasanMe application, while studying the Nganasan language. During the participatory design session, mostly qualitative data was obtained. Additionally, to get more insights about what two volunteering families think and feel about the application the participants answered the interview questions. The interviews were a part of the PD session, while children were making a drawing task. Further details are described in Procedure section 4.4.3 and section 5 Results.

4.4.2 Participants

Two Nganasan families were involved in the participatory design session. These families have a good Internet connection at their homes, which ensures suitable conditions for making the calls. Both families live in Dudinka, which is considered one of the biggest cities and Nganasan settlements in Taymyr. The first family consists of 4 members: mother, grandmother, and two kids (female, 4 and 7 years old), where only grandmother knows and speaks Nganasan language. In the second participating family there are 4 members: mother, father and two kids (male 17 years old and female 11 years old). The whole family knows the Nganasan language well, where adults have full proficiency, while children can speak and understand the language. The age of adults varies from 28 to 51. Both families have at least one cultural worker, where in first family grandmother works in Taymyr museum in Dudinka, while in the second family a father works in Nganasan cultural club.

Due to the conversation with the second family, more kids later were engaged for the application co-creation. The next Procedure section describes how the participatory design session was carried out.

4.4.3 Procedure

The Taymyr Peninsula is located on the far North of Siberia, and the geographical location of this area affects the level of technology access. Hence, the low Internet connection and the time difference made the study challenging and required to take the actions depending on the situation.

After having a long deliberation, it was decided to make a video call with both families, in which all family members could join the call. The participants were notified that in case

of bad Internet connection occurs, they can switch off the camera and continue the conversation with just a regular What's app voice call.

The participants were two Nganasan families, where there was at least one native Nganasan. The families took part in this study at their homes in Dudinka city, since one of the goals of this research was to test how the application will be used in a non-school environment. Lidia, native Nganasan, who helped with the project organization, proposed one potential family for the participation and her own. The schedule for the sessions was agreed upon according to the participants' availability. The interview and participatory design session were moderated by the author of the thesis and observed, assisting the children during the activities, by the second researcher - Alisa Burova. Each call (PD session + interview) with one family lasted about 1,5 hours.

The first call was planned in advance with Lidia, her daughter and the granddaughters. The instructions and brief introduction clarifying what had to be done were partly given to the participants in the What's app conversation. Another part was presented at the beginning of the session. Children were informed about the context of the study in the beginning of the experiment. Also, the family was informed that the received ideas and artwork will be used to develop a game that would be used by themselves.

The session has started with a warm-up interview with children. The children were asked about their names, hobbies and how well they know the Nganasan language. Also, they were asked what Nganasan fairy tales and the characters from them they know. That was curious that the children know a little number of the characters from Nganasan books. Instead of this, kids called characters from modern cartoons and fairy tales. According to this situation, it was considered to draw a favorite character, a young girl, from a Russian fairy tale wearing national Nganasan clothes, characterized by a special ornament and traditional colors. The parents were notified in advance that, additionally to a piece of paper, a variety of drawing tools could be used to produce the illustrations, for example, colored pens or crayons. The session took approximately 1 hour, and the kids worked together. The researchers nor the parents have not influenced their ideas but were ready to help children in their work. While children worked on their artworks, adults were interviewed and shared more about their lifestyle. In total, one drawing was produced by the children. They were encouraged to describe what they have drawn. The drawing can be found in section 5.3 Participatory design results.

The next session with another family was scheduled in one week after the first session. The session, as well as the previous one, was scheduled in advance to minimize the challenges, making sure the participants will be able to connect to the Internet, and find

the most suitable time for the whole family. Instructions were provided partly before the call and during the introduction at the beginning of the call. Similarly, the context of the study was outlined as well as task clarifications were announced. Since in this family people were even more deeply interested in language revitalization, children were very encouraged and supported the idea of this study, which was presented in the introduction. In the beginning the session had the same logic as in the first session with another family: research has started with the warm-up interview. Then, based on the situation, it was decided to interview children first, where they were asked about how they like the application, about its' weak points, and possible adjustments. Next, parents were interviewed and asked pretty much the same questions. The point of this double interview was to know both opinions from different generations, especially from teenagers, who are still young, but can already express their opinion. Since a father from the family works in the cultural Nganasan club, and also the conversation about the application took a long time, it was decided that the participatory design will be facilitated with more children later in the cultural club under his supervision. Based on the discussion with this Nganasan family, the most interesting topic for the new lessons was the basic activity of local residents-fishing, which in the future children produced in a form of drawings (section 5.3 Participatory design results). At the end of the conversation a father of this family promised to send ready drawings in one week via What's app.

4.5 Ideation

Considering the data received from Offline study and materials created by children during the participatory design, it was decided to organize ideation session with parents in order to contribute to the application development. Ideas for the application were created in low-fidelity prototype format, illustrating possible implementation of the gathered materials. Also, the goal was to make participated children to identify their proposals in the application. Discussion chapter further describes the ideas and suggested future work.

5. RESULTS

This section presents the results of this study. The data is organized following the same structure as in the previous chapter—first, the results of offline studies, and then the participatory design workshops outcomes will be presented. The data further discussed is collected from different sources: feedback from the families and individual participants, research team observations, drawings from the children, and data obtained during the questionnaires and the interviews.

5.1 Observations

The challenges have been already partly mentioned in section 4. First of all, the research was carried out from the distance, which caused the problems related to the recruitment of the participants. Because of Taymyr’s far geographical location and other factors, Nganasans are considered as a low technology-adopted community, and that is why they were difficult to approach. The majority of locals do not have a strong Internet connection in their homes, but some of them, who live in bigger cities and try to keep a more social lifestyle use technologies in their everyday life. As was said in the previous chapter, the most popular application for being up to date about community life and for conversations is the What’s app messenger. Once the What’s app group was initiated, some Nganasans showed a somewhat negative reaction. Some of their comments are presented below:

“They must be the students. They want to make a scientific work in order to please their own purposes. How many times has it happened...”

“They want to benefit from their projects. I do not think they care about our language.”

“It sounds funny that Finns will teach Nganasans.”

However, only after Lidia’s authoritative opinion, which she shared in the What’s group, it was possible to find a common language with Nganasans and engage them to participate in the study. Potential participants further even perceived the experiment as interesting and useful for Nganasan language learning. Figure 6 presents the conversation between Lidia and the researchers, where Lidia explains the situation.

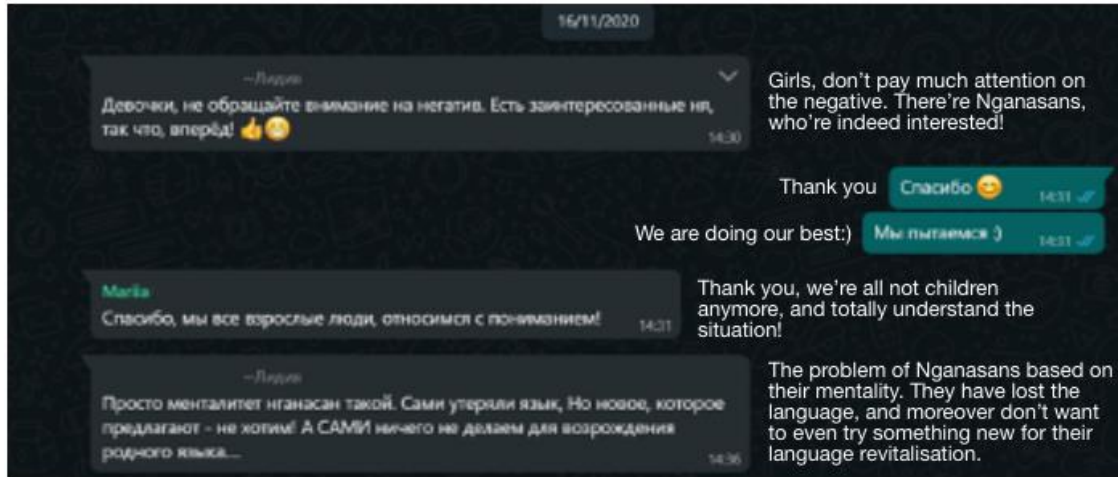


Figure 6. Conversation of Lidia and researchers in a private What's app group

In total, 18 responders gave their consent to participate in the study through the Google Forms background questionnaire. When the offline study has begun, this number of participants became slightly lower than was expected. For example, when the instructions and the application were sent to the conversation, no activity was seen from the participants, even in two weeks (according to instructions, two weeks were given for participants to end up with the tasks). As a result, neither the questionnaire nor the interview answers have been sent back. The possible problem might be a delay between announcing the research for the first time and sending the materials to the participants. Usability evaluation took a few weeks before the application and materials for the research were sent to the participants. Even though after the reminders were sent to the conversation, participants still were not active. However, few participants responded that their Internet is not strong enough to download a file with the application. Some people in Taymyr travel from the small villages to Dudinka and back. While they are in Dudinka, the Internet works better than in small villages, but when they are back home, they lose the connection again. For this reason, such people were not able to participate in this study.

Another guess why participants were keeping silent is that the materials were sent at once, and for the Nnganasans with low technology proficiency it was complicated to figure out quickly what was required to be done. Also, as was discovered during the PD workshop with the family of Lidia, Nnganasans are shy and used to communicate directly. Later she explained that they are getting more approachable when they know a conversationalist better. Based on these grounds, Lidia suggested to approach the participants one by one via What's app call, what exactly was done in the future. During the calls, partic-

Participants were asked the same questions according to the interview plan, and the questionnaires were sent to remind them to fill it in. The results of the questionnaires and the interview will be presented further in this chapter.

The recruitment of the participatory design participants was much easier, comparing to searching for the participants for offline studies. The results of the workshops are demonstrated also in this chapter.

5.2 Offline studies results

This section reports the results of offline studies and its' outcomes. Insights from the questionnaire and then the interview answers will be reported in separate sections. Above all, the most valuable artifacts of this study were the cultural materials received from Nganasans, like photos, historical facts, and traditions (Figure 7).



Figure 7. Example of the research artifacts. Pictures sent by one of the Nganasan community members

5.2.1 Post-questionnaire results

Surprisingly, just a small part of the participants completed the questionnaire. From 18 participants only two sent their feedback back. Anyway, the overall reaction to the application from the participants, who returned the questionnaire, was positive.

The list of the questionnaire statements and questions is presented in Appendix A translated in English. Participants had to mark how they felt about each statement using a Smileyometer scale (Figure 8).



Figure 8. Smileyometer icons

Since only two participants returned the answers, it is difficult to build the diagram based on only two questionnaire results to illustrate the reactions in a graphical way. For example, one participant evaluated all questions by highest positive reaction (face 5, meaning the happiest face). The second participant was more objective in answering the questionnaire. Her answers are illustrated below (Figure 9).



Figure 9. Answers for the USE questionnaire of the second participant

Additionally to the USE questionnaire, participants answered the Likert questionnaire. As well as in the first questionnaire, one participant followed the same logic and marked

all the statements with the highest rating. The second participant's answers were mostly positive or neutral (Figure 10).



Figure 10. Likert scale questionnaire answers of the second participant

5.2.2 Interview results

After the first try of sending interview questions with the instructions and the app file, 0 responses were collected. Only after sending the request in one week for a private call interview, finally it was found 7 participants. Of the 7 participants, who agreed to participate in the study, just 4 replied that they are ready to be interviewed by the call. Another 3 participants either have not responded or had a slow Internet connection to continue taking part in the study. Table 1 demonstrates the list of the participants and what data was obtained.

Table 1. Participants and their activity in the study

Participant ID	Activity
P01	Has not responded. Long time has not been active in What's app.
P02	Application has been tested. Agreed to have a call and make answers for the questionnaire.
P03	Application has been tested. Agreed to have a call.
P04	Has not responded. Last seen online recently.

P05	Slow Internet connection. Not able to open the application and questionnaire.
P06	Application has been tested. Agreed to have a call and make answers for the questionnaire.
P07	Feedback was given by the participant in free form.

Further, the main findings from the interview will be presented under each interview question.

Q1: What do you like the most in the app?

In response to Question 1, most of those interviewed indicated that they like the concept of learning the language with help of the application and find it useful. Even a small amount of the participants identified many benefits of such application. One participant highlighted that the idea of the application is a very good way of learning the language in a modern way. No participants indicated negative feelings towards the application. However, one participant stated that the application is made more for kids, rather than for adults.

“Cool application! I especially like the feature when you pronounce the words and then listen how you sound. This way I can understand how correctly I speak. Memorization of the material is easier this way” (Male, 38).

Q2: What do you like the less in the app?

When the participants were asked about weaknesses of the application the majority commented that there are noise and interference in the recording sound, and they were not able to recognize how to pronounce the words in a correct way. The same comments from two participants were related to the mistake in illustrations of a traditional costume. The participants recommended to check the colors, which usually are used on traditional Nganasan clothes. Also, one participant stated that some words, like “a birch” is never used in Nganasan society, since the birches simply do not grow there. And on the other hand, some words are missing, for example, different kinds of birds and animals.

“Some games have repeated several times, I would make the lessons more in the format of mini-games. When I press the Listen button, a recorded woman's voice speaks indistinctly. For example, the voice pronounced a word, and it cut off immediately. I don't

understand what the correct way in which the word should be pronounced. The recording should be clear enough to recognize the words” (Female, 17).

Q3: What topics for language learning would you like to see in the app?

Almost two-thirds of the participants said that they wish to include the words related to everyday life. Mostly the participants are interested in learning words about family, home, food, and animals. One participant highlighted that for example for girls it would be especially useful to learn the words related to the kitchen, while boys should learn more men’s activity-oriented words (ball, hunting, fishing). Also, everyday activities, like shopping and household chores attracted participants’ attention. The point of these topics is to be able to use them in everyday life, in other case the words will be quickly forgotten. One participant showed interest in learning how to describe a people's appearance and personality, while others were suggested to include numbers in the new lessons. Two participants wished to see in the lessons for the younger generation the rules of etiquette, including for example the rules of conduct, respectful attitudes towards the older generation, having a gift visiting someone’s home. One participant stated that it is especially important to pay attention to studying old traditions related to nature, respect them, and remember where you are coming from.

Q4: How do children learn the Nganasan language nowadays? Do you personally want so that your children know the Nganasan language well?

Nowadays, in Dudinka there are no teachers to teach kids the Nganasan language. One participant stated that the application would be very useful for the school curriculum, being a part of it. Usually, kids study the language at home with their families. However, all participants wish to make their children know the Nganasan language.

“I would like my children to support their language. Each parent will say that they would like their children to be able to speak their native language” (Female, 35).

To support language learning at least inside the family, for example in one family adults speak Nganasan with kids every day, when they have dinner. Also, kids in other family like to take part in traditional Nganasan holidays. But it is challenging to keep learning a language frequently without proper education.

“In Dudinka children do not learn the language in school. All the language skills children gained from their parents. There is no daily practice of Nganasan language inside the family, but children really like to take part in national holidays. They like to dress up in NG traditional outfits and perform” (Male, 38).

Q5: What do you think about the future of the Nganasan language? Is there a chance to keep it alive?

The question about the Nganasan language's future was surprising and challenging for the responders. Answering this question, participants were very careful and brooding. Unfortunately, the majority of respondents felt that if the language is not being systematically studied, it will be lost.

"There are doubts that the language will be developed and rise the big interest to learn it, but we really respect it. We really want so that children study the language. Most likely the language will be lost. Nowadays even among the older generation there is a very low percentage of people, who speak Nganasan language. I think someday it will get lost anyway" (Female, 51).

One participant assumed that in the nearest future people will not speak in Nganasan, however, if the kids would be interested in language studying, it could be the chance for its' revitalization.

"To my mind, a new application could be very useful for Nganasan language learning support. We, Nganasans, are very excited to use the app, because it might be a new beginning of language revitalization. Also, the app could be useful also for the adults" (Male, 38).

Q6: How would you describe the Russian North? Do you like to live here?

All 4 participants had something to say about life in the North. According to the responses, Nganasans are tethered to their place of residence and love their motherlands.

"I love the North. The North is power and severity, you should always keep yourself ready if something happens, for example when someone is stuck in a blizzard or is lost in a tundra. It is no secret that life here is harsh, but people are always kind and in a good mood. I grew up in a village, not in the urban settlement, I know all the traditions and the way of living, and that is why I have used to all the difficulties" (Male, 38).

"The North is amazing, mysterious, and memorable. A person who has visited the North will remember it for a long time. Therefore, a lot of people, who visit the North for different reasons, settle here and do not want to leave. Also, there are many beautiful natural phenomena, such as the northern lights" (Female, 51).

Q7: How would you describe a typical Nganasan person to people, who never heard of you?

Almost all responders stated that the Nganasans are friendly people, kind, and very hospitable. They also emphasized that at first sight, Nganasans might seem closed, but if you are getting them better, they will show you all their best personal qualities.

“The indigenous people of Taimyr are hospitable, naive, and simple. They will share with you the last piece of bread. We live in Russia, but we are not Russians, we consider ourselves Nganasans.”

5.3 Participatory design results

Two design sessions were held online via What’s app call. According to the initial plan, kids from two families had to participate in the workshop. However, while having a call with the second family, more participants were found to take part in the participatory design session. Each session took about 45 minutes (not including the interview), and the children worked alone or in a group of two. As a result, all kids produced individual drawings.

The first family, who has participated was the family of Lidia. It consists of two 7 years old and 4 years old girls, their mother, who is 29 years old and a grandmother 53 years old. In total, 1 drawing was produced by two children. The drawing indicated a very good idea for the game, illustrating a girl in a traditional costume with lots of the objects around (a cow, Christmas tree, a rabbit, snow, clouds, and others), which will be useful assets for the content for the new lessons (Figure 11).



Figure 11. Drawing of the children from the first family

Several attempts have been made to make a video call with the family. Unfortunately, the participant's Internet connection was sufficient only for having a voice call, so it has been decided to continue the conversation without a video. The drawing was sent to the research group after the conversation when it was ready.

During the call interview, it was discovered that one adult from the second family is a culture-related worker, being responsible for Nganasan cultural club. After the interview, he suggested to engage his children and even more children, who are members of the Nganasan club, in the design creation process. In the ideation with the participant, it was decided to illustrate one of the traditional and the popular activity of Nganasan society-fishing.

Since in the second design session more children were involved, two weeks were given to finish this task by the participants. This design session took place in the Nganasan club and was moderated by an adult from the second family (Figure 12).



Figure 12. Participatory design in Nganasan cultural club

Based on the moderator's feedback after the session, the children were very excited and had fun during this activity. Moreover, before the workshop, children had a short lesson about the NganasanMe application, where they knew why it is important. The moderator

encouraged children in their work, giving tips about what objects are essential to include them in the drawing and making sure the scenario of the drawing keeps the natural and traditional way of fishing. In total, three individual drawings were produced by three children from the Nganasan club, and one drawing by two children of the participant's family (Figure 13).

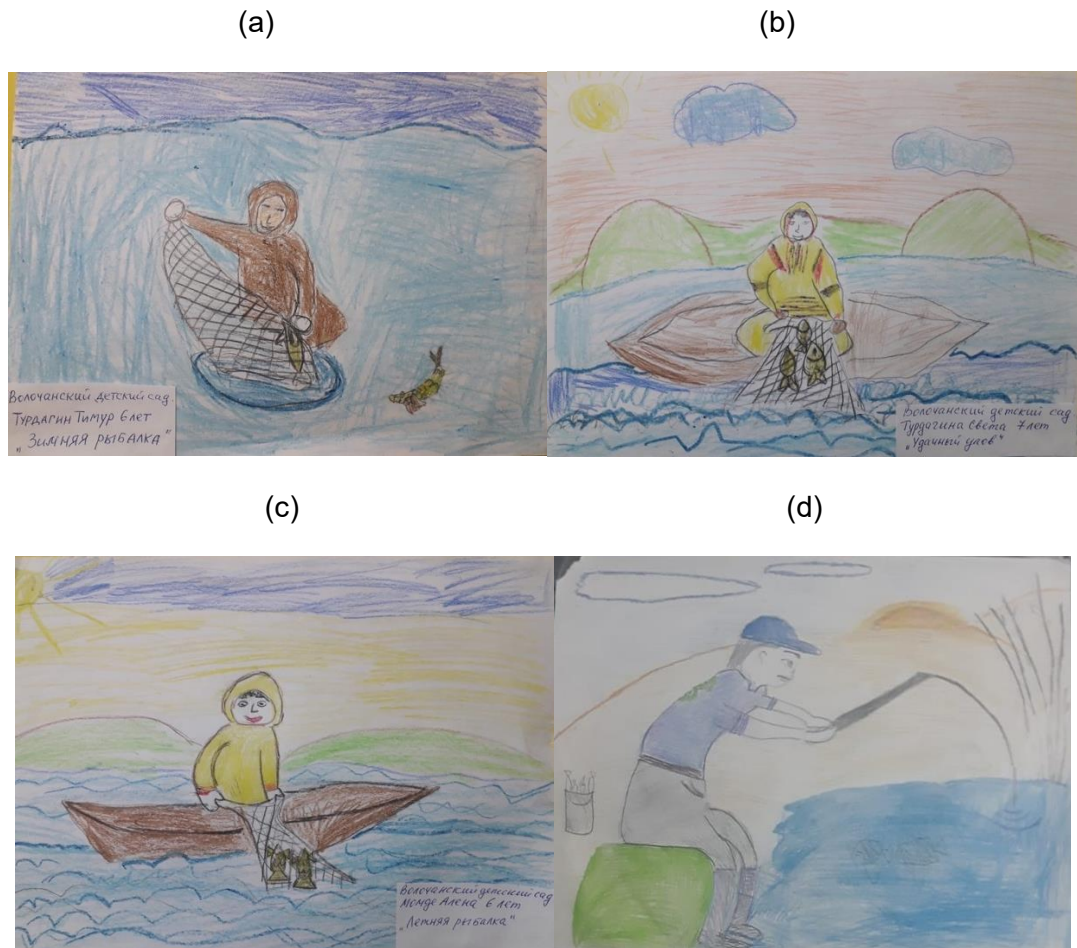


Figure 13. Drawings of the children from the second participatory design session: (a) (b) (c) drawings of the children from the cultural Nganasan club and (d) drawing of the kids from the second participating family

6. DISCUSSION

The main aim of this study was to explore how people of the ethnic minority can be engaged in the development process of endangered language learning mobile application development. Based on the previous research work, which has emphasized the importance of digital learning games affecting the user's motivation and learning outcomes (Acquah & Katz, 2020; Peterson, 2010; Squire, 2002, 2008), the author of the thesis tried to find the answer for the question of how to preserve endangered language with technology. To achieve this there were used several UCD methods: online questionnaire, interviews, and participatory design session. The families, who were involved in this case study are considered indigenous Nganasan ethnic minority members. The research was conducted remotely using the What's app application for communication with Nganasans.

6.1 Findings in brief

Designing an application for language learning was an important activity for the Nganasan community. The members of the community were able to use their skills in order to benefit the whole community and make meaningful the learning of indigenous language for the kids. The overall reaction to the NganasanMe application was positive. The participants emphasized the importance of such application in Nganasan language revitalization. Both participating adults and children were motivated and showed a big interest in using the application, as a new way of learning Nganasan. This proves that the way of learning languages with the use of technology is a promising approach to help in languages revitalization. However, some of the results of the study were below expectations, especially while lack of participants has occurred. This limitation will be discussed further in this chapter. On the other hand, considerable progress has been made with regard to participatory design. The thesis presented that the people's engagement in the design process is an efficient approach to better know the user group, which is involved in the study, and, additionally, it helps to get qualitative data, as design artifacts created together by the participants being potential users of the future product. The study proves that drawing is considered as a very natural task for the kids, which were very enthusiastic to be a part of the design team and produced good materials (Pitkänen-Huhta & Pietikäinen, 2014). Hence, the applied kids' artworks formed the content for the new lessons' ideas, based on the topics considered the most important according to their parents' opinion.

The thesis work has succeeded mostly in the facilitation of remote participatory design using the What's app application to communicate with the participants. This way of communication helped to approach the participants, even though the amount of them was lower than expected. The obtained results demonstrated that remote studies with ethnic minorities are potentially possible, but in fact, there are many challenges that appeared during all stages of the research.

6.2 Challenges and opportunities of developing apps for endangered Nganasan language in indigenous Nganasan ethnic minority

From the beginning the research was contradictory, and it was found out that the research cannot always be carried out in accordance with the initial planning, especially in the community with different social and cultural specificity (Shahid & Kramer, 2009). It is not possible to say why people were skeptical and reacted negatively to this study, while just learned about the project. In such cases, the methods and research procedure need to be organized according to the situation. That is why inspecting the design process at different stages and adapt it based on the demands of the target users are very important steps to avoid unexpected surprises. Clearly, the study had other limitations. However, this thesis work could be the basis for further studies about the impact of technology inclusion on language revitalization in ethnic minorities. Furthermore, answering RQ1, this study demonstrated that even with the limited number of participants, offline user study and PD sessions delivered various useful insights and design artifacts, as culture-related information, information about social specificity and children's drawings.

Only a few participants answered the UX questionnaires and the interview. Considering the small number of participants in the user study and their limited participation, this thesis cannot pretend to bring a meaningful impact on the Nganasan language revitalization. Moreover, it indicates that people from ethnic minorities are not ready yet to take part in participatory design sessions, especially from the distance. One of the possible reasons can be the fact that existing socio-economic problems affect society. Low technology adoption of the society has prevented to get quantitative data even though at the beginning of the study 17 volunteers have been found. The lack of participants also can be explained by that the most participants live in small villages rather than in the cities. There were only a few participants from the cities, who were in this study the representatives of Nganasan society and, moreover, their job is closely connected to the art and culture. The majority of participants had difficulties even with downloading pictures with

the questionnaire from the What's app due to the failure to connect to the Internet. However, when any of the participants had a chance to visit a city, for example, Dudinka, they notified the research team about it, and then the call was organized or like in the case with one participant he sent his feedback in the free form. Unfortunately, by this single case study, it is not possible to influence language revitalization, and it should be supported by other levels. Nevertheless, this study demonstrated that the researchers, especially those who conduct the study with ethnic minorities, where people are more closed-minded in their attitudes, should make relevant research about the community, for example, their social and cultural norms, life condition and behavior (Shahid & Kramer, 2009).

The current study has only investigated the overall reaction of the individual families, because of the unavailability to conduct the study with children only. Moreover, the age of the kids varied dramatically, which caused the need of being the adults together with kids of younger ages. The pandemic situation in the world and the little number of the participants did not allow to give a voice to the kids. Therefore, children's feedback might be affected by their parents or other family members. Nevertheless, participatory design with kids, being the main part of the thesis, showed positive results and contributed to changing the investigation style of further steps in the research. The lack of the interaction of children with each other during the studies (how it was supposed in the initial study planning) was not an issue. On the other hand, while one adult member from the second family suggested the workshop with a group of children, it was a big surprise, since as was observed and highlighted in previous studies (Sim et al., 2015; Roschelle et.al., 2000), that children are more motivated and encouraged, when they are interacting together in a group. This workshop was effective in reaching out the initial workshop goal-getting the design artifacts, as children's drawings.

According to the situation, in which quick actions were needed to change slightly the research direction, it was identified during the participatory design sessions that the app is engaging also for the adults. Despite the app was initially created for children, it might be useful also for adults in learning the Nganasan language. Since the communication inside the community strongly affects the opinion of the people, more active members, such as cultural workers, could be the influencers in order to motivate people to support the learning of the endangered Nganasan language. From the interview answers it was obvious that Nganasans respect their indigenous language and wish to support it. The problem is only that there is a visible lack of motivation, preventing people from supporting the language. If the cultural club would take an initiative to systematically teach the

Nganasan language in an informal atmosphere, this might be a chance to motivate people to learn the Nganasan language more actively.

Anyway, in the case with kids or with adults, proactive people are needed to organize the community and inspire people to continue learning of Nganasan language. The studies investigated the results for the informal environment, making it difficult to find the participants. In the school environment, where kids are used to studying, a teacher could be a mentor and instructional designer in the participatory design process, who will support kids in their language learning, for example giving the task as homework to complete a few levels from the NganasanMe application, and give the resume of the results, transcribing them from the pedagogical point of view (Sim et al., 2015). In any way, it is not possible to affect the community to study the Nganasan language actively, and integrate the language in schools, but the NganasanMe application could be a very useful tool for this aim being a new method of language learning.

The research was carried out completely from the distance using the What's app as a way of communication with community members. Even though it was an apparent time difference between Finland and Taymyr and challenges in organizing the studies, the voice calls with the participants were organized according to the schedule, discussed before each call. The study demonstrates that if the research is well managed, the participants and the researchers do not have troubles with misunderstandings related with the time and date. The local time on Taymyr was considered every time, when the message with an invitation for the study was sent to the participants.

In spite of the fact that there are limitations due to the social-economic problems in the society, the study has contributed to the language revitalization of Nganasan. However, to continue developing the application for the indigenous Nganasan community more resources, like time and financing, are needed. In fact, this means that the project aiming to help to revitalize the language is definitely more than a thesis project format. Further data collection is required to determine how technology inclusion affects endangered language learning in the context of remote communities.

6.3 Implementation design artifacts into NganasanMe application content

This study has gone some way towards enhancing the understanding of how to design content for native language learning application based on the insights gained from participatory design with kids. As a contribution of the thesis and the answer to RQ2, the list of design suggestions was made to promote further research on developing language learning applications based on the design artifacts after participatory design workshops.

Moreover, implications for the content development of learning Nganasan endangered learning are provided below based on a cultural fairy tale and one of the traditional Nganasan activity. The implications were created after all participatory design workshops have been facilitated. Also, some of the presented ideas could be considered as a continuation of earlier work made for the NganasanMe application, with a renewed focus on the implementation of new content.

First of all, speaking about possible design artifacts (kids' artworks) implications into the design, to make the application commercial looking and more attractive for the users, graphic design should have high quality and also possess well-implemented animation. In this case, the design artifacts could have many implications for the new lessons in the language learning application. For example, one of them could be the using of one of the main subjects from a drawing as a leading character (avatar) in the game, having the main duties, like providing a user with the task or a useful tip, praising a user for the good results or showing user's results and achievements in the end of the lessons. This way of using kids' drawings could make the game more personalized and attractive. Additionally, funny and non-professional kids' artworks might help to bring to the game creativity and create a unique visual style.

As mentioned previously, the new lessons will be considered as a continuation of the existing material. This means that by being able to understand the alphabet, the users could continue with the learning of new words from the picture inserted into the application in reversed digital format. For instance, one possible task for both fairy tale-based and fishing-based lessons could be learning the new words illustrated on the picture by tapping on the object or the subject. Figure 14 demonstrates the low-fidelity prototype of the principle (words in English should be replaced with the Nganasan words).

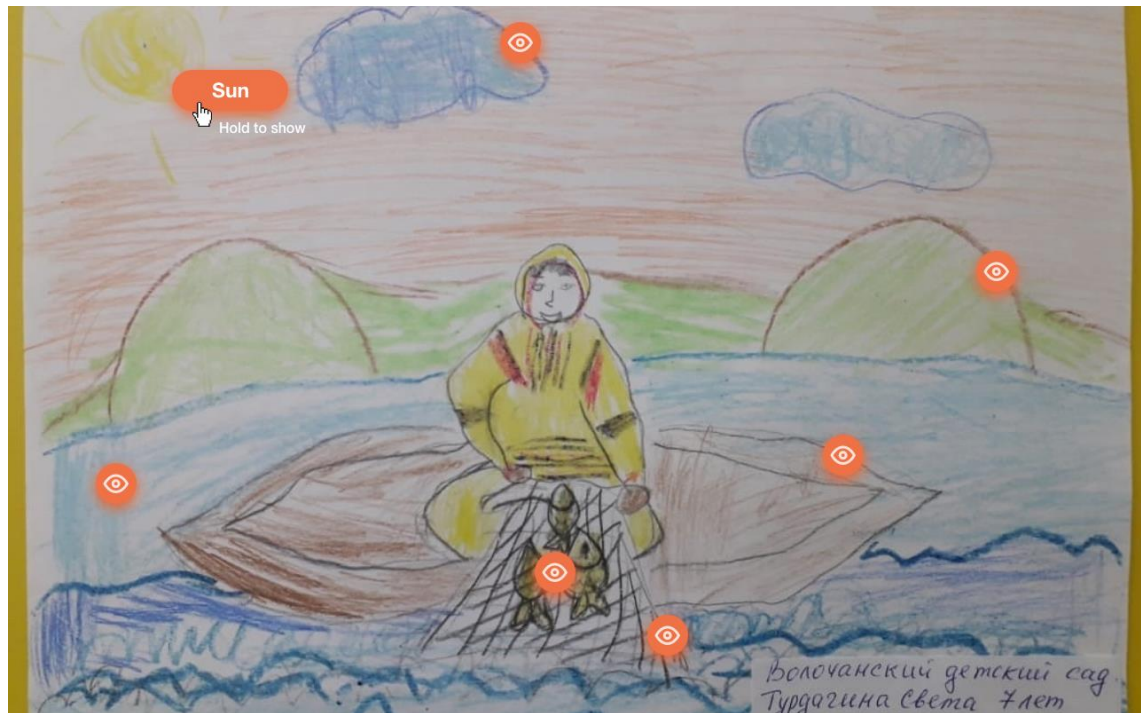


Figure 14. Design implication using “tap on object” task

With this way of learning words, the users will be able to memorize the object names also using visual perception. The next follow-up lesson might be represented in a question form complemented with the pictures, asking for example: “Which of these is a *fish*?”. The same type of question might be given to learn the colors. Then after learning the words from the picture, the application might ask the users to translate phrases, created with already learned words, like “Yellow fish”.

In the context of the fishing-based lesson, the fishing scene might consist of curious facts about this cultural activity. Again, by tapping the object on the picture a user will be able to get useful information about the fishing. Following the same logic, the users could learn such topics, like colors, some basic facts about nature, numbers, differences in winter and summer fishing, various types of webs, and the weather conditions.

The lessons based on the fairy tale might be presented in the format of a short story, where, for example, the main characters have been lost expressing sad emotions, until a user will help to find them the correct positions (Figure 15).

(a)



(b)



Figure 15. Design implication for the low-fidelity prototype: (a) original kid's drawing and (b) find correct positions task

In this thesis, all these ideas are presented in the format of the low-fidelity prototype. To be able to implement them into reality, high-quality commercial graphics and animations are required. Nevertheless, these results represent a good example of how PD artifacts can be utilized for the development of the language learning application.

6.4 Future work

This research has thrown up many questions in need of further investigation of how to engage people from ethnic minorities into the design of the endangered language learning application. Hence, it is important to address the limitations presented above by conducting future work in indigenous communities, where there is no access to the technology. Exploring ways to how to motivate members of such communities not only to participate in the study, but also to use the application in school and informal environments could be a valuable research direction. The motivation of the learners always was one of the main questions in online education and needs to be further examined. Future studies on the current topic are therefore required in order to establish the potential future of Nganasan or other endangered languages. However, an important issue to resolve for future studies is how to get research data without being able to meet indigenous communities face to face. In the case of this study, it was impossible to meet Nganasan people in person.

What is more, after evaluation of the user experience towards the existing application, several future improvements emerged for the next version of the application. First of all, the application requires the upgrade of the graphics to make it commercial looking, like best-known applications for language learning. In addition, good quality of the sound (in order to understand correct Nganasan words' pronunciation) and funny animations could bring to the application a new brand look of a quality product. Also, new lesson creation is an initial part of the future work, since the participants experienced a lack of the new study materials to continue their education with the NganasanMe application. For this aim design implications presented before should be taken into account. Furthermore, to address the goal of creating new lessons for the application, the help of a cultural representative is important to avoid potential cultural mistakes in further app design. According to the interview insights about the desired content for the application, future work towards new lessons could include study topics, like family, shopping, etiquette, food and other related closely with the context of everyday life. The gamification features: lesson bonuses, lesson scores given at the end of each lesson, daily challenges, and daily achievements, which can be shared to various social networks, messages with praise appearing in the middle of the lesson-might be also a very useful asset for increasing motivation. Also, reminders to the learn-long-term habit could appear in the app to emphasize the importance of creating a daily habit to study the language. Another important practical implication is that social network inclusion is considered as one of the main features in the application to boost motivation.

Furthermore, the results of the participatory design indicated a high interest in being a part of the language learning application design. Definitely, people's engagement in the design process provides many positive outcomes. That is why continue involving people as co-creators and more research in the same field can be generally recommended.

7. CONCLUSIONS

This thesis has described the experience of performing the research of the HCI field in a user-centered manner in a remote community. This research was conducted to study how people of the Nganasan ethnic minority can be engaged in developing endangered language learning mobile-based NganasanMe application. The study was conducted remotely with the indigenous people of Taymyr-Nganasans, using the What's app application for communication. Offline user study and participatory design methodology were used to investigate user experience towards the application outside the school environment and co-create with children to design new content for the application, making them feel empowered and motivating learning their indigenous language. First of all, during this study, much cultural information was obtained, providing better awareness about cultural aspects of the Nganasans' lifestyle. Moreover, a participatory design session was a successful part of this research, where kids produced the drawings, being a useful asset as the design artifacts for further development of the NganasanMe application. The NganasanMe application was found to be engaging for both adults and kids. A learning experience with the application promotes Nganasan learning by gamified lessons, making users being interested in their endangered language. Based on the results, most of the interviewees indicated that they like the concept of digital language learning and find it useful.

Nevertheless, it was investigated that the research in remote communities cannot always follow methods prepared in advance, due to socio-economic limitations of the society and cultural differences. Based on the case study results it can be claimed that only a limited amount of people from ethnic minorities are ready to take part in user studies and participatory design workshops. On the other hand, those members of the community, whose work related to culture and art were excited to promote their culture and participate in both parts of the research. Hence, customization of the methods should be made based on the research circumstances. The possible ground of this limitation might be based on the low technology adoption of the Nganasan society. Due to socio-economic and cultural differences, it is also difficult to propose new methods of digital learning, however, using the technology in the educational system might affect positively Nganasan learning in schools and outside the informal environment. With the assistance of a teacher or proactive person (for example, in Nganasan cultural club), the Nganasan

learning with NganasanMe gamified application can become a good beginning of developing technical skills, which nowadays, is considered as crucial for assimilation into the society of 21st century.

According to the interview responses given by the participants, the chances that the Nganasan language will save its' relevance in the future are very low. However, Nganasans respect and try to support learning the language of their ancestors mainly in families and during national holidays. Still, the youth, who was the main target users in this study, might influence on future of their native language with the help of technology. Hence, engaging the young generation in developing similar minority language applications is highly recommended.

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APPENDIX A: PRE-QUESTIONNAIRE AND POST-QUESTIONNAIRE

Pre-questionnaire:

- 1) Name [text input]
- 2) Name of your kid/kids [text input]
- 3) Age [text input]
- 4) Age of your kid/kids [text input]
- 5) What is your nationality? [text input]
- 6) How well do you know Nganasan? [I am a native speaker, Nganasan is my native language / I can speak Nganasan / I know many words, but I cannot speak / I do not know Nganasan]
- 7) How well do your kids know Nganasan? [They can speak Nganasan / They know many words, but they cannot speak / They do not know Nganasan]
- 8) How often do you use a mobile phone? [text input]
- 9) What is the brand of your mobile phone? [text input]
- 10) What is the brand of your kid mobile phone? [text input]
- 11) For what purposes do you use a mobile phone? [text input]
- 12) What apps do you use on your mobile phone? [text input]
- 13) Do you use a laptop or PC? How often? [Every day / Few times a week / I do not use]
- 14) For what purposes do you use a laptop and PC? [text input]
- 15) Do you use a tablet? How often? [Every day / Few times a month / I do not use]
- 16) For what purposes do you use a tablet? [text input]
- 17) What Nganasan fairytales and games do you know? [text input]
- 18) How do you involve kids into Nganasan culture? [text input]
- 19) Would you like to participate together with kids in the study? [Yes / No / Maybe, if time will fit me]
- 20) Why did you agree to allow your kid to take part in the study? [text input]
- 21) Do you have any expectations towards the project? Do you expect that your kids will learn or archive anything? [text input]
- 22) Do you know the project's goals and the background? Would you like to have an opportunity to ask questions during the project? [text input]
- 23) Will you have an opportunity to answer a questionnaire and a few questions after the study? [Yes / No / It depends on a method]
- 24) I accept the terms and consent to participate [Yes]

Post-questionnaire Part 1 (USE questionnaire):

- 1) I think that Nganasan language learning application... (on a 5-point scale, 1 = Strongly Disagree, 5 = Strongly Agree)
 - a. ...is pleasant in use
 - b. ...is intuitive in use
 - c. ...does not require significant effort to use it properly
 - d. ...is easy to study
 - e. ...is natural in use
 - f. ...is useful
 - g. ...is attractive

Post-questionnaire Part 2 (Likert questionnaire):

- 0) What is your mood today?
- 1) How interesting was it to play this game?
- 2) How interesting was it to study Nganasan language with this game?
- 3) How attractive was this game?
- 4) How satisfied are you with your success in this game?
- 5) Would you like to play the game at home yourself?
- 6) Would you like to learn Nganasan in the future?
- 7) Will the app help in language learning?
- 8) What do you think about learning the foreign language with the help of the game?

APPENDIX B: INSTRUCTIONS FOR THE PARTICIPANTS OF OFFLINE STUDY

Introduction

Welcome! Thank you very much for your interest and participation in our experiment.

Our names are Alisa and Maria. We are conducting research at Tampere University, Finland. We are developing an application for learning the Nganasan language by children using technology. Why exactly for children? Because, as you know, children are our future. Children are easy to learn. There is a high probability that if to provide a language learning for children from a young age, the knowledge will be used in the future to preserve the language as a cultural heritage. That is why we really need your help in creating the application.

The purpose of the experiment

The purpose of this experiment is to understand whether the application is easy to use, how interesting is to learn a language with its help, and what are the weak points of the application. In general, the goal is to make the application better and more useful.

DigiKieli is a project created to support the endangered Nganasan language using technology. We were guided by the fact that with the help of technology, language learning can be easier and more interesting. As a result, an application was designed consisting of various lessons on several topics. To improve the app, we'd like to work with you to see how much you enjoy using it. Especially for this purpose, the opinion of the children is very important to us, as they will be the main users.

Remember that we are testing *the application*, so this test *is not a test of your technology skills*. The role of children in this process is very important, as children will help us to test and work on the design of the application. This will be discussed below.

Test procedure

A mobile phone is only what you will need. The test will take about 1 hour, including the application testing, answering the questionnaire and the interview. Answers to the questionnaire and the interview will be given offline, in the What's app conversation, where we communicate with you.

You will be sent a file that you need to download to get the application.

Next, you give the phone with the application to the kids, and they start playing with it.

The application consists of different lessons. By opening the app and choosing a character, you will see the lessons. You need to **complete the first lesson** in order to continue with the next.

During the testing you need to write down the time needed to complete 1 lesson.

Note! Since it is very important for us to know the opinion of the kids (not their parents), we kindly ask adults to not interrupt the kids' activity, when they are testing the application.

After completing several lessons, the children should answer the questions in the questionnaire based on own thoughts, feelings and opinion. You will find instructions in video format in What's app conversation.

Next, we will ask you a few questions. The answers you will send us in **audio format**.

If any of the tasks causes questions or misunderstandings, then feel free to contact us.

Anyone who wants to work with us further, please let us know in the What's app. We will describe to you all the details.

If everything is clear, you can download the application and follow the instructions that are presented above😊

APPENDIX C: INTERVIEW QUESTIONS

- 1) What do you like the most in the app?
- 2) What do you like the less in the app?
- 3) What topics for language learning would you like to see in the app?
- 4) How do children learn the Nganasan language nowadays? Do you personally want so that your children know the Nganasan language well?
- 5) What do you think about the future of the Nganasan language? Is there a chance to keep it alive?
- 6) How would you describe Russian North? Do you like to live here?
- 7) How would you describe a typical Nganasan person to people, who never heard of you?