Customized Robot-Assisted Language Learning to Support Immigrants at Work

Findings and Insights from a Qualitative User Experience Study

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ABSTRACT

There is a strong societal pressure for the immigrants to learn the local language to be able to properly enter the work-life and social life in the new culture. The limit of resources in second language teaching and the challenges related to language practicing with native people, encourages us to search for alternative options for the second language learning. Robot-assisted language learning (RALL) provides one potential option. In this article, we focus on exploring the potentials of customized language robots for immigrants to support their professional development and adaptation to the local work contexts. We describe our qualitative and exploratory user study with 10 immigrants as participants, focusing on their user experience (UX) of the customized RALL solution for language learning at work settings. We collected data through 1) *field observations of the authentic RALL sessions* in a user pilot, and 2) *user interviews* in the end of the pilot. The research shows that customization of several aspects of RALL is needed to support immigrants' language learning at work. These include, e.g. the vocabulary and tasks, the level, the speed of language, and the timing of the RALL. The optimal customization can be achieved by co-designing the RALL within the multidisciplinary team including the workplace representatives, language trainer and programmer. The RALL provides a lot of potential for immigrants' language learning as it offers unique learning experiences and many possibilities to keep up the learner's attention and motivation. However, there are also challenging aspects, which need further consideration.

CCS CONCEPTS

• Human-centered computing ~ User studies • Human-centered computing ~ Empirical studies in collaborative and social computing

KEYWORDS

Robot-assisted language learning (RALL), social robots, immigrants, user experience (UX), customization, work context.

1 Introduction

Migration is recognized as one of the major societal challenges that we are facing nowadays. Factors such as war, climate change, and lack of employment among others force people to leave behind their home countries to look for a better life somewhere else. This situation is not different in Finland, which since the late 1980s, has become a destination for large-scale migration in Western European countries [17]. At the end of 2015, the official number of foreigners living in Finland was 339 925 persons, which is about 6% of the total population. Among other challenges, lack of the local language can lead to social isolation and create a significant barrier to find a job. That is why one of the most important actions done by the government is to provide *language training and professional education* with courses that help immigrants in the entrance to the labor market. According to Saukkonen [17], the current system separates language courses and work orientation. The need for integration of these two is imminent.

Computer-assisted language learning (CALL) is a field that searches and studies technology-based applications for language teaching and learning [10]. Among others, Nielson [14] has investigated computer-assisted language learning programs, focusing on two popular commercially available products. She has found out that for the adult learners, the language learning is difficult. They would need more support, guidance and resources

to benefit from the self-study. Nielson points out that in the future, the self-study materials should focus more on learners' needs and goals, as well as on instructor-mediated training. Many technological solutions can be utilized for the implementation of the CALL. The field called *robot-assisted language learning (RALL)* inspects *the use of social robots for learning*. According to a massive amount of recent research, social robots provide a potential platform for language learning [3; 21; 23]. The robot can be included in several different kinds of learning tasks, e.g. vocabulary, grammar, pronunciation, reading, speaking and listening [15; 20]. A social robot is *an autonomous or semi-autonomous robot that communicates and interacts with human beings and obeys the behavioral norms set by humans* [2]. Social robots can have different kinds of possibilities for social interaction depending on the robot's type, e.g. speech, sounds, lights, expressions, gestures and movements. According to our knowledge, *customized robot-assisted language learning* to support immigrants in the *work context* has not been investigated before our research. *Immigrants as a target group for the RALL* have been explored rarely, even though some research does exist, e.g. [8; 12; 13]. Immigrants form a very heterogeneous target group, and the context of work is also versatile. To provide a better learning experience that could potentially lead to better results in the integration process of the immigrants, *customization* of the learning programs is strongly needed. *User experience (UX)* perspective is an important approach to find out the *needs, expectations and experiences* of immigrants towards the RALL to be able to find out the optimal way of designing such customized solutions for the target group. The main goal of this article is *to explore the user experience of customized robot-assisted language learning for immigrants to support their work-related language learning and thus, adaptation to the local work contexts*. To address this, we have formulated the following research question: **What user experiences does the customized robot-assisted language learning to support work evoke on immigrants?** In addition to the user experience findings, we present some practical implications concerning the customized RALL in the target context.

2 Robot-Assisted Language Learning (RALL)

Robot-assisted language learning (RALL) is a popular research topic, and the field is evolving at a fast speed. Many parties have recognized social robots' potentials on supporting language learning, although some technological aspects, for example, voice recognition, still needs to evolve for perfect functionality [9]. According to the Belpaeme et al.'s review [3] about the robots that support education through social interactions, out of more than 100 current articles, most focus on children as a target group. For example, recently, Ahtinen et al. [1] studied the Nao-based Elias robot to support the language learning in primary school settings for four months and found out that in the naturalistic and long-term settings Elias became a natural and motivational learning companion for the pupils. Among other topics, social robots' motivational aspects in learning as well as heir strong novelty

effect, e.g. [19; 21; 23] have been studied deeply. Adults as a language learning target group have been studied more rarely [3; 8; 15; 21]. However, some research already exists concerning adults. For example, Leyzberg et al. [11] conducted an experiment on Keepon robot helping adults on puzzle game solving, and based on their findings they conclude that embodiment of the robot, as well as personalized advice, play important roles on robot-assisted learning.

Some of the existing research in RALL is focusing specifically on *immigrants as a target population* and their specific needs due to their current situation, such as language learning. Out of these, again, most work focuses on children. For instance, Carolis et al. [7] developed an application on a robot to teach immigrant children culture-specific gestures to support their integration in the new country. L2TOR project studied massively the second language tutoring using social robots [22]. Their focus was mainly on preliminary school children, who were learning their second language (L2). One of the outcomes was a set of guidelines for designing L2 tutor robot, including pedagogical and child-robot interaction issues [4].

Focusing on adult immigrants as learners, Simo et al. [18] designed a robot that would assist refugees in their primary needs, such as a request for migration status or language advice. Engwall et al. [8] studied the human-robot interaction and four different interaction styles of the robot with immigrant students who were learning Swedish as a second language. Their study setup utilized Language Cafe concept, where two learners and the Furhat robot were present. Their findings present that the training with a robot was perceived as less intimidating than with a human teacher, and also that the setting resulted in collaboration between the learners. Also, they state that *"targeting adult learners has implications in that more realistic robot appearance and behavior are required than for younger learners"* (pp. 21). They found the Furhat robot to suit well for a realistic conversational partner role in L2 learning, but that the use of nonverbal displays, for example, eye contact and eye blinking behavior, should be improved. Furhat's anthropomorphic appearance and behavior were positively received by the participants. As a future work they suggest the adaptation of the RALL based on the learner's language level and other attributes.

Customization and personalization of the robot's behavior and learning content to improve the user experience and the general outcomes of the interaction is a crucial topic among the RALL researchers. For instance, in their review article, Belpaeme et al. [3] explained that when the robot personalizes the content based on user's performance during an interaction, positive results are achieved in cognitive learnings. Additionally, they mentioned that personalized social support, such as addressing the learner by its name, referring to situations in previous interactions and showing empathy with the pupils has satisfactory outcomes in the general user experience and result in learning increments. Furthermore, Bruno et al. [6] recognized culture as a critical factor for the robot's adapted behavior when interacting with humans to achieve higher levels of acceptance from them.

Based on the prior work, we can conclude that there is much space for exploring the user experience in the field of the RALL targeting adults, especially when considering the specific focus of supporting immigrants to learn work-related language. Customization is needed because the immigrants form a very heterogeneous user group. Also, the levels of the learners vary a lot, as well as the language content needed in different workplaces.

3 Methodology

3.1 Study Participants, Procedure and Methods

We arranged a qualitative user study with 10 participants (F=9, M=1), who were immigrants living in the Sea-Lapland area in Northern Finland. They were 22-62 years old, 43 years on average. The participants had stayed in Finland for 3-12 years (average 7 years). Despite of the relatively long time in Finland, all of the participants had the need for the profession-based language learning. They hailed from Southeast Asia, Western Asia, Eastern Europe, Southeast Europe and Western Africa. None of the participants had earlier experience in robots. Examples of the fields they were training or working in were service, technology, social and health care and education. 10 study participants were a subset of 65 immigrants participating in the project called Own way to the future, and they were selected based on their availability and willingness to take part in the study. Participation was voluntary, and each participant signed a written consent.

The study was conducted as part of a long-term employment project for immigrants in Northern Finland. The overall aim of the project was to improve the employability of immigrants by offering customized working paths for them. On the training model used, the language trainer gave the immigrants guidance that *combined work and Finnish language education*. There, we supported the Finnish language learning of the immigrants with the RALL by using the Nao robot at their workplaces, utilizing the robot in work-related language learning tasks (Figure 1).

The research process consisted of two phases: 1) the RALL pilot with the participants at their authentic work contexts, and 2) the final evaluation of the customized RALL. On the first phase, i.e. on the RALL pilot, the language trainer and the researcher brought the Nao robot, called Välkky in this case, with the customized RALL application to the workplaces. During the pilot, they visited the workplaces with the robot from 1 to 10 times (on average 3 times). From time to time, a technical person was also involved. The number of training sessions varied based on the language support needs and the schedules of the participant, employer and the language trainer, and the opportunities offered by the workplaces. The RALL sessions lasted from 30 minutes to 3 hours. During the RALL sessions, the researchers used the observation method to gather data about the human-robot interaction and the user experience. The more specific themes to be observed were the successful aspects of the RALL and the challenges related to it. The notes were written by hand to the observation forms and discussed and completed during a reflective discussion between the researchers immediately after the session. The RALL sessions and observations were conducted during the period of 1.1.2018-24.2.2020. The second phase took place after the RALL pilot was finished. The researchers conducted theme interviews with the participants to find out what kind of user experiences the trial had evoked, and what aspects of the RALL they considered as successful and challenging. The interviews were conducted during March-April 2020. Due to the exceptional situation caused by the COVID-19, the interviews were mainly conducted by remote methods. More specifically, Teams or other digital connection was established with eight participants to conduct the interview, and two participants were met face-to-face. The interview script included open-ended questions. The length of the responses varied from a few words to whole paragraphs, depending on the level of language proficiency of the person. The interviews were recorded, but two records were lost due to technical challenges. During the interview, the researchers wrote down the responses of the interviewees, and the final transcription was completed with the record when possible. The length of the interviews was approximately 25 minutes.
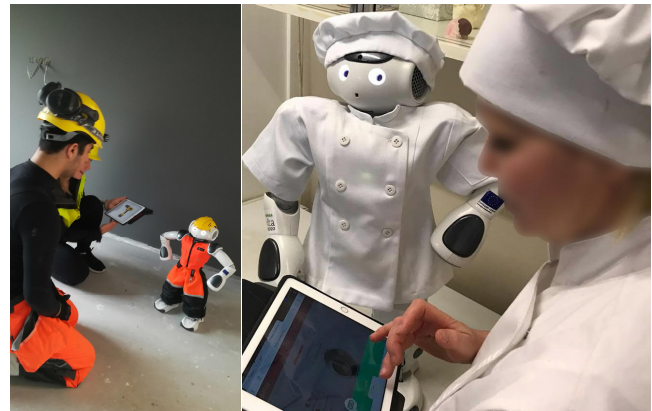

Figure 1: Authentic RALL session at two workplaces.

3.2 Data Analysis

Before the analysis, all the data was anonymized and coded with the workplace and participant number. The observational data (observation notes) and interview data (transcript) were analyzed by using qualitative methods, i.e. thematic coding. To find the answer to the research question, the researchers categorized the data by using the following analysis questions:

1. How did the participants describe language learning with the robot?
2. What were the successful aspects and advantages of the RALL for the immigrants to support work-related language learning?
3. What were the observed or perceived challenging aspects of that?
4. Other emerging aspects

The researchers initially explored the data by looking at the notes and transcripts through the defined analysis questions. The

researchers searched for the data items, which fitted the analysis questions. After that, the researchers systematically grouped the data under the analysis questions on the spreadsheet, where the similarities and differences among the observations and responses between the participants were easy to perceive.

3.3   Research Platform Nao and the Learning Applications

Nao 6 humanoid robot by SoftBank Robotics (https://www.softbankrobotics.com/emea/en/nao) was used as the research platform due to its relatively easy programming opportunities, as well as because it is easy to transfer due to its size and form. Also, it provides a suitable level of social interaction for human-robot interaction, including speech, gestures and movements. In our case, the robot's basic behavior was designed to be neutral, i.e. the robot was gesturing and motioning a little bit making it appear lively.

The project *Own way to the future*, where we conducted our study, aimed to improve the employability of immigrants offering customized working paths. In the project, the language teacher gave them guidance that combined work and Finnish language education. The goal was to enhance and strengthen the Finnish language skills of immigrants by using the Nao robot at the workplaces, utilizing the robot in various jobs and tasks. The main goal with all the immigrant learners was to strengthen their oral Finnish language skills related to their work tasks and professional skills. A multidisciplinary team consisting of a Finnish language trainer, researcher, vocational teacher, workplace instructor and a programmer co-designed and implemented tailormade Finnish language learning tasks on the Nao robot based on each learner's individual needs and the needs of the workplaces. In most cases (80%), the learning programs were implemented for the NAO robot by using Choregraphe (http://doc.aldebaran.com). In some cases (20%), the Elias language learning application (eliasrobot.com) was used for the implementation. The designed robot-assisted language learning tasks included, for example, vocabulary and sentences (workplace-related terminology such as tools and verbs, customer service vocabulary), work instructions, the occupational safety training content, and discussion about the workday, as well as job interview questions. The programs were modified and further developed during the pilot if needed.

To integrate the robot more properly to the workplace context, the robot was personalized with clothes and hats or a helmet (Figure 1). Students from the unit of textile and fashion of a vocational college designed and produced the work uniforms for the robot. At the time of the study, the robot had different uniforms for construction area, bakery area and beauty area. The robot was also given a name, Välkky (Smartie in English) and parts of its sayings were programmed to be heard with the local dialect.

4   Findings

4.1   Enablers for the Successful RALL to Support Immigrants at Work

Based on our findings, there seems to be many enabling factors that can support immigrants' work-related robot-assisted language learning, and many advantages related to the RALL. Next, we describe these enablers and advantages.

Multidisciplinary collaboration in co-design of the customized RALL. In our model, the learning programs for the robot were co-designed in close multidisciplinary cooperation with the Finnish language (S2) trainer, the workplace instructors, vocational teachers, and the programmer. *The Finnish language trainer* knew the learners and had identified their language proficiency levels and development goals. She created the customized language programs for the learners by writing down the main goals. *The workplace instructors* had a crucial role in providing up to date and necessary information about, for example, what kind of vocabulary is needed in the workplace, what shortages the learner has on his/her language skills and what areas of language skills must be strengthened. The expertise of *vocational teachers* was used, for example, for professional terms. *The programmer* implemented the programs created by the language trainer on the Nao robot. This multidisciplinary teamwork enabled the creation of the appropriate level and content for the learning tasks to support the learner's and workplace's language learning needs. Based on the observations, the learning sessions co-designed in close multidisciplinary cooperation supported the individual learning. The RALL sessions designed in the close multidisciplinary cooperation enabled well designing the learning contents for the specific learners in specific workplaces.

Customized RALL. According to our observations, the advantages of the RALL were strongly related to the programs customized for the learner and the workplace, i.e. the designed program was on a right language level, speech speed adequate for the user, and the learning content was designed for the specific workplace. The development of the programs was also iterative: if the researchers noted that the program was too difficult or too easy for the learner, they customized the program adequate for the learner. The interview data support the observations. Based on the interview data, the customized RALL sessions were constructed from several elements. The features of a successful RALL session were, for example, learning the specific professional vocabulary, understanding what the robot says, the importance of repetition and receiving feedback on learning.

Three learners out of ten highlighted in their interviews that the *feedback given by the robot* was important for their learning. The illustrative example excerpt from the interview data below tells how important it is that the robot helps the learner to articulate right. The quotation also shows how hard for the learner is to hear his or her pronunciation errors: *"In the Finnish language the grammar.. I can not hear.. but the robot hears me, whether I speak right or wrong: ö, y, ä, ö is difficult"* (learner no 3). The observations

confirm the importance of the robot's feedback in learning. The robot repeated the word after the learner, of which the learner could hear how to pronounce the word correctly. If the robot did not react to the learner's response, it demanded the learner to focus and repeat the word once more.

Based on the observation, *the repetition* seemed to be important for the customized language learning session. The learners could repeat what they have heard as many times as they wanted. They could ask the robot to repeat the question or answer as many times as they liked to. They felt that the robot did not get tired of asking or answering. Two interviewees mentioned the possibility of repetition during the RALL session: *"The possibility to repeat sentences and words is important to me." (learner no 4).*

In our project, the goal of implementing the RALL in the workplace was, for example, to strengthen the speech ability and the vocational vocabulary of the learners. The RALL sessions were planned and designed to increase and strengthen professional vocabulary and the vocabulary related to the work tasks and work environment. Based on the answers of the interviewees, it seems that for most of the learners, the individual learning programs were successful and supported learning. The learners described that they learned the content that was planned for them.

Workplace's positive attitude towards the RALL. We observed that in our target workplaces, the entrepreneurs and workplace instructors had a positive and open-minded attitude towards the robot and language learning. This aspect contributed both to the development of the individual programs as well as to the individuals' learning. None of the workplaces did prohibit RALL in the workplace. Six out of ten workplaces had a clearly positive attitude to the RALL in the workplace. The workplace instructors had a positive and open-minded attitude towards the RALL, which is reflected by their willingness to participate in the planning and creation of the programs by presenting wishes and ideas for the development. The entrepreneurs and workplace instructors also allowed to arrange the learning sessions in the workplace premises and within the working hours. Thus, an essential cornerstone for implementing the RALL successfully, is the functional cooperation with the workplace, especially with the workplace instructor and the entrepreneur.

Learner's positive attitude towards the RALL. Based on the observation data, the robot seemed to inspire the learners. Seven learners out of ten were enthusiastic and curious towards it. Based on the observations, this was related to the appearance and behavior of the robot. Those learners who were enthusiastic about communicating with the robot maintained their enthusiasm until the end of the pilot. The learning process seemed to be successful for those who had a positive attitude towards the robot. Those three learners who were not enthusiastic about the robot did not become inspired by the robot and they experienced challenges in learning with it (see 4.2).

Most learners seemed to learn how to communicate with the robot even during a short session - six out of ten learners communicated very fluently with the robot. These learners seemed to communicate naturally and warmly with the robot. They spoke towards the robot with a gentle voice, smiled and laughed. They noticed very quickly how to act if the robot did not operate properly. They spoke towards the robot if it did not hear them, bent over the robot, repeated their words if necessary, raised their voice if the robot did not hear or answer. Although many of the learners communicated naturally and fluently with the robot, the observations also showed that the role of the language trainer in the learning situation was, however, important (see 4.2).

Fast and efficient learning in RALL sessions. According to our interview data, two learners out of ten highlighted the robot as a new language learning technology. According to them, the robot helped to learn the language quickly and efficiently as well as to remember better what had been learned. Two learners felt that during the RALL session, they learned and remembered more effectively compared to the classroom learning session: *"The robot is an active learning process. It makes interesting, it is not boring." (learner no. 6).* There can be several reasons for aforesaid. Both learners had previous study background, as well as good study and technical skills. The RALL session in the workplace differs from the classroom language learning session in many ways. The learners felt that with the robot, it was easy to learn, and the robot accelerated learning. The duration of each RALL session was from 30 minutes to 3 hours. During that time, the learner was able to concentrate on the pre-planned and designed language learning material and limited content. The moderately limited learning time may explain the learner´s perceptions about effective learning with the RALL. A short but regular RALL session brings variation to a normal day in the workplace and therefore, can enhance memory and learning. For all the learners, the RALL situation in the workplace was a new type of learning situation. So, the situation, the robot and the language learning program of the robot were novel to them. The novelty of the RALL can make it a memorable learning experience and bring in variety for the learning. This aspect may correlate to the learners' perceptions of the RALL sessions being effective.

An easy-going learning atmosphere. One learner out of ten highlighted the aspect of an easy-going learning session: *"Friendly, active, no stress when you sit with the robot. Positive feeling." (learner no. 8).* The learner pointed out that she learned in patience with the robot. The learner had to concentrate on her smooth and precise communication so that robot understood the learner. Although this came out only in one interview, the observations support this finding. According to the researcher´s interpretation based on the observations, the RALL session brings in an easy-going learning atmosphere, as well as slower pace of learning. Nowadays, classroom learning sessions can be hectic, and language learning contents are wide, and the amount is large. The RALL session at the workplace is limited to specific content.

Personalization of the robot. According to the interview data, the fun factor and the appearance of the robot were also highlighted and for some learners they seemed to influence positively on

motivation. The robot was described as "fun, easy, activating and interesting". One learner described it as a toy. For three learners it was also important that the robot had similar work clothes as the learner. They described how the clothes made the robot more human-like and more approachable. The clothes also raised discussion and acted as an icebreaker.

4.2 Challenges in the RALL to Support the Immigrants at Work

There are many different positive aspects related to the RALL in the workplaces, but we also found challenges related to it, which we describe next.

Frustration. Based on the observation data, two learners were frustrated with the robot's instructions, they did not follow them, and they did not see the additional value about the robot for their learning. These participants felt that they did not get benefit from the RALL.

The aim of the RALL is, among other things, to strengthen the verbal language skills. Our RALL sessions were integrated as an integral part of learners' work tasks. The frustration, according to the researchers' interpretation, arose out of the situations, where the learner did not see the added value that the robot would bring to his/her learning. The learner knew how to do the work and therefore did not follow the robot's instructions and tasks. In these cases, the tasks given by the robot were, for example, encouraging to speak more or using more vocational vocabulary, and involving themselves more in the professional discussions. The researchers noted that the frustration was related to the learners' willingness to handle the work task itself very well. She/he did not necessarily see the robots' help in that particular situation as a benefit. In addition, these learners did not see the robot as an appropriate teacher in the workplace environment. The learner's interpretation might be that the language learning is more based on the classroom learning, and he or she should only concentrate on the work tasks in the workplace.

One of the interviewees highlighted the naivety of the robot. She thought that the robot would suit better for the children's education than for the adults. According to researchers' interpretation, this aspect brought in the feelings of frustration during the RALL session for this specific learner.

Challenges in understanding the robot. Another challenge of the RALL in the workplaces was the challenges of comprehension: *"We have to repeat the program several times for the learner until she understood the purpose of the program", observation notes, learner 1.*

The challenges of comprehension were usually related to the program's design. Despite the careful and elaborate planning of the program, it proved to be too challenging for some of the learners. Three learners had challenges in comprehension. In practice, the researchers took this into account in the further development of the program, for example by designing the programs punctual, cutting off additional instructions of the robot, reducing the speech rate and adding pauses for the program.

Sometimes the challenges in understanding the robot related to the technical features of the robot. Due to the robot-like voice and the way of pronunciation, the Finnish language did not always sound fluent and natural. The interviewees found the sound and pronunciation of the robot difficult to understand sometimes. They wished that the robot's voice would be less technical or even a woman's voice. Thus, the robot would be easier to understand. We also observed that the difference between the long and short vowels was not always clearly audible and therefore difficult to understand. Especially, it interfered the understanding of the advanced Finnish learners. In these situations, the role of the Finnish language trainer was significant to avoid misunderstandings and to correct pronunciation errors.

The robot's basic behavior was designed to be neutral. The lack of body language was one of the factors that challenged the understanding of the robot's speech: *"The [robot] lacks body language, that does not support comprehension, but makes it difficult" notes no 1.* The language learners may have accustomed to the fact that the trainer uses a lot of body language and gestures, and it helps and supports the understanding of the speech. Because the robot lacked the proper non-verbal communication, it disturbed the instructions given by the robot.

The need of support from the human language trainer. Based on the observation data, the Finnish language trainer played a key role in the implementation of the RALL in the workplaces. Although most of the learners communicated naturally and fluently with the robot, the researchers' interpretation shows that only three out of ten learners would have been able to use the robot by themselves, although it was organized technically ready to operate. The use of the learning programs required multiple times of using with the language trainer guidance before learning how to use them independently. The main areas where the language trainer's support was needed were in understanding the robot's pronunciation and understanding the robot's questions and instructions. The language trainers support was also needed for continuing the robot's program and encouraging learner to use the program by themselves. The trainer was responsible for the technical operation of the robot at the workplace. She had to understand the technical features of the robot as well as the operating principles of the Choregraphe program. So, the language trainer had a role of an encourager and facilitator for the RALL, at least in the beginning, as well as a technical support.

The background noise of the work environment. In the workplaces, the environment drastically differs from the environment of the classroom. In our study, we brought the robot in the learners' current workplaces. The workplaces were from seven different sectors. In three workplaces out of ten, the background noise affected the robot's speech recognition and complicated the learning session. The background noise was caused, among other things, by various devices and machines as

well as normal workplace noises such as voices of co-workers or phones ringing.

The number of the learning sessions. Three learners mentioned that the number of the learning sessions with the robot was insufficient. We interpret that in the RALL, the continuity is essential. It is important for the language trainer to understand the differences in students' learning styles, and special attention should be paid to the number of the learning sessions when designing customized RALL.

Limited competences of the robot. Two interviewees thought that the robot did not have as much knowledge as the human teacher. They commented that the teacher has more knowledge, skills and experience than the robot. However, both learners found robot still useful for learning.

Resourcing. Based on the researchers' observations and analysis concerning the customized RALL process in the workplaces, the key element is the time needed for planning, designing and coding the programs. Because the planning, designing and development of the programs was done as a multidisciplinary teamwork, it obviously demanded plenty of time and other resources. To ensure the technical functionality of the programs, the program had to be tested in advance for several times. Sometimes it was good to have several different levels of difficulty for the same program. Time was also needed for conducting the RALL sessions in the workplace. Sometimes the robot worked smoothly and sometimes there were technical problems before the session and solving them took some time.

5   Discussion

The robot-assisted language learning (RALL) is a popular research topic, and the robots have already proven their power in engaging especially kids for learning [1; 3; 21]. We conducted a qualitative pilot study about the robot-assisted language learning, targeting the user group, which has rarely been studied in the field of the RALL: adult immigrants as language learners. It is important to study and develop effective methods for the immigrants' second language learning, as large-scale immigration is common in Western European countries [17], and the local language skills are relevant and needed especially when entering the work life. Differently to the previous work around the RALL for the immigrants conducted by Engwall et al. [8], the context of our pilot study was authentic work settings. We explored how the RALL can support language learning in the workplaces, where the immigrants were training to become professionals. We were focusing on the user experiences of the immigrants to be able to get understanding about how to design better RALL for the immigrants to support their language learning at work. Based on our findings with 10 participants, it seems that the key enablers and implications for the successful RALL at the work context are the following:

Customized language programs for the learner. Engwall et al. [8] describe the need for adapting the RALL for the learner's level

and other aspects. We co-designed the RALL programs based on the learner's language skills and the workplace's requirements, to respond to the needs of the user and work context. The vocabulary and learning tasks, the level, the amount of the sessions, the timing of the RALL session (e.g. before, during or after the work task; length of the session) as well as the robots features such as the speed of speech, were adjusted for the learner. The customization of the RALL seemed to be a successful aspect in our pilot study. Similar findings about the customization or adaptation have been reported before in the review article about the social robots for education [3]. We also made observations about the neutral behavior of the robot, which made it challenging for some participants to understand it. Better non-verbal communication of the robot could improve effective learning, as also noticed by Engwall et al. [8]. It would be interesting to study, how the robot should adapt its non-verbal communication culturally, i.e. what kind of cultural behaviors and expressions it would need to adopt considering the learner's culture. According to Bruno et al. [6], culture is a critical factor for the robot's behavior to achieve higher levels of acceptance from the humans.

The multidisciplinary and iterative design of the RALL sessions. The whole team including e.g. the language trainer, vocational teacher, workplace instructor and programmer, are needed for the successful co-design of the language program. It is also very important in the RALL that the learning sessions are reflected afterwards and developed further when needed. Obviously, this makes the customized RALL as a quite resource intensive method. Current online co-design platforms might provide more cost-efficient platforms for the co-design and would be worth of exploring for these kinds of co-design projects. Also, the development of artificial intelligence may bring in automatic adaptation of the learning contents and tasks based on the learners' needs and development.

The supportive attitude of the workplace towards the RALL. The target workplace needs to accept and support the RALL and have a positive attitude towards the robots. The workplace needs to accept the time and space required for the RALL sessions and be prepared to possible interruptions. The practical things need to be properly discussed and planned with the workplace before starting with the RALL, and this can be done ideally by taking the workplace as part of the co-design process, as discussed above.

The RALL sessions run by the human language trainer. In our RALL model, the RALL was implemented at the workplace in collaboration between the human language trainer and the robot. Based on our findings, the human trainer was necessarily needed to support the robot-assisted learning. It was found out that the human trainer needs to have enough of technological competence to instruct the RALL for the learner, and to handle the robot in, e.g. error situations. Lopes et al. [12] made similar findings about the superiority of the human moderator over the robot. Engwal et al. [8] used a different combination in the robot-assisted language cafe concept. In their model, there were two learners and a robot present in the learning situation, and their participants reported that

learning with the robot was less intimidating than learning with the human instructor. We did not observe any signs of the human instructor to be perceived as intimidating in our model. Instead, we observed that the human instructor's role was very meaningful in the RALL to support the learning. Similar findings have been made by Nielson et al. [14] about the computer-assisted learning in general.

The learner's positive attitude and acceptance of the robots. The RALL does not suit everybody, and it should be considered as a one learning tool among others. The learners need to accept the robots for the RALL to become a successful learning method. When considering suitable learning methods for the learners, the planners would need to screen the learners' attitude and readiness to learn with the robot. One way to access the learner's attitude towards the robot would be to ask her/him to fill on the robot attitude scale (RAS) [5].

The unique learning experience with the RALL. Robots can provide unique and motivational learning experiences for the immigrants to support work-related language learning. The experience of the RALL conducted in the workplace is much different than the classroom learning situation and can be very positive if carefully designed and implemented. In our study, most of the learners showed empathy towards the robot and discussed kindly with it, which shows that they formed a kind of companionship with it. Similar findings of the robots' potentials as a learning companion have been made in many previous studies, e.g. [1; 23]. Based on our study, it remains unclear how much the novelty effect of the robot affected on the positive and motivational experience, and for how long the effects would last, but on the other hand, there are many potentials to keep updating the RALL based on the development and needs of the learner, as also noticed by [1].

Design of the robot's behavior and appearance. In our case, the pragmatic and task-oriented design of the robot worked well with most of the learners. The robot was not designed with any playful behavior as such, but it's behavior and content directly and pragmatically focused on language learning. In line with our findings, Engwall et al. [8] state that more realistic behavior of the robot is needed for the adult learners than for the younger ones. For the kids, a playful design of the robot works very well [1]. However, even without any explicit playful behaviors, some of our participants considered the robot as funny and playful, and this aspect seemed to affect positively to their learning motivation. One design element on our robot was its work uniforms, which were designed to fit the work contexts. As the robot's uniform was similar to the worker's uniform, the worker seemed to feel sense of belonging with the robot. The robot wearing the work uniform seemed to inspire the learners and made it more human-like and easy to approach. More research would be needed to explore the need and potentials for these kind of inspirational design elements on the adults' RALL at the work context.

We are aware of the limitations and challenges of the presented study, leading to interesting topics for the future work. Qualitative and exploratory study with 10 participants provided knowledge,

based on which only cautious conclusions can be made. However, the purpose of the study was to provide preliminary insight about the studied subject, based on which more studies with more participants from different cultures can be conducted. One pragmatic challenge in our study was the varying language levels of the learners, which sometimes affected the, e.g. getting in-depth information on the interviews. Therefore, we used both observations and interviews in our study. As a future work, the effectiveness of the RALL at the workplace context would be good to study more. Worth of studying would be, for example, the learning outcomes of the RALL sessions for the learners with different language proficiency levels. It would be interesting to compare individual RALL session in the classroom and in the workplaces, as well as the effects of the RALL compared to other interactive technologies. Another topic for the future work would be to the study the cultural aspects that would need to be customized or adapted on the RALL for the immigrants. In addition, the role of the human instructor would need more in-depth study.

6 Conclusion

We have presented the findings from our qualitative user study with 10 immigrants as participants, focusing on their user experience (UX) of the customized robot-assisted learning (RALL) solution for language learning at work settings. The customized RALL lessons were programmed for the NAO robot after the multidisciplinary co-design process. We collected the user experience data through the observations of the authentic RALL sessions for immigrants, which were conducted in the workplaces. In addition, we interviewed the participants to get more understanding about their user experiences. The main findings can be summarized as follows: 1) customization of the RALL lessons is needed based on the learner's and workplace's needs, 2) the RALL lessons are optimally designed in the multi-disciplinary and iterative process, 3) successful RALL requires positive attitude from the learner and the workplace, and 4) a human facilitator is needed to support the successful RALL. When properly designed, the RALL can provide unique learning experiences for the learners and can support immigrants' language learning in the work context. Further research would be needed about the design aspects of the robot's behavior and appearance for the immigrants' RALL at the work context, but based on our findings, integrating the robot to the workplace with, e.g. personalized work uniform, seems to be one of the supporting design aspects.

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