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Supporting Pupils' Learning and Interaction with Educational Technology During the COVID-19 Pandemic: A Value Sensitive Approach

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Abstract

Teachers around the globe had to change from in-class teaching to remote teaching in a matter of days due to the COVID-19 pandemic. We used a value sensitive approach as an analysis method to investigate how Finnish teachers experienced the utilisation of educational technology to support learning and interaction during the remote learning period. The experiences resulted in valuable insights about remote teaching. Thematic analysis of nine Finnish teachers' interviews showed that, overall, the teachers did not compromise their teaching-related values but wanted to offer ideal teaching. They managed to create a successful remote learning environment consisting of several systems and services. However, there was room for improvement, as the technology did not fully support all of the teachers' relevant values. The main finding was the need to develop a more comprehensive visualisation of the pupils' learning activities in order to better monitor their progress and the need for support.

Keywords

Remote teaching, Education technology, Value Sensitive Design

1. Introduction

The remote learning period in spring 2020 due to the COVID-19 pandemic showed the importance of educational technologies. It also provided valuable information on how the technologies could better serve the needs of teachers, pupils, and families. In Finland, educational institutes, from basic education schools to vocational institutes and universities, had to switch from contact teaching to alternative teaching methods in a matter of days in March 2020 [9]. As contact teaching was to be suspended with a few exceptions, distance learning and digital learning environments and solutions were recommended to be used as much as possible. The switch from contact teaching to alternative teaching methods was rapid and did not leave much time for teachers to prepare for the change, e.g. by incorporating new remote teaching strategies and solutions.

In this study, we concentrate on the experiences of Finnish basic education teachers during the first remote teaching period in spring 2020 lasting from March till May [10]. Basic education in Finland covers grades 1 to 9 for children aged 7 to 15 [6]. The Finnish curriculum for basic education has many elements in addition to the compulsory subjects, such as mathematics and history. For example, the curriculum includes seven transversal development areas in which needed competencies are taught regarding various aspects of life, including information and

communication technology (ICT) competence. The curriculum also highlights many non-academic values, such as the uniqueness of pupils, the joy of learning, and a school culture that enriches interaction between pupils and teachers [6].

We focus on investigating the ICT learning environment the teachers used to support pupils' learning during this time. This environment refers to all the teaching and communication systems the teachers used when they were in remote contact with the pupils, both in teaching and in monitoring their learning process. The main objective of the study is to discover what the teachers' experiences reveal about the various needs in relation to the use of remote learning technologies. We explore this by identifying the teachers' relevant values and how the technological learning environment supported or hindered them. Understanding values and their meaning in this context can help in designing better products for online learning [5].

Our study aims to provide answer to research questions: what kind of values do the teachers describe when reflecting on their remote teaching experiences? Also, we aim to discover, how did the teachers experience the technological learning environment as a support or hindrance for the realisation of their teaching related values?

2. Technology-Enhanced Learning and Interaction

The current technological transformations in modern societies are extending people's learning and interaction opportunities in educational and professional contexts generally [3, 11, 18]. However, to implement technology in education in pedagogically meaningful ways, evidence is required on how information and communication technology affects learning and interaction processes [13, 19, 23, 26].

Increasingly, the teacher's role is changing from the imparting of information and knowledge to the designing of the learning experience [14, 16]. The aim is to empower students to take an active role in planning and conducting their learning activities, and the teacher's role is thus to foster beneficial student interaction and design optimal conditions for learning, giving the pupils direct support when needed through cognitive, metacognitive, emotional, and motivational activities [14]. How teachers provide feedback and encouragement to students both individually

and as a group has an effect on their learning [14, 28].

The findings regarding the effects of the remote teaching periods due to COVID-19 show the concerns of both parents and pupils regarding meeting social needs through interaction with peers and teachers [21, 25]. Primary school teachers reported many areas of concern, such as fewer teaching method options compared to contact teaching, the lack of technology skills negatively affecting learning, and the longer screen times due to the demand to develop e-content [25]. Some K12 teachers reported that monitoring pupils' progress and holding them accountable for their schoolwork were teaching-related concerns during this period [27]. In addition, some teachers reported challenges related to technology, such as the lack of internet access or devices [27].

Remote learning also has decided effects on interaction. During the remote teaching period in spring 2020, many teachers had concerns around communicating with pupils and their families [25, 27]. Providing instructions, giving feedback, gauging understanding, and providing support to pupils and families were seen as challenging [25, 27]. Furthermore, reading pupils' facial expressions is a common way for teachers to discern if they have understood the issue or paid attention, but during the online classes, this was often impossible, as many pupils did not choose to keep their video on [16].

2.1. Value-sensitive technology design and adaptation

The interest in values as part of ICT design has grown as technology has become an almost inseparable part of our everyday life and environment [12]. When designing technology, such as an information system, taking the stakeholders and their values into account is an ethically sound approach [8] that pays attention also to the users' needs [1, 12]. Technologies have numerous affordances and features which are well suited for certain activities and human values while possibly hindering others [8]. By human values, [8] refer to what a person or a group considers important in life. Values guide people's behaviour and decision making [15], thus understanding values provides insights of the various needs. In this study, we concentrate on context-related values, i.e. the values related to teaching.

Value sensitive design (VSD) is an approach for designing and exploring technology taking into account human values [7, 8, 30]. It consists of three types of investigations, which can be used iteratively and integrated in a way that is best suited to the situation [8]. *Conceptual investigation* focuses on identifying the relevant direct and indirect stakeholders, i.e. the individuals, groups, and other entities affected by the technology either directly as users or by implication. The second part of conceptual investigation is to identify the relevant values of and consequences for each stakeholder. *Empirical investigation* is often needed to deepen the understanding of the human context in which the technology is used or intended to be used. To explore how the stakeholders experience the technology and how the values imbedded in the technology affect them, various research methods can be used [29]. *Technical investigation* focuses on the properties of the technology which might hinder or support the identified stakeholders' values [7, 8]. It can be done retrospectively on an existing technology as well as proactively when designing a new technology [7].

By investigating the values that are important to the relevant stakeholders and how they are or should be realised in a technology, it is possible to influence the use of a technology and enhance its effects. For example, VSD were used to study how the values important to diabetic patients are or should be embedded in a self-management technology [4]. The participants were interviewed after they had used a self-management application for a while. The use of the application helped the participants to elicit their hidden values. The findings showed that the values (e.g. joy, sense-making, and hope) and their presence or absence in a technology affected in how the patients managed their illness [4]. Thus, taking into account the stakeholders' relevant values and their meaning in the context can help in creating more effective tools and practices [4].

However, some identified values might conflict [7, 8]. In order to solve these conflicts, it is necessary to prioritise the values and find suitable compromises, e.g. based on the effects the value choices may have. In the case where a technology already exists, some incorporated values may conflict with users' values. This conflict can be seen, for example, when a user values privacy, but the technology demands the user give up their privacy more than they are willing to. This conflict can be resolved simply by not using the technology. Though, in many cases, the user has few or no options to make a carefully thought-out decision. This is the case with the teachers in our study, since the required switch to remote learning happened with very little time to prepare and regardless of how much experience the teachers had with online learning technologies.

Previous studies have indicated that teachers use technology when they believe it will promote the underlying value of student learning [24]. Also, users' values, such as self-enhancement, have been found to have an increasing effect on individuals' intention to adopt e-learning technology [20]. The unique situation caused by the pandemic in spring of 2020 forced the teachers to adopt remote education technologies, regardless of their views about using them. It is important to study how teachers' values were supported and hindered by education technology, and how designers can take these values into account as development requirements.

3. Methodology

To study teachers' experiences during the remote learning period, interviews with nine Finnish basic education teachers were conducted. The interviewees volunteered to be interviewed when they filled in an online survey about their remote teaching experiences during the COVID-19 pandemic. The survey was done in collaboration with the company Qridi in order to reach teachers who had utilised its learning management system. The system, also called Qridi, is a tool for formative evaluation, which also supports teachers to organise their teaching in a way that allows their pupils to take responsibility for their learning. A total of 196 teachers completed the online survey. The nine participants in this study were selected from these 196 according to their willingness and availability. The interviews were conducted between the 9th and 24th of June 2020 and lasted between 59 and 83 minutes each. The aim of the interviews was to collect teachers' perceptions about use of technology for teaching and interacting during the remote learning period. All the interviewees were Finnish, and all but one teacher was teaching in a Finnish school; that one teacher, Paul_Subject, taught Finnish pupils in a European school (see Table 1).

The interviews were analysed using thematic analysis, a method for identifying themes and patterns from qualitative data [2, 22]. This was

considered a suitable means to explore different teachers' perceptions, highlighting their similarities and differences, and to further identify unanticipated insights [3]. All interview data was first transcribed and then coded using inductive thematic analyses and constant comparison of the data. The analysis was conducted using NVivo 12. The aim was to identify teachers' relevant, context-related values and how the technological remote learning environment hindered or supported them.

Table 1 The interviewed teachers

Pseudonym	Sex	Teaching during spring 2020	Technological learning environment[a]	Pupils' ICT devices
Ann_2ndGrade	female	2nd grade teacher 7th grade subject teacher (Textile work)	Google Drive, Seesaw Qridi at first, later Google Classroom to unify with rest of the school	School provided Chromebooks and tablets to those who did not have access to any
Cristy_2ndGrade	female	2nd grade teacher	Qridi	Some devices provided by school to those who did not have access to any
Jenna_Subject	female	7th, 8th, 9th, and 10th grades subject teacher (Mathematics and Computing)	Qridi, Microsoft Teams for live online teaching	None from school. All had access to at least a smartphone at some point in the day
Paul_Subject	male	9th grade subject teacher (Mathematics, Physics, Computing)	Teams as required by the school, Qridi partly with one group	None from school. All had at least smartphones; some had a computer
Marge_1stGrade	female	1st grade teacher 4th, 5th, and 6th grades subject teacher (Religious Education)	Qridi	Pupils used tablets and smartphones
Liz_4thGrade	female	4th grade teacher	Qridi, Teams, Pedanet	Every pupil had access to a smartphone, tablet or laptop at home
John_3rdGrade	male	3rd grade teacher	Qridi, Teams, WhatsApp	School provided laptops for those who did not have access to them at home
Katy_5thGrade	female	5th grade teacher	Qridi, Forms, Classroom, Meet	Chromebooks for each provided by the school two years before the pandemic
Barb_4thGrade	female	4th grade teacher	Qridi, Teams	School could lend devices if needed

Four authors took part in forming the categories. The main analysis of the themes was done by the first author, while the four authors made several iterations to combine the themes into suitable categories. Both deductive and inductive analyses were used to determine the final categories and subcategories. The first iterations after identifying some of the values resulted in the two main themes: learning process and interaction. These themes emerged as some of the values related to pedagogical process and some clearly related to interaction and communication. Further analysis by four authors produced subcategories to differentiate the two main themes at a deeper level.

category of supporting the pupils includes the values of being in charge, reinforcing self-management skills, and acknowledging different needs. The values describe how the teachers promoted the pupils' learning process. Promoting a sense of belonging, encouraging active participation, enabling informal interaction, and involving parents constitute the values in the third category of utilising interaction. This category describes how the teachers utilised interaction to support their pupils and their learning process in various ways. The fourth category, interaction form, relates to the values guiding the form of the interaction.

4. Results

The analysis produced a total of four value categories related to learning process and interaction, namely organising teaching, supporting pupils, utilising interaction, and interaction form (see Table 2). The values in the organising teaching category (stability, routines, and versatility) affected the ways the teachers planned the daily and weekly schedules as well as how they kept the pupils interested and motivated

Table 2 Identified values in categories

Value category	Value	Definition
Organising teaching	Stability and routines	Keeping suitable routines as classroom teaching and creating new ones for the remote learning period
	Versatility	Utilising a variety of teaching and learning methods
Supporting pupils	Being in charge	Providing all the guidance and support the pupils need
	Reinforcing self-management skills	Supporting the development of pupils' self-management skills, including self-assessment, and taking responsibility for one's own learning process
	Acknowledging different needs	Considering pupils' individual needs and skills regarding learning and understanding assignments
Utilising interaction	Promoting a sense of belonging	Feeling of being part of a group. The pupils form a team among themselves and with the teacher
	Encouraging active participation	Creating opportunities for everyone to actively participate
	Enabling informal interaction	Discussing non-school-related matters as well as using humour to lighten everyday life and strengthen the team spirit
	Involving parents	Being in contact with each pupil's parents to keep them up to date and to discuss any concerns
Interaction form	Being available	Low barrier and multiple ways for the pupils (and parents) to contact the teacher
	Responding quickly	Aim to respond quickly, at least with something, when a pupil asked a question
	Connection with each pupil	Having personal contact with each pupil
	Utilising non-verbal communication	Paying attention to the variety of non-verbal signs to verify, for example, if the pupils had learned the lesson or if they needed some support

4.1. Organising teaching

One of the first tasks for the teachers when switching to remote learning was to organise the teaching. Many decisions had to be made in order to build a suitable solution for the unique situation with the resources they had. The decisions not only pertained to the technological environment but also to the various practices and teaching methods. The teachers took pride in their work and wanted to do their best in this remote learning period, during which they learned what worked in their situation and what did not. When something was found as hindering the learning process or effective communication, changes were made accordingly. As Marge_1stGrade explains: "*For about the two first weeks, I taught through Wilma [a system for school-home communication]. This meant that I informed the parents about my expectations, assignments, and homework. When the parents replied [only] that the assignments were done, I understood that I had no idea what was actually happening in the homes.*"

The teachers valued **stability and routines**. This was shown both in their desire to keep the same old routines, when possible, but also to adapt quickly to develop new ones suitable for remote learning. For example, if the pupils had already used an online learning platform or office software, the teacher continued using them unless there was a clear need to change them. Also, the study books used in the physical classroom were also used during the remote period. However, in all cases, the teachers had to make some adjustments to the old teaching routines, since remote learning differs significantly from classroom learning.

It was challenging for the interviewees to adhere to the same previously structured days with lessons scheduled at specific times. However, according to the teachers, there was still an apparent need for a daily and weekly rhythm. At the very beginning, the practices varied among the teachers, as they were still discovering what options they had to organise their teaching and what seemed to be working for their class. As the basic practical issues were taken care of (e.g. checking that all pupils had access to the online learning environment), all the teachers discovered that giving assignments for the day worked the best. The daily assignment list provided the backbone for each school day and helped to form a rhythm. Some had online teaching sessions and online meetings for doing the assignments together, but in most cases, the pupils could do the assignments independently as long as they returned them during the day. There was some variety in how the assignments were provided. For example, Ann_2ndGrade gave the assignment list

via Drive together with a instruction video, but most found the Qridi's task list tool to be enough. Ann_2ndGrade stated, "*We had this kind of plan for a day. I showed it always in the morning video and explained it. I wrote it like a summary. Since they were accustomed to having symbols [in the timetable], that now we have mother tongue and now mathematics ... It suited them that there was a plan for every day that they could follow according to their own schedule at home.*"

Having **versatility** in the teaching methods was a struggle for some of the teachers. On the one hand, the remote situation opened up new kinds of opportunities, while some methods were hard to fit to the new situation. The teachers could make use of the technology to create new types of assignments, as well as teach in different ways. Some began making and using teaching videos and utilising a bigger variety of online learning materials and services. Liz_4thGrade gave an example of technology-oriented assignments: "*We had all kinds of vlogging assignments. Many of the ones who don't normally blow their own horns turned out to be quite the vlogging personalities when they sent their videos. Also, these kind of great traits would be nice to bring up also in the contact teaching. And use a similar type of assignments.*" On the downside, interactive contact teaching did not seem to easily transfer to the remote setting, although the new means compensated for this to some extent.

4.2. Supporting pupils' learning process

For all the interviewed teachers, it was important to **support** and help each of their pupils as much as reasonably possible. This could be seen from the various actions the teachers described. For example, they mentioned that it was important for them to be easily approachable and to closely monitor each of their pupils' progress to notice immediately if anyone needed help. As John_3rdGrade put it: "*In practice, it went like I had Teams open or I had the computer open at home while I did something, and all the time somebody called to ask what to do with this [assignment] and what I should put here, etc.*" The technological learning environment affected and, in some instances, determined the ways the teachers were able to support their pupils.

Being in charge of the pupils' learning process was found to be an important value for the teachers. To achieve this, they needed to know what their pupils were doing. As Jenna_Subject explained: "*After all, I think that is one of the most important things, that it is somehow visible what the pupil has done. Since if the pupil does the assignments at home, you don't see it.*" The teachers explained that they aimed to monitor each pupil's learning progress as well as their overall coping during the remote teaching. There were many different methods for monitoring the learning processes depending on the age of the pupils and the subject. For example, some teachers checked and assessed every assignment the pupils returned, while some checked only certain assignments. Teaching remotely greatly affected the workload, which the assignment checking increased even further despite the tools digital educational tools offered. The teachers described that Qridi's assignment tool was useful in showing at one glance all the returned assignments and how the pupils perceived their difficulty. From this tool, the teachers could relatively easily notice the pupils who needed help. However, monitoring each pupil individually became much harder when the class size was bigger and the amount of assignments grew. In certain subjects, such as mathematics, the pupils could assess their own answers by comparing them to the correct ones given by the teacher. In those cases, the teachers perceived the pupils as mature and trustworthy enough not to need close monitoring. As Jenna_Subject described: "*You could see it from the returned assignments in Qridi. As an example one pupil commented, simply that they didn't understand at all the assignment and did not return anything at that time. With Qridi you could see quite clearly how things were understood. You could say that, at least in my case, I had a much better picture about how each [pupil] understood the subject area than in contact teaching.*"

The teachers valued **reinforcing self-management** skills supporting pupils to take greater responsibility for their own learning process compared to classroom teaching. In fact, all of the interviewed teachers promoted self-management skills, e.g. by giving the pupils more freedom to do the school assignments according to their own schedules. For example, regarding

her 1st graders, Marge_1stGrade described: "*It suited them that the daily instructions were there and they followed them according their own schedule.*" In a similar manner, Paul_Subject explained how he perceived his high school pupils: "*I think they like doing those daily assignments on their own more than being there with the whole class.*"

The teachers took into **account the pupils' individual needs**. Technology proved useful in supporting these individual needs, since the learning progress became more visible. The teachers could be in contact with each individually to help understand an assignment or a topic or by arranging daily online meetings for them to do the assignments together. They also offered additional assignments and (online) learning material for those who wanted to do more. Some teachers, however, faced challenges in this respect, as the use of technology was not always straightforward. As Marge_1stGrade explained: "*I knew that there were those extra assignments, but I sweated for two days before I found them and another two days about how to attach them to our class's assignment lists [via Qridi].*"

With the younger pupils especially, the teachers had to pay attention to their still evolving reading and writing skills. For instance, the written instructions for the daily assignments needed to be very clear and appealing. As Marge_1stGrade put it: "*For the first graders, it was not enough to refer them to the ABC book page 127 and the assignments from page 52. No, instead I took into account their imperfect reading skills and wrote, for example, that 'today we will visit the Rinkelimäki swimming hall and swim race and read how Tarmo races and what Lempi does'. I was pleased that you could use different colours; for example, the homework pages were always in red, and I tried to indicate this so the ones with poorer reading skills would know they need to check the red ones.*" It also helped to have pre-recorded videos or online meetings to explain the assignments in addition to the written instructions. The instructions for the assignments had to be very clearly phrased also for the older pupils to decrease the amount of misunderstandings. Some teachers utilised joint online meetings for doing the assignments at the same time so the pupils could easily ask for help.

In many cases, however, it was practically impossible to find a time which would suit the whole class, since the situations at home varied: for instance, many pupils did not have their own device to bring to the online meetings but had to share it with their siblings or parents.

4.3. Utilising interaction

The teachers highlighted interaction as an essential part of the classroom activities. Marge_1stGrade described the significance of interaction: "*I must say that the interaction, which is rewarding also for the teachers, was almost completely absent, and it made this spring hard.*" Close interaction between teachers and pupils was important especially in the lower grades but important also in the higher grades, although the type of interaction varied. Transferring to the remote mode had a huge impact on the interaction on many levels, revealing the related values. There were several objectives to the interaction, but they all related to supporting pupils.

One of the challenges was to maintain and **promote a sense of belonging**. As everyone interacted only via technology, a big part of the usual daily interaction was missing. The technological environment did not seem to encourage the feeling of belonging to a team, but the teachers were able come up with new practices to increase the sense of communality. Actions such as making time for informal interaction, forming smaller groups for easier interaction, and being in contact with each pupil helped to increase the sense of belonging. However, there was still room for improvement. As Ann_2ndGrade put it: "*Maybe, in thinking about Qridi, the environment could be developed to be more communal, more interactive. It is quite dismal.*"

Some teachers faced challenges in organising common online classes due to scheduling problems but also due to the technology itself. Some teachers were able to utilise the video conferencing tools successfully, whereas some found those hindering their teaching: the teaching became more a lecturing type of teaching, whereas in class it had been more active and participatory. Thus, they wanted to find ways to **promote active participation**. On a positive node, a few teachers noticed that the normally quiet pupils were more eager to comment when

they could do it via chat. But even the chat, video, and audio communication possibilities did not seem to fully compensate for the loss of classroom interaction. Some teachers found it beneficial to divide the class into smaller groups. As Liz_4thGrade explained: "*Yes, it was quite a lecturing type of teaching. Also, the pupils just did the assignments and returned them. It was quite monotonous and one-sided. Maybe there was a little development when I took a small group at a time, and at least there was some discussion.*"

The switch to the remote learning mode and the decreased time spent together also affected the amount of **informal and spontaneous interaction**. Especially the teachers with younger pupils mentioned how the remote learning period affected informal interaction. According to the teachers, informal interaction has many benefits, such as strengthening team spirit and bringing joy to the school experience. Although the teachers and pupils knew each other before the remote period started, their interaction was not immediately as close when it occurred via technology. To encourage informal communication, some teachers organised non-teaching related activities., like Ann_2ndGrade who had twice-a-week online group meetings: "*They were very light. Not so much about teaching, since we had separate teaching videos, where we taught, for example, math and the mother language ... They were mainly for seeing classmates and their teacher and being able to share news. Once we had a joke meeting, where someone could tell a joke if they wanted to.*"

In addition, having direct **contact with the parents** was a topic that almost all the teachers highlighted. As Cristy_2ndGrade explained: "*I called my pupils' parents regularly, and they spoke to me quite openly and revealed what had been challenging.*" Usually, the communication with the parents happened via the same multiple channels as with the pupils.

4.4. Interaction form

In addition to the teachers' objectives for interaction, some identified that interaction values were related to the form of interaction. Technology plays a huge role in how those values were realised.

One the main values regarding interaction in our study was for the teachers **to be available** and easily reachable not just by the pupils but also, in many cases, by the parents. Teachers made sure there were multiple ways to contact them, such as via SMSs, messages via a phone application, voice calling, video calling, and leaving comments when returning assignments. Technology made it possible to use a variety of simultaneous channels, which was one of the positive aspects of the challenging situation. As Liz_4thGrade described: "*Pupils mostly asked via WhatsApp when they encountered problems with an assignment, but some used Teams. They knew how to call with Teams and asked questions through it.*"

The teachers also wanted **to respond quickly**. They could reply to messages and give feedback also in the evenings and on weekends, as some pupils preferred to do their schoolwork only when their parents were home. Marge_1stGrade described her reasons for giving feedback to her pupils as soon as possible even though that often-meant long workdays, sometimes over 12 hours: "*I couldn't limit it, since I thought the kids needed the feedback right away. So, I tried to give it immediately, and I tired myself physically and mentally.*"

The teachers also valued having a personal/individual **connection with each pupil**. Some had regular calls or chats with the pupils, while some contacted a pupil if there was any sign of their needing support. As mentioned, the teachers monitored the pupils' learning activities and responded if the assignments were late or the answers were not as expected. With the remote connection tools, the teachers felt it was easy to make a (video) call or send a message to a certain pupil. However, there were cases where the teachers felt that the remote interaction was not always enough. In such situations, the teachers might ask the pupil to meet face-to-face, as Paul_Subject did: "*Last week I asked a couple of the pupils to visit the school. They had an important deadline coming, and there were some problems working independently at home or some motivation issues, so I asked them to come to the school for a short time.*"

Naturally, the contact with the pupils revealed how they were doing, but the teachers also utilised their own instincts and paid attention to **the non-**

verbal signs. For instance, if the pupils did not respond to the messages from teachers or returned their assignments late, if at all, the teacher could infer that something was off. Although, for example, Qridi's assignment list tool provided an overall view of each pupil's assignments, there was also a need for other ways to easily see the pupils' actions. Marge_1stGrade suggested a useful feature: "*One thing I missed in Qridi was, like in WhatsApp, one can see if the recipient has read the message. I would have liked to have that kind of feature to know if they have seen it [feedback] or not.*" Regardless of the various ways to monitor pupils' learning progress via technology, in the end, the teachers could not always be fully confident about the pupils' level of knowledge. For example, Cristy_2ndGrade had some doubts: "*I saw their learning [from how they returned their assignments], but when we got back to contact teaching, I wondered if the kid had actually done those assignments themselves. The competence at the end of May was not quite what could be expected based on the assignments in Qridi*

5. Discussion

The results of this study indicate that several values affected teachers' actions and choices during the remote learning period. The identified values and their meaning in the context help in understanding the different needs in using remote learning technology. The values were categorised into two main themes: learning process and interaction. These categories were considered important areas that might affected when switching from the classroom to remote learning.

In previous studies, primary school teachers had concerns about remote learning and felt that the lack of technological skills might negatively affect the learning progress [25]. According to our findings, however, the teachers were able to utilise technology successfully during the remote learning period in spring 2020, especially when taking into account how little time they had to prepare for the change from classroom learning. The ability to utilise different digital tools and pedagogical methods shows that Finnish teachers can be versatile when there is a need to make adjustments. However, according to the interviews, not many teachers had explored these learning technology options before the pandemic. Quite likely this is soothing finding overall for

education technology designers. Currently tools that are available appears to be useful and relatively easy to use. Our findings point to a direction that current bottlenecks for large scale remote teaching are lack of ICT devices and different situations at homes.

For all the teachers merely surviving the remote period was not enough, but they strived to uphold their values even when it made their work more burdensome. The teachers cared about their pupils and supported them and their learning in many ways, which is in line with [14]. By establishing a daily and weekly rhythm, they provided predictability and a sense of security for their pupils in an otherwise chaotic situation. At the same time, however, the teachers utilised versatile methods to keep the learning interesting and found suitable methods for presenting different topics and subjects. For education technology designers offering pedagogical tools for the teachers to describe the learning process and its goals clearly should be the core of the development.

One of the themes mentioned most often in our study was monitoring the pupils' learning progress and their overall coping in order to offer them suitable support. Monitoring was mentioned as one of the concerns of teachers regarding remote teaching during the COVID-19 pandemic [27]. Monitoring, and especially visualising the pupils' actions, were crucial features the technology (e.g. Qridi) offered, but there was room for improvement. Monitoring each pupil's progress (e.g. returning assignments and perceived difficulty) individually but also being able to see the whole class's performance at once gave important information to the teachers to make pedagogical decisions. Monitoring enabled them to be in charge of the learning process, but it also helped in reinforcing pupils' self-management skills and acknowledging their different needs. For education technology designers this value opens new possibilities, where more sophisticated analytical tools utilizing e.g., artificial intelligence could be used. Especially need for better visualization tools is evident according to our results.

Not surprisingly, some of the teaching methods used in classroom teaching could not be used the same way in remote learning. Some studies have also found the limited teaching methods available when teaching remotely as a concern [25, 27]. The pupils' different situations at home complicated things further. For instance, the teachers could not always organise online

teaching sessions due to the pupils' lack of access to devices. The same problem was reported by [27]. Overall, the teachers had to make many compromises and, at times, change their former methods drastically to adjust to the remote environment. From a system developer's point of view, teachers should be experts in the context they are systematising. However, as this study shows, teachers should not be tied too much to a specific process or pedagogical model. Certain school subjects are more complicated to systemise than others. Thus, the flexibility and versatility of education technology will allow the teachers to use and develop their preferred methods without restricting their decisions before they could even make them.

The change to remote learning had a significant effect on interaction. In our study, the teachers found it highly important to promote a sense of belonging, encourage pupils' active participation, and enable informal interaction. They also wanted to be available and respond promptly when a pupil needed help, as well as to involve parents. In addition, connecting with each pupil individually was highlighted. However, in earlier studies, teachers reported their concerns about the difficulties in reaching all the pupils and knowing if they understood the issues and instructions when interacting remotely [27]. In our study, realising all the interaction values proved challenging. The teachers compensated for the lack of in-class interaction by having multiple means for interaction and incorporating informal conversations. However, there is a need to develop the means in remote learning to allow versatile interaction. The teachers not only relied on verbal communication but also utilised non-verbal communication to the extent the technology enabled. Interacting via technology, whether using video, voice or text differs vastly from face-to-face interaction as there is remarkable less non-verbal signs and thus big part of human interaction is missing. The teachers could not read e.g., facial impressions to know if the pupils understood the issue or instructions. Additionally, even when the pupils were present and had the video on, interpreting facial expressions from tens of pupils through a relatively small screen was hard. To education technology developers this brings extremely big challenge. On one hand technology is mature enough to give deeper analytical tools for the teacher, but it also brings big privacy concerns. Technology can study facial expressions, it can recognize voice, way of typing is personal. When

a pupil is being bored and almost falling asleep it is relatively easy to recognize in a classroom, but it is not impossible to do with the technology either.

Using education technology does not mean that everything must happen online. Most likely, tools that are able to work in a hybrid mode, combining classroom and digital teaching, would contribute to potential success stories. For example, the clear visualisation of the learning progress of each pupil and the classes as a whole would help teachers to modify their teaching further in this context.

6. Conclusions

According to our findings, the teachers were able to utilise education technology successfully during the remote learning period in spring 2020, especially when taking into account how little time they had to prepare for the change. Following our results, the ICT skills of pupils and teachers appear to be more than adequate, and the teachers were satisfied with pupils' learning and progress, although in some cases after returning to the classroom some pupils had learned less than anticipated.

However, the monitoring and visualisation of the pupils' learning progress and overall coping need to be developed. More advanced monitoring would make the teachers but also pupils more aware of the learning progress and the possible challenges. There is also a need to support various teaching and learning methods more comprehensively to give teachers more freedom to choose the methods they see most suitable. Now the teachers had to make many compromises with teaching methods and prioritize some school subjects over others as some were too challenging to teach remotely.

In addition, attention should be put also into developing versatile interaction means to serve the various needs better. Although in spring 2020 the technology made it already possible to use different means to interact, the interaction was not at the same level as it is in classrooms and a big part of human interaction was missing.

Value analysis was beneficial in creating a more profound understanding of the teachers' needs for remote learning technology. A deeper understanding helps education technology designers to design better and more suitable solutions in the future. However, further studies are needed to identify more context-related

values. Future studies will help to create a more comprehensive picture of the teachers' relevant values and needs, as in this study, the values were not the focus of the interviews but were used as an analysis method. It is also necessary to study other relevant stakeholders, such as pupils and their parents, and take into account other issues such as cultural differences.

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