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A qualitative study in Denmark

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ABSTRACT

Background: This study explores expectations for telepresence robots as a tool to reduce absence in education as school absence negatively influences children's academic advancement and psychosocial wellbeing.
Design: A qualitative semi-structured interview study.
Method and population: Using convenience sampling, we interviewed 11 children aged 8–17 years with cancer (n = 4), neuromuscular diseases (n = 3) or anxiety (n = 4) who had a high level of school absence (more than 15 days' absence in a school year), and who had recently encountered a telepresence robot; and eight of their teachers. A thematical analysis and a deductive approach based on the theory of Technological frames were used.
Results: The children's and teachers' expectations of how telepresence robots could support them in reducing their school absence were identified and structured in three categories and five main themes: 1) Nature of technology: a) Learning, b) Sociality, c) Additional supportive resources; 2) Technology strategy: a) Flexible school day; 3) Technology in use: a) New workflows.
Conclusion: This study indicates that implementation requires additional resources from teachers. Children with disease-related school absence and their teachers expect telepresence robots to reconnect the children socially, by maintaining or creating new friendships, and academically, by fostering inclusion and reducing absence.

1. Introduction

School absence could be countered by using telepresence robots for children with chronic illnesses or school refusal (Newhart et al., 2016; Page et al., 2020; Weibel et al., 2020). Not attending school can lead to educational and social setbacks and is a key trigger for school disengagement (Lum et al., 2017; Martinez-Santos et al., 2021; Maslow et al., 2011). Technological improvement has enabled homebound children to connect to their schools despite being physically absent (Fletcher et al.,

2023; Newhart et al., 2016; Page et al., 2020; Vetere et al., 2012). Traditional video conference services offer communication only via a monitor screen (Tanaka et al., 2013). Telepresence robots can be a computer-, tablet- or smartphone-controlled robot equipped with a microphone, monitor, camera, and speaker, allowing the physically absent child to interact in the classroom. Compared to other video conference platforms, e.g., Skype, Teams or Zoom, telepresence robots enable children to control an anthropomorphic body in school and remain physically embodied and socially connected (Johannessen et al.,

2022; Kristoffersson et al., 2013; Page et al., 2020; Schouten et al., 2022). Research further suggests that telepresence robots offer more social presence due to the personification of the robot (Ahumada-Newhart & Eccles, 2020; Schouten et al., 2022). In school, classmates and teachers call the telepresence robot by the child's name, dress it up, and classmates treat it as a living thing (Newhart et al., 2016; Weibel et al., 2020). The research proposes that telepresence robots can establish access to education and create a connection with the child's school environment (Lister, 2020; Page et al., 2020; Powell et al., 2021; Soares et al., 2017). However, research on this area mainly consists of small-scale explorations studies (Fletcher et al., 2023; Page et al., 2020).

School absenteeism is intricately linked to numerous disease groups, including cancer, neuromuscular diseases, and anxiety with differing absence patterns in education (Tomberli & Ciucci, 2021). Children with cancer have up to 40% absence, caused by the disease or the 1–2 years treatment accompanied by frequent hospitalizations and treatment-related side effects (Charlton et al., 1991; Helms et al., 2016; Sandeberg et al., 2008). At school reentry and the following years, 50% of children with cancer experience psychosocial or school-related problems (Beeman & Henderson, 2012; Boonen & Petry, 2012; Helms et al., 2016). Children with neuromuscular diseases have a more dispersed pattern of absence, with 2–4 days' absence per month during their entire education span due to their chronic diseases where symptoms, such as fatigue and pain, are part of their everyday lives (Andrews & Wahl, 2018). Children with anxiety-related school absenteeism try to avoid negative emotions triggered by school and social situations, leading to increased school absence or even school refusal (Dannow et al., 2020; Inglés et al., 2015).

Implementing a telepresence robot in school involves stakeholders, e.g., healthcare professionals, teachers, parents, school leaders, and children (Ahumada-Newhart & Olson, 2019). A prerequisite for the successful use of telepresence robots is an alignment of expectations, prior to implementation, of what the technology can deliver as a social or academic tool because unclear expectations can result in disappointment for both children and teachers (Weibel et al., 2020). Therefore, it is essential to explore expectations for telepresence robots as a social and educational tool for children with cancer, neuromuscular diseases, and anxiety.

2. Theoretical background

To adopt new technology, people use their cognitive structure to comprehend the technology (Scott & Barrett, 2005). The cognitive structure or frames that people have around technology create meaning for their expectations, knowledge, and assumptions regarding the new technology (Orlikowski & Gash, 1994). In this study, we examine expectations of telepresence robots through the theory of Technological frames, which clarifies how different groups using the same technology can have different understandings and different strategies regarding its use; accordingly, the groups' expectations differ regarding how to use the technology and the problems it should solve (Orlikowski & Gash, 1994; Spieth et al., 2021). Orlikowski and Gash (1994) divide Technological frames into three main categories: 1) Nature of technology: referring to the function and understanding of the new technology, including the importance of how the users comprehend the concept of the new technology for it to be a success; 2) Technology strategy: capturing the organizational goals for the impact of the new technology and referring to the strategy for technology use; and 3) Technology in use: the understanding of how the technology is used and changes the daily work (Orlikowski & Gash, 1994). With this, Orlikowski and Gash (1994) use the theory of Technological frames to describe how people make sense of technology and their mutual understanding. Nevertheless, technology understanding can change over time and through social interactions (Olesen, 2014; Orlikowski & Gash, 1994). From a Technological frames approach, expectations of new technology, such as telepresence robots, may differ among different groups. In this study, we

use the theory of Technological frames to understand children's and teachers' expectations of telepresence robots as a tool to reduce school absence across different patterns of absence.

3. Aim

The study aimed to explore [1] the expectations of children with a high level of absenteeism as well as [2] teachers' expectations regarding telepresence robot solutions as a means of reducing school absence.

4. Methods

4.1. Study design

The study had a qualitative design and used a thematic analysis and a deductive approach based on the theory of Technological frames (Braun & Clarke, 2019; Orlikowski & Gash, 1994). The analysis and interview guide were inspired by the theory of Technological frames, and the results are presented reflecting this analytical approach (Braun & Clarke, 2019; Orlikowski & Gash, 1994). The COREQ checklist for reporting qualitative research was followed (Tong et al., 2007).

4.2. Telepresence robots

In this study, the following types of telepresence robots were used: AV1©, Fable Connect©, GoBe Robots© and OriHime, as illustrated in Fig. 1.

4.3. The implementation process

The implementation process of the telepresence robots for children who participated in the study is shown in Table 1. It consists of oral and written information about the project alongside technology presentations for children, parents, teachers, and classmates.

4.4. Participants and context

This study was conducted from January 2020 through July 2021. Children newly diagnosed with cancer were offered a telepresence robot at the University Hospital of Copenhagen (Rigshospitalet). Children with neuromuscular diseases applied to access a robot through the muscular diseases' foundation. The National Association for Mental Illness (SIND) selected children with anxiety who applied through email. Based on convenience sampling, the inclusion criteria for this study were: 1) school-aged children (5–17 years); 2) a diagnosis of cancer, neuromuscular disease, or anxiety; 3) a high level of school absence (more than 15 days' absence in a school year); 4) a maximum of 1–2 weeks' telepresence-robot experience. A sampling criterion for the study was that children from all three diagnostic groups were represented. Exclusion criteria were inability to speak Danish or cognitive disorder.

4.5. Data collection

We conducted 11 face-to-face semi-structured interviews in the homes of school-aged children with the following characteristics: cancer (n = 4), neuromuscular diseases (n = 3), or anxiety (n = 4). We conducted eight interviews in the classroom with the children's teachers. Due to COVID-19 school restrictions, three teachers could not be interviewed. Further details of the participants' characteristics are shown in Table 2.

The interview guides were inspired by the theory of Technological frames' three main categories (Nielsen et al., 2016; Orlikowski & Gash, 1994) and guided by a semi-structured approach that included open-ended questions. Examples of interview questions are shown in Table 3. The participants were interviewed during January 2020–July 2021 by the first authors, MW & SS, and the author NCS. The interviews

The Telepresence robots

	AV1	Fable Connect	OriHime	GoBe
One-way camera	Yes	No	Yes	No
Two-way camera	No	Yes	No	Yes
Face screen	No	Yes	No	Yes
Two-way auditive communications channel	Yes	Yes	Yes	Yes
Drive	No	Yes	No	Yes
Rotate	Yes	Yes	No	Yes
Battery life	8 hours	6 hours	6 hours	8 hours
Speakers	Yes	Yes	Yes	Yes
Eyes that show emotions	Yes	Yes	No	No
Raise a hand function	Yes	Yes	Yes	No
Admin, assistant and user app	Yes	No	Yes	Yes

Fig. 1. Functionalities of AV1, Fable Connect, OriHime and GoBe telepresence robots.

Tables 1
Decription of the implmentation process.

1:Oral and written information	Children and their parents received oral and written information about the study before participation.
2:Technology information	A telepresence robot and iPad/tablet were given to the child.
3:Implementation in school classes	MW, SS or NCS implemented the telepresence robot in the child's class. The implementation consisted of oral and written information about the study for teachers, classmates and their parents and technical information about the telepresence robot. Further, we talked to the classmates about how to be a good friend to a child who uses a telepresence robot to reduce school absences.
4:Ongoing contact	We had ongoing contact with teachers and the family if questions arose about technical issues, ethical questions or if they merely wished to discuss a practical or educational situation.

were conducted after the children had accepted participation in this study but had only had a maximum of 1–2 weeks of experience with the telepresence robot. At this point, the children had not gained experience in whether the robot could solve the problem they wished it to solve.

The semi-structured interviews allowed the interviewers to ask further questions for elaboration of specific topics, if necessary. Open-ended questions were used to ensure the participants reflected on their experiences (Tanggaard & Brinkmann, 2020, pp. 33–64). The length of the interviews varied between 15 and 30 min. The interviews were audio-recorded and transcribed verbatim. All data were analyzed using the software program NVivo12.

4.6. Data analysis

The theory of Technological frames inspired the exploration of children's and teachers' expectations regarding telepresence robots in school settings. We used the concepts of Technological frames and the three categories: 1) Nature of technology, 2) Technology strategy and 3) Technology in use, as a structure for the interview guides to analyze and discuss the results (Orlikowski & Gash, 1994). The division of the three frames is not entirely rigorous as some of the understanding will overlap and the given artefact may change over time.

The data were analyzed using thematic analysis (Braun & Clarke, 2019). The analyses were deductive (Braun & Clarke, 2006) and divided into six steps. 1) The analysis started by coding our recorded and transcribed interviews in Nvivo20.2) The first authors, MW and SS, read the transcripts until they gained an in-depth understanding of the content. 3) Then MW, SS, and HBL discussed and agreed code definitions. 4) Then, MW, SS and HBL placed the phenomenon (expectations regarding the telepresence robots) in a new theoretical context, Technological frames, to better understand the phenomenon. Expectations and understandings of the telepresence robots were grouped into three main categories. 5) Next, the authors defined and (re) named subthemes. 6) The analyses stopped when the authors experienced nuanced descriptions of the research questions. In the analysis, children were considered one group, but the variation in their expectations regarding the telepresence robots was explored across diagnoses. Technological frames was used to analyze data to explore the users' understanding and sense-making of the telepresence robot (Orlikowski & Gash, 1994).

5. Ethics

This study was assessed by the Regional Ethics Committee of the

Table 2
Description of participant.

Children	N = 11
Sex	n (%)
Female	6 (55)
Male	5 (45)
Age	Median (range)
Age at interview	12.5 (8–17)
Diagnosis	n (%)
Cancer	4 (36)
Neuromuscular diseases	3 (27)
Anxiety	4 (36)
Teachers	n = 8
Sex	
Female	4 (50)
Male	4 (50)
Diagnosis of child in the teacher's class	n (%)
Cancer	4 (50)
Neuromuscular diseases	1 (13)
Anxiety	3 (37)
Telepresence robots	N = 11
AV1 users	3 (27)
Cancer	2
Neuromuscular diseases	1
Fable Connect users	6 (55)
Cancer	2
Anxiety	4
OriHime users	1 (9)
Neuromuscular diseases	1
GoBe users	1 (9)
Neuromuscular diseases	1

Table 3
Examples of interview questions in the interview guide.

Theory of Technology Frames	Children	Teachers
Frame 1: Nature of technology Referring to the function and understanding of technology.	*"What do you expect a telepresence robot can support you with in school?"*	*"How can a telepresence robot support sick children?*
Frame 2: Technology strategy	*"When was the last time you went to school physical?"*	*"Have you made any special agreements with the child and her/his family about how she/he should participate in the teaching through her telepresence?"*
The organizational goals for the impact of technology	*"Do you receive teaching in any other way than through the telepresence robot?"*	
Frame 3: Technology in use Referring to the understanding of how technology is used and changes daily work	*"How do you expect the telepresence robot to be used in teaching situation?"*	*"Do you expect that the telepresence robot intervention requires something extra of you as a teacher? Why/why not and how?"*

Capital Region (file. H-19008107), the Regional Ethics Committee of the Central Jutland Region (File.H-1-10-72-274-21) and the Danish Data Protection Agency for collecting data (VD-2019-276). All participants (parents for children under 15 years) provided written informed consent before participation in the interviews and all personal information was treated with confidentiality. All participants had the opportunity to withdraw their consent. Further, we used the principles outlined in the Declaration of Helsinki II.

6. Results

The analysis resulted in three categories from Technological frames and five subthemes were identified: 1) Nature of technology: a) Learning, b) Sociality, c) Additional supportive resources; 2) Technology strategy: a) Flexible school day; 3) Technology in use: a) New workflows. The three categories gave insight into the expectations of the children and their teachers regarding the telepresence robot as a solution to reduce school absenteeism.

Common for all children in the study was that they could not participate physically in their school education due to school refusal, hospitalization, adverse treatment effects, consequences of their chronic illness or isolation because of the COVID-19 pandemic. All children were enrolled in schools that were not closed due to the COVID-19 pandemic at the time of this study. The period of absence varied from between 3 and 12 months to a dispersed pattern of absence throughout their education. However, the four children with anxiety had not regularly attended school for a year. All children were expected to have a continued high level of absence. Most children reported not receiving any home instruction during their absence period; those who had, described it as a few hours per week where a teacher had visited their home.

6.1. Theme 1: nature of technology

6.1.1. Learning

Children expected that telepresence robots could be used as a learning tool that might establish access to education and connectedness to the teaching environment in their school classes. Children described how they expected the telepresence robot to maintain academic skills:

"So, I can learn something." (Child with anxiety).

"So, I can be a little bit more involved (..) and not miss homework and stuff like that." (Child with cancer)

"One thing is the teaching, another is hearing and feeling the classroom's noise and life and just seeing them [classmates] "(Child with neuromuscular disease)

Repeatedly in the interview the children described how they expected to participate in courses such as mathematics and Danish as these are courses with the most 'board' teaching. Most children saw it as unrealistic to participate in courses that require physical activity such as sports and science. Although the children with anxiety feared being physically in school, they described telepresence-robot participation as being something different. Moreover, they reported they would like to participate in group work and do presentations via the telepresence robot.

Teachers were also positive toward telepresence robots as a learning tool:

"I think the telepresence robot has value for the academic part. (..) If you have followed some of the teaching via the robot, then you might be a step nearer to physically getting back to school." (Teacher of a child with anxiety)

They expected the child could learn when they follow visual teaching via the technology, making it easier to return to school.

6.1.2. Sociality

The children were enthusiastic about the telepresence robot being a promising tool to help them be more present at school. They described how their absence had created a distance from school, which led to a feeling of loneliness or alienation. The children had positive expectations of the new technology as a social tool that could support them in staying connected with their school and peers, as one child with cancer

described:

> "I thought the telepresence robot sounded interesting and it's a good way to be with my friends and still be a part of the social life in the class instead of being in hospital all the time." (Child with cancer)

And as one child with a neuromuscular disease described:

> "If I didn't have the robot, I wouldn't be able to be with them [classmates]. I'd be socially distanced and feeling alone. They are together in the classroom, and I'm not there." (Child with neuromuscular disease).

Children with anxiety also focused on the social aspect of the telepresence robot and emphasized the importance of creating new friendships, of becoming reacquainted with school, and of being present in the classroom. One child described:

> "So, I can get to know the school better. To me it doesn't matter which lesson it is, just that I'm still in the classroom."(Child with anxiety)

There were different expectations of which social elements the telepresence robots would promote: creating inclusion, maintaining friendship, or avoiding isolation or marginalization.

Similarly, teachers expected the telepresence robot to help the child reconnect with the class community. One teacher explained:

> "I think it will be very good for her to have some contact with her peers. (..) So she can see and be part of what's going on [in the school] and not miss out on more teaching than she already has." (Teacher of a child with cancer)

The teachers talked about the importance of children being connected with peers during their period of absence to support their psychosocial development.

> "I really hope it'll be a success, that she can get a bit more connection with the class and that it can help her to get to school more. And that she can feel she knows what's going on during the teaching, so she won't be prevented from showing up because she doesn't know what happened the day before." (Teacher of a child with anxiety)

Teachers described telepresence robots as a tool to help children understand the teaching situation in the class, which may support them in returning to physical attendance.

6.1.3. Additional supportive resources

The teachers expected the telepresence robots to require something additional resources of them. They described how they expected a need for them to be both technology experts and expert users of the robots, which in turn would require additional resources to integrate the technology in the teaching. The teachers expected to shift from face-to-face learning to blended learning when implementing and using the robots. They explained that using the technology would require additional coordination between school and home, including emails/text messages and scanning educational materials so the child could follow the courses from home.

> "Because I would have to scan things and papers every day, which I wouldn't do otherwise, and send emails and stuff. Almost daily (..) It means that both us teachers and the parents must cooperate on getting the right material for every lesson. (Teacher of a child with cancer)

Some teachers described the need for tight structuring around the use of telepresence robots. Structuring is necessary for clear guidelines on how to use telepresence robots in the teaching, agreements about when the child will be connected, in which classes, and for how many hours per week the child can use the telepresence robot:

> "(..)there is a need for very tight control around the telepresence robot project

> And perhaps plan and agree on it with the person responsible in the hospital and … then we can have a schedule and say: 'this is the time when you're on', right?"

(Teacher of a child with cancer)

For other teachers, structuring the use of the telepresence robot was less important at the start of the implementation process. They wanted to try and see how the new technology worked in practice and based on their experience find a way to structure its use in the classroom. The framework was learning-by-doing, as one teacher described it:

> "Until Easter, it will be like "trial and error", we try it out [the telepresence robot] and see how it works."(Teacher of a child with cancer)

Despite the teachers' concerns about the telepresence robot, they agreed to use it because of its potential to reconnect the child with the school. However, they were uncertain about what it required in their daily workflow. As one teacher explained:

> "I said yes because I thought it would be really good for him. I actually found it difficult to understand what it required of the teachers because I didn't really know what a telepresence robot involved, but that shouldn't stop him from being allowed to try it out." (Teacher of a child with cancer)

Regardless, the teachers were willing to include the children via the telepresence robot as it could make a difference to the child's social position in the class and academic performance. The technology represented a new solution to the problem of absence by potentially creating an opportunity to be present in the classroom with out being physically there.

6.2. Theme 2: technology strategy

6.2.1. Flexible school day

The teachers expressed that their main reason for including telepresence robots in education was to secure the opportunity for children with high levels of absence to participate in the teaching. Teachers believed the technology could supplement home instruction. They expected the telepresence robot to provide flexibility in the school environment because the children could shift between face-to-face (physical) learning and online learning depending on their illness period or well-being. The teachers thought the telepresence-robot solution created an opportunity and an advantage:

> "With the help of the robot she can decide herself: 'Can I follow the teaching from home? Have I got the necessary energy to join in?'(..) When she has been in school for two to three hours, her normal school day if we look back, she goes home because of tiredness. Then when she's sitting at home and has recharged, it could well be that she can manage to join in the teaching." (Teacher of a child with a neuromuscular disease)

Teachers expected the telepresence robot would be used when the child felt ready and could follow the teaching from the home or the hospital. Others highlighted the need for a plan regarding in what situations the child should participate via the technology. One teacher explained:

> "We have decided that we, the teachers, have the right to decide when the telepresence robot is turned on or off and in what teaching situations it makes sense for her to join in." (Teacher of a child with a neuromuscular disease)

Teachers expressed concerns about how the child could participate concurrently with their treatment or disease. They also described that it was not their task to decide whether the child was able to participate in the schooling if she/he did not feel well:

> "It depends on how she's feeling and how well she is. It seems now that she has such good help from her support person, they'll communicate a lot,

and then her support person will let us know each day how she's feeling."
(Teacher of a child with cancer).

The teachers explained that it was the children's (or their parents') decision whether they would participate. The children emphasized that they liked the flexibility the telepresence robot provided because it enabled them to join in school regularly, as one child with anxiety described:

"*There is a big difference from not being in school for weeks or months and then being able to be there all the time through the telepresence robot. It could be lovely. You're not missing out on social things that much.*" (Child with anxiety)

The children expected the telepresence robot to considerably minimize their days of absence as it allows flexibility in the illness period. The children liked having the option to participate despite not being physically present in school.

6.3. Theme 3: technology in use

6.3.1. New workflows

The teachers had different perspectives on how to organize the education and whether the telepresence robot would affect the school environment. They expected telepresence robot use to involve individualized teaching via the technology:

"*I have to be more aware that she's there. The others [classmates], if they don't get attention, they just get up and start tugging my arm or something like that.*" (Teacher of a child with cancer).

The teachers expected the new technology to necessitate new workflows and processes in their daily work. They expected to have the responsibility of taking the telepresence robot into the classroom, ensuring it was charged and ensuring the children were connected, regardless of having none to limited experiences with using the robot in a classroom setting. One teacher explained that technological experience is a key competence to gain:

"*The thing that is important is experience. Just as soon as we have some processes in place, when there is a child who needs to have a robot, we know the process. How do we manage the process of contact with the parents(..)? How should the teachers handle it so we have enough resources?*" (Teacher of child with a neuromuscular disease)

For some teachers the telepresence robot required time-consuming restructuring of the child's teaching. Others regarded it as a positive challenge to include the new technology in the teaching. In contrast, the children were less concerned about their own technical skills and the technological use of the robot. They were more concerned about how their presence via the telepresence robot would impact the class environment and about how their classmates would respond to the presence of the robot in the school and how they would handle it. The children also addressed practicalities such as where the telepresence robot would be placed in the classroom, which lessons they would attend, and how they would participate in group work or breaks.

7. Discussion

In this study, we report the expectations of teachers and children diagnosed with cancer, neuromuscular diseases, or anxiety regarding the use telepresence robots in school. Both teachers and children had positive expectations about the new technology being a social and academic tool to support children's integration in the school environment.

Overall, the children with a high level of absence focused on how telepresence robots could ensure inclusivity, both socially and academically. However, in relation to inclusion, the expectations across diagnostic groups varied from an opportunity of creating friendships to maintaining existing friendships. Children with anxiety expected the telepresence robot to create an entry to and a platform for developing new friendships, re-educating them to be in a school environment, and developing their social skills. Children with anxiety expected to eventually be able to return to school psychically and saw the telepresence robot as a steppingstone toward that goal. Current research has mainly focused on the use of telepresence robots for chronically ill children who are isolated and absent from school and lacks general perspectives from groups diagnosed with mental disorders (Page et al., 2020).

Children with cancer or neuromuscular diseases expected the telepresence robot could support them in staying connected with their peers and provide a feeling of presence in school. Similar findings found that children with chronic illness expected the telepresence robot to be a tool to allow them to be socially and academically connected with their school during treatment (Ahumada-Newhart & Olson, 2019; Weibel et al., 2020). In the present study, children and their teachers described telepresence robots as providing a unique opportunity to participate in the school environment and a means of creating an educational bridge between their home/hospital and school. The advantage of telepresence robots in school is the child's control of an anthropomorphic body, providing a visual presence. Depending on the telepresence robot type, the children can move it around the room, rotate it, make it raise a hand and make it show emotions (Beeman & Henderson, 2012; Kristoffersson et al., 2013; Schouten et al., 2022). Børsting and Culén (2016) stated that easier access to education via telepresence robots provides an opportunity to follow the teaching for children with chronic diseases. Similarly, Powell et al. (2021) showed that telepresence robots can effectively enhance learning and establish connectedness with academic tasks for children. The present study indicates the need for good communication, flexibility and structure around the telepresence robots used in school. Similar findings from Børsting & Cúlen (2016) and Newhart and Olson (2017) indicate that telepresence robots can support children's academic development but, nevertheless, a high level of coordination between the teachers and family is required. Newhart and Olson (2017) suggest that the school administrators must bring the parents and teachers together to create ground rules and define the responsibilities (Newhart & Olson, 2017).

The present study indicates that telepresence robots require new workflows and structures when implementing the technology in educational settings. Teachers' lack of prior experience fostered an expectation that telepresence robot implementation would require extensive resources. The teachers address the implementation process and how it will impact their teaching methods and the school environment. Teachers expected the robot to support the children's feeling of again being included in the school environment. However, they expressed uncertainties regarding the level of additional resources it might require. Also the study by Newhart and Olson (2017) found that teachers were apprehensive about using and integrating telepresence robots in education (Newhart & Olson, 2017). Furthermore, studies emphasize that it is essential that someone oversees the telepresence robot implementation, and the teachers are informed about the children's capabilities and schedule before they log on (Newhart & Olson, 2017; Schmucker et al., 2020). The teacher's willingness to address these issues related to telepresence robot use determines how well the technology will function (Børsting & Culén, 2016; Powell et al., 2021).

The teachers concerns related to teaching via a telepresence robot can be considered as concerns related to blended learning (a mix of online and face-to-face teaching) where the teacher must navigate between teaching activities in class and students being present online (Hodges et al., 2020). Teachers must manage two different forms of teaching simultaneously and think differently to generate solutions meeting all needs. This may influence their expectation of the additional resources the new technology requires.

The present study highlights the need for more knowledge about the organization around the technology. Specifically, the need for clear guidelines about responsibility and who to ask if there are questions about the implementation of telepresence robots (Newhart & Olson,

2017). Our study shows contrasting findings between the expectations regarding how to organize the telepresence robots in the teaching. Some teachers approached the inclusion of telepresence robots in the organization with a flexible attitude, while others needed structure and clear agreement on when and how to use the technology.

8. Strengths and limitations

In this study, we endeavored to have a varied sample size: different sexes, different ages, and different diagnoses to increase the likelihood of trustworthiness as we analyzed expectations regarding telepresence robots from the perspectives of children and their teachers. The children in the study had recently been introduced to telepresence robots, had a high level of absence, and had experience related to the study's aims.

A limitation can be the participants' motivation. Only children who were motivated to use telepresence robots were included; children who expressed no interest or who did not volunteer to use a telepresence robot were not included.

The interviews varied between 15 and 30 min, which can be considered as short in qualitative studies. During the interviews the interviewer was sensitive to the child's signals and ended the interview when the child showed signs of fatigue or lack of concentration. Children and their teachers were informed about the background and purpose of the project before the interviews. This information may have affected their expectations.

This study comprises children with different diagnoses and school absence patterns (Andrews & Wahl, 2018; Dannow et al., 2020; Helms et al., 2016). The result indicates that all three groups of children could benefit from using telepresence robots in school settings. However, more research is needed compared to participation patterns across the different groups of children to determine in what areas of socialization or education children benefit. The study is limited as we cannot say how the children fared and performed through the telepresence robots or whether their grades changed from before the telepresence robot implementation. We recommend that these aspects be addressed in future research.

Social isolation caused by chronic illness is not new (Newhart et al., 2016). However, the COVID-19 pandemic has heightened the demand for technological solutions and rethinking how to interact (Baskaran et al., 2022; Cacioppo et al., 2021; Kaelin et al., 2021). This study highlights the need to rethink how children with a high level of absenteeism can be included in school despite physical absence. From a prolonged perspective, telepresence robot implementation may reduce the risk of children having psychosocial and academic problems and reduce the need for extensive rehabilitation. This study showed how teachers were willing to use and include telepresence robots in teaching. The wake of the COVID-19 pandemic may have influenced the teachers' openness toward new technology, potentially affecting the study's results.

In this study, we tested telepresence robot technology in school settings. Telepresence costs considerably more than other video conferences technologies. However, research suggests that telepresence robots provide a stronger feeling of social presence and self-control (Kristoffersson et al., 2013; Schouten et al., 2022). This study was implemented in a high-income country, where the child's parents do not bear the cost of the telepresence robot. Therefore, the results may not be transferable to low-income countries. Research is needed to analyze the return on investment of implementing telepresence robots.

This study would have benefitted from the classmates' perspectives. Since we know from other studies that classmates are essential for the child's experience of social inclusion through telepresence robots, their perspective would have strengthened this study (Newhart et al., 2016; Weibel et al., 2020).

A limitation in relation to our use of the theory technological frames is that frame 1 (Nature of technology) is described more than frame 2 (Technology strategy) and 3 (Technology in use). This may be

influenced by the implementation strategy, which is still in an explorative stage in the school arena and because participants lack experience in how the new technology will eventually change their workflows. Technological frames 2 and 3 could be unfolded more (Orlikowski & Gash, 1994).

9. Conclusion

Children and their teachers had positive expectations regarding the new technology as being a flexible tool to support children with high absence in re-integrating in the school environment, both socially and academically. This study indicates that telepresence robot implementation requires additional supportive resources from the teachers such as establishing blending learning situations, new workflows in education and coordination between family and school. The organization around telepresence robots in school settings is lacking because the implementation process is still in an explorative stage. It is a simple technology, but it requires new workflows and structures in the organization and school environment. However, the teachers were willing to allocate the resources because they see potential in the new technology as a tool to reduce the high level of absences.

Further research is needed on how the telepresence robot can be a social and academic tool for children with high absence and guidelines are needed on using and organizing the technology in education environments.

Declarations of interest

None.

Data availability

The data that has been used is confidential.

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