

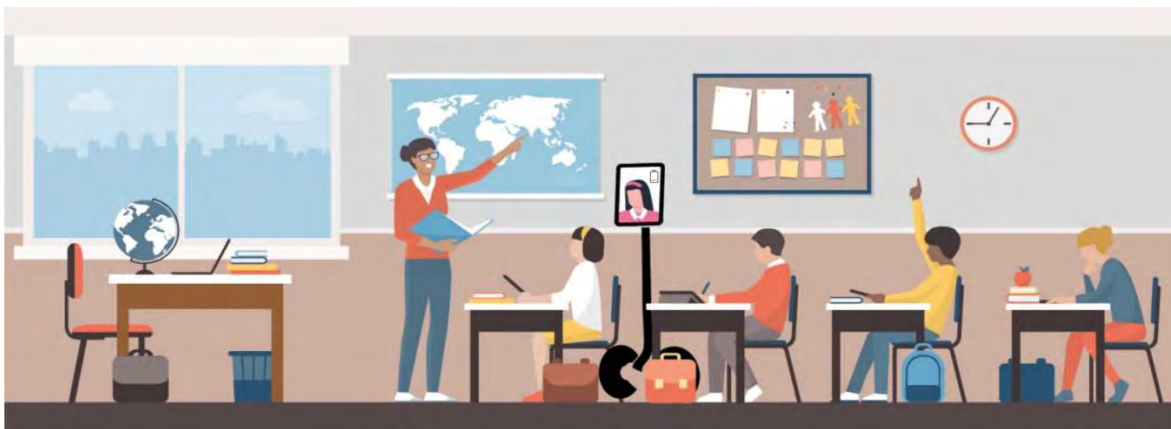


CASE STUDY OF INCLUSION - THE ROBOT IN THE CLASSROOM

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The Robot in the Classroom – A Case Study of Inclusion

This case study focuses on the deployment of a Double 2 telepresence robot at a secondary school in Hamburg, Germany, over a period of six-month where a student undergoing chemotherapy utilized the technology since she was unable to attend class in person due to health reasons. The major benefit of the case study was the integration/inclusion of the student in the classroom. Challenges such as internet connectivity issues, limitations in physical activities, and logistical hurdles in document exchange were identified. The analysis also shows that while the fellow students appreciated the telepresence robot's positive impact on class dynamics, they were not certain whether they would be willing to try the technology themselves.



Deployment in Hamburg: A Long-Term Exploration

Launched under Erasmus+, the InClass project embarked on an exploration of the practical application of the Double 2 telepresence robot. The initiative, initiated in 2022 by the Performance Institute at Leuphana University Lüneburg, specifically addressed the theme of fostering inclusion for health-challenged students within conventional classrooms. Over a period of six months, the project unfolded at a Hamburg secondary school, with a primary focus on supporting Lisa (not her real name), a 13 year old Grade 8 student undergoing chemotherapy.

Comprehensive Data Insights

Utilizing diverse data collection methodologies, including interviews with the student and her mother, classroom observation and a questionnaire study of the classmates' perception of the use of the robot, the case study provides valuable insights into the impact of the telepresence robot on students, teachers, and the broader school community.

Positive Integration and Collaborative Efforts

A notable outcome was the positive integration of the telepresence robot into the school setting. Actively supported by classmates, teachers, and the school principal, the project demonstrated a collaborative effort that seamlessly fused this innovative technology into daily school life. Lisa's sentiment, "It's as if I were there," captures the essence of the positive reception within the student body. Despite its success, some technological challenges, primarily related to connectivity in stairways and outer areas, were identified. Lisa's observation of initial technical challenges suggests the need for continuous improvement of telepresence robots for school contexts; however, she also makes clear that her experience is very positive overall. The only additional capabilities she was wishing for are to be able to drive faster in the hallways, and to be able to hang out in the breaks outside, which is currently not possible because the internet connection is often lost outside the building.

Lisa's mother also mentions that because of the robot, Lisa is now leading a normal life, getting up in the morning in time for class, has breakfast, connects to the robot, disappears in her room for the lessons, comes out again during the breaks, and disappears again for the next lesson. She states that 'it's as if she was going to school.'

Lisa mentions that her classmates have become a bit more quiet and considerate because they are afraid of being too loud, and that the atmosphere in the classroom is more pleasant now.

Lisa also comments favorably on the possibility to change the loudness of the robot so that she can talk to the whole class and to near-by classmates in the appropriate volume. She also mentions that she can share her screen, and that this allowed her to lead a game in which she was drawing something that everyone else had to identify – this also suggests that the teachers undergo some efforts to integrate Lisa into the social activities in the class – which also became apparent in the classroom observation.

In the interview, the student and her mother both compare the telepresence robot with other video conferencing technology, and both state that the robot was much superior, especially concerning network connectivity; moreover, Lisa states that the robot allows her to move freely, without having to be carried around by someone.

Regarding robot embodiment, both Lisa and her mother stress the fact that it is easy to carry the robot so that also the girls in her class can fetch the robot from the principal's office and return it there for charging during the longer breaks. During the shorter breaks, Lisa remains in the classroom on the robot and uses the opportunity for socializing.

A classroom observation of a two-hour lesson in Spanish reveals that the remote student is able to respond to the teacher and other students clearly, and she can be easily heard, both when she speaks in front of the class and when she speaks to her neighbor quietly. She changes her height depending on whether she speaks to all or whether she is sitting next to her neighbor.

In one activity, students throw a ball to each other to determine who may answer next. Lisa cannot participate in this activity, and it would also not be possible for her to indicate to others behind her that she would like to answer. However, this is only one activity out of very many.

When handouts are distributed, the partner student (buddy) sends her a picture of it online. Basically everyone is willing to help, and most copresent students do anticipate problems and are ready to help; the extent of cooperation in the classroom is impressive. It is obvious that the teacher does a lot to integrate the student into the classroom; for instance, she gives Lisa special roles (like to read the vocabulary the other students then need to recall) and also ensures that she has a partner and a copy of the handout etc. This is reflected in Lisa's report on her role in the game in which she was drawing something that the others had to guess.

The observation also shows that there are always students who take the robot to the headmaster's office to charge and bring it back to class before class starts, and she also drives out independently into the corridor knowing that someone will take her down the stairs. Many different students were involved in this. There is also a neighbor, who is the default person for group work, and she gives Lisa no special treatment, but is generally helpful.

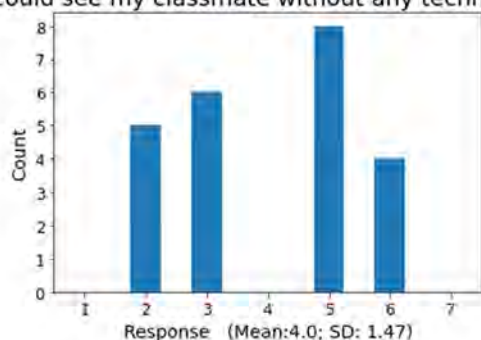
During technical problems outside the building, everyone seems very happy to assist, and students gathered around and all tried to help connect her again when the connection was lost in the school grounds.

Natural Assimilation into Daily Life

Lisa's mother highlights the natural assimilation of the telepresence robot into Lisa's daily life. The choice of language, where Lisa referred to being "carried down" (instead of the robot being carried down), emphasized the seamless integration of the robot into her self-perception. The mother's observation, "It's accepted that way, that there's no difference at all in the wording," emphasizes the normalization of Lisa's presence through the telepresence robot, both in her own perception and in the way her classmates talk about it, when they say, for instance, that they have to 'get Lisa from the principal's office' when fetching the telepresence robot in the morning. She also reports that her daughter comes back from her classes happy and excited, and that the other girls in the class are just happy 'that Lisa is back', while the boys find the technology interesting.

Student Perspectives on Telepresence Technology

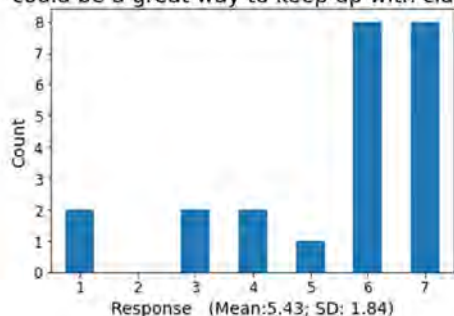
Q4. I could see my classmate without any technical issues



In addition to the interviews and classroom observation, a questionnaire was handed out to the classmates. The results of the post-experimental questionnaire with responses from 23 students reveal diverse perspectives on telepresence technology. In one question, gauging the ease of seeing their classmate Lisa without

technical difficulties, 52.2% (12 students) expressed agreement, while 47.8% (11 students) voiced disagreement. This indicates a mixed response regarding the technical aspects of the telepresence robot's functionality.

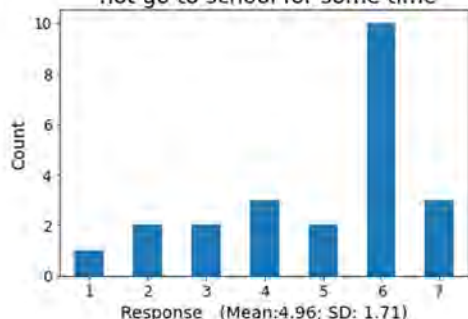
Q6. If I could not go to school, a telepresence robot could be a great way to keep up with classes



Another question delved into the students' opinions on the telepresence robot as an alternative for those unable to physically attend school. Here, 73.9% (17 students) agreed or completely agreed, 8.7% (2 students) remained neutral, and 17.4% (4 students) disagreed. That the majority leaned towards agreement suggests a positive inclination toward the robot's

potential role in maintaining academic continuity for absent students.

Q10. I would like to use the telepresence robot if I could not go to school for some time



The students' willingness to use the telepresence robot in case of a prolonged absence was explored, too. Results indicated that 65.2% (15 students) would be open to the idea, 13% (3 students) remained neutral, and 21.7% (5 students) expressed reluctance. This finding reinforces the nuanced nature of student attitudes toward incorporating telepresence

technology for an extended period.

Post-experimental questionnaire responses from these 23 students, particularly in the context of seeing their classmate Lisa, highlight varying sentiments regarding the use of telepresence technology. This underscores the importance of considering student

perspectives in future implementations to ensure a more effective and inclusive integration of such technology in educational settings.

Positive Aspects and Challenges

The integration of the Double 2 telepresence robot in the InClass project revealed commendable collaborative efforts within the school community, fostering positive engagement and mobility among students. The ability to conduct group work, one-on-one interactions, showcase drawings via the camera, and express non-verbal communication highlighted the higher degree of inclusion achieved compared to conventional methods like Zoom. Despite these positive aspects, the study unearthed challenges, particularly concerning internet connectivity and limitations in the robot's capabilities, hindering certain student activities. The varied sentiments among the classmates underscore the need for tailored implementations to address specific concerns.

Practical Take-aways As the interview shows, the remote student's experience was very good overall, and also many fellow students found a telepresence robot a useful tool for participating in the classroom. Some factors that may have contributed to these positive experiences are:

- the robot was placed in the principal's office and hence accessible for everyone, which made it easy for a large number of classmates to take turns in fetching and returning the robot for charging;
- the principal, teachers, parent and children all collaborated to make this a positive experience; the principal stated that this was because they all found it equally important that the student felt integrated. The teacher whose class was observed gave much thought to assigning roles to the remote student which allowed her to participate in the classroom activities as much as possible;
- the fellow students were responsible for troubleshooting the technical issues, and they seemed to enjoy this responsibility;
- the particular robot model, the Double 2, seems to have been very well suited for the purpose because of its ability to change height and because of its little weight.

While it is not possible to say what the relative weight of these supporting actions are, it is plausible to assume that all of these factors contributed to the success of the robot deployment for this particular child.

Recommendations for Improvement

To address the challenges identified, several recommendations for future enhancements were proposed. Investing in improving the school's infrastructure to ensure consistent and reliable internet connectivity emerged as a crucial step. Collaborating with robot manufacturers to enhance control mechanisms, incorporating

a more responsive system and object manipulation features, was suggested to improve the robot's capabilities, especially in physical activities. Integrating a camera or scanner directly into the telepresence robot was proposed to overcome challenges posed by external tools like WhatsApp. Qualitative research, such as focus group discussions or interviews, could help understand the variation in the fellow students' sentiments better. Additionally, implementing training and awareness programs for students, teachers, and staff emerged as a vital strategy to foster a positive perception of telepresence technology and address potential apprehensions.

Role Assignments for Implementation

Implementing these strategies requires a coordinated effort. Collaboration with the school's IT department for a connectivity assessment and establishing an IT support team for ongoing improvements are essential steps. Engaging with the robot manufacturer, conducting pilot testing, and iteratively designing enhancements before wider implementation will ensure a smoother integration process. Clearly communicating scanning functionality specifications, conducting comprehensive training sessions, and gathering feedback for continuous improvement are essential components. Understanding student sentiments through interviews or focus groups will help address concerns with targeted awareness campaigns. Developing a robust training program for all stakeholders, with a focus on regular refresher courses and active participation, is crucial for ensuring a positive and inclusive experience for all involved parties.