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Co-developing Immersive Learning Experiences in Interdisciplinary Projects in Upper Secondary Education

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Research topic and aim

Through dialogic design practices, we explore how we can create innovative learning designs with immersive technologies. Existing research has demonstrated the benefits of such technologies in education (see Markowitz et al, 2018), but there is a need to generate more knowledge about how immersive technologies can be integrated with collaborative learning activities (Enyedy & Yoon, 2021). Our aim is to create digitally mediated learning experiences targeting the special interdisciplinary curricular topic of "health and wellbeing". Researchers are working together with teachers from language arts, social science, and sports science to employ Augmented Reality (AR) and Virtual Reality (VR) technologies to create embodied learning experiences that both align with and disrupt existing classroom practices. We do not develop technical immersive solutions, but rely on pre-existing tools. Our focus is on understanding the potentials and pitfalls of introducing immersive experiences, pursuing a dialogic and participatory "bricolage" approach to design practices where participants make creative re-use of available technologies (Richter & Allert, 2017).

The project is ongoing (2020-2023) and in this poster, we account for the project framing, collaborative design work, and concept development. It is important to reflect on the lessons learned during these initial and middle phases of design-based projects, as these processes are often obscured and given less attention in the learning sciences community (Svihla & Reeve, 2016; McKenney & Reeves, 2018). Our study is guided by the research question: *How does teacher-driven innovation develop in the context of the design of immersive pedagogies*?

Across the narrative description of the design work presented below, we identify three ideas as particularly innovative and relevant for the learning sciences community: (1) the unique organization of a design-based project that is initiated and deeply driven by teachers themselves; (2) the "health and wellbeing" concept as a driver of design work; and (3) our approach to immersive technologies as dialogic and collaboratively oriented.

Theory and methodology

In designing and researching immersive technologies in learning, we draw on sociocultural and dialogic approaches emphasizing a more comprehensive understanding of the learner as well as a focus on how learning is inextricably bound up with motivation, identity and features of learning ecologies that learners dwell in (Silseth & Arnseth, 2011). Classrooms are complex learning ecologies and the effects of innovations can be unpredictable. Through developing and testing prototypes, we study how teachers and learners adjust innovative ideas to the classroom context. Prototypes represent solutions to concrete problems and they enable us to test innovative ideas in practice. They also enable and support collaboration through externalizing knowledge into objects that we together can act on. In order to research how design ideas emerge and become materialized into more elaborate designs, we document the process by video-filming activities. We draw on design-based research where the strategy is to engage in mutual development of ideas and practices together with teachers and students (Sandoval & Bell, 2004). Our collaborative relationship with the school came about because the teachers wanted to explore how AR and VR could make learning more engaging and abstract concepts more tangible and meaningful to students.

In the past decade, an increased emphasis has been put on the contributions and status of stakeholders in design-based methodologies, such as social design experiments (Guittérez & Jurow, 2016), research-practice partnerships (Coburn & Penuel, 2016), and recent interpretations of DBR (Bang, et al. 2016). However, we often find that university researchers lead the innovation process. It is therefore important to underline that the problems and issues emerged in and through teachers practical experiences.

Narrative description of the trajectory of design work

Rather than engaging in design and re-design iterations, where these processes are clearly distinguishable, we pursued a dialogic design practice mediated by conceptual artefacts such as sketches, prototypes, or technological resources. In our first meeting, we introduced examples of VR and AR applications to teachers and challenged them to specify and articulate their understandings of the new interdisciplinary topic of "health and wellbeing". Through dialogue issues related to students understanding of the body and how it works came up, as did issues related to

digital images of the self and how people use filters to play with their appearances and identities. Issues related to how we can design for embodied experiences of gender and identity also came up as ideas to explore.

Before the next workshop, we summarized these ideas into a conceptual artefact and introduced a more systematic suggestion for an interdisciplinary topic. Based on teachers' initial ideas, we suggested focusing on the topic of "The body across physical and digital spaces". We did not suggest any clear learning goals or learning activities at this point, because we wanted these specifications to come from the teachers themselves. The teachers found this topic interesting and we decided to continue specifying and operationalizing the topic into more concrete pedagogies.

In the third meeting, the researchers visited the school. Here, the purpose was to test different types of immersive technologies. The teachers tested VR headsets and tried out different types of games and software. At this stage, it was important that the teachers involved actually got first-hand experience with AR and VR resources. This was also done to engage the teachers and enable them to search for and explore applications that could be relevant for them in their daily work and what they wanted to accomplish in their classroom and work on the interdisciplinary topic "health and wellbeing". The teachers were interested and fascinated, particularly with VR games and design programs such as 'tiltbrush', as well as voicing concerns with implementing VR/AR as part of a more comprehensive learning activity and making experiences available to all members of a classroom community. Through dialogic design practices, the concerns and opportunities of immersive technologies dynamically emerged instead of being inferred or presupposed.

In the fourth workshop, which took place at the University, we tried to more explicitly develop and articulate prototypes for learning designs. We split into two groups and teachers, researchers and designers together tried to come up with ideas for learning activities. We did not want to put limits on the teachers' creativity, so they were urged to come up with as many ideas for learning activities as possible. Our aim was to enable teachers to reflect upon learning goals and pedagogical methods and strategies. This became an interesting session where the teachers contributed with insights about both opportunities and challenges when designing for immersive learning environments. Through dialogic design, the contextual framing for understanding the opportunities and constraints of immersive technologies for learning were gradually introduced and made more complex for participants.

In the fifth meeting, we continued to work on the development of the prototype. Between the last two meetings, teachers had also had the chance to discuss and test VR and AR solutions amongst themselves. As a result of our dialogic design practices, it became clear that it would be premature to develop and test a comprehensive learning design with students. Among other things, this was because the learning situation would be too complex and there would be a high risk for not being able to go through a common activity for all students at the same time. Therefore, we agreed to include a set of VR/AR experiences for students as learning stations in the classroom, split students into groups, and have them test the technologies, as well as reflect on what they experienced and how these immersive technologies can be used meaningfully in future classroom activities.

Through our co-design pedagogical concepts are emerging, namely one task focusing on identity and ethnicity through immersive video and construction of avatars, one task focusing on body representations and a more open task focusing playing with the possibilities for social interaction using RecRoom. The next step in our joint design work will be to further involve students in the dialogic development of innovative immersive learning designs through in-class pilot testing.

Conclusion

We found that it was important that teachers themselves initiated and have ownership of the project. Even though it has been challenging to organize the project and for the teachers to find time to innovate during a pandemic year with many constraints, they still have a stake and interest in the project. This is crucial for further innovation. In our design work, we have been careful to not simply develop a design independently and bring it to the school. We have been concerned with organizing the design work dialogically, and our suggestions have been sensitive to teachers' voices in the emerging design work. At the same time, during the development, we have analyzed and reflected on what kind of support teachers need to create pedagogical innovation. The teachers' everyday experiences of immersive technologies and of "health and wellbeing" concepts were transformed into new pedagogies through dialogic design processes with us. We have experienced that it is challenging to align immersive technologies with collaborative activities, because the number of devices needed would not be feasible and because aligning attention across multiple devices is difficult. Still, it is important to emphasize that immersive experiences makes up only a fraction of the overall activities. Small group discussion and design work and whole-class reflection are planned to occur before, during, and after the immersive experiences.

