BEYOND TOUCH: AN EDUCATIONAL DESIGN INTERVENTION TO INVESTIGATE THE AFFORDANCES OF EMBEDDED TACTILE AND SENSORY TECHNOLOGY

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Introduction

The pandemic brought many changes to educational innovation due to the immediate shift to online learning resulting in a lack of learning design. This resulted in questioning how useful the existing tools and methods are for online pedagogies (1). Limited blended learning experiences were observed with little concern for engagement, participation and deeper learning. A formalised approach to learning design is therefore needed to adjust to blended teaching and learning practices.

Embedded Tactile and Sensory Technology (ETaST) pedagogies are showing potential to support blended learning through socially constructed forms of learning (2). However, these have so far only been used in limited settings for traditional STEM-based education (3). It is not integrated into various disciplines in Higher Education (HE) and there is little research done due to a lack of pedagogical knowledge, limited access to such technologies and outdated curricular practices, inter alia (3;4).

ETaSTs like 3-Dimensional Printing (3DP) have shown potential to improve learning outcomes in HE through multi-sensory experiences (5;6). However, in South African HE, the implementation has been problematic and remain underexplored (3). This is due to resource and institutional constraints, but also entrenched pedagogical practices that inhibit innovation (7). This presents a twofold problem: universities cannot afford certain aspects of these technologies such as upskilling with appropriate technology literacy and simultaneously HE are not offered suitable opportunities to engage with these technologies (3).

This study explores the fundamental hindrances and opportunities of integrating ETaSTs such as 3DP in blended educational practices. A 3DP programme at an undergraduate level will be designed and implemented at a University of Technology (UoT) across a variety of disciplines. This programme is designed to stimulate co-creative engagement and learning through the lens of experiential learning theory. The research will reflect critically on the outcomes of this programme at both micro ("classroom") and meso (institutional) levels. Simultaneously, the study unpacks the affordances of 3DP as an ETaST for a contemporary educational landscape in South Africa. In doing so, it grounds this research in the national (macro) discourse of 4IR, which foregrounds the transformative potential of emerging technologies (4;7).

Problem Statement

Educators need to develop a meaningful understanding of the potential and/ or limitations (affordances) of emerging technologies, to identify pedagogical opportunities. If no understanding of the technology's affordances can be generated, its effectiveness for teaching and learning will be compromised (8).

Aims and research question

This study aims to co-design an intervention for Embedded Tactile Sensory Technology (ETaST) from within an UoT, across different disciplines to better prepare learners for 4IR. A secondary aim of the study is to investigate to what extent or how HEI curricula and pedagogical practices respond to the implementation of ETaSTs.

What are the educational affordances and hindrances of embedded tactile and sensory technology for embodied learning within a UoT context?

Theoretical frame

This study is grounded in Kolb's Experiential Learning Theory (ELT), which is structured on four modes of practice (Figure 1) that involve Concrete Experience, Reflective Observation, Abstract Conceptualisation and Active Experimentation (9;10;11).

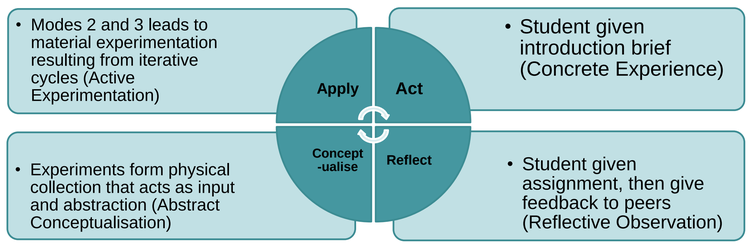

Figure #1 Experiential learning

Methods

The methods that will be employed in this study will be qualitative and follow a DBR approach due to focusing on a practical rather than a theoretical nature. Interventions are developed for specific limitations and implemented to investigate how well they function. A cyclical process is followed to establish the functionality and to modify these interventions. This systematic DBR process follows specific steps to create, test, investigate and refine interventions. An adjusted version of the 4-phase Reeves model will be adopted for this study (12).

In **Phase 1** analysis of the problem takes place through collaboration and literature review. In **Phase 2** development of solutions are created through combining design principles with emerging technology and further literature reviews. **Phase 3** tests and refines the design principles through case studies, interviews, data analysis, identifying improvements and a 2nd iteration. **Phase 4** reflects on the design principles tested in phase 3 to implement enhanced solutions that will contribute to theory and practice (Figure 2).

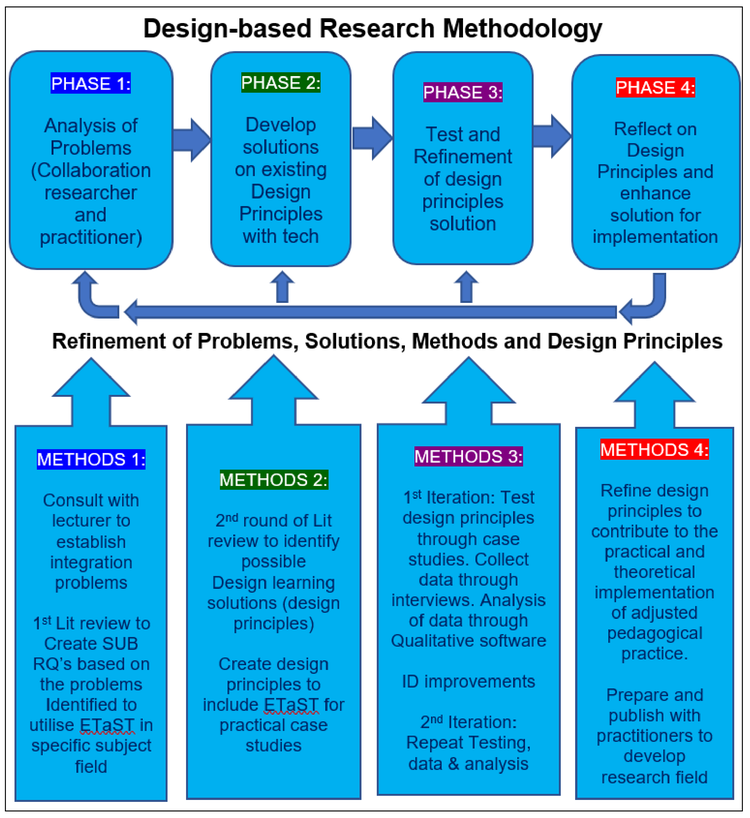

Figure #2 new DBR 4-phase Reeves model

Expected contribution

This study will explore new methods of educational practices to identify opportunities and hindrances in the use of emerging technologies such as ETaSTs 3DP across various disciplines. From a theoretical perspective, it will add to the body of knowledge of tactile and sensory pedagogical practices and how they can be used in new ways through various disciplines. It will lead to better understanding of how the affordances of ETaSTs could ready the UoT landscape to adapt to the challenges and opportunities brought by new innovative teaching and learning practices. From a methodological perspective, it will adopt various conceptual frameworks that integrate emerging methods such as CDIO, DBR, TPACK and Connectivism. From a practical perspective, it will contribute to the development of pedagogical practices to produce a newly informed understanding of the use of ETaSTs, across disciplines, to produce better-equipped graduates at a UoT-level.

Conclusions

ETaSTs like 3DP evidently improves learning outcomes in HE. However, in SAHE, implementation of such technology seems problematic and underexplored, due to resource and institutional constraints. The preliminary literature review shows that universities cannot afford these technologies and lecturers and students are not allowed to engage with these technologies. This study explores the fundamental hindrances and opportunities of integrating 3DP in educational practice. A 3DP programme is designed to stimulate engagement and learning. The study will reflect critically on the outcomes of this programme at both micro ("classroom") and meso (institutional) levels. It will also unpack the affordances of ETaST 3DP for the 'modern' educational landscape in South Africa. In doing so, the study grounds this research in the national (macro) discourse of 4IR, which speaks to the transformative potential of emerging technologies (4).

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