

Smart Learning Environment Research

Abstract

The core objective of this research is to explore ways of applying educational theories within a smart learning environment that learns about the learner and adapts the material presented to foster conceptual change within the domain of learning.

Background

The premise of this research is that the way that we act in the world and the way that we approach learning tasks is influenced by the conceptions that we already hold about the things we do and the nature of the learning task that we are approaching. When we receive a new task, our perception of that task is influenced by the framing stories that we hold in relation to that task. This perception in a learning context influences our approach to the task and consequently the learning outcome (Ramsden, 2003). Likewise there are framing stories that influence the way that we live and interact with others and our environment (Stibbe, 2015). If these arguments are valid then if we are seeking to improve a learner's learning outcomes in a subject area or to foster a change in the way that a problem is perceived then we need to influence the perception held by the learner or participant of the nature of learning and of the subject domain, and if we want to foster change in society, we need to influence the framing stories by which the society lives.

The approach being proposed is to consider the conceptual change as relating to what Meyer and Land (2005) call threshold concepts. They describe threshold concepts as being “transformative (occasioning a significant shift in the perception of a subject), irreversible (unlikely to be forgotten, or unlearned only through considerable effort), and integrative (exposing the previously hidden interrelatedness of something). In addition they may also be troublesome and/or they may lead to troublesome knowledge for a variety of reasons” (pp. 373-374).

A student may struggle with learning to program because their conception of the nature of a program or their conception of a programming concept or construct doesn't enable them to produce the desired outcome for the programming task. They could copy another person's code but they are unable to perceive how they themselves could create that code. The obstacle to their learning could be their understanding of learning or it could be that their frame of reference doesn't help them understand the nature of programming or of the programming concepts that they are expected to use.

A political leader struggling with a difficult economic problem rejects some alternatives because their framing story doesn't see those alternatives as producing the desired outcomes. For example, how could supporting the poor be seen as being of economic benefit if the politician's framing story fosters the belief that the poor are lazy and are poor because they refuse to work. The belief is firmly held and what others see as contradictory evidence is rejected.

Both of these scenarios, will require change in the beliefs or understandings of the participants. The problem is how to open up the space of learning to enable conceptual change to occur. Virtual learning environments, such as Blackboard, utilise a model of learning primarily focused around acquisition of knowledge to be learnt and applied. They do nothing to understand the learner or the learner's learning needs.

Aims and Objectives

The aim of the project is to explore ways in which a smart learning environment possibly utilizing game-based learning can endeavor to learn about the way in which a learner understands core concepts and then based on that knowledge open up the space of learning to facilitate seeing the core concept in other ways. The focus initially will be around fostering conceptual change in relation to already identified threshold concepts. However, it is envisaged that it should be possible to help identify threshold concepts to enable the learning facilitator to plan learning strategies that may overcome these roadblocks to learning or conceptual change.

As an approach to open up the space of learning, the project seeks to draw on Vygotsky's (1978, 1986) zone of proximal development where a learner is open to learning specific concepts or ideas because they within a zone of awareness for the learner. Anything else outside this zone would be difficult for the learner to perceive or comprehend. It is envisaged that Marton's (2015) theory on the conditions necessary for learning with its emphasis on fostering awareness of critical aspects of the object of learning will be used as a way of fostering understanding within the zone of proximal development and to expand that zone for the learner.

Although these theories are discussed in the context of human learning, it is envisaged that concepts of computational intelligence especially machine learning and self-aware systems will be utilized to build the required smart learning environment. It is also possible that the educational ideas may influence the design of the machine learning engine.

Research Context

There are two areas in which the primary researcher is interested in applying the ideas being developed. These are in the learning of computational thinking and programming within Computer Science, and in fostering the exploration of economic alternatives. However, it is intended that the core system should be able to be applied within any subject domain.

References

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