



Context

Are virtual learning spaces effective places for STEM educators to acquire new (STEM) knowledge?

Focussed within the context of STEM education, this study seeks to explore how participants acquire new (STEM) knowledge, and embed it into their own practice in order to support the creation of a diverse STEM-literate society.



Research engaged eleven practising teachers of STEM subjects, and sought to explore their attitudes and investigate how knowledge and understanding of STEM is developed, and how new knowledge is gained and evolves through collaboration. Participants were selected for their ability to provide rich and varied accounts of their experiences initially via convenience sampling, moving to theoretical sampling techniques as conceptual categories emerged as concurrent data generation and analysis coding procedures were undertaken.

Methodology

Constructivist grounded theory (Charmaz 2006), underpinned an interpretivist ontology has been adopted for this study. This approach was adopted because it is abductive and combines both inductive and deductive theory generating procedures, and also takes account of the reflexive and biographical stance of the researcher (Alvesson and Skoldberg 2009).



Knowledge is constructed between the researcher, and those being researched, with theoretical concepts being constructed, rather than being 'discovered'.

This approach presents teachers as agents of change, working within the structure of a prescribed curriculum. In this study participants were encouraged to relate the positioning of individual subject discipline within the wider field of STEM education.

Data Analysis

Data was gathered via a focus group and semi-structured interviews. Utilising procedures advocated by Finch (1987), built up from elements of the data, three vignettes were created and represent aspects of the research findings as a whole.

Findings

Initial findings suggest that participants learn in the following ways:

- Formally
- Informally
- Independently

Formally

This may be defined as learning occurring at work through formally convened training. Where formal learning occurs within the workplace this is reflective of 'cultivating communities of practice' (Wenger et al. 2002) which represents a shift from the original work which emerged as an apprenticeship, model of learning that is 'usually unintentional rather than deliberate' (Lave and Wenger 1991). Findings suggest that costs associated with formal learning are prohibitive, resulting in limited opportunities which are restricted to small cohorts. In this study participants cited limited access to formal training which many also perceived to be divisive, due to hierarchical selection procedures that restricted access to formal training courses and subsequent didactic dissemination mechanisms by those who did attend.

Informally

This method of knowledge acquisition may be defined as occurring when formal training is disseminated informally. Knowledge morphs and is re-created by the learner as new knowledge and understanding within the context of the practice within which it occurs. Informal learning encompasses cross disciplinary meetings, and networking, which participants identified as being of significance in their development of personal STEM knowledge, skills and understanding.

Professional knowledge is harnessed and members draw upon tacit knowledge (Nonaka, and Takeuchi 1996). This leads to 'theories-in-use' (Argyris and Schon, 1974), where theory evolves from participants day-to-day experience. Knowledge is constructed socially within the context and culture it was learnt.



Independently

In this method of acquisition participants move beyond the boundaries of the immediate physical workplace to acquire STEM related skills, knowledge and understanding that falls within the notion of 'common ground' (Clark and Brennan 1991). Findings indicate that participants are increasingly comfortable with the notion of developing their practice independently, through virtual networks, professional online learning communities, e-learning and affinity spaces (Laurillard 2016, Jobe et al 2014, Gee and Hayes 2012, Steinkuehler et al 2012, Philip and Mitra 2012) Membership of these groups is achieved through active participation. Mutual trust evolves, individuals become an effective, cohesive group. Findings suggest that this is a highly effective way to acquire new STEM knowledge. Information shared is unconfined, and subsequently learning is limitless (Dalkir 2005). Everyone contributes, newcomers gain 'wisdom', established members gain new ideas (Hildreth and Kimble 2004).

Conclusion

In the UK STEM funding focuses upon science and mathematics (Morgan 2014, ESRC 2014). This expedites the silo nature of STEM delivery. In order to facilitate learning learners must become adept in thinking across subject boundaries (Saunders 2006), become STEM literate.

Findings from this study would suggest that research participants are confident in developing their practice independently, learning informally through physical or virtual self organising learning environments (Dolan et al, 2013) and collaborative online communities.



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