Chapter 5.14
Using Mobile and Pervasive Technologies to Engage Formal and Informal Learners in Scientific Debate

Dawn Woodgate
University of Bath, UK

Danaë Stanton Fraser
University of Bath, UK

Amanda Gower
BT Innovate, UK

Maxine Glancy
BBC Research & Innovation, UK

Andrew Gower
BT Innovate, UK

Alan Chamberlain
University of Nottingham, UK

Teresa Dillon
Polar Produce, UK

David Crellin
Abington Partners, UK

ABSTRACT

In a climate of concern in the United Kingdom about a perceived loss of interest in science among schoolchildren and the general public, we consider the relationships that exist between science education and public engagement in science, and "formal" and "informal" learning contexts. The authors move on to describe four case studies drawn from our research, where mobile technologies have been used in ubiquitous ICT-based science-related learning activities. Three of these studies were of school based activities which took place in timetabled science lesson time. The fourth was set in Kew Gardens in London, during a holiday period, and involved leisure-time visitors of all ages. Finally, they describe a planned integrated trial, which will draw together "formal" and "informal" learners in environmental and scientific debate, scaffolding previous mobile learning experiences towards a genuinely multiplatform e-learning system.

INTRODUCTION

Maintaining school pupils" enthusiasm for STEM subjects (Science, Technology, Engineering and Mathematics) can be problematic. Too often, these subjects are perceived to be more difficult than many of the others on offer, and science in particular often tends to be seen as remote from young people's everyday lives and experiences. There is evidence too, that this ambivalence about science is of a wider nature, extending beyond the classroom to the adult community. This has led to concerns in the UK about levels of what has been termed "scientific literacy" (Bybee 1997; Murphy et al., 2001), and prompted a number of initiatives intended to "engage" people (both schoolchildren and the general public) with science. Promoting a wide-scale interest in science is seen as essential, not only because of the economic need for a workforce equipped with sufficient scientific and technical skills to secure the nation"s competitiveness in the global marketplace, but also because science is an important part of our culture (Osborne & Hennessy, 2003). People who lack a measure of basic scientific knowledge run the risk of being excluded from taking a full part in debates on the social, economic, legal and ethical implications of new scientific and technical developments that affect all of us.

The reasons for this seemingly widespread lack of interest in science amongst the general public are likely to be complex and multidimensional, but one unintentional contributory factor may be the science education system itself. During the early years of primary education in the UK, most young children are enthusiastic about their science lessons. There is at this stage an emphasis on constructivist, "learning by doing" methods, where they are engaged in practical investigative activities. However, by the later primary years and the transition to secondary schooling, there is a move away from constructivist principles towards more factual and theoretical forms of learning, in response to the perceived demands of the National Curriculum and the system of formal assessment linked with it (Hacker & Rowe, 1997; Murphy, 2003; Wadsworth, 2000). This switch of emphasis has been implicated in pupils" disengagement, and changes are currently being implemented in the curriculum to introduce a greater number of practical investigations for older children, and foster in them more of an understanding of how "real" science works.

One way in which curricular changes of this type could be supported is through the use of new technologies. In particular, the potential of emerging mobile technologies has excited a great deal of interest, because of their portability and relatively low cost. These small devices can be used in any classroom, which contrasts with the traditional scenario of expensive desktop computers sited in school IT suites, where access is necessarily limited, due to timetabling demand. Furthermore, mobile technologies can be taken outside for fieldwork, accompany pupils on school trips to museums, or even be taken home to help with homework, thus blurring the boundaries between what have been termed "formal" and "informal" learning contexts.

Our aims in this chapter are firstly to consider the relationship between "formal" and "informal" learning settings. We will argue that this distinction is not clear cut, and predict that the adoption of emerging mobile technologies for learning will render it still more ambiguous. We will describe four case studies drawn from our research, where mobile technologies have been used in ubiquitous ICT-Based Educational activities. Three of these studies took place in what could broadly be termed "formal" educational settings, in that they were school-based activities which took place in timetabled science lesson time, though in the interests of accuracy, it should be stated that pupils, teachers and technologies moved in and out of the confines of the physical classroom as appropriate to the activities concerned. The fourth was set in an unequivocally "informal" learning context; that of Kew Gardens in London, during a holiday