Chapter 1
Science Education with and through ICT:
Curriculum Design and Questioning to Promote Active Learning

Francislê Neri de Souza
University of Aveiro, Portugal

ABSTRACT

One of the contemporary society characteristics is that the amount of information available to any individual is enormous, generating problems to manipulate, assess and take the best of this information. In this case, student need to be educated to evaluate it and have skills to construct personal knowledge, developing understandings not only about the content of science, but also its methods. One of the science education challenges issues is how to stimulate active learning and develop competences in ICT-rich environments. Due to the importance of questioning skills to promote active and reflexive learning and the few studies on questioning profiles in e-learning or b-learning contexts, we propose the development of curriculum design, as well as to discuss the adequate use of strategies that could be implemented to stimulate student and teacher questioning. This chapter has the intention to also continue a deep discussion about many aspects of the epistemology of questioning in these contexts.

INTRODUCTION

It is a common fact that the use of internet-based and/or Information Communication Technology (ICT) can promote a set of potential benefits not just to students but also to teachers. The most obvious manifestation of this importance is the improvement in number of computers for students and schools connected to the internet. In the Portuguese context the announcement of the distribution of 500 thousand laptops with Internet access for pupils in the first cycle of basic education is a signal of such an investment. The computer, called Magalhães, was the first laptop with internet access assembled in Portugal, and makes part of the program "e.escolinha" that aims to provide all children access to ICT resources (Governo Português, 2007).

More recently the Brasilian government announce the acquisition of 900 thousand tablet

DOI: 10.4018/978-1-4666-8803-2.ch001

computer, but does not know exactly what to make of this technology that has just acquired (N/A, 2012), others public and private international institution follow similar pattern. This show a recurrently unbalance between two polo of public policy about ICT integration on educational background. Generally the quantitative aspect is reinforced over qualitative dimension. In the scheme below we represent some of components of this continuous.

This balance point between qualitative and quantitative dimensions is called by Neri de Souza & Mol (2013) *Pedagoware*. It is the systematic integration of some elements as hardware, software, student, teacher and content for education in interdisciplinary contexts to promotion of teaching and active learning. *Pedagoware* is the logical part or set of instructions or teaching strategies that take into account the complexity of the act of teaching and learning in different context.

Learning in virtual environments has grown fast for users, mainly teachers and students, who recognize the benefits of ICT tools for teaching and learning. Since then, teaching and learning in virtual environments has changed from eccentric experiments made by a few universities to the highest priority in the agendas of all academic centres in the world.

Beyond the quantitative aspect, such as hardware and software access, we need to discuss the qualitative dimension portrayed through the questions: What is the potential of ICT in Science Education? What exact role should ICT play in Science Education? To discuss the role of ICT in science education it is first necessary to identify the objectives of education in this area and then analyse if its implications are significant.

Osborne & Hennessy (2003) ask questions like: What's the main purpose of school science? To form a minority for a science-related career or to prepare a majority for active participation in a scientifically based culture? Scientific literacy is currently a widely accepted objective of science education (van Eijck & Roth, 2007). It not only involves the knowledge of key concepts in the natural sciences, but also procedural understanding of scientific inquiry.

For Osborne & Hennessy (2003) there are four common views of science education: a) *the utilitarian* (science is practically useful to everyone); b) *the economic* (we need scientifically trained individuals to sustain and develop an advanced industrial society); c) *the cultural* (science and technology are an achievement of contemporary society); d) *the democratic* (participating in the debate of the political and moral dilemmas requires a knowledge of some aspects of science and technology).

One of our contemporary society characteristics is that the amount of information available to any individual is enormous, generating problems to manipulate, assess and take the best of this information. In this case, pupils need to be educated to evaluate it and have competences to construct personal knowledge, developing understandings not only about the content of science, but also its methods (Driver, Leach, Millar, & Scott, 1996).

Figure 1.