# Linking E-Assessment to Student's Use of Online Learning Content

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## INTRODUCTION

This article will examine the development and implementation of two information and communications technology (ICT) e-assessment tools—a diagnostic assessment system and an intelligent content assessment marking system—for the teaching of secondary science. An e-learning management system (ELMS, see Figure 1) was used with second-year secondary students in science which provided both content and online assessment tools for teachers. By using this system, teachers had the opportunity to modify how they assessed their students by shifting the skills and knowledge being tested and also when and at which stage of the learning they are tested. The use of the ELMS had also assisted teachers to move away from the narrow confines of standardised tests with their discrete and decontextualized 'items' towards more complex, holistic, contextualised, and authentic forms of assessment (e.g., Pellegrino, Chudowski, & Glaser, 2001).

Using these diagnostic tools for assessment teachers could better help students gain mastery in specific content areas, in particular, the more abstract concepts in science education. The ELMS was used to collate the data from the two assessment tools and provided an additional online diagnostic profiling system (DPS). This profiling tool was then used by teachers to detect the extent and nature of each individual student's knowledge and competence within topics of study in order to help that learner progress ahead in developing independent mastery and lifelong learning skills.

## CAPTURING THE POTENTIAL OF E-LEARNING AND E-ASSESSMENT

In schools where traditional assessment modes prevail, teachers are often swamped with setting and marking different forms of assessment, usually aimed at preparing students for high-stake examinations. In order for them to adequately assess which difficulties confronted by students impact learning most strongly, they need effective tools to develop ways and means to collect and analyse data in class. With the help of ICT tools, teachers can locate timely information about student learning which allows them to set meaningful and measurable goals for future learning. Assessment whether online or not can be used as one of the most powerful ways of improving learning. By simply changing the assessment of the subject, teachers can in turn affect the way students engage with the subject content (Black & Wiliam, 1998). New pedagogy is also needed to effectively leverage the use of technology. E-assessment cannot simply invent new technologies which recycle current ineffective practices (QCA, 2004).

As Conole (2004, p.3) pointed out, one of the affordances of ICT is the potential for multimodal and nonlinear approaches to navigating through information. She highlights the fact that the nonlinearity of the Web (epitomised by hypertext and the use of powerful search engines) leads to the potential for different routes through, and forms of, learning. Yet many research studies have concluded that much of the current online training materials still appear to follow a linear, assembly line mode of learning. Many 'e-learning' packages are built on behaviourist principles of atomised experiences that need to be completed in a specified order before the individual is positively reinforced and

permitted to move on—a form of electronic page-turning (Conole, 2004).

When designing online learning systems, the structure of how learning content is incorporated is vital to its success. According to Boettcher (2003), course content—the material to be learned or studied—is only one of the four key core components of the learning experience. The other three are the *teaching*, the *learner*, and the *environmental* components. In her research, she emphasized that online learning based on well-structured content can impact the identification, selection, and development of course content in three ways:

- Content must be semantically well-structured for instruction; this corresponds to the *teaching* component of the learning experience.
- Content must be a good fit or well-structured for a particular student; this corresponds to the *learner* component of the learning experience.
- Content must be technologically well structured; this corresponds to the *environmental* component of the learning experience.

Boettcher extends this notion well beyond the dictionary meaning of well-structured content. It includes the nuances of interaction with the other three components of the learning experience—teaching, learner, and environmental.

Therefore, in practice, when researchers work with teachers and students in schools, how can course content be sufficiently well-structured to be really meaningful to the students? Just as being an expert in teaching science is not by itself a guarantee of good pedagogy, any ICT technology tools might miss the mark if they are not fine-tuned to the content the teacher wishes to present. It is well established that how the tools are being used is more important than whether the students and teachers like them. Therefore, when designing content for online delivery, teachers, instructional designers, and other stakeholders need to actively investigate and formulate their own strategies on e-learning as well as how to apply ICT tools to e-assess students.

With the emergence of online technologies as a new space for instruction, a lot of research has been conducted on the effectiveness of the teaching and learning process rather than on what students are doing within the learning experience. The organization of what is being taught and how content is being taught and assessed online—the structure of the course content and associated tools used to evaluate learning gain—have received much less attention.

Meanwhile, content development has certainly not been neglected. Large amounts of funds have been spent on developing digital libraries, learning objects, and online learning systems. These are all efforts that foster the evolution of learning management systems and tools for easy mounting of content and access to such content resources. There is clearly a trend for governments worldwide to continue further development of knowledge repositories at all levels of education. However, putting content online or packaging them as learning objects does not in itself guarantee the quality of teaching and learning. It may help students access learning opportunities, but it is unlikely to prove acceptable unless online learning is carefully and appropriately designed and structured to assess learning outcomes. Online learning materials cannot be stand-alone units; they have to blend in with teaching, learning, and assessment strategies.

Within the context described above, the main purpose of the article is to present the framework used for content creation when developing the online learning system which incorporated technology tools to facilitate a better understanding of profiles of student learning and the effective use of e-assessment. The framework established from this implementation guides us to understand how to utilize ICT tools and capabilities to enhance online learners' abilities to acquire knowledge through experiencing the process of guided e-assessment.

One critical factor for designing appropriate student-centered e-learning is to understand how students actually interact with the content and the ELMS. Another critical factor is: how can the ELMS develop and provide a profile of each student's learning which in turn allows teachers to attend to student learning deficiencies? The diagnostic assessment and content marking tools integrated in the ELMS presented in this article help to raise fundamental questions about the whole learning and teaching process. This is a process which needs continual research if we are to achieve the desired goal of maximizing the potential technologies offer to improve learning, teaching, and assessment.