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How do I enhance motivation to learn and higher order cognition among students of Science through the use of a virtual learning environment?

Mary McMahon

Mary McMahon

Dublin City University

Ireland

Abstract

In this paper I explore the capacity of Moodle to enhance the teaching and learning of Leaving Certificate Biology within a small urban secondary school. I simultaneously investigate the potential of the technology to enhance higher-order cognition and motivation to learn among the students. Adopting an action research approach has led me to a much deeper understanding of the tacit knowledge that inspires my work. The chief stimulus to my research was the realisation that my explicit practice was in negation of my implicit values. I have come to know my practice and over time changed it. I can now see evidence of a greater congruence between my espoused core educational values and my explicit actions. Cycle one of the research focuses on setting up and introducing Moodle to a group of Biology students. The second cycle shows the feasibility of a community of enquiry through a discussion-forum. A process of social validation runs concurrently, in which interested individuals substantiate my claim that my core educational values are being translated into my practice. Throughout I learn to strike a balance between co-learner and guide. Consequently the students come to act as co-authors in moving away from authoritarian dissemination of facts. This facilitates a community of inquiry, revolving around the collaborative negotiation of meaning. There is clear evidence of increased higher-order cognition and motivation to learn among the participants within this virtual community.

Keywords: Virtual learning environment; e-Learning; Higher order thinking; Motivation; Action research; Living theory; Biology.

1. The context of the study

1.1. My educational context

This study is an action research enquiry into how I can improve my professional practice. I work in a second-level school as a teacher of Leaving Certificate Biology. The average age of the students that I teach ranges from fifteen to seventeen. The research examines how I can enhance learning among students of Leaving Certificate Biology by using a virtual learning environment (VLE) called Moodle to support the delivery of the curriculum.

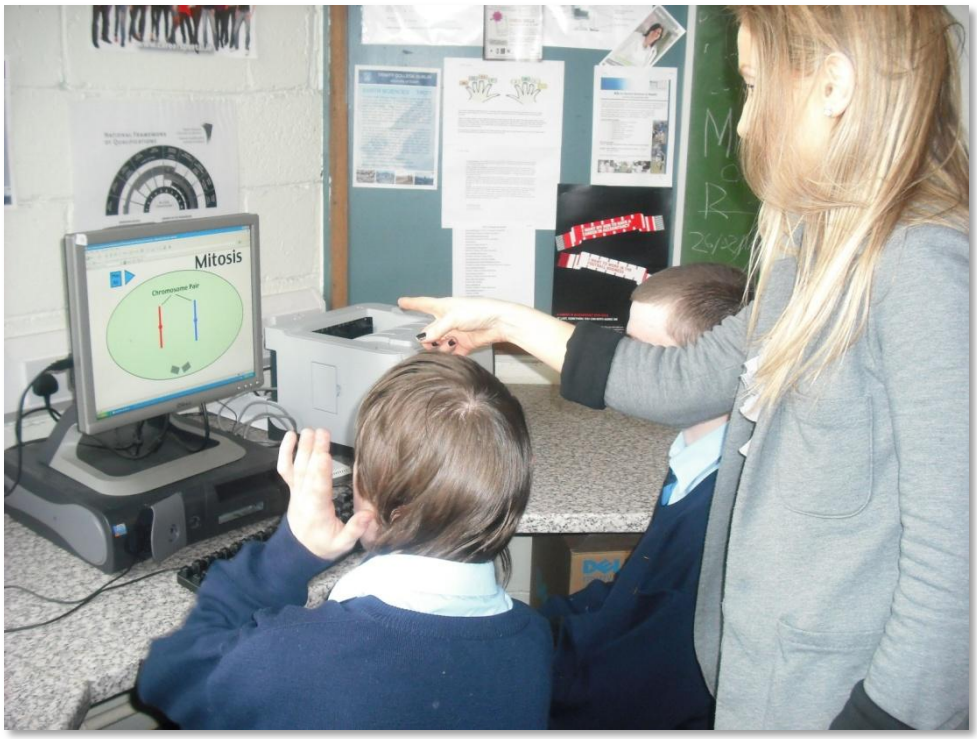

Figure 1. Mary Mc Mahon and Leaving Certificate Biology students exploring Moodle.

Throughout my teaching career, I have experienced firsthand how tremendous a vehicle the Web can be in augmenting traditional classroom learning, and how immensely motivating the notion of engaging with technology is to the students I teach. My learning in Dublin City University (DCU), as part of the Masters in Education and Training Management (e-learning), further encouraged me to appreciate the vast potential of ICT to enhance the entire learning process. Throughout the programme of study, Moodle became the cornerstone around which a close-knit community of enquiry among class members in the Masters programme flourished. This community facilitated the evolution of a "web of betweenness" in which each participant developed their own sense of being through learning in relation with others (Farren, cited in Farren and Crotty, 2010). I am now committed to bringing the resulting knowledge and skills I have gained as part of the

eLearning programme to bear in the classroom. The roll-out of a VLE has been tentatively mentioned by school management on a number of occasions, so the work I am undertaking is of immense interest to many of my fellow staff members, and could potentially have far reaching consequences for the entire school population.

The Leaving Certificate Biology syllabus was revised in 2004. A recurring theme echoed throughout the revised syllabus is that students should be encouraged to integrate technology into their study of Biology (DES, 2004). The National Council for Curriculum and Assessment (NCCA) proposes that the realisation of the learning espoused within the revised syllabus rests on teachers adopting, "new roles in collaborative, interactive and cross-curricular activities" (NCCA, 2003, p. 92).

1.2. My core educational values

My educational values were *the* single most influential force at the root of my research. Their importance truly cannot be over-emphasised. After much soul-searching and discussion with interested others, I identified autonomy, dialogic co-enquiry and inclusion to be my three core educational values.

Autonomy: My intuitive interpretation of autonomy is that I recognise and respect the rights of the individual. In relation to others I respect their right to think for themselves, even when the consequences of this run counter to my own thoughts, views and beliefs (Hymer, 2007).

Dialogic co-enquiry: I see dialogue as being an integral element of the education process. However, I am not alluding to conversation, debate or discussion. Rather, I maintain that dialogue is concerned with *understanding* the ideas and opinions of others.

Inclusion: I perceive that inclusion is the practice of ensuring that the students I teach feel a strong sense of belonging. Inclusion makes each individual feel respected and valued for who they are.

The specific link between each of these values and my research question is explained in detail here.

1.3. The role of Information and Communications Technology (ICT) in education

The student of today lives in a world in which ICT is increasingly embedded into their daily lives. As access to ICT facilities increases both at home and in school, there is increased scope for flexible, computer-based learning. The past decade has seen substantial investment in the IT infrastructure of Irish secondary schools, primarily as an outcome of the Schools IT2000 initiative (DES, 1997).

Among the key findings of research conducted by European Schoolnet into the impact of ICT on education is the strong motivational effect of ICT, and its capacity to impact positively on the attainment of higher order thinking skills among students (European Schoolnet, 2006). The power of technology to motivate is also echoed within the Investing Effectively In ICT In Schools, 2008 – 2013 report which notes that "when used well, ICT

enriches learning and enhances teaching. It is a powerful motivational tool for students" (DES, 2008, p.1).

The Strategy for Science, Technology and Innovation (2006 – 2013) is based on a vision to build a truly knowledge based society by growing the skills of the Irish population from primary to post-doctoral research level (DES, 2006). Ranking chief amidst the strategy's recommendations is the promotion of measures to counteract the alarming downward trend in the uptake of science at secondary level, especially in the senior cycle (DES, 2006). Such measures include a reform of the science curricula at senior cycle through placing greater emphasis on hands-on investigative approaches, allied with the embedding of ICT skills by the provision of enhanced web-based resources.

There is a growing awareness of the benefits of using virtual learning environments (VLEs) to facilitate the establishment of subject-specific online communities within secondary schools. The Report of the Task Force on the Physical Sciences lists among the myriad benefits of incorporating a virtual learning environment into the practice of Science teachers, its potential to, "add value to existing activities and structures", and to "catalyse innovation in teaching and learning" (DES, 2002, p.124). This view is more recently substantiated by the Investing Effectively in ICT in Schools, 2008 – 2013 report (DES, 2008), which lists among its chief recommendations the use of virtual learning environments to facilitate curriculum delivery. The virtues of embedding VLEs into the working practices of schools are further extolled by the ICT in Schools Inspectorate Evaluation Studies: Promoting the Quality of Learning report, which evaluates the infrastructure, planning and use of ICT in primary and secondary level schools during the 2005/2006 academic year (DES, 2008a). The report lists a whole host of benefits revolving around ICT usage in the classroom that can be derived by teachers, students, parents, administration and management alike.

2. Virtual learning environments, motivation to learn and higher order cognition.

I examined three main themes in the literature to inform my understanding of my research: virtual learning environments, virtual learning environments and motivation to learn, and virtual learning environments and higher order cognition.

2.1. Virtual learning environments

At the heart of any virtual learning environment is the concept of providing every student with a personal online-learning space, offering them access to learning opportunities including learning resources, activities and assessment (Sanchez et al., 2004; BECTA, 2007; DES 2008). Facilities promoting collaboration are another integral component of all VLEs. Research has demonstrated the pedagogical value of fostering a strong sense of community through the use of collaborative web-based learning (Dawson, 2006; Farren, 2006; Owen et al., 2006; Rudd et al., 2006). According to Piccoli (2001) this pedagogical value stems primarily from the fact that: "the learning process is no longer an individual

endeavour, but can incorporate and leverage the many-to-many relations among learners and with instructors" (p. 403).

There are many available VLEs with similar sets of features and a range of capabilites to support various learning situations. The Open source course management system Moodle (Modular Oriented Developmental Learning Environment) is one such example. Moodle was developed along the pedagogic goals of social constructionism (Dougimas, 2000), emphasising that successful learning takes place when learners solve contextual real-life problems through active engagement, and extensive networking, communication and collaboration (Grabinger et al., 2007). Facilities for synchronous discussion (not in real time) offer, through dialogue with teachers and peers, the opportunity for students to appreciate multiple perspectives, and to reflect on their own opinions before making a contribution (Mayer, 2003; Beasley & Smyth, 2004; Farren, 2008). This affords them a real opportunity to engage in a richer; more sophisticated and considered dialogue than is often possible in synchronous face-to-face situations.

One of the main stimuli behind my decision to incorporate Moodle into my pedagogical practice was the desire to foster the increased opportunities for collaboration and dialogic co-enquiry that are extensively purported to be associated with Moodle usage within the literature. While undergoing teacher-training at University, my fundamental instinct was to be collaborative. I placed great merit on the potential of dialogue with peers and colleagues in advancing my own learning. However, throughout my teaching career to date, I find that my practice has begun to veer away from this approach. In hindsight, this attitude shift reflects an adjustment to the dominant practices of the school where I am presently employed (Korthagen & Kessels, 1999). Through embracing Moodle I hope to move back towards a more collaborative approach that is better in keeping with my core educational values.

However, it is imperative to bear in mind that blending online-learning with traditional approaches requires new pedagogic skills. Jackson and Anagnostopoulou (2002) argue that, "both the main barriers and the main pathways to improving the quality of student learning online lie not with the use of particular technologies, but with the pedagogical conceptions and assumptions underlying their use" (p. 54). Teachers must adapt their practice or adopt new approaches in order to maximise the potential of this new technology (Piccoli et al., 2001; Garrison & Cleveland-Innes, 2005; Condie & Livingston, 2007).

2.2. Virtual learning environments and student motivation

I am committed to fostering a passion for science and the natural world within the students I teach. However, I have become concerned that my teaching approach is not very conducive to realising this ambition. All too often I fall into the trap of assuming a didactic stance where I am focused primarily on outcomes such as the ability to recall facts. In the process I pay no heed to more fundamental goals such as eliciting enthusiasm and passion for the subject matter. Through engaging in the research process, I wish to overcome this "living contradiction" (Whitehead, 2008).

An evaluation conducted by Condie and Livingston (2007) into an online-learning programme designed to support students during the post-compulsory years of schooling in Scotland, found that, "the opportunity to interact with a range of materials in different formats, in a way that is appropriate to the students" needs at a time of their own choosing, may have contributed to an increase in their confidence and motivation to study (Condie and Livingston, 2007, p. 4). Increased levels of interest, motivation and engagement among students are also reported in a study examining the effects of introducing a VLE into a primary school science-classoom in Singapore (Ang and Wang, 2006). The authors proposed that the new technology enabled teachers to, "present scientific knowledge in a way more appealing than traditional textbooks", and that this appeal may have led to, "an increased level of engagement with the content" (Ang and Wang, 2006, p. 1).

However, Salmon (2002) warns aspiring e-moderators never to assume that the "joys" of using the technology itself will provide any kind of motivation for students to learn. Even the most apparently confident individuals need support so they do not become demotivated whilst completing an online activity. Emphasis must be placed on the importance of meaningful, motivational feedback as part of the web-based learning experience (Salmon, 2002).

One way to consider motivation in a Virtual Learning Environment is in terms of expectancy-value theory. This theory states that the learning activity must hold value for the learners and that they must expect to succeed (Salmon, 2002; Hodges, 2004). Accordingly, when designing an online-learning activity it is vital to specify its purpose clearly, and to make that purpose achievable. Expectation to succeed ties in with Bandura's ideas regarding self-efficacy (Bandura, 1997). Self-efficacy lies at the heart of motivation (Hodges, 2004).

Keller's ARCS model is one strategy for incorporating motivational strategies into the learning experience (Keller, 1987). The acronym, ARCS, stands for Attention, Relevance, Confidence and Satisfaction. The model operates under the premise that learners will be motivated if they feel they can achieve success and that there is value in their learning. Therefore, this model operates within the parameters of expectancy-value theory.

Biggs (1987) proposes that students' motivation for completing a task will affect the approach to learning that they adopt. He examines students' approaches to learning under two main headings; the surface approach and the deep approach. Students who adopt a surface approach to their learning do not see interconnections between elements, or the meanings and implications of what is learned (Kanuka, 2005). In contrast, when a deep approach is adopted, there is a personal commitment to learning, which means that the student goes below the surface of the text to interpret the true meaning (Biggs, 1999). Students can move from one approach to another and do so in response to the climate and requirements of their learning environment (Garrison & Cleveland-Innes, 2005; Kanuka, 2005). The literature links extrinsic motivation with more surface-learning strategies and intrinsic motivation with deeper learning strategies (Biggs, 1987; Pintrich, 2004).

Interest in the subject has been described as an essential characteristic of a deep approach to learning (Biggs, 1993). However, Matthews (2006) advises the importance of distinguishing between the related matters of interest and motivation when dealing with science students' responses to activities. He maintains that motivation, in the sense of a personal response that gives a strong sense of direction to one's present and future activity,

is not the same as an interest, which is a more fleeting and temporary response (ibid.). This view is reiterated by Leaman (2004), who through observing her grades five and six students in an online-setting found that starting and finishing with students' immediate interests does not automatically create deeper understanding.

2.3. Virtual learning environments and higher order cognition

Higher order cognitive skills involve changing the form or organisation of information when resolving a problem by applying, analysing, synthesising, extending and evaluating its content (Perrott, 1994; Anderson & Krathwothl, 2001). Bloom's taxonomy offers a framework for categorising thinking skills, with a progression in terms of difficulty from lower order thinking skills such as knowledge acquisition up towards higher order thinking skills such as evaluation. This taxonomy offers a way to make decisions about the approach to learning (i.e. deep or surface) and the levels of learning-outcomes that can be derived from any activity (Passey, 2000; Anderson & Krathwohl, 2001).

I maintain that learning is not simply a matter of rote-memorisation; rather it is a process involving the active seeking of meaning. This is exactly why I chose higher order cognition as one of the central themes of my enquiry. I wanted to move away from the didactic approach to teaching which I had gradually succumbed to by introducing a form of technology into the classroom that is claimed within the literature to possess the capacity to promote high levels of an active construction of knowledge among students.

For instance, Hatzipanagos (2006) asserts that the asynchronous discussion forum facilities within VLEs potentially encourage higher order thinking-skills by, "providing an additional communication channel to students, leading to more sophisticated arguments and allowing reflection which cannot take place in synchronous face to face sessions" (p. 2). In a similar vein, Salmon (2002) proposes that as the results of online discussions are available for revisiting and reconsidering in a way that cannot happen with more transient verbal conversation, it is possible to "rewind" a conversation and make very direct links between different messages. This, according to Garrison and Anderson (2003) – in combination with the time-lag inherent in asynchronous communication – provides learners with opportunities for the critical reflection, which is necessary for higher order learning.

In order to assess students' levels of higher order knowledge construction in a virtual learning environment it is necessary to look at some type of framework. A number of analytical rubrics have been devised to analyse transcripts of dialogue from threaded discussion forums for evidence of higher order thinking skills. One such framework that is commonly used is Biggs' SOLO taxonomy (1999). SOLO (an acronym for Structure of the Observed Learning Outcome) was built on research into the two approaches to learning, i.e. deep and surface (Kanuka, 2005). It also has obvious links with the cognitive domain of Bloom's taxonomy (Hatzipanagos, 2006). The SOLO taxonomy differentiates between in-depth and surface processing of material learnt by placing students' responses into one of five predetermined, hierarchical categories:

1. Prestructural: The task is not attacked properly; use of irrelevant information; the student has not understood the point.
2. Unistructural: Focuses on one relevant aspect only.

3. Multi-structural: Focuses on several relevant aspects, but they are not co-ordinated together.
4. Relational: The several parts are integrated into a coherent whole: details are linked to conclusion; meaning understood.
5. Extended abstract: Answer generalises the structure to a new area or topic; higher order thinking is used to bring in a new and broader set of issues. (as cited in Kanuka, 2005; Hatzipanagos, 2006)

However, Rourke et al. (2001), advise caution when analysing transcripts of asynchronous, text-based online discussion. They suggest that this technique may be susceptible to the infiltration of subjectivity and interpretive bias. If the "discovery of an excessive degree of subjectivity" arises, they recommend that this "should signal to the research team that further refinement is needed" (ibid., p. 4). On another cautionary note, Kanuka (2005) points out that, "if the instructor wishes to have students working at the higher levels of the SOLO taxonomy, assignments must be directed towards that level" (p. 15). Therefore, setting assignments that elicit extended abstract responses is essential in encouraging higher order responses from the students (Kanuka, 2005).

Salmon's model of teaching and learning provides a framework for active and interactive online-learning that links together the three main themes of the study: online collaboration, motivation and higher order cognition (Salmon, 2002). The model discusses the following five stages of adoption within a hierarchy: Access and Motivation, Online Socialisation, Information Exchange, Knowledge Construction and Development. Salmon (2002) proposes that, "given technical support, good human intervention from an e-moderator, and appropriate e-tivities to promote action and interaction, nearly *all* participants will progress through these stages of use" (p. 12). She maintains that consequently they will become "online *authors* rather than transmitters of information" (p. 29).

3. Methodology

3.1. Action research

Action research encourages researchers to reflect systematically on their pedagogical practice while implementing informed action to bring about enhancement in that practice for social benefit. Reflection moves learning forward by allowing the protagonist to tap into their deep tacit knowledge and raise it to explicit levels of awareness (Whitehead & McNiff, 2000). The participative nature of action research, in which both researcher and subjects are active participants in the research process, is an aspect of the approach that I find especially appealing.

Much of the literature surrounding action research points to its capabilities to transform individuals and situations through this process of critical reflection (Mezirow, 1991; Farren, 2008). This is one of its aspects that I find most fascinating, and ranks among the primary reasons why I have opted for it as my proposed methodological approach.

A defining characteristic of the action research approach, as put forward by Whitehead and McNiff, is the strong emphasis it places on the practitioner's educational values. Laidlaw (1996), and later Whitehead and McNiff (2006), propose that these values can come to act as living standards by which we make judgements about the quality of our practices. I found the clear emancipatory philosophy of Whitehead's approach extremely appealing. The challenge to live my values supports the emergence of truth in the research.

Similar to many other practitioners in the field of education, I find that my values are often in direct conflict with my everyday practice. According to Whitehead (2008) if we announce our values and then ignore them in the process, we become "living contradictions". On my part, this living contradiction is primarily due to the constraint of covering a lengthy syllabus in a limited amount of time. I engaged in this research study primarily in order to overcome this contradiction, and to find ways of working that were more fulfilling for myself and the students I teach.

While carrying out my research-study, I utilised the Action Plan proposed by Whitehead and McNiff (2006) to bring a sense of order and discipline to the process of enquiry I was engaging in. McNiff (2002) maintains that asking questions in the form of those contained in the Action Plan enable the practitioner to go someway towards overcoming the living contradiction, so that they might live more fully in the direction of their educational values.

3.2. Data collection

McNiff and Whitehead (2006) describe data as constituting the actions and phenomena that are recorded, gathered and stored throughout the duration of the research-study. Maintaining the correct focus is essential when gathering data. This helps ensure that the resulting data is appropriate for generating the kind of evidence that will withstand robust critique in supporting the researcher's claim to knowledge.

In order to provide a rich source of evidence to address my research question, I collected a range of qualitative data from a variety of sources including online reflective journals, discussion forums within Moodle and audio clips of student interviews. All the while I adhered to Whitehead and McNiff's (2006) advice that the dual aims of data-collection are to highlight episodes of practice that show how I developed my own learning, and also the episodes when I think the new learning has influenced the learning of others in an educational way. My selection of various media to aid in producing a "visual narrative" of my research was greatly influenced by my learning on the Masters programme and the work of Crotty (2009).

I am aware of the inherent bias I bring to the research process. This stems primarily from the fact that I, similar to other researchers, arrive at the situation with certain pre-established standpoints. I strived to ensure that I took appropriate measures to reduce this risk. I deliberately chose to scrutinise the data from multiple perspectives in order to substantiate my account of the situation. According to Golafshani (2003), this process of triangulation leads to, "more valid, reliable and diverse constructions of realities" (p. 604).

3.3. Validating the evidence

An integral element of supporting a claim to knowledge is that action research practitioners submit their research findings to the critical scrutiny of others to see if they can withstand criticism, in other words, have validity (Whitehead & McNiff, 2006). Throughout the duration of the study, I called upon the observation and judgements of interested individuals to evidence my claim that my core educational values and beliefs were being adequately translated into my practice. Each of these individuals would have been explicitly aware of the ontological values and related epistemological values that were at the essence of the study.

By drawing on Habermas's (1987) criteria of social validity I helped convey the validity of my research claim. Habermas maintains that a claim to knowledge can be judged in terms of whether it is sincere, authentic, comprehensible and appropriate to the situation. I made my work available for the analysis and commentary of a validation group comprising of my peers on the M.Sc. in Education and Training Management (e-Learning) in DCU. The resulting critical feedback proved invaluable in helping me to evaluate the quality of my research and in gaining fresh insight into the nature of my concern.

Throughout the period of the study, I took care to constantly articulate and examine the value-laden standards that I employed to make judgments on my work. This helped demonstrate the rigorous nature of my work, and consequently assisted me in adhering to the six criteria for rigour as outlined by Winter (1996).

3.4. Ethical considerations

All participants were entitled to withdraw voluntarily from the study at any stage. They were assured that the data generated would not be used for any other purpose other than research for my study. I have not identified the school in the research**.** The names of students who participated in the study have not been revealed in order to assure their anonymity.

4. Implementation and evaluation

4.1. Introduction

The desire to reduce the dissonance I experience when my implicit values are denied in my explicit practice, prompted the evolution of two main cycles of action research. Cycle one of the research focused on setting up and introducing Moodle to the participants. The second cycle was concerned with the possibility of fostering a community of enquiry through the use of the discussion forum facility within Moodle.

The research took place over a ten week period in the 2008-2009 academic year, beginning at the end of February and finishing in mid-May. It was conducted among my fifth year Biology class which comprises eight students in total, all boys. The class consists of a

wide array of abilities, ranging from students who are aiming for a pass at Ordinary level to those aspiring towards top grades at Honours level.

4.2. Cycle One

In endeavouring to guarantee that the students' first encounter with a VLE was a positive experience, I was mindful of adhering to the expectancy-value theory and the ARCS model. Consequently I employed the utmost discretion when uploading resources onto Moodle to ensure that they were relevant, enticing, educationally sound and would complement existing textbook content. I strived to ensure that the directions guiding students through any activity were explicitly clear, and that all of the introductory tasks were easily achievable. Furthermore, I also constantly questioned how the online activities would link together and integrate with the face-to-face classroom sessions.

Throughout the initial phases of cycle one, the students were provided with ample opportunity to explore and familiarise themselves with the layout of Moodle. They were shown its various features such as the journals, discussion forums, and glossary, and encouraged to access the supplemental material which I had placed online for their viewing such as slideshows, video clips and links to other websites.

I took care to introduce the students to the technology in a phased manner. Accordingly I did not reveal all the resources and activities which I had posted up at once. I kept many "hidden" from the students' view, and then based on their progress within the lesson I gradually revealed them. My reasoning behind this also stemmed from the fact that, as this was new uncharted territory for me, I was unsure about the exact timeframe in which it would take to complete the various activities. The students' responses to their initial introduction to Moodle were overwhelmingly positive, as is demonstrated by the following audio clips (audio 1 and audio 2) and within their personal journals (journal 1).

I realised that I needed to capitalise on the students' positive preliminary reactions to the technology. I knew that I needed to tailor future lessons to ensure that the initial interest they had expressed was converted into longer-term, less fleeting goals such as increased intrinsic motivation and high levels of knowledge construction. The resounding message that echoed from the work of key authors such as Salmon (2002), Garrison and Anderson (2003) and Hatzipanagos (2006) pointed me in the direction of linking the technology with assessment. With this in mind and based on advice from colleagues on the Masters programme in DCU (discussion 1), I posted up revision notes that the students could access to aid them in revising for their Easter test. I further linked Moodle with assessment by giving the students an online assignment to complete that would constitute 20% of their end of year grade.

Throughout the three weeks between the initial introductory session to Moodle and the Easter holidays, I was conscious of fostering the students' confidence levels in online communication. The students' feedback following these sessions was generally very positive. Many of them pointed to increased interest in the subject and motivation to learn as being among the chief benefits involved (journal 2).

4.3. My values in cycle one

As the desire to live more in accordance with my implicit values was one of the primary factors motivating this study, I questioned whether there was now more of a congruence between them and my explicit practice. What I found did not best please me. On reflection, I had been so consumed with introducing the technology, and ensuring that this was a positive experience for the students that I had lost focus of my ultimate goal – to live more in the direction of my values. Whilst I felt that I had succeeded in integrating the technology into our practice and highlighting its educational potential to the students (reflection 1), I now could see that I had done so at the expense of my values (reflection 2).

I claim to value inclusion, yet was I encouraging fragmentation between the students who did and those that did not have Internet access in their homes? I certainly did not want any student to feel isolated from the rest of the group, yet was this what my actions were tantamount to?

One of my main motives for engaging in this study was to promote the learner autonomy which had been negated through my didactic style of teaching. However, I now see that within my intuitive interpretation of this value, there lies a conflict which I had hitherto not considered. My definition of learner autonomy implies that it is a departure from education as a social process which happens to be at the essence of dialogic co-enquiry, another core value of mine. Instead of viewing this apparent contradiction between my values as a problem, I began to see that it was possible to hold two potentially conflicting values in tension.

Furthermore, I began to appreciate the intricacies of, "the catalytic reaction that comes about in response to the juxtaposition of ideas, thoughts, beliefs and experiences which have an analytical tension at the surfaces, but synthetic power at the depths" (Hymer, 2007, p. 111). I realised that I needed to modify my definition of learner autonomy to encompass collaboration and dialogue. The key to achieving this would be to strike the correct balance between learning as a collaborative activity and realising autonomy on the part of the learner.

4.4. Reflection on cycle one

One of my main motives for integrating a VLE into my practice had been to introduce collaboration and dialogic co-enquiry into the classroom. I had aspired to create a space where students and teacher could come together to start to share resources, collaborate and create a community of enquiry. Yet, at the end of cycle one, I could see little evidence of increased interaction (reflection 3). I was not fully exploring Moodle's capacity to support social constructionism. I seemed to be using Moodle mainly as a medium to post up revision notes, resources and activities. The students were largely just transcribing information from their textbooks onto the system, and I could see little evidence of the higher order thinking which was meant to have been a focal point of the study. To date the discussion forums had been used in an ad hoc manner with little evidence of indepth discussion or debate (discussion 2). Interviews I conducted among the students at the end of this cycle mainly referred to the materials which I had posted onto Moodle for their viewing, especially the

video clips and slideshows (audio 1 and audio 2). These interviews made little reference to their own online contribution and no reference at all to collaboration. Somehow I had deviated away from my ultimate motives for introducing Moodle to my students.

A chief stimulus behind the research study was my desire to improve motivation levels among my students. Certainly judging by the feedback I received via taped interviews with the students (audio 1 and audio 2) , the students' journals (journal 1 and journal 2), my personal observations as documented within my journals (reflection 1) and the observations of a colleague (feedback 1), overall it did seem that students' motivation to learn had been increased, and that this was as a direct consequence of using the technology. Yet I realised that I should not become too complacent regarding the progress in this respect which had been made to date as past experience has taught me how fragile in nature, and susceptible to unexpected external influences motivation can be. On one level, there was the niggling doubt that maybe some of the students' enthusiasm might stem from the change of scene and the diversion from classroom reality that using Moodle entailed. Furthermore, I still had to uncover whether there was truth in Biggs' claims that increased student motivation can be converted into a deeper approach to learning (Biggs, 1987; 1993).

While I appreciated that the students' and my own learning had been greatly affected over the three short weeks that comprised cycle one, I saw that what we had achieved to date was merely a stepping stone in the pursuit of greater educational rewards. I now realised that in order to derive the potential benefits of the technology I would need to greatly re-focus my usage of the system.

4.5. Paving the way for cycle two

It was at this juncture that I returned to the literature surrounding curriculum delivery through a VLE for guidance. All of the literature was pointing me towards Salmon's five stage model for teaching and learning online. This marked a significant turning point in the direction of my work, as here was a model that addressed and linked together the three main themes of my research: motivation, online socialisation and higher order thinking. Stage four of the model was particularly inspirational as it promises that by placing certain prerequisites in place and adhering to certain optimum criteria, electronic discussion forums can be used to promote higher order cognition among students.

After consulting with the second stage of Salmon's model (i.e Online Socialisation), I realised that I had been too quick to dismiss the use, to date, which we had made of the online discussion forums. Now I see that these interactions were vital stepping stones in establishing the online presence that is so crucial to the formation of a community of enquiry (Garrsion & Anderson, 2003). In many cases, through their sharing of resources such as web links, the students were advancing into stage three (Information Exchange) of Salmon's model.

I now saw that by consolidating all we had achieved to date, we could move forwards, and possibly make a reality of the online discussion's potential to elicit the higher stages of Salmon's model. In my capacity as e-moderator, I needed to start setting more challenging online-tasks which would be more conducive to realising this objective.

4.6. Cycle two

The focus of the second cycle was to ascertain whether asynchronous text-based communication can foster higher order thinking via peer interaction, whilst continuing to build on and consolidate the students' motivation levels. Over the course of this second cycle I set up the following two discussion forums (Table 1):

Table 1. Discussion forum 1 & 2.

Discussion forum 1	
Unit of syllabus:	Unit 3 – The study of living things
Theme:	Human reproduction
Discussion forum topic:	Do you think that the use of IVF is ethical?
Start date:	20th April 2009
The transcripts from discussion forum 1 may be accessed here.	
Discussion forum 2	
Unit of syllabus:	Unit 2 – Genetics
Theme:	Evolution and variation
Discussion forum topic:	Watch the short video about the discovery of the Laetoli footprint. Why was this footprint such a significant find?
Start date:	5th May 2009
The transcripts from discussion forum 2 may be accessed here.	

I strove to ensure that motivation was integrally involved as part of both the process and the experience of cycle two. When devising the discussion forums, I was conscious of evoking their potential to elicit the higher order thinking and meta-cognition asserted by Salmon as being the outcome of online activities at the higher stages of her model (Salmon, 2002). However, at the same time I wanted to ensure that the tasks I set were adequately challenging, yet reachable, and wouldn't exclude some students from participating by being too daunting. This would build on the students' expectations of success, thereby increasing their self-efficacy (Bandura, 1997). I took further care in ensuring that the online activities were of relevance and had value for the learner. The aforementioned strategies tie in with the main premises of expectancy-value theory, the ARCS model and stage 1 (Access and Motivation) of Salmon's model, each of which are outlined within the literature-section.

All the while I was also conscious of the potential of the online activities to attain the higher levels in the cognitive domain of Bloom's taxonomy. I hoped that the online dialogue would take the students beyond a narrow focus on recall, recognition and reproduction of information to the evaluation, analysis, synthesis and reconstruction of knowledge.

Subsequent to a face-to-face introduction to the topic, students were encouraged to continue their discourse through the medium of the online discussion forums. The following audio clips capture the students' reactions to this departure from our traditional classroom practice (audio 3 and audio 4). In order to promote participation each student had to respond to my initial post, and that of at least one other student. While accepting that the obligatory nature of this exercise could have led to lower levels of discussion, I considered it vital in ensuring students' participation.

Initially the discussion forums required a considerable amount of scaffolding in the form of my support, encouragement and critically constructive feedback. I found that the challenge was, as Salmon (2002) points out, "to provide the balance between too much structure and too little" (p. 31). The first postings made by some of the students tended to be quite brief, and did not delve sufficiently deeply into the topic in order to construct a complete argument (posting 1). My role in this instance was to mould the technical savvy which these "digital natives" already possessed (Prensky, 2001). I did so by encouraging them to post up more considered responses that would "model" my own online example.

However, as the students became more proficient and confident with the online dialogue, I was gradually able to withdraw some of these scaffolds. The opportunities for scaffolding were now increasingly to be found in the student-centred nature of the learning environment (Oliver & Herrington, 2003). During the instances when I engaged with the students in the forums, my chief purpose was along the lines proposed by the Knowledge Construction stage of Salmon's model (Salmon, 2002). I aimed to pull the discussion together by stimulating fresh strands of thought, introducing new themes and suggesting alternative approaches (posting 2).

By early May both of the forums were active. It was evident from the quality and insightful nature of much of the online dialogue that the students were realising the key characteristics of higher order thinking as explained within stage four of Salmon's model. Their levels of confidence with this medium of communication were really flourishing. Students were drawing on their personal experiences to add weight to their arguments (posting 3). They were considering the notion that there may be multiple answers in the solution to any one problem (posting 4). They were employing creative skills to imagine and invent new possibilities and solutions (posting 5). There were also instances where they exhibited reasoned evaluation by prioritising the issues which they perceived to be most critical (posting 6).

However, despite all of these achievements, I saw the need for a concrete scientific method of asserting and classifying the occurrence of higher order cognition within the forums. I re-engaged with the literature once more in order to gain some clarity. At this point I happened upon Biggs' SOLO taxonomy which provides a framework to qualitatively evidence the occurrence of higher order thinking in discussion forum transcripts (Biggs, 1999). One of my main reasons for selecting the SOLO taxonomy was because of the explicit nature of the various levels. There is a clear dividing line marking the transition from increasing knowledge to deepening understanding. When learners are operating at levels four and five of the SOLO taxonomy, they are actively constructing new knowledge. This, according to Salmon, is *the* defining characteristic of higher order thinking.

I now decided to revisit both forums and to look at them in light of the SOLO taxonomy. During the content analysis of the forums, my approach centred on locating thematic units which highlighted evidence of higher order thinking (Hatzipanagos, 2006). In doing so the emphasis was not on size, such as sentence unit or paragraph unit, but on units of meaning. In order to obtain a more comprehensive view on the incidence of higher order thinking within the forums, I collated the number of thematic units from each of the five levels of the SOLO taxonomy into the following table:

Table 2. Thematic units from each of the five levels of the SOLO taxonomy.

Level of SOLO Taxonomy	Number of occurences	
	Discussion forum one	**Discussion forum two**
1. Prestructural	4	5
2. Unistructural	5	3
3. Multi-structural	5	5
4. Relational	5	3
5. Extended abstract	2	1

4.7. Reflection on cycle two

At the end of cycle one I felt that the educational values that I espoused were still not being lived in practice. I became aware that I was so consumed with the mechanics of posting resources online and encouraging students to contribute that I was in danger of negating my core educational values.

As I stepped into a more facilitative role in cycle two, the students began to exercise more independence. The focus began to move from teaching to learning. The interweaving web of collaborative virtual relationships began to manifest into a learning community built on trust and responsibility. A real sense of camaraderie and support began to emerge (journal 3).

This increasingly learner-centred approach was a marked departure from the didactic style of teaching I normally assumed. It was at this juncture that I began to experience a more satisfying and effective balance between the dualism that is guide and co-learner. My role became no longer that of, "'sage on the stage', imparting information but rather that of 'guide at the side' facilitates the acquisition of transferable skills" (Sanchez et al., 2004).

As I reassessed and delved deeper into my values, the dawning of a profound revelation took place (reflection 4). I realised that all this time I had completely failed to acknowledge the value that was at the very essence of everything I strive to achieve in an educative capacity. This value is love. I love the work I do. I am passionate about my role in potentially reaching out and affecting others. This loving energy that I feel for my work, is the foundation on which my other aforementioned values are built. Without it they would

cease to exist. It is the driving force that instils me with passion and enthusiasm for my role as a teacher.

I now accept that the extent to which in my being and practice, I embody this value comprises the chief standard of judgement upon which this enquiry is based. The acceptance of the life-affirming loving energy that I feel imbues my work with a renewed sense of passion, commitment and focus.

However, I do not work in isolation. Consequently the research marks the harmonic intertwining and juxtaposition of the voices of not one, but many. I engaged in a stream of dialogue with interested others that constantly dissected the claims I was making, and in the light of their evaluation prompted me to make the appropriate modifications to my work. Being open to the challenge of new learning was an essential precursor to the process. The research has led me to a much deeper understanding of the embedded tacit knowledge that inspires my work. I can now see evidence that my explicit practice is more in congruence with my implicit values. In the process I have transformed my learning and that of others.

5. The Journey

5.1. The integral role of my values in the enquiry

The chief stimulus that compelled me to engage in the research process was the realisation that my explicit practice was in negation of my implicit values. In researching my practice I have come to know my practice and have over time changed that practice. Consequently I now see that I am living more in the direction of my core educational values. I will not claim that these values emerged easily. Much preliminary work had to be done before substantial progress was made.

The research process marked the dawning of a profound revelation – the realisation that the core value at the root of this research study is love. I now see how love for my work informs the ideals that I aspire to, and is the foundation on which all my educative beliefs rest. Engaging in the research process has given me the courage to openly proclaim this value without any sense of fear or discomfort.

Over the course of this enquiry I have come to understand my values as being real-life practices, not abstract concepts (Whitehead, 2008). I have been enlightened on the extent to which my values underpin and permeate all that I strive to achieve in an educative capacity. I now appreciate that my effort to live more in the direction of my values will continue to be challenged, and that it is through this struggle that learning takes place.

5.2. The educational significance of the study and future recommendations

Over my research I have developed my own living theory grounded in my practice. While the aim of the study was never to provide a model that is replicable elsewhere, I expect that much of the research will carry resonances for fellow educational practitioners. In doing so it may inspire others elsewhere to embrace the technology in the bid to ascertain if they too can derive similar benefits to those which I have outlined within the study.

The timely publication of the Investing Effectively in ICT in Schools (2008-2013) report greatly informed and influenced the direction the study pursued (DES, 2008). If the report's recommendations regarding the adoption of VLEs into the practice of schools by 2013 are to be successfully fulfilled, I now see that certain prerequisites must be laid in place. First, there is the need for appropriate in-service training programmes to foster the new technical and pedagogical competencies that implementing the technology demands. Furthermore, as online instruction is more time intensive and requires more continuous attention than traditional classroom practices, I recommend that the workload of teachers be re-evaluated before this new educational tool is adopted within the education system.

5.3. The transformative influence of the study

Engaging in the study has empowered me to, borrowing from the words of Byrne and Gallagher (2004), "be no longer cast as a passive observer in an unchangeable process, but rather the key actor in the production of a better education system" (p. 31). As the research advanced the students came to act as co-authors, assisting me in moving away from the authoritarian dissemination of facts. This facilitated the nurturing of a community of enquiry, revolving around the collaborative negotiation of meaning. Whilst honing my facilitation-skills I have over time learned to strike a balance between the dualism that is co-learner and guide.

Since embarking on this virtual journey, my learning has undergone a marked transformation. The progression has been so subtle that it is almost imperceptible, yet cumulatively the influence on my pedagogy has been enormous. This profound process has prompted me to challenge everything I had previously held true. Even though I have been practicing as a teacher with a relatively short length of time, through engaging in this enquiry my practice has been revitalized and reenergized. My passion and love for teaching have been consolidated by adopting a living theory approach to the study.

I now see that the ten weeks that comprised this study were not an isolated episode in my practice. Rather they mark the start of a perennially-evolving and dynamic saga that will ultimately stretch far beyond my current horizons.

References

Anderson, L. W. and Krathwohl, D. R. (2001*). A taxonomy for learning, teaching and assessing – a revison of Bloom's taxonomy of educational objectives.* New York: Addison Wesley Longman, Inc.

Ang, H. K and Wang Q. (2006). *Proceedings of the First International LAMS Conference 2006: Designing the Future of Learning*. Paper presented at Nanang Technological University, Singapore.

Bandura, A. (1997). *Self-efficacy: the exercise of control.* New York: Freeman.

Beasley, N. and Smyth, K. (2004). Expected and actual use of an online learning environment: a critical analysis. *Electronic Journal of e-Learning, 2*(2), 21-29.

Becta. (2007). *Technology for E-Learning – Choosing a VLE*. Retrieved November 11, 2008, from http://ferl.becta.org.uk/display.cfm?page=99

Biggs, J. B. (1987). *Student approaches to learning and studying.* Melbourne: Australian Council for Educational Research.

Biggs, J. B. (1993). What do inventories of students' learning processes really measure? A theoretical review and clarification. *British Journal of Educational Psychology*, *63*(1), 3-19.

Biggs, J. B. (1999).What the student does: Teaching for enhanced learning. *Higher Education Research and Development, 18*(1), 57-75.

Byrne, G. and Gallagher, T. (2004). *Research Papers in Education, 19*(2), 161-183.

Condie, R. and Livingston, K. (2007). Blending online-learning with traditional approaches: changing practices. *British Journal of Educational Technology, 38*(2), 337-348.

Crotty, Y. (2009, June). *The importance of assessment for learning when creatively using digital technology and web 2.0 technologies in a research based Masters programme*. Paper presented at 9th DIVERSE Conference, Aberystwyth University, Wales.

Crotty, Y, & Farren, M. (2009) Promoting Creativity in Higher Education, In: Branko Bognar, Mira Peric Kraljik, Ladislav Bognar ed.Creative Approach to Teacher Education, Profil International, Zagreb

Cuban, L. (1984). *How teachers taught: Constancy and change in American classrooms, 1890 - 1980*. New York: Longman.

Dawson, S. (2006). Online forum discussion interactions as an indicator of student commumity. *Australasion Journal of Educational Technology, 22*(4), 495-510.
Department of Education and Science. (1997). *Schools IT2000: A policy framework for the new millennium.* Dublin: The Stationery Office.

Department of Education and Science. (2002). *Report of the taskforce on physical sciences.* Dublin: The Stationery Office.

Department of Education and Science. (2004). *Leaving Certificate Biology syllabus*. Dublin: The Stationery Office.

Department of Education and Science. (2006). *Strategy for science, technology and innovation, 2006 – 2013.* Dublin: The Stationery Office.

Department of Education and Science. (2008a). *ICT in schools inspectorate evaluation studies: Promoting the quality of learning.* Dublin: Stationary Office.

Department of Education and Science (2008). *Investing effectively in information and communications technology in schools, 2008 – 2013. The report of the Minister's strategy group.* Dublin: The Stationery Office.

Dougiamas, M. (2000). Improving the effectiveness of tools for Internet based education. Paper presented at Teaching and Learning Forum 2000. Retrieved December 10, 2008, from http:// lsn.curitn. edu. Au/tlf/tlf2000/dougimas.html

European Schoolnet (2006). *The ICT impact report: A review of studies of ICT impact on schools in Europe.* Retrieved March 17, 2009, from http://insight.eun.org./ww/en/pub/insight/misc/specialreports/impact_study.htm

Farren, M. and Crotty, Y. (2010). Learning through action research and technology. *Teaching Reflections, 1*(1). Retrieved from http://www.dcu.ie/ovpli/liu/Teaching-Reflections/Issue-1/TR-1-AR-and-technology.shtml

Farren, M. (2006). *How am I creating a pedagogy of the unique through a web of betweenness*? (Doctoral dissertation, University of Bath, 2006). Retrieved from http://www.actionresearch.net/farren.shtml

Farren, M. (2008). E-learning and action research as transformative practice. *Innovate Journal of Online Education, 5*(1), 1-4.

Garrison, D.R., and Anderson, T. (2003). *E-learning in the 21st century: A framework for research and practice.* London: Routledge/Falmer.

Garrison, D.R. and Cleveland-Innes, M. (2005). Facilitating cognitive presence in online learning: Interaction is not enough. *The American Journal of Distance Education*, *19*(3), 133-148. Retrieved from http://www.library.dcu.ie/Eresources/daatabases-az.htm.

Golafshani, N. (2003). Understanding reliability and validity in qualitative research. *The Qualitative Report, 8*(4), 597-607.

Grabinger et al. (2007). Instructional design for sociocultural learning environments. *E-Journal of Instructional Science and Technology, 10*(1), 217-229.

Habermas, J. (1987). *The theory of communicative action volume 2: The critique of functionalist reason.* Cambridge: Polity Press.

Hatzipanagos, S. (2006). *HOT and flaming spirals: Learning and empathic interfaces in discussion forum text-based dialogues.* Retrieved March 10, 2009, from http://www.eurodl.org/materials/contrib/2006/Stylianos_Hatzipanagos.htm

Hodges, C. B. (2004). Designing to motivate: Motivational techniques to incorporate in e-learning experiences. *The Journal of Interactive Online Learning, 2*(3), 1-7.

Hymer, B. (2007). *How do I understand and communicate my values and beliefs in my work as an educator in the field of giftedness?* (Doctoral dissertation, University of Newcastle, 2007). Retrieved from http://www.actionresearch.net

Jackson, B. and Anagnostopoulou, K. (2002). Making the right connections: Improving quality in online learning. In J. Stephenson (Eds.), *Teaching and learning online: Pedagogies for new technologies* (pp. 53-66). London: Kogan Page.

Joint Information Systems Committee. (2008). *Effective use of virtual learning environments.* Retrieved March 7, 2009, from http://www.jiscinfnet.ac.uk/InfoKits/effective-use-of-VLEs/index_html

Kanuka, H. and Kreber, C. (1999). *Knowledge construction in the virtual classroom.* Retrieved April 17, 2009, from http://www.oise.utoronto.ca/CASA/cnf99/kanuca.htm

Kanuka, H. (2005). *An exploration into facilitation higher levels of learning in a text-based internet learning envoronment using diverse instructional strategies.* Retrieved April 17, 2009, from http://icmc.indiana.edu/vol10/issue3/kanuka.htm

Keller, J. M. (1987). Development and use of the ARCS model of instructional design. *Journal of instructional development*, *10*(3), 2-10.

Korthagen, F. and Kessels, J. (1999). Linking theory and practice: Changing the pedagogy of teacher education. *Educational Researcher, 28*(4), 4-17.

Laidlaw, M. (1996). *How can I create my own living educational theory as I account for my own educational development?* (Doctoral dissertation, University of Bath, 1996). Retrieved from http://www.actionresearch.net/moira.shtml

Leaman, E. (2004). *Action research: investigating the integration of ICT and higher order thinking.* Retrieved April 18, 2009, from http://www.ltag.education.tas.gov.au

Matthews, P. (2006). *The relevance of science education in Ireland*. Retrieved December 18, 2008, from http://www. ria.ie/publications.rose.html

Mayer, K. A. (2003). Face-to-face versus threaded discussions: the role of time and higher-order thinking. *JALN, 7*(3), 55-6*5.*

McNiff, J. (2002). *Action research for professional development: Concise advice for new action researchers.* London: Sage Publications.

McNiff, J. and Whitehead, J. (2000). *Action research in organisations*. New York: RoutledgeFalmer.

McNiff, J. and Whitehead, J. (2006). *Action research: Principles and practice (2nd edition).* New York: RoutledgeFalmer.

Mezirow, J. (1991). *Transformative dimensions of adult learning.* California: Jossey-Bass.

National Council for Curriculum and Assessment. (2003). *International developments in upper secondary education: Context, provision and issues.* Dublin: NCCA.

National Council for Curriculum and Assessment. (2004). *Curriculum assessment and ICT in the Irish context: A discussion paper*. Retrieved November 10, 2008, from http://www.ncca.ie/index.asp?locID=62&docID=-1

Neo, M. (2005). Web-enhanced learning: Engaging students in constructivist learning. *Campus-Wide Information Systems*, *22*(1), 4-14.

Oliver, R. (2002). Exploring the development of critical thinking skills through a Web-supported problem-based learning environment. In J. Stephenson (Ed.), *Teaching and learning online: Pedagogies for new technologies* (pp. 98-111). London: Kogan Page.

Oliver, R. and Herrington, J. (2003). Exploring technology mediated learning from a pedagogical perspective. *Interactive Learning Environments, 11*(2), 111-126.

Oppenheimer, T. (1997). The computer delusion. *The Atlantic Monthly, 280*(1), 45-62.

Owen, M., Grant, L., Sayers, S. and Facer, K. (2006*). Opening education - social software and learning.* Retrieved November 10, 2008, from http://www.futurelab.org.uk/research/opening_education/social_software_01.htm

Passey, D. (2000). *Higher order thinking skills: An exploration of aspects of learning and thinking and how ICT can be used to support these processes.* Retrieved March 10, 2009, from http://www.northerngrid.org.ngflwebsite/hots/HOTSintro.pdf

Perrott, E. (1982). *Effective teaching: A practical guide to improving your teaching.* New York: Longman.

Piccoli, G. (2001). Web-based virtual learning environments: A research framework and a preliminary assessment of effectiveness in basic IT skills training. *MIS Quarterly, 25*(4), 401-426.

Pintrich, P. R. (2004). A conceptual framework for assessing motivation and self-regulated learning in college students. *Educational Psychology Review, 16*(4), 385-407.

Prensky, M. (2001). Digital natives, digital immigrants. *On the Horizon, 9*(5), 23-27.

Rourke, L., Anderson, T., Garrison, D. R., and Archer, W. (2001). Methodological issues in the content analysis of computer conference transcripts. *International Journal of Artificial Intelligence in Education, 12*(1), 101-111. Retrieved from http://ihelp.uask.ca/iaied.ijaied/members01/archive/vol_12/rourke/full.html

Rudd, T., Sutch, D. and Facer, K. (2006). *Towards new learning networks*. Retrieved November 15, 2008, from http://www.futurelab.org.uk/download/pdfs/research/handbooks/networks.pdf

Salmon, G. (2002). *E-tivities*. London: Kogan Page.

Sanchez, I. A., Savage, T. and Tangney, B. (2004). *Higher education (HE), information technology (ICT) and learning: ICT for replication or innovation.* Retrieved April 15, 2009, from http://www.cs.tcd.ie/crite

Whitehead, J. and McNiff, J. (2006). *Action research and living theory*. London: Sage Publications.

Whitehead, J. (2008). Using a living theory methodology in improving practice and generating educational knowledge in living theories. *Educational Journal of Living Theories, 1*(1), 103-126.

Winter, R. (1989). *Learning from experience*. London: Falmer.

Winter, R. (1996). Some principles and procedures for the conduct of action research. In Zuber-Skerrit, O. (Ed.), *New directions in action research* (pp 13-27). London: Falmer Press.