An Investigation of the use of Web 2.0 in Education and the Development of a Resultant Personalised Learning Environment.

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Declaration

I herby certify that this dissertation which I now submit for assessment by the School of Computing, Dublin Institute of Technology on the programme of study leading to the award of MSc in Information Technology is entirely my own work and has not been submitted for assessment for any academic purpose other than in particular fulfilment for the stated above.

Signed

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Date

12 – Nov - 2007

Abstract

The term Web 2.0 is a controversial term and draws much debate. Regardless of one's opinion towards the term, the components such as blogs, wiki's, podcasts and RSS feeds are used by millions on a daily basis. The objective of this dissertation is the creation of a framework for the inclusion of Web 2.0 technologies in University.

To illustrate this objective a personalised learning environment (PLE) is presented in this dissertation. The PLE is designed taking into account research completed on educational philosophy, learning styles, motivational techniques, design techniques, Web 2.0 techniques and the social aspects that are encountered when developing systems in an educational environment.

The dissertation presents a framework for the inclusion of Web 2.0 technologies. The framework is created through the assembly of information gathered by the research of academic literature, through the surveying of computer science lecturers in Ireland and through the interviewing of educational experts in Ireland.

Keywords: Web 2.0, Technology in education, Behaviourism, Constructivism, Cognitivism, Learning Styles, Wiki, Blog, Podcast, RSS, Videos, Personalised Learning Environment, Technology frameworks.

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Glossary of Acronyms Used

ARPANET	Advanced Research Projects Agency Network
BIOS	Binary Input/Output System
CERN	European Organization for Nuclear Research
CLT	Cognitive Load Theory
CORBA	Common Object Request Broker Architecture
GML	Generalised Mark-up Language
NCCA	National Council for Curriculum and Assessment
NCTE	National Centre for Technology in Education
PC	Personal Computer
PLE	Personalised Learning Environment
RPC	Remote Procedure Call
RSS	Really Simple Syndication
SGML	Standardised Generalised Mark-up Language
SOAP	Simple Object Access Protocol
TCP/IP	Transmission Control Protocol/ Internet Protocol
WSDL	Web Services Description Language
XML	Extensible Mark-up Language

1 Introduction

1.1 Background

It can be argued that Information technology within educational institutions has evolved in the same manner that many organisations evolve, decentralised, fragmented and underleveraged. Each University and faculty has evolved and developed in its own way and certain Universities and faculties are more technologically developed than others. This is not because of a lack of effort by many professors, lecturers and administrators in each University. There have been and continue to be many advances and developments made, but there is no global vision or strategy for the incorporation of technology in the classroom particularly the technology known as Web 2.0. In this research it is identified that there is a desire amongst computer science lecturers for more frameworks which document the inclusion of new technologies in the classroom.

It does not come as a surprise that amongst Computer Science lecturers in Ireland, the most commonly used method of information dissemination is the use of a traditional lecture accompanied with summarised presentation slides which are also made available through a traditional web site. This common theme amongst learning methods has created an environment where the motivation of students becomes more difficult. Students merely attend lecture after lecture where little changes other than the time of the day and all notes are readily available in electronic format.

The addition of Learning Management Systems is a positive move in many ways; it has brought information access into one portal where students can access most resources through one login. But the learning environment in place is already one of little differentiation and many LMS are from the very same mindset. They compound the monoculture that exists in education. Instead of browsing to a website created by a lecturer, the students visit a web portal no different to the portal offered by any other lecturer. In each module every student is confronted by an uninteresting

undifferentiated, generic discussion board, an imaginative lecturer might make use of the chat room. Discussion boards and chat rooms are most certainly not the technology of the present or the future and they are not the technologies being used throughout the workforce. How can educational institutes expect to develop students, in the words of a typical graduate job description for Microsoft, to be "critical thinking, innovative, problem driven, Ability to quickly understand and extend complex systems, Excellent written and verbal communication skills, skilled in Web Services and deployment of user driven technologies".

An answer to the question posed here is given in the question; Web Services are technologies that have been developed because of the problems identified with the technological predecessors of Web Services. The lack of interoperability, the difficulties included in scalability and the lack of a standardised language to develop systems all contributed towards the difficulties of enabling the collaboration of groups and organisations.

Tim O'Reilly, who created the term 'Web 2.0', describes it as, "the business revolution in the computer industry caused by the move to the internet as platform, and an attempt to understand the rules for success on that new platform". The term and its definition(s) have been the cause of much debate but many services within Web 2.0 allow users easily share opinions and resources. Blogs and Wikis are major components of Web 2.0 and the success of these software tools and other software that comprises Web 2.0 is dependent upon user's contributing and interacting regularly. Web 2.0 software is being introduced into the educational environment but there is no global vision or strategy for its inclusion. There are some professors who embrace this method of learning where as many professors feel that the traditional classroom is the only place to effectively disseminate course content. Although many professors are unsure of the pedagogical benefits of Web 2.0 in education, there is unanimous agreement amongst computer science lecturers that the inclusion of technology in the classroom motivates students. It is extremely difficult to achieve a learning objective of understanding when a student is not motivated.

This research will demonstrate that the use of Web 2.0 tools in the classroom enable a participative and personalised learning environment which is not a replacement for the classroom, but rather a rich and interactive aid to a lecturer. The availability of legally editable documents and books throughout the Web provides an area for learning unheard of before the creation of Blogs, Wikis and Podcasts.

Many people in universities and in workplaces throughout the world have begun to incorporate Web 2.0 technologies into their learning environment and still more people are beginning to use Web 2.0 for personal and a vocational purposes. With the extensive increase in popularity of Web 2.0 sites in recent years, educational institutions are now presented with students whom are already well versed in the use of social networking applications, of bogging, Wiki articles and of videos and podcasts. The foundation work for the familiarisation of the knowledge contributing and sharing tools is completed before students attend third level. It is this familiarity that students already possess which can be manipulated to develop students into individuals who can successfully integrate into the workforce.

This research identifies the possible techniques in which the components of Web 2.0 can be used in a pedagogical manner. This research presents a framework for lecturers to reference techniques they can use and also presents a personalised learning environment which is the gel between the many different techniques that a lecturer can employ.

1.2 Research problem

Academic research on the use of technology in the classroom and of learning styles is substantial and profuse. The one and only constant in technology is change and therefore research in technology and education is a never ending entity. The research problem in this instance is the analysis of the suitability of Web 2.0 tools in the education environment. Learning styles are a controversial topic and there is little

agreement upon their effectiveness, accuracy or pedagogical characteristics but there is general agreement that we each learn in different ways in different scenarios. This research explores the possibility of the customisable and varied characteristics that exist in Web 2.0 tools correlating to the varied characteristics of learning styles. The research determines if Web 2.0 has a pedagogical value and offers a framework of how to include Web 2.0 in the classroom.

1.3 Research objectives

The aim of this research is to investigate the different methods of learning offered by theorists and philosophers and to compare these objectives to the pedagogical characteristics offered by Web 2.0 techniques. The objective of the research is to identify how students are taught and identify what is the desired outcome for each student. By identifying the objectives of these teaching methods, it enables a connection to be made to the pedagogical potential of Web 2.0 technologies. The research includes the exploration of components which comprise Web 2.0 technologies, the research of Web 2.0 technologies in use in educational environments, and in workplaces. The aim is to identify what contributes towards the success of Web 2.0 in education and what contributes towards its failure.

The outcome of the research is be the development of a framework for using Web 2.0 technologies in undergraduate education and the creation of a learning artefact created from the guidelines within the framework.

1.4 Research methodology

The first component of the research methodology is the Analysis of Requirements stage. As this research is focused on student learning, this involves the identification of what is the objective for teaching students, what do we attempt to achieve when student enrol in University. What do we attempt to achieve by using the methods that are currently in use? In an attempt to determine the answer to this question, it is essential to explore the learning techniques which are employed in the western world. This research is completed through the use of desk-based research. It is carried out by reading research papers, text books, journals, conference articles, theses, working papers and academically rigorous articles available on websites. This stage includes research into the views of educational philosophers, learning theories and motivational techniques used by professors in the education environment. The objective is to identify how Web 2.0 can be used in an educational environment and thus the research involves the analysis of the Web 2.0 technologies

The research includes the exploratory interviewing of educational experts and obtaining their views on the current status of incorporating technology into everyday education. The sample of experts interviewed is small, but the views expressed are diverse.

A wider survey is also compiled in order to obtain quantitative data from a larger sample of educational experts. The questionnaire is presented to lecturers in computer science throughout Ireland. The survey enabled the identification of statistical data which would have been relatively easy to anticipate but also has presented data which may not be as easily predicted.

The next stage in the project is the design stage. It involves the analysis and synthesis of the data discovered during the data collection stage. The outcome of this stage is the development of a teaching framework which includes Web 2.0 Technologies.

The framework is based upon data obtained by interviewing experts in education and also upon data compiled through the literature research. The Framework is based upon the amalgamation of the participatory and customisation characteristics of Web 2.0 techniques and the learning theories discussed in this document.

1 .5 Chapter Roadmap

Chapter two follows with a discussion of educational philosophers and theories that they have articulated. The chapter discusses learning theories that can be applied to the instructional design of a module. The chapter introduces motivational techniques which encourage a student's attention. The chapter also discusses the types of learners that exist within society and discusses the different types of technology that may be suitable for their learning preferences.

Chapter three discusses the use of learning management systems and eLearning. The chapter then discusses Cognitive Load Theory and how it impacts the design of systems which are PC based. This chapter then discusses how to use Web 2.0 techniques in education and offers a substantial amount of possible methods which lecturers can employ in their classroom

Chapter four discusses the interview and survey methodologies used in this research project and records the large volume of qualitative and quantitative data assembled during the research.

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Chapter five presents a framework for the inclusion of Web 2.0 techniques in educational institutions and presents a prototype of a personalised learning

environment developed using Web 2.0 techniques which enables a student subscribe to the many methods which are offered in the framework.

Chapter six completes the research project with a discussion of some conclusions of the research findings and offers some suggestions as to the future work for this research area.

2 Education, Motivation & The Web

2.1 Introduction

The aim of this chapter is to discuss the concepts of educational philosophy and research the current learning methods in use in education. The chapter also discusses motivational techniques which can be incorporated into the instructional design of a course module. Following this, the chapter briefly discusses the evolution of the World Wide Web and finally describes the components of what is known as Web 2.0 or the Read/Write Web.

2.2 Educational Philosophy

Philosophers of education analyse the concept of education and analyse the questions that are central to education. These questions have been asked long before current day philosophers began to research this branch of philosophy. Most prominent philosophers throughout history have considered this subject in their writings. The questions and concepts of the philosophy of education include; *what are the objectives of education? Who should be educated? How should a person be educated? Where should a person be educated? How long a person should be educated for? What role should friends, family and state, play in the role of education? What of an individual?*

These questions have been asked since the beginning of civilisation and these questions are still asked today. One may ask, why research questions which never seem to be answered. An answer to this question is that every society must answer these questions for their own context and must take into account all possible combinations of current technologies, education philosophies and social sciences for the benefit of their society. In the following sections, some of the educational philosophers beginning with Ancient Greek philosophers are discussed.

2.2.1 The Socratic Method

(Golden *et al* 1983) describe the Socratic Method as,

> "The sequence and rhetorical strategies that are used give dialectic its uniqueness and scientific thrust. Adhering to a chronological pattern, it begins with a definition of terms and proceeds through analysis and synthesis to an ultimate conclusion based on enlightened understanding."

Socrates did not label himself as a teacher and his key philosophical perspective was that he himself knew nothing. He interacted with adult learners where he used a technique which involved teasing answers out of a student by using cross examination (dialectic debate). The Socratic Method is treated as any form of group discussion where the members of a group questioned each others opinions and thoughts. The Socratic Method is present throughout modern society from the legal system that employs an adversarial approach of defence and prosecution, to the political systems of liberal against conservative and is used today in many law course curricula (Noddings 1998).

(Golden *et al* 1983) describe the Socratic Method as a unique method of enquiry, which is a chronological or sequential method of enquiry, one that begins with a brief description of a topic and a question. The question and subsequent answer leads to the learner being presented with another question. Socrates would ask questions such as "what does it mean to be just?", he would allow an answer and follow this answer with another question which would begin to direct the learner towards his opinion. Though each question would differ in detail, each would present a common theme of what it is to be just from a wide spectrum. Eventually through cross analysis he would convince his learner what it is to be just.

The following excerpt from The Republic Book 1, details a discussion where Socrates convinces Polemarchus that harming the unjust is a faulty opinion.

Socrates: *"But the good are just and would not do an injustice?*

Polemarchus*: True.*

Socrates: *Then according to your argument it is just to injure those who do no wrong?*

Polemarchus*: Nay, Socrates; the doctrine is immoral.*

Socrates: *Then I suppose that we ought to do good to the just and harm to the unjust?*

Polemarchus*: I like that better.*

Socrates: *But see the consequence: --Many a man who is ignorant of human nature has friends who are bad friends, and in that case he ought to do harm to them; and he has good enemies whom he ought to benefit; but, if so, we shall be saying the very opposite of that which we affirmed to be the meaning of Simonides.*

Polemarchus*: Very true, he said: and I think that we had better correct an error into which we seem to have fallen in the use of the words 'friend' and 'enemy.'*

Socrates: *What was the error, Polemarchus? I asked.*

Polemarchus*: We assumed that he is a friend who seems to be or who is thought good.*

And how is the error to be corrected?

Polemarchus: *We should rather say that he is a friend who is, as well as seems, good; and that he who seems only, and is not good, only seems to be and is not a friend; and of an enemy the same may be said.*

Socrates: *You would argue that the good are our friends and the bad our enemies?*

Polemarchus: *Yes.*

Socrates: *And instead of saying simply as we did at first, that it is just to do good to our friends and harm to our enemies, we should further say: It is just to do good to our friends when they are good and harm to our enemies when they are evil?*

Polemarchus: *Yes, that appears to me to be the truth.*

Socrates: *But ought the just to injure any one at all?*

Polemarchus: *Undoubtedly he ought to injure those who are both wicked and his enemies.*

Socrates: *When horses are injured, are they improved or deteriorated?*

Polemarchus: *The latter.*

Socrates: *Deteriorated, that is to say, in the good qualities of horses, not of dogs?*

Polemarchus: *Yes, of horses.*

Socrates: *And dogs are deteriorated in the good qualities of dogs, and not of horses?*

Polemarchus: *Of course.*

Socrates: *And will not men who are injured be deteriorated in that which is the proper virtue of man?*

Polemarchus: *Certainly.*

Socrates: *And that human virtue is justice?*

Polemarchus*: To be sure.*

Socrates: *Then men who are injured are of necessity made unjust?*

Polemarchus: *That is the result.*

Socrates: *But can the musician by his art make men unmusical?*

Polemarchus*: Certainly not.*

Socrates: *Or the horseman by his art make them bad horsemen?*

Polemarchus*: Impossible.*

Socrates: *And can the just by justice make men unjust, or speaking general can the good by virtue make them bad?*

Polemarchus: *Assuredly not.*

Socrates: *Any more than heat can produce cold?*

Polemarchus: *It cannot.*

Socrates: *Or drought moisture?*

Polemarchus: *Clearly not.*

Socrates: *Nor can the good harm any one?*

Polemarchus: *Impossible.*

Socrates: *And the just is the good?*

Polemarchus: *Certainly.*

Socrates: *Then to injure a friend or any one else is not the act of a just man, but of the opposite, who is the unjust?*

Polemarchus: *I think that what you say is quite true, Socrates."*

2.2.2 Plato

Plato was one of Socrates more famous students. He wrote much of his educational theory in his books, The Republic and Law. In The Republic, Plato creates his ideal society named "The Republic". Within this society his education system is a functionalist theory where the education system produces competent citizens whom can meet the needs of the republic. Plato's plan for education provided for the special education of workers, of guardians, and of rulers within the republic. Plato argued that

all children should be given an opportunity to show their abilities and they would be gradually categorised according to their natural ability (Noddings 1998).

Plato founded a school in Athens in 387BC, over time the school took on the name "Academy". In Plato's Academy students would present their wisdom and wit, and afterwards their content would be subjected to analysis which would be almost an attack on their offering. Students would attend and they would listen, learn and ask questions. Both young and old were accepted into the school but each person was required to pass an entrance examination conducted by Plato. Plato stated that the aim of his academy was too educate individuals as philosophers, who in the future would populate the positions of authority in the state (Kraut 2004).

Plato felt it necessary for students to endure difficult tests to evaluate their abilities. The evaluation included testing their memory, testing their resistance to pain and seduction, and testing their ability to carry out hard works. Those who passed the tests would proceed into the educational process. Those who did not pass would work for the community by providing all types of services to the citizens of the society (De Oliveira 1999).

2.2.3 Aristotle

Aristotle who was Plato's most famous student has a theory of education somewhat similar to Plato, involving training of a child at the task, in which they show skill or interest. Aristotle believed that once a person is directed towards a path in which they should go, they will develop an expertise and not depart from it. Aristotle believed that once a student received his or her training as a child, the person will in their twenties begin to develop the ability to question, analyse and criticize. Aristotle compiled a list of lessons which are organised by traits of character. The list included; obedience, honesty, unselfishness, consecration to duty, industry, courage, justice and patriotism (Noddings 1998).

2.2.4 Rousseau

Jean-Jacques Rousseau, (1712 – 1778) was a Swiss philosopher who disagreed with Plato's theory of education due to decayed state of society during his lifetime. Rousseau believed that children are born naturally good but are coerced by other members of society into wrong doing. His theory of education involved education through the senses, he believed that children should be educated away from the coercion that existed in society, that children should be educated in the countryside. In his book 'Emile', Rousseau describes the role of the teacher whom is teaching the student Emile. Rousseau's theory claims that the teacher should act as a facilitator to the student. He or she should be present to facilitate the student's queries and too provide appropriate objects and potential experiences for the student. The theory would require the teacher to anticipate the direction of growth in which the student is developing (Noddings 1998).

2.2.5 Behaviourism

(Ertmer and Newby 1993) describe behaviourism as equating "learning with changes in either the form or frequency of observable performance". (Winch and Gingell 1999) describe it as "a theory of learning which suggests that the only proper concern of the teacher is that of behaviour modification". Behaviourism originated with the work of John B. Watson, he claimed that psychology was not concerned with the mind or human consciousness but with behaviour. His research was based upon work by Ivan Pavlov who studied animal behaviour. In his best known experiment Pavlov would ring a bell as he fed a group of dogs. The dogs became accustomed to hearing the bell when they were fed; this method of learning is described as *conditioning* (Pavlov 2003; Hilgard *et al* 1994).

Learning accomplished by conditioning involves alterations of predecessors and consequences of behaviour. The alterations are repeated until a correct response is observed. When a correct response is apparent, the observed may be rewarded, if the observed does not carry out the correct response they are not rewarded (Winch 1999).

Ertmer &Newby (1993) describe the key elements of behaviourism as the stimulus, the response and the association between the two. The primary concern is how the response is made, how it is strengthened and how it is maintained. A learner is categorised by the reactions made in specific conditions. There is no attempt made neither to determine the student's knowledge nor to assess the mental processes in which they should use to complete a task.

Behaviourism is most often associated with the researcher B.F. Skinner, although he was not the first to introduce the concept, he is credited as the first to test the theories in a laboratory environment. Skinner developed the theory of *operant conditioning*; he felt that we behave in certain ways because we associate this behaviour with particular outcomes in the past. Skinner (1998) describes this conditioning through the visualisation of feeding an organism, at first a tray is passed to the organism, the tray is inspected and quite possibly the organism will attempt to interfere with the observation in place but soon will eat the meal, eventually after being fed repeatedly, the organism eats readily and thus response to the stimulus is recorded.

Behaviourists consider both the learner and the environment to be important factors but environmental factors receive most attention. A behaviourist will assess a learner to determine when they should begin instruction and to determine which instruction is most effective for a learner. However, it is generally agreed that behaviourism cannot explain the acquirement of higher level skills that have need of a greater depth of analysis and processing (Ertmer &Newby 1993).

2.2.6 Cognitivism

In the 1950's, learning theory began to move away from the approach of focusing on behaviour towards research of the cognitive sciences. Scientists began to emphasise more complex cognitive processes such as thinking, problem solving, language, concept formation and information (Ertmer &Newby 1993).

Cognitive theories are attentive to the acquisition of knowledge and internal structures. They focus on the conceptualisation of a student's learning process rather than their behaviour. They focus on how information is received, organised, stored and retrieved by the mind. Learning is concerned with how learners know and how they have come to know. The cognitive approach focuses on the mental activities of a learner that allow a learner to articulate a response; the mental activities include the process of mental planning, of goal-setting and organisational strategies.

According to cognitive theories, information transfer is a function of how it is stored and transferred in memory. When a person understands how the transfer of information is achieved and can apply it to other scenarios, then transfer has occurred. Understanding is seen as a set of rules and concepts which can be used to logically justify a transfer. Prior knowledge is used to establish boundaries and constraints within that transfer, the understanding of this knowledge and the uses of this knowledge must be stored in memory in order for the cognitive processes to transfer and apply this knowledge. Specific scenarios and circumstances will trigger particular responses, but a learner must value the knowledge and deem it useful and appropriate before applying it (Ertmer &Newby 1993).

Cognitive theorists focus on the method in which knowledge is communicated or transferred to a learner. It is considered more appropriate for the dissemination of complex forms of learning, i.e. reasoning, problem solving, information-processing. Two techniques used to achieve this are simplification and standardisation. These are analysing and decomposing knowledge into simplified building blocks. If information is irrelevant then the information is removed from a learning artefact. The information is sized and chunked as cognitive theories claim a learner will consume information more efficiently if presented in such a manner. Behaviourists would be more concerned with the design of the environment in which the learner exists but the cognitive theorist is more concerned with how the learner receives the information (Ertmer &Newby 1993).

A behaviourist will use feedback as a way of modifying behaviour whereas a cognitive theorist will use feedback to guide and support mental connections. Cognivists observe a learner in order to identify the learner's predisposition to learning. This observation allows a designer to determine where lessons should begin i.e. what level of knowledge the learner possesses. The observer will also determine which design would be most effective by determining what consequences are most desired by the learner.

Ertmer & Newby (1993) describe the four following specific principles that are important to cognitive instructional design;

- an emphasis on the active involvement of the learner in the learning process (e.g self-monitoring, self-planning),
- use of hierarchical analysis to identify and illustrate prerequisite relationships,
- an emphasis on structuring, organising and sequencing information to facilitate optimal processing,
- the creation of learning environments that allow and encourage students to make connections with previously learned material.

Cognitive theories emphasise making knowledge meaningful and helping learners to relate new knowledge to existing knowledge. Analogies and metaphors allow learners to apply meaning to knowledge.

Cognitive theories also emphasise the fact that learners bring knowledge to various experiences which can impact learning outcomes. When designing the learning environment the designer must be aware of the previous knowledge acquired by a learner and design the environment based on this knowledge. The designer must also obtain feedback in order to effectively and efficiently accommodate the learner.

2.2.7 Constructivism

Constructivism is a learning theory that dates back to the works of Vgotsky, Piaget, Bruner and Von Glasserfeld (Hadjerrouit 2005). Constructivism is a theory that equates learning with creating meaning from experience. A student constructs knowledge through an active process of construction rather than simply receiving knowledge (Mordechai 1998). Constructivism is seen as a branch of cognitive theory where learning is perceived as a mental activity, but it is different from traditional cognitive theories. Constructivists believe that the mind filters its own meaning from the world to create reality. They believe that humans create meaning for reality as opposed to acquiring it, that what humans know of reality stems from our own interpretation of experiences. Bednar *et al* (1991) describes constructivism as a process whereby the individual is constantly building representations of reality based on their experiences. This internal representation is ever changing as each experience unfolds, therefore in order to understand learning that has taken place the actual experience also has to be examined.

Both the learner and the environment are critical to the constructivist. Constructivists claim that behaviour is determined by the environment in which the learner exists. The learning of a new skill is enhanced by the subsequent viewing of the skill in practice, just as the learning of a new skill is enhanced on its first practical use; the skill is then also enhanced with each new use. It is for this reason that it is critical that learning occurs in realistic settings where each learner may construct meaning and value to a skill.

Ertmer and Newby (1993) describe that the goal of instruction “is not too ensure that individuals know particular facts but rather that they elaborate on and interpret information”. The requirement of an individual is not too memorise one single process but too develop the ability to retrieve information from a number of tasks and compile these tasks into an efficient solution for a particular problem. Constructivism focuses

on creating cognitive tools that reflect the wisdom of the environment in which they are used; it focuses on the insights and experiences of the individual. Brown *et al* (1989) describe three crucial factors for a successful constructivist learning environment as the activity, the concept and the environment.

Constructivism is not without its criticism, critics say that constructivists claim learning is active, but it can be argued that not all learning is active. Therefore in this regard critics may claim that constructivist theory may not cover all forms of learning. Secondly the idea that the world and truth is a person's own creation can lead to a rejection of ethics (Winch & Gingell 1999; Mordechai 1998).

Jayakanth Srinivasan and Kristina Lundqvist of the Massachusetts Institute of Technology are one of many groups of instructional designers whom have applied constructivist theory to the teaching of computer science (Srinivasan & Lundqvist 2007). They discovered that disseminating software processes at undergraduate level was challenging because it proved difficult to recreate the organisational context within which software processes were developed. They developed a game to allow students to learn about software processes. The game allows six roles, five of which are played by students and one of which is filled by the lecturer. Figure 1 displays the six roles.

The rules of the game include iterative processes requiring students to design and review their respective stages. The game required students to interact amongst each of the groups during the different stages, at all time under supervision of the lecturer/coordinator. Srinivasan & Lundqvist concluded that the game developed using constructivist instructional principles allow students to experience the processes in a context that is more practical and participative, and that it also increased the level of long term memory retention.

Role	Responsibility
 Requirements	Create a work package where the total weight of requirements is larger than, or equal to 50.
 Design	Create a design that in the worst case is based on one incorrect requirement, and two ambiguous requirements.
 Implementation	Create an implementation that is in the worst case based on three ambiguous requirements.
 Integration	Successfully integrate the system, ensuring that the implementation has no ambiguous requirements.
 Revenue	Manage the funding for the project.
 Coordinator	Ensure that the game is being played by the rules, and observe team dynamics during the game. May also act as customer in later iterations.

Figure 1: The Six Roles of Software Design (Srinivasan & Lundqvist 2007)

2.2.7.1 John Dewey

In John Dewey's, Experience and Education (1938), he offers his ideas pertaining to the needs, the problems and the possibilities of education. Dewey describes the subject matter of education as an institution where bodies of information and skills which have been worked out in the past are transmitted to a new generation. The training consists of conformity with these rules and standards. Dewey contrasts the instructional nature of the school environment, with its ordinary classroom, its time-schedules, schemes of classification, its examinations and rules of order. Dewey asks us to contrast this scene of the schooling institution from any other form of social organisation.

Dewey's intent here is to describe to a reader that the purpose or objective of education for the young is to provide the learner with the skills for future responsibilities and success in life. Dewey describes the traditional method of teaching where a student is required to be one of "docility, receptivity and obedience". Dewey accounts the rise of progressive schools as being due to discontent with traditional education. Dewey insisted that not only should teachers have aims and objectives for students, but that the students themselves be involved in setting

objectives for their own learning. In the current day workforce environment, each person is subject to a review process. In the process many people define goals to achieve in a time frame, usually a year in length. Although these goals are somewhat set by the individual's employer, the individual still has an element of input and control over their learning and development.

Dewey is known for his analysis of experience and its centrality in education, he realised that the rejection of the traditional form of education required the creation of a new type of education; he felt that departure from the old alone does not solve problems. Dewey felt that experience does not simply mean exposure but that experience must mean something to an individual. He believed that education must be built upon or connected to prior experience. Dewey was also quite clear in the fact that not all experience is equally educative as some experiences are mis-educative.

Dewey describes a mis-educative experience as one "that has the effort of arresting or distorting the growth of further experience". He felt that traditional education offers a plethora of examples of experiences of mis-education. Dewey asks "how many students were rendered callous to ideas, and how many lost the impetus to learn because of the way in which learning was experienced by them?" Dewey also asks the question, "How many students power of judgement and capacity to act intelligently in new situations was limited" due to the methods used in the traditional classroom. He asks "how many students came to associate learning with ennui and boredom?" and also asks how many students found what they learnt to be so foreign to the situation of life outside the classroom, that it gave them no control over the latter (Dewey 1938).

Dewey did not ask these solely to criticise traditional education but too emphasise the fact that all learners have previous experiences in which to build upon. Teachers must start at the level where students are, but must also ask where experience will lead. Dewey felt that this continuity must exist and that an interaction between learners and teachers must exist. Once this relationship is lost between a learner and a teacher, then the student is only concerned with giving answers and getting approval from their

teachers. The objective of the construction of an analytic mind capable of sound decisions when confronted with new scenarios is lost, when the learner is trained to read, rehearse and repeat (Dewey 1938; Noddings 1998).

2.2.7.2 Kolb

David A. Kolb is an American education theorist whose theories have some similarities to John Dewey. Kolb compiled a theory of Experiential learning which contains four stages. The theory is a spiral theory where learning may begin at any stage in the spiral although it most commonly begins in the concrete experience stage. Figure 2 depicts the experiential learning theory where one can see that there is not a compulsory starting point which must be obeyed.

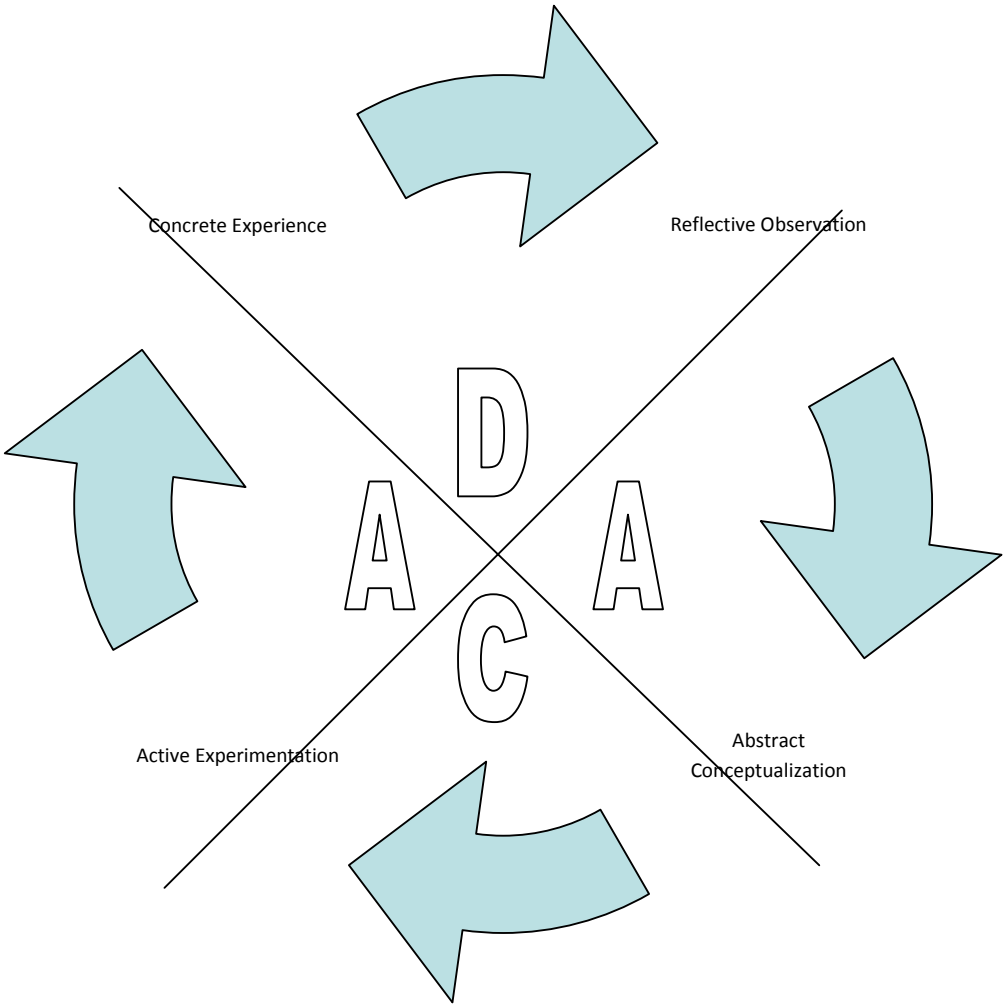


Figure 2 : Kolbs Experiential Learning Theory

Kolbs learning theory is based upon four types of learner; designated as Diverger, Assimilator, Converger and Accomodator. A Diverger is said to be a type of person who will associate towards other people and towards feelings. A Diverger will require the answer to the question "why", they will want to know why they are learning a particular subject and will not learn as efficiently if they are deprived of this information. An Assimilator is a person who uses logical thinking and analysis when they are learning. They thrive on knowing the facts related to the topic they are learning. A Converger is a person who thrives on 'how' something works. The fourth type of learner identified by Kolb is the Accommodator, the Accommodator likes to explore information and ask questions such as "what if…?" (Sharp 2001).

In their study of teaching teamwork communication with Kolb's learning style theory, (Sharp 2001) researched the learning styles of engineering students based on Kolb's theory. In the study carried out at Vanderbilt University, Nashville, USA, 1013 engineering students were surveyed and the results displayed in Figure 3 were concluded.

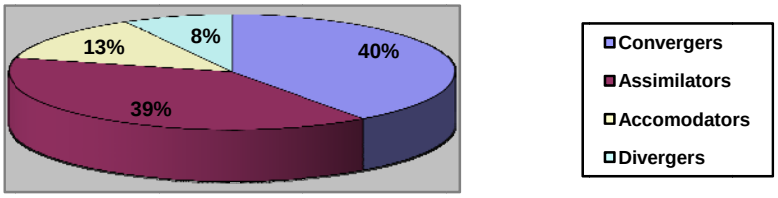


Figure 3: Engineering Students Kolb Learning Styles

In addition to the learning methods that a lecturer will use when designing a course, a learner also has different methods in how they learn. A lecturer may use a constructivist approach in their lecture, but a student will use a particular learning method to absorb the information presented to them.

2.2.8 Approaches to Learning

Entwistle (1994) in an experiment to identify student learning types interviewed a sample of lecturers, asking them "what is your expectation of your students?", an interviewed English lecturer held the view that students need to develop evaluative skills and answered the question as follows;

> *"I would be expecting a kind of alertness and openness – that may sound very general. Alert to what? Alert to all the signs of interest or significance in passages of literature. We try to develop their evaluative skills to develop the sense of what is the first hand piece of writing and what is purely derivative..*

> *The prime moral outcome of a literature course (should be the) ability to enter into different individual and social conditions… to be able to realise what it is like to be somebody else, so that we can properly interact with other people and not always expect them to be mutations of oneself or of one's own culture"*

A history lecturer interviewed sought the need for critical analysis of documents, to develop the skills of separating opinion from fact.

> "*History, typically does involve the assembly of evidence, coming to conclusions about certain problems… (you tend) to consider (an idea) from all angles with a critical eye. Basically if you're treating it non-academically you tend merely to accept it then to file it.. (but) then there's going to be no progress or change. Things are not going to move if you merely accept. You've got to scrutinize what you're doing (to see) if the thing cannot be done better"*

Research carried out by Ference Marton at Gothenburg involved thirty first-year students reading a 1500 word article (Entwistle 1994). In the experiment each student was informed that they could make notes if they wished but also must be ready to answer questions on the article. The students were asked questions such as "well now, perhaps you can tell me about what you've been reading?" The experiment also involved asking more detailed and specific questions about the article. The students were also asked how they would normally approach an article when studying. Table 1 tabulates the description of two learners identified and the characteristics of these learners

Deep Approach	- Intention for Deep understanding of meaning, - Questioning Authors Arguments, - Relating contents to cognitive knowledge, - Evaluating the author of the article's conclusion based

	on the evidence offered in the article.
Surface Approach	- Anticipating possible questions and attempting to memorise these parts of the article, - Resulted in a attention to specific facts of disconnected information.

Table 1 : Marton's Learning Approach Experiment Results (Author)

Fransson (1977) carried out an experiment which included 81 students who were presented with an article. In order to control the level of intrinsic motivation, a sample of students was selected so that the article would be relevant and also irrelevant to some of the students. It was possible to identify four types of responses in the experiment.

a) Conclusion-orientated, Detailed

This type of student summaries the argument in the article and explains how the evidence offered by the author of the article supports the argument. The student will also offer how they themselves have reached their own conclusion.

b) Conclusion-orientated, mentioning

Similarly to student 'A', this type of student will summarise the article and present how the author reaches their conclusions, but this type of student will not offer their own evidence to also back up the argument.

c) Description, detailed

This type of student presents a list of the points in the article but does not show how these points are proved by the articles author.

d) Description, mentioning

This type of student makes disorganised points about the article. Some of the points may be relevant and some may be irrelevant. This type of approach conveys an impression of confusion and misunderstanding.

2.2.9 Learning Style Models

Coffield (2004) carries out a systematic review of learning style models. The research includes a critique of thirteen learning styles. The style name, a short description and the overall assessment of six of the styles are listed in table 2.

Allinson and Hayes Cognitive Styles index (CSI)	- This model is a self-analysis test which contains 38 questions. The respondent must select one of three possible responses which are true/uncertain/false to each question (Graff 2006). - This model was found to be the most reliable of models studied by Coffield. It was found that the constructs of analysis are relevant to decision making and work performance, but the pedagogical implications are not fully explored (Coffield 2004).
Apters Motivational Style Profile (MSP)	- The AMSP model is a 40 item questionnaire which determines the length of time a respondent remains within one of eight emotional states. The theory operates by calculating the dynamic interplay between reversing motivational states.

	- This theory was found to be one which poses a threat to fixed state learning style models, but it is fundamentally a measure of personality rather than a students learning style.
Dunns and Dunns model and instruments of Learning Styles	- The model is based on Environmental, Emotional, Sociological, Physiological and Psychological Stimuli Preferences. Preferences are recorded from the 20 factors displayed in figure 4 - This model is found to make simplistic connections between physiological and psychological brain activity. It is a model which will determine instructional preferences rather than learning preferences (Coffield 2004).
Entwistle's Approaches and Study Skils Inventory	- Entwistle's Model includes deep and strategic approaches to learning. The models purpose is to provide information on a students motivation for learning and their learning style (Heinstrom 2000; Entwistle 2002). - The model is found to be complex and requires a specialist to reliably examine the results. Coffield (2004) concludes that the model requires a significant amount of development and testing.
Gregorc's Style Delineator	- Gregorc's Model is based on determining which of one of four categories a student is strongest in. The categories are concrete sequential (linear learning style), concrete random (Concrete learning styles, quick learner and thrives on problem solving), abstract sequential (Thrives on

	mentally challenging and ordered learning style) and abstract random (emotional person who prefers an active and informal learning style) (Gordon 2004). - Coffield (2004) is quite clinical in their appraisal of this model. They describe it as "not suitable for the assessment of individuals".
Kolb's Learning Style Inventory	- Kolbs Learning Style Inventory is based on Kolbs experiential learning theory. The tool aims to identify a learners approach to learning by analysing their experiences to date (Kolb 2005; Gordon 2004). - This model has received criticism over its reliability, validity and its learning cycle (Coffield 2004).

Table 2 : Analysis of Learning Style Models

Environmental Stimuli Preferences	Sound Preference Light Preference Temperature Preference Design Preference
Emotional Stimuli Preferences	Motivation Preference Persistence Preference Responsibility Preference Structure Preference
Sociological Stimuli Preferences	Self Preference Pair Preference Peers/Team Preference Adult Preference Varied Preference
Physiological Stimuli Preferences	Perceptual Preference Intake Preference Time Preference Mobility Preference
Psychological Stimuli Preferences	Global/Analytic Style Hemisphericity Preferences Impulsive/Reflective Preferences

Figure 4 Dunn & Dunn's Learning Style Factors

The approaches to learning discussed so far are tests which attempt to identify the particular learning style a person has. This method does not have wide support in academia because of pigeon holing a person to a particular learning style. A student's learning style changes over short periods of time for reasons such as their level of expertise and motivation. A student may also dislike a particular topic and therefore will again change their learning style. Although these described criticisms exist, there is a general agreement that students learn more efficiently when the course content matches a preferred learning style (Gordon 2004).

2.3 Learners and Learning Styles

2.3.1 Introduction

The preceding sections have discussed a sample of methods and theories philosophers and psychologists have discussed in their writings. These models attempt to identify the learning method which is most effective for a learner and provide a framework for the development of a course. The following section discusses the methods in which a learner can absorb information.

2.3.2 Holist and Serialists/Linear

Pask and Scott (1972) carried out research to discover differences amongst learners and their learning styles. In their study they presented students with two imaginary species of animals. The students were provided with cards displaying information such as habitat, physical characteristics and drawings of the animals. These cards were initially placed face down and the students were allowed to turn over the card if they wished to learn about the particular characteristic. The study recorded the hypothesis used by each student to select each card and this identified differences in ways that each student selected the characteristics which they deemed more

significant. At the end of the learning period, each student was also required to communicate their understanding of the task in the form of a lecture.

In the selection of the different characteristics, each student was required to reveal their hypothesis for their selection of each characteristic; the first group of students identified are described as Serialist. The students would operate using a step by step process asking a question about a single property of the animal, such as “does the animal have fangs?” Other students were not as linear in their approach, they would ask questions from a more global view point, this type of student might ask questions such as; “are there more animals with fangs than not?”. This approach was described as Holist.

Pask (1972) identified a third strategy described as Redundant Holist, this type of student would ask questions which depend on discriminating between the species. They would identify that the first was quite gentle, but the second was more aggressive, because it had more wounds. This conclusion would be reached because of the identification of wounds in the second animal, not because it was apparent that the animal was in fact more aggressive. The Redundant Holist personalises their learning and the aggressiveness is determined from characteristics that the individual associates with aggression.

When these students where asked to teach back what they had learned, similar results were found between the Serialist and the Holist. The Serialist students would describe the animal in a logical and straight forward manner keeping it to the bare essentials. The Holist students would describe the animal in a very different way, the Holist would describe the essential properties but would describe them in an almost journalistic manner. The Holist would start their description by introducing the reader to the topic with a striking point. The Holist may use an anecdote, an illustration or an analogy whereas the Serialist uses these sparingly if at all.

Pask's further study determined that Holists have the ability to bring together a wide range of information whereas Serialists work their way step by step through topics bringing together only what they are forced to bring together. In the end both groups reach a level of understanding that is quite similar but their path to reaching this is quite different. Pask claims that learning has occurred once a person can reconstruct the lesson they have studied, and can also present understanding by applying the topic to a new situation. Pask found that the Holistic learner makes use of personal and idiosyncratic analogies, moving from one idea to another sometimes without an obvious connection. The Holistic learner will if left to themselves, put off the more uninteresting parts of a topic. In contrast the Serialist is found to be in an opposite scenario where they do not make use of analogies and do not identify how different elements connect together in a topic (Pask and Scott 1972).

2.3.3 Visual/Auditory/ Kinesthetic Learners

Visual learners learn from what they see. They are usually more comfortable with diagrams, flowcharts, movies and other visually intensive media. A visual learner tends to learn best by seeing the information. A visual learner will make a sequence of images in their mind when they are reading information. They will pay close attention to the body language of others. Felder (1988) concludes that most people of college age are visual learners while most teaching in colleges is verbal. If something is verbally communicated to a visual learner, it is quite possible that they will not remember it.

Verbal learners remember much of what is said to them and what they hear. A verbal learner will also get great value from the discussion of a topic. A verbal learner will get great value from the information they hear, but even greater value from information that they can also say. A verbal learner will get more value from a discussion than a visual demonstration and will learn effectively by explaining information to others. A verbal learner usually has strong language skills and a well

developed vocabulary; they are usually talented with giving speeches, oral reports and presentations (Felder 1988).

Kinesthetic learners are individuals who learn best by moving their bodies, activating their muscles as they learn. They can concentrate more effectively when body movement is involved. A kinesthetic learner will often wiggle their leg or tap their foot during a lecture when they sit. A kinesthetic learner will benefit by taking notes and highlighting the important components of a lecture (Felder 1988).

2.3.4 Active/Reflective

An active learner needs to be an active participant in their learning environment. They need to experience the knowledge they are acquiring by actions. They need to get involved in tasks in order too maximise the potential of the learning and to test the information they have received. An active learner will not learn a great amount in an environment which requires them to be passive, most lectures enforce passive learning. The active learner is a student whom benefits by participating in class, the participation may be in the form of discussing, posing questions, brainstorming, debating, role-playing, and reflecting. Active learning therefore includes reflective learning (Felder 1988).

A reflective learner is a person whom prefers lessons at a slower pace, they need time to reflect upon the content of a topic in order to digest the information and construct it internally and at their own pace. A reflective learner will not efficiently learn in an environment where they are not given the opportunity to reflect on their newly acquired information (Felder 1988).

2.3.5 Factual

A factual learner prefers concrete facts and data about a topic. This type of learner prefers information to be efficient and not too contain information that is not relevant to the topic (Felder 1988).

2.3.6 Self-Explanation

Chi *et al* (1989) found that physics students whom were presented with worked-out examples and attempted to understand the answer by studying the answer where in fact more efficient learners. Simply providing a learner with worked-out examples is not enough to guarantee efficient learning; it depends on the learner understanding the example. When a learner attempts to complete a new problem, the existing worked-out example is used as a framework in which to refer to when attempting to complete the new task (Anderson 2000). Sorden (2005) concluded that procedural skills are developed through practice and by making references to past problems. Chi *et al* (1989) emphasise the point that self-explanation is not conveying the meaning of a problem to another person. The focus is on the learner understanding and making sense of the information before them.

2.4 Motivational Techniques in Design

2.4.1 Introduction

There are a number of motivational techniques that can be applied to a learning environment to suit different learning styles, these techniques stimulate responses in an individual and increase the level of attention. Lecturers understand that it is crucial to keep students motivated in order to achieve optimal learning results. Students who are intrinsically motivated often out perform students who are extrinsically motivated.

Figure 5 depicts Keller's ARC Model of Motivational Design. According to the ARC theory there are four stages of motivation that influence and sustain student motivation. The four stages are attention, relevance, confidence, and success (Keller 1983). There a number of techniques one can employ in order to achieve the required

level of motivation. This section discusses these techniques and provides examples of how to include them in the dissemination of course content.

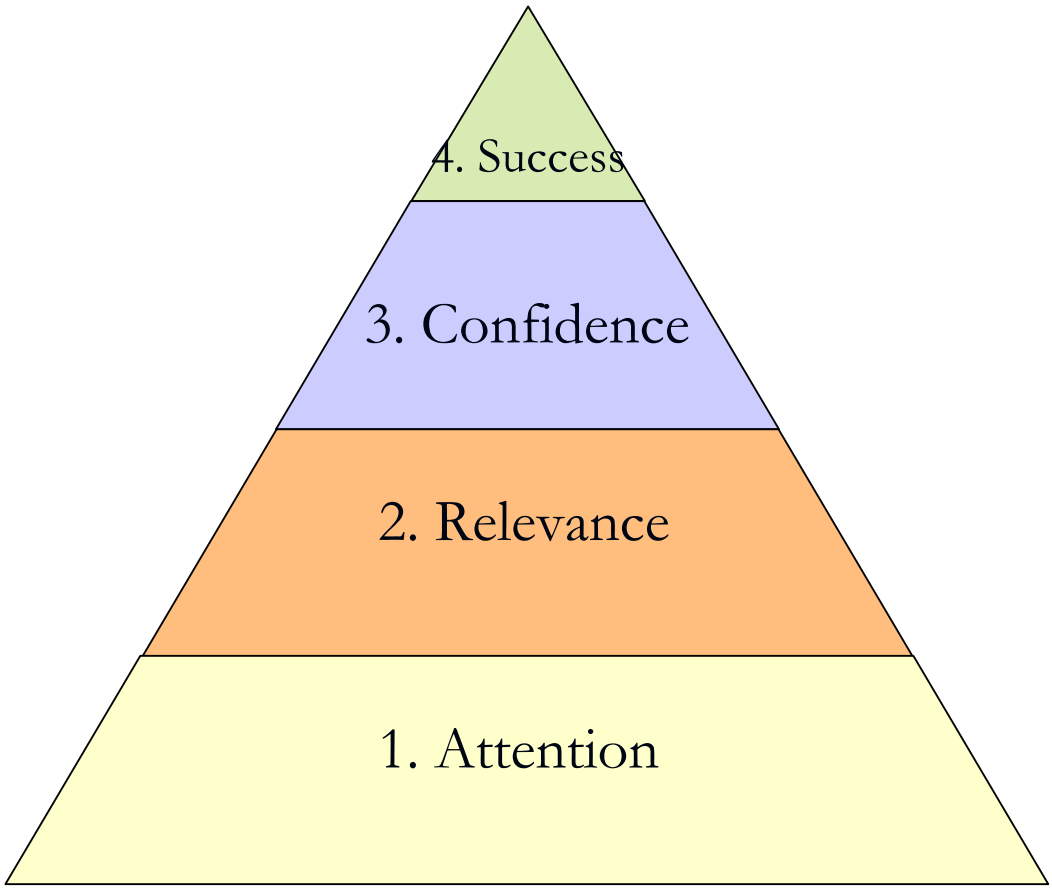


Figure 5 The ARC Model of Motivational Design (Keller 1983)

2.4.2 Manding Stimuli

Taran (2005) lists a number of techniques for capturing attention which one may use in the design of educational environment. Mandling stimuli is capturing stimuli by demanding it through using phrases such as “watch out” or “it is important to remember”. A lecturer can include perceptual arousal where they arouse the curiosity of the student, a lecturer could present a box with a question mark on it. If the particular course module suited, a physical box could be used, but a lecturer can also use a virtual box in any technology available to them.

2.4.3 Anticipation

Anticipation increases one's excitement about a task, words and phrases such as "wait until you see whats next", and "I cant wait to show you" increases one's anticipation and attention. Taran (2005) suggests that the use of anticipative phrases at the end of a lecture can increase a student attention. A lecture may end with the phrase "and next week I will tell you the meaning of life".

2.4.4 Inquiry

A person's attention is stimulated when they are asked a question. Quite similarly to the Socratic method asking questions throughout a learning process, the learner will naturally read these questions and attempt to answer them thereby stimulating their attention. "Do you find that technology in the classroom motivates students?" (Taran 2005). A lecturer can present a topic to a class and then present a question to the classroom and attempt a brainstorming session based on what they have just studied.

2.4.5 Participation

Participation requires attention; therefore a student whom must answer questions is required to pay attention. A lecture or professor should not intimidate a student with many difficult questions as this can result in a student feeling uncomfortable in the environment and thus losing interest in learning. A student whom participates in a class engaging in problem solving activities increases motivation and compels them to think about the information and to organize the information in their working memory (Greitzer 2002; Taran 2005).

2.4.6 Breaks and Energizers

Learners can not keep their attention for long periods of time. Each person usually requires a break from a particular subject after approximately 40 minutes (Taran 2005).

2.4.7 Story Telling

Story telling that relates the content to practical and real world example's can increases attention levels (Taran 2005). This technique is closely associated with relevance, the story being told should be relevant to the learners and help provide them with solid justification for learning the content.

2.4.8 Incongruity

Incongruity is when a person expects a particular answer but receives another, this enhances a person attention level by propelling curiosity (Taran 2005).

2.4.9 Concreteness

Concrete facts increase attention, when a person is informed that 69% of Irish Males earn over 67,000 euro per year, or that this topic has appeared on five of the last six exam papers, this heightens interest in the topic (Taran 2005).

2.4.10 Relevance

Relevance is a commonly reported factor that improves motivation, if a task is relevant to a learner in either a personal form or in a work capacity. Hodges (2004) reported that students who were informed that a task is "authentic" display a greater motivation for a task. A lecturer can clearly state the learning objective of a session which also adds to the relevance of a lecture. Lecturers can also allow student to present their information in writing or orally depending on the students learning style. It is beneficial for students to be encouraged to attempt styles which are not their preferred option but a lecturer should use their discretion in determining which is more suitable in a particular situation, will the particular student benefit more from producing a good piece of work in a style they prefer, or will the student benefit more by being encouraged to deliver their content in a different style. In addition to

relevance feedback is noted as an extremely important component of the learning cycle. Students must know if they are on the right path or not but it is too late when they receive their end of term grade (Bonk 2002; Kelly 2006).

2.4.11 Variability

Variability in instructional design is often referred to as ‘Blended Learning’. Students tend to be more attentive to information that is changing. If a person listens to a traditional lecture for 60 minutes that does not change from start to finish, it is quite difficult to retain a high level of attention. If the lecturing technique changes during the 60 minutes, it can increase attention levels. These changes can be the type of media being used in the learning, the tone of language in the learning, or even the presentation of data (Taran 2005; Bonk and Graham 2005; Bersin 2004). Variability is an issue beyond even the sixty minutes in a lecture as a student may six or seven hour long classes in a day. If the student attends classes with little or no variety in them over an entire day or week, motivation becomes ever more difficult.

2.5 The World Wide Web

2.5.1 Origins of The Web

Plato whom much of the philosophy of western education may be accredited to is known to have said “that necessity is the mother of invention”. The world has evolved because people whom have the need for an item become inventors and they use technology available to them to carry out the task they wish to complete. Over time this item may become more efficient or more complex. It may then become a tool used to create another item or possibly used itself as a major component of a new item.

The Web itself owes its existence to many inventors and scientists. In more recent times the more obvious CERN projects and ARPANET projects have contributed to the internet. The birth date of the internet is given as July 1977 where a communication was sent around the world from the U.S across Europe and back to the U.S.. A major component to the internet was created in the late 70’s, a technology which standardised communication among computers, TCP/IP. In 1984 IBM created the Generalised Mark-up language (GML), it was a hierarchical language and had opening and closing tags. The SGML language was a more efficient version of GML and was developed in 1986. Another technology was Hypertext, linking information together, it is a technique used throughout the evolution of the human race in electronics and more recently in the linking of text (Oxford Brookes 2002).

Sir Tim Berners–Lee while initially working for CERN was to develop a remote procedure call which would allow varied systems at CERN to work together. The ENQUIRE system necessitated that all files required for processing be on one machine but Berners-Lee needed to access files on different machines, Berners-Lee’s work on the RPC allowed him to develop a system where RPC worked over TCP/IP. The ENQUIRE system had long allowed hyper-texting and the SGML language was an established mark up language. The problem that now existed was the lack of a

world wide addressing scheme. Berners-Lee submitted a proposal for this scheme in 1989 to the CERN management but did not receive a response. In 1990, Berners-Lee attended a workshop on hyper-texting, in the same year a NeXT machine arrived at CERN. Berners-Lee was extremely impressed with the machine and he submitted a revised proposal for his addressing scheme to the CERN management, this revised proposal was called the World Wide Web (Berners-Lee 1990).

Berners-Lee's proposal was accepted although he was provided with slightly less resources than were listed within the proposal. HTML was the mark-up language used in Berners-Lee's early set-up of the Web. It was based on SGML used at CERN and the original HTML parser ignored any tags it did not recognise. Berners-Lee's first Web Browser on his NeXT system allowed users to edit pages just as easily as it would allow them to view them. The World Wide Web went live on Christmas day 1990 (Oxford Brookes 2002).

A turning point for the World Wide Web was the introduction of the Mosaic browser; this browser was a graphical browser allowing users to display multimedia content. In 1994, the World Wide Web had over 2 million users but mainly in academia. As the World Wide Web began to grow, companies such as Netscape and Microsoft began to take notice and create web browsers, the World Wide Web quickly became a place where some published many documents but millions consumed their contents.

2.5.2 Web Services

From the existence of the traditional Web site companies began to offer services to the public. Companies such as Amazon [1] and EBay [2] started to offer services to the public. They recognised the web as a business opportunity to reach customers in new and inventive ways. Many other companies soon after began to offer other types of services. Weather services, movie listings, world maps, news coverage, sports coverage, accommodation listings, employment listings and repositories of literature all became available as services available to the consumer via the web.

These services became known as Web Services. Web Services are built upon standardised technologies and it is with these standardised technologies that allow multiple services to interact with each other. It also provides a framework for developers throughout the world to write new Web Services which can potentially communicate with Services written by other developers (Roy 2001). Earlier efforts required software developers to write software using the same code and platform in order to share information. Technologies such as CORBA were introduced in an attempt to rectify this scenario but CORBA does not offer the same flexibility as is enjoyed by Web Services. Web services are developed using XML and two other languages created using XML.

The first of the three is the Web Services Description Language (WSDL); this allows developers to describe the components of the web service. The second is Simple Object Access Protocol (SOAP) which again is a standardised type of XML which is used to allow software components communicate with each other. The actual data of the applications/services is then contained in XML files (Roy 2001).

[1] www.amazon.com

[2] www.ebay.com

2.5.3 A New Approach to the Web

The Web has gone through stages of e-commerce and dot com booms, companies such as Amazon have remained since the early days and others have spawned. In the 21st century a shift has occurred where those who were once solely consumers of information are now active contributors of information.

The development of Web services created a new stage of Web Applications. The web now hosts dynamics applications along with the traditional websites. Web services have created the environment where software components can communicate and share data with other software components with a far greater ease than was previously enjoyed. Web applications can dynamically request information and update particular portions of interfaces without the requirement to refresh Web Browsers; applications have become data-driven rather than static and dependent upon a user.

Web users contribute to the Web on a daily basis in their millions; this contribution of knowledge has been aided by the creation and rise in popularity of new approaches to the Web. These new tools and approaches are subject to much controversy even in their name. Many members of society refer to them as the read/write web and contribute them to Berners- Lee's original concept for the Web, whereas many also refer to them as Web 2.0. In the following sections a range of software tools will be discussed which can be considered as Web 2.0 tools.

2.6 Web 2.0

> "A second phase in the evolution of the World Wide Web in which developers create Web sites that look and act like desktop programs and encourage collaboration and communication between users" (IEEE Spectrum)

Buzz word or cutting edge technology? Web 2.0 has received a lot of attention since the O'Reilly group coined the phrase in 2005. Figure 5 created by the O'Reilly group displays the myriad of names that have been associated with the phrase. The purpose of this research document is not to exhaustively discuss the many possible characteristics of Web 2.0 but to discuss the more tangible components.

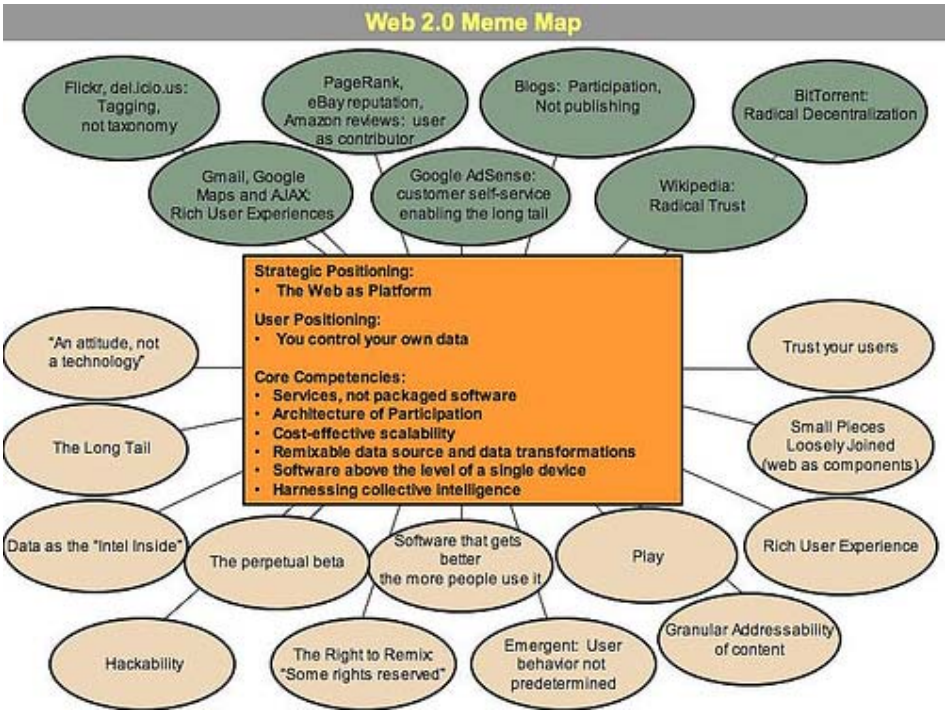


Figure 5: Web 2.0 MEME Map (O'Reilly 2005)

Many in academia have been discouraged from using the term Web 2.0 for a variety of reasons ranging from a disliking of the term through to a fear of legal repercussions. ITCork.ie is a not for profit organisation whom set-up a Web 2.0 seminar only to receive a letter the solicitors representing the O'Reilly group. The complaint from the group amounted to the fact that ITCork[3] was using a term which was in fact trademarked by the O'Reilly group.

2.6.1 Blogs

A Web-Log, blog for short, is a web page that allows a user to publish information in a dated log format. The creator of a blog, known as a blogger can record their activities, thoughts, ramblings and musings for others to read. A blogger may update their blog frequently, the frequency of new posts range from hourly to weekly in active blogs. Technorati [4] is one of the many popular blogging sites and in his latest blog 'the state of technorati', creator David Sifry describes his website as a social media provider. Sifry's blog reports a daily total of unique visitors at over four million in December 2006 reaching to a value of 9 million daily unique visitors in March 2007 (Sifry 2007).

A blog is similar to a web page and it can be comprised of any of the components featured in a traditional web page. A blog page allows the blogger to publish pictures, text, audio and video and embed third party interfaces. Blog entries are arranged chronologically with the most recent entry appearing at the top of the page. There are two basic blog styles, filters and journals. The filter style is primarily comprised of links to other websites which relate to the blog. The journal style is a blog which is largely an on-line diary, Charlie Lindahl & Elise Blount in the IEEE Computer Journal, describe the journalistic style of blogging as a "stream of consciousness" recalling James Joyce's style of writing (Lindahl 2003).

[3] www.itcork.ie

[4] www.technorati.com

Historically a traditional web page creator required an element of technical competence. This requirement has prevented many Web users from contributing to the Web leaving the power of publishing in the hands of a minority. In contrast if one wishes to create a blog, the task is of a similar skill level to sending an e-mail. For the more computer literate, a blogger can include news feeds from other websites and also other third party functionality. This functionality is available through the use of APIs which are provided with many of the commonly known web services (Richardson 2007; Gordon 2006).

Linking is providing associations to related documents within a blog. It is an important part of blogging as it deepens the discussion and provides links to related topics. Linking within a blog is somewhat similar to the bibliography in a thesis or research paper. It facilitates the retrieval and referencing of information that is discussed in the blog (Anderson 2007).

Although linking is a common process used throughout the Web, the process has not been without its difficulties. One of these difficulties is the legality of linking. In a famous case (Shetland Times Ltd v. Dr Jonathon Willis) in British Law, the Shetland Times was a long established news paper which also had an on-line edition. An ex-employee created a new on-line newspaper called The Shetland News. The Shetland News linked to a story which appeared in the on-line version of the Shetland Times; this link was a deep link and would forward a Web user straight to a particular story on the Shetland Times website bypassing the introductory page. The Shetland News and Dr Willis claimed that through bypassing the introductory page, the Shetland News would become less appealing to advertisers. This argument became weakened once the court was made aware that direct access can be prevented. The case was settled and the conditions were that each link must feature a logo and an attribution "A Shetland Times story" (Hamilton 1996).

There have been many court battles in British Law over online copyrighted headlines such as the Exxon Corp. v. Exxon Insurance Consultants Ltd case and many cases

contesting the linking of websites (Kolah 2002). The first US case of linking was TicketMaster v Ticket.com, this case similarly to the Shetland Times case was related to claims of direct infringement. In the case of Ticketmaster v Ticket.com, ticket.com rather than inform their customer that they did not have tickets to a particular gig, would link their customer to TicketMaster.com. This case in US Law seems to have legitimised deep linking as no copying or direct infringement was found to have taken place (Central District 2000). Lawyers are still divided on this issue and the Law's in Europe and the US are quite vague. The courts have not defined clear unambiguous laws in many fields of computing, and deep linking has survived challenges in the European courts but a blogger nonetheless should be aware of the possible repercussions of their content.

Duffy and Bruns (2006) describe the components of a blog as the following, post date, category, title, body, trackback, comments, permalink and footer. Each blog has its own unique identifier called a permalink, the permalink is generated by the blogging system which hosts the blog and it is applied to a particular post upon its creation. The permalink does not support versioning and therefore remains unmodified if a particular post is edited. A blog trackback allows a blogger to notify the original blogger that they have referenced their content. Trackback must be enabled in both blogs and it operates by the second blog notifying the original blog that their content has been referenced. Once the original blog is notified, its system creates a record of the permalink of the blog which is referencing it.

A blog-roll is another term used in blogging; it refers to a list of blog links which a particular blogger finds useful. This list is similar to the favourites or bookmarks in a Web browser. Each blog can also be tagged by readers of the post, this allows a description of the post to be used in order to categorise the posts. This tagging technique, known as a Folksonomy is used in other Web applications such as Flickr and del.icio.us. Research at the both the University of Southampton and at Hewlett Packard's Information Dynamic Lab has concluded that the Folksonomy tags agree more closely with human generated keywords than automatically generated keywords. At the University of Southampton the results of their research has also shown that the

semantic value of the Folksonomy generated tag set was more correlated to the regulated indexer set than the Yahoo TE search (Al-Khalifa 2006; Golder 2006).

A Blogger may also allow another blogger the ability to comment on their blog. It exposes the original blogger to a wide spectrum of bloggers within the 'blogosphere' who can offer ideas or questions on the topic. Blog software offers an extremely useful technology called syndication. It allows a blog reader to subscribe to a blog by using syndication techniques such as RSS and Atom. The syndication feed allows a person to aggregate the feed along with other feeds of their choice into their preferred reader.

In the educational environment, both the mature learner and the immature learner need each other. Quite obviously the immature learner needs to acquire the knowledge that the mature learner possesses. But the mature learner also needs to articulate the knowledge which they possess in order to clearly define it (Dewey 1944). The use of Blogs provides this environment for both the mature and immature learner to interact in a casual fashion.

2.6.2 Wiki

Imagine a world in which every single person on the planet is given free access to the sum of all human knowledge. That's what we're doing

- Jimmy Wales, Wikipedia founder (2004)

A Wiki is a webpage that can be edited by any user, although the original creator of the page can limit the users whom may edit the page. The first Wiki was created by Ward Cunningham in 1995, he required an authoring tool that would allow Web Users easily contribute and publish content. A Wiki page encourages collaboration amongst contributors and gives a contributor a sense of responsibility and ownership. It develops collaborative skills amongst contributors; it requires contributors to negotiate with others, to agree on the accuracy, the content and the structure of the topic. Contributors of a Wiki begin to teach each other, to refine each other's knowledge of a topic (Richardson 2007).

A Wiki page generally has a history function which allows the user participating in the creation of the page to rollback to an earlier version of the page. Each user can view each version of the page and edit it accordingly. Proponents of Wikis cite their openness and ease of use as some of the many reasons as too why they are a useful tool when working in groups (Lamb 2004). Wiki pages can be often vandalised where a vandal updates the content with incorrect or inappropriate information. The history property of a Wiki page allows a previous version of the page to be reinstated with ease. This alone is a deterrent to any would-be vandals.

A large challenge created by Wiki participative communities such as WikiPedia, is to determine which sources can be trusted and which can not. Many educational facilities discourage the use of Wikis as a resource to be cited as it may not be accurate, although Wikipedia is encouraged by many professors and lecturers as a starting point in research. For many years we have successfully relied on published literature and peer-reviewed literature, but now we are faced with a dilemma, can we collectively produce information that is as high a quality as what a trusted few produced in the past. Halavais (2004) tested the collaborative peer review offered by the Wikipedia community; in his experiment he edited 13 separate Wikipedia entries. Each of his edits was corrected within a couple of hours. Members within the Wikipedia community members discuss their potential edits before they proceed with the edit, the Web 2.0 entry in Wikipedia has forty two active discussions where community members argue for and against particular words or paragraphs. There are certainly individuals or groups within society whom will attempt to edit articles for their own personal gain. Wikipedia Scanner developed by Virgil Griffith has identified that edits in Wikipedia articles about specific companies were made by employees within the same company. This has included Wal-Mart removing sections describing a claim that they had paid employees less than the minimum wage and companies such as e-voting machines producer, Diebold, removing information claiming that they had contributed to the American presidents fund raising campaign. It can be concluded that the number of members of the Wikipedia community who

positively contribute towards the contents of the articles far outweighs the number who wish to distort the facts.

2.6.3 Audio/Video Blogging

Audio Blogging, also known as a podcast, is a blog comprised of audio. A video blog is a blog where the blogger records themselves speaking in video. A video blog can also be in the form of screen-casting where the blogger captures what is happening on the computer screen while narrating.

The blogger can produce a video clip containing a recording of themselves or others, or can create video contents comprised of text, images, special effects and so forth. A video blog allows the creator to edit a blog in a similar fashion to a text blog. The video blog can be updated as regular as a text blog and can also avail of the use of RSS update feeds. Video blogging provides a richer multimedia experience to the viewer. Many video bloggers would argue that a video blog provides a more natural medium for communication than text based blogs. Modern desktop computers and laptops are now equipped with webcams and the creation of a video blog requires no more than clicking a record button. The downside to video blogging is that the editing tools currently available can be somewhat time-consuming in their use if one wishes to create closely refined content (Educase 2005).

2.6.4 RSS Feeds

The techniques and tools described so far in section 2.6 focus on the user acting as publisher and consumer, RSS feeds change this somewhat. RSS is an abbreviation for Real Simple Syndication. RSS is a dialect of XML and an RSS feed should conform to the XML standards provided by the World Wide Web Consortium. (Richardson 2007).

Most Web 2.0 software generates XML feeds behind the scenes, this XML feed contains the data which is in the component. The feed is described as a feed as it

allows a person to subscribe to it. The XML feed describes the RSS format and the data which is in a format easily read by an RSS reader. A RSS feed reader is a relatively simple computer application similar to an e-mail application. A user subscribes to the feed and they will then receive the information as it becomes available in their application of choice. The latest version of Mozilla Firefox Version 3 which is available in beta format as of June 2007, allows a user to subscribe to RSS feeds in their browser. Regardless of the application or browser a person may subscribe to many different feeds, a student simply subscribes and the up to date and relevant information is delivered to them (Richardson 2007).

In 2003, the internet engineering task force created a second syndication technique in an attempt to remove some inconsistencies that had occurred during the evolution of the RSS formats. This newer syndication technique is named 'atom'. In true Web 2.0 character, the update to Atom is largely concealed from the user.

2.6.5 Tagging and Book Marking

Taxonomy is the traditional classification of an object; Folksonomy is a system of text labels or tags attributed to an object by the users of the object (Russell 2006). Tagging and book marking have become commonly used tools on participative websites such as flickr and del.icio.us. Flickr is a community where each person can upload their images; each user within the community may then both tag the image and rate the image. Similar to the Wiki page, the up loader of the image may restrict those within the flickr community, who view the image. The del.icio.us website is a site where individual users create a set(s) of related internet bookmarks.

Dr. Jill Freyne a Postdoctoral Researcher from University College Dublin, Ireland identifies four motivations in users when participating in Web Communities. The first is "Anticipated Reciprocity", Users participate in these communities as they contribute to projects if they believe they will benefit in return. A second reason is

that some user's will also be motivated to participate in order to increase their reputation within the community, some participative communities recognise user contributions through the calculation of submitted posts to the community or views to that person's profile page, thereby elevating the members status within that community. A third motivational factor is a sense of efficacy, if a user feels that their contribution makes a difference, it will encourage them to participate. Many users have contributed to web sites for many years for this reason; Lonelyplanet.com and amazon.com allow users to voice their opinion on holiday destinations and consumer products respectively. A fourth motivation is the sense of community that exists within on-line communities; many computer users will feel a sense of belief that they are part of a bigger community. The community provides an environment where a person may respond to other contributions and also see the responses to their own contributions (Freyne 2007).

One might expect that with such a vast range of users on web sites which depend upon user's tagging objects, that the tags would become extremely varied. Research has shown that this is not the case, Folksonomy tags have proven to be more accurate than machine generated tags (Khalifa 2006).

Research carried out at the University of Southampton displayed that the results from the taxonomy tagging had a greater semantic value that that of the keywords extracted by a search engine. In this research, it was found that users tend to develop patterns in tagging objects as users tend to imitate other users. Therefore if an object is tagged by a first user with an accurate description the subsequent users are likely to use the same words (Golder 2006).

2.7 Conclusion

Learning styles and particularly learning models are indeed a controversial topic, there is little agreement upon their effectiveness, their accuracy and their exact definition. Many educators believe that students learn in different ways but moving from this basic assumption to a structured and agreed upon framework is more challenging. Perhaps the best way to educate students and lecturers on the effectiveness of learning styles is that learning styles are not a stable cognitive factor. The attempt to pigeon hole a learner according to the results of a questionnaire created by a theorist is arguably the biggest barrier to the concept of learning styles. Lecturers are attempting to develop students to critically analyze literature from all relevant angles and to create a rounded learner, if the attempt is made to inform a student that they are one and only one type of learner, it is counter productive to the learning objectives of most lecturers.

The dynamic quality of learning styles provides them with one of their strongest features, it encourages awareness amongst students who are educated about learning styles to approach tasks with the realisation that there are many ways in which knowledge can be applied to a particular task and many ways in which information can be presented and absorbed. In order to develop students into rounded learners they must be aware from the beginning that information presented to them is designed in the same manner which is desirable for them to approach new tasks.

Students and adults have their preferences when learning, some like to read large amounts of literature, some like to listen to audio describing a topic, some like to watch and listen to a lecturer, some like to watch a task being completed before them and some like to try out the task. As each person can change on a daily basis, variety in learning is a stimulant for attention and motivation.

It can be argued that a lecturer's primary role is information dissemination, for many years a lecturer is thought of as skilled for their role if they possess expertise in the field in which they are teaching. This author would argue that the knowledge of the subject is secondary to the skill of knowledge dissemination. A lecturer should be skilled in the techniques of knowledge dissemination to multiple learning styles and of stimulating attention amongst learners and developing methods in which to achieve this attention. Many lecturers have their own personal ways to encourage particular types of students; this skill has been developed and honed over years of teaching and seeing various types of students attend their lectures.

Not all students will master a task on first attempt and some need to see a task being carried out repeatedly before comprehending the method. A task that computers can perform with relative ease is repeating recorded information. The availability of screen recording software, audio recording software, blogs, video blogs and rss feeds have aided the creation of an environment where a lecturer can provide more than traditional notes for their students with relative ease.

The use of technology is an aid to lecturers, it provides an environment which allows a lecturer to utilise wider styles of learning. It is also fair to say the pedagogical value of technology is dependant upon a student's intrinsic motivation and the context of the technology. The Web 2.0 techniques discussed in this chapter offer the characteristics, among others, of customisation, personalisation, scalability and collaboration. This is the technologies inherent value and provides the tools for the development of an environment in which the lecturers can apply pedagogical value and help students reach a learning objective by facilitating exposure to multiple styles of information.

The term Web 2.0 has also created controversy, the O'Reilly group has trademarked the term and thus many can not use the term. Others will not use the term as they do not feel that the use of blog, wiki, podcasts and rss represents a large enough step in the evolution of the Web to warrant a version two. In the research carried out in this project, one hundred and forty five research papers where referenced which contained information on the tools described thus far as Web 2.0. 58% of the documents describe the tools as Web 2.0, where as the remaining 42% refer to the tools as blogs or wiki's or RSS and do not mention Web 2.0. Published Literature referenced in this document also makes use of the term Read/Write Web rather than Web 2.0. This reluctance to use the term and the uncertainty in the naming of the tools has aided the ambiguity amongst academics and individuals when identifying what indeed Web 2.0 is.

The move towards social constructivist pedagogical methods which employ collaborative techniques for learning provide a new environment in which knowledge dissemination can occur on a larger scale. New media tools such as blogs, wiki, pod casting, video blogging help to create the networked environment that prepares students for the workforce in a knowledge based economy. The technology provides lecturers and students alike with sources of information that were previously unavailable with such ease. The following chapter discusses the potential uses of the Web 2.0 tools in educational institutions.

3 Learning Management Systems & Web 2.0 in Education

3.1 Introduction

The following chapter discusses the use of eLearning applications, learning management systems and Web 2.0 techniques in educational institutions. Cognitive Load Theory is an important aspect of instructional design when incorporating technology as overwhelming a student can result in a mis-education experience. This chapter discusses potential methods to use Web 2.0 techniques and also presents methods currently in use in Universities and Colleges.

3.2 E-Learning

E-Learning has evolved through a number of stages in the past 20 years, in the 1970's and 80's it was referred to as computer assisted learning and computer based learning to name just two. In terms of pedagogic training style, the applications involved electronic page turning and where didactic in approach. By the 1990s, this form of learning began to include other types of media, particularly the use of video, audio, e-mail lists, discussion groups and other computer mediated communication (European Communities Publication 2004).

E-Learning is available in many forms; standalone courses are taken by a solo learner, the stand alone course allows the user to set their own pace without interaction with an instructor. Virtual classroom courses are structured like a classroom course with online meetings. E-Learning techniques also include learning games and simulated activities that require exploration and lead to discoveries. Embedded E-Learning is the existence of a separate computer program such as a diagnostic procedure or a help file. Mobile learning is learning through the use of mobile devices such as PDA's or

mobile phones. Blended learning is the use of more than one of the described techniques (Horton 2006).

Many lecturers feel that the class lecture is the most effective way to disseminate course content and this is not contested but the benefits of E-Learning are many, one is that it allows a lecturer to provide additional content to the student thereby allowing a student to review a lesson as many times as they wish through a medium which is more interactive than traditional notes. Many students are sometimes reluctant to ask a question during a lecture if they do not understand a concept. The use of an E-Learning application allows a student to re-visit a concept as many times as they wish in order to comprehend the lesson. An E-Learning application that provides analysis of subject areas in which students are competent or require additional focus allows a lecturer to identify the areas of strength within a group and also the areas of weakness. Education is an iterative process and is also a process which requires confidence within a student (Horton 2006; Keller 1983).

E-Learning allows flexibility in learning, in the commercial environment it saves time and money because students do not have to travel or spend excess time away from the work place. The self paced style of E-Learning allows students to take module based lessons, which allow students absorb a lesson before moving onto the next stage at the time they find convenient. A student controls the speed of E-Learning and thus can move faster through lessons they are comfortable with and move slowly through more difficult lessons. The control given to a student regarding both the time and speed in which the lesson is taken can encourage motivation as the power and control is given to the student (Horton 2006).

E-Learning can lead to increased retention and a stronger understanding of a subject. By using the different technologies such as video, audio, quizzes, games and rewards for completion of exercises, it increases the user participation. The application allows a person to re-visit or replay lessons that he/she finds more difficult to comprehend. E-Learning applications which produce statistical analysis allow lecturers to identify

the weaknesses and strengths of the students in their classroom and provide an enhanced teaching environment before graded assessments determine a permanent result (Obringer 2006).

Implementations of projects which require adjustment to established methods will encounter barriers. Barriers to effective E-Learning include its adoption rate. A successful E-Learning application might exist but getting a lecturer or university to encourage the use of such an application is often a stumbling block (Mallak 2001). A professor or lecturer whom already has a full timetable and has an established teaching method may be unable or unwilling to make the time to move content over to a new system. It is quite common for lecturers to present a lecture using slides, an E-Learning application which allows conversion with relative ease would encourage migration. The infrastructure within a college may require additional resources to host additional networked applications and a college may not be in a position to allocate additional funding and human expertise necessary to maintain an E-Learning application. Creating an application which matches the learning objectives of a lecturer and clearly aids a lecturer in delivering content will encourage the lecturer to use the E-Learning application. Constant feedback from students on how well features are working and feedback on additional features which would be beneficial will help promote the effectiveness of e-Learning systems (Mallak 2001; Sinay *et al* 2004).

3.3 Learning Management Systems

The use of learning and course management systems has grown in higher education. Universities and colleges are using systems such as Web CT and Moodle. Jafari (2006) carried out research to identify the advantages and shortcomings of current learning and course management systems. The advantages and disadvantages are divided into three areas; compatibility and interoperability, usability and smartness/dumbness.

The issue of compatibility and interoperability was important to administrators in Jafari's research, some administrators seen the use of open source as a potential

option which would reduce costs and gain local control of systems. Some administrators interviewed also preferred the stability and support offered by commercial options. Integration with current systems is also another issue that administrators of current learning and course managements systems are concerned with. Transportability between existing systems is a necessity sought after by administrators of the system and was discovered to be a large problem in educational institutes (Jafari 2006).

Browser incompatibility was also a commonly reported problem; lecturers interviewed by Jafari reported that they had to inform users which browser works best with the system they use. Students also had a number of log-in names and passwords to remember to access services such as e-mail, portfolios or grading records. The opinion concluded from this area of the research was that a student should have one access point to all areas of information such as course content, library, grades, e-mail. The student should not have to be concerned with technical issues or be overwhelmed with multiple access points and passwords.

> *"Having access to grades and financial aid from the same interface would be a more perfect world for both instructors and students"(Jafari 2006)*

The second of the three areas was smartness/dumbness, it was identified that current systems only provide basic alert messages or notification of the most recent updates or modification in a course. Students and administrators expressed the desire for a system that uses artificial intelligence algorithms to compile profiles on their preferences and to tailor their learning environment to match who they are, what they like and the position in the system they paused their most recent session.

The last of three key areas concluded by Jafari is usability. Administrators were found to value transparency and ease of use very highly. Ease of use was found to be more important than a system which presents a large amount of rich tools to the student. It was found that some groups of lecturers would encourage the creation of new sets of

tools whereas others would frown upon the creation of more tools in an already complicated interface. The balance between a rich tool set and an inviting interface is a difficult balance. The alternative not discussed by the interviewees in Jafari's study is a customisable interface where students are educated about cognitive load theory but remain in control of their interface, this is a basis for what is presented later in this dissertation.

3.4 Cognitive Load Theory

Cognitive load theory describes the variables that hinder what Drommi *et al* (2001) describe as '*schema development'* and also describes methods to reduce the effect of overload on a student. Drommi *et al* (2001) studied the issue of cognitive load theory in interface design and they concluded that the premise of cognitive load theory is that quality of absorption will increase if an emphasis is given to the constraints and abilities of the human working memory.

Feinberg (2000) conducted research which established that the use of recording videos onto a website, and 'dumping' them into an interface for an instructional website is not an effective method for an on-site audience. The research found that not only can the design of an interface inhibit learning but that a particular interface design can impose unnecessary cognitive demand upon the student. Cognitive Load Theory categorises human memory into three parts; sensory memory which deals with incoming stimuli, working memory which is where learning takes place and long-term memory which is where all long term information is stored. Cognitive theory affirms that the human working memory comprises of a very limited area of space and must be carefully used lest it becomes overloaded (Greitzer 2002).

As the working memory or short term memory is the area of the human memory that is highly active when learning, CLT attempts to identify what hinders the working memory. The split attention effect is when competing graphics and irrelevant activities have a negative impact on learning. Some students may find an interface

extremely confusing and thus will inhibit their learning experience. The redundancy effect is when a person processes non essential information. This again increases the cognitive load and can hinder a students learning. A third effect named the 'modality effect' has shown that more items of information are consumed and retained when information is presented to the user in both text and audio formats. However if the auditory or video component is too long then the working memory again becomes strained (Feinberg 2000; Pass 2003).

Greitzer (2002) conducted research in developing eLearning packages and concluded that interactive applications should exploit the content of learning material in such a way that the learner is compelled to organise and structure responses to problems. These activities should be organised in small chunks in order to manage the cognitive load. Greitzer's research found that an interactive learning platform should supplement the classroom and lecture halls, the design of which should include stimulating semantic knowledge structures by using phrases such as "did you know", phrases which are also referred to as factoids.

According to Sweller (1998), there are three types of cognitive load; intrinsic, extraneous and germane. The intrinsic cognitive load occurs between the expertise of the student and the content the individual is learning. The extraneous cognitive load occurs when the student must split their attention amongst the material and other factors such as presentation methods or multiple sources of information. The third type is germane, the germane cognitive load enhances learning and results in the student being devoted to schema recognition and automation (Sorden 2005). Instructional designers can do less to manipulate the intrinsic load than the extraneous and germane cognitive loads.

Feinberg (2000) concluded that cognitive load theory provides for the design of effective instruction and that principles of split attention, redundancy and modality have a clear importance in instructional design. Cognitive theory is compatible with

interface design and provides an additional set of guidelines to be conscious of when developing interfaces.

Drommi *et al* (2001) concluded that instructional designers need to take into consideration the expertise or level of understanding that a student has when creating an interface to suit different groups of students. Drommi's research also concluded that the presenting of cognitive science principles to students resulted in the incorporation of cognitive science principles in final year projects.

Sweller (1998) proposed several instructional design techniques based on cognitive load theory, these are listed in table 1.

Goal Free Effect	A Goal free effect suggests that students are not given one single end-goal. A student should be asked to complete a task and find one of many end-goals to suit their ability and knowledge.
Worked Example Effect	Providing students with fully worked-out examples can be just as effective in building schemas as a student working out a problem themselves. The strategy of self-explaining is a tool that aids students to understand a lesson.
Completion Problem Effect	A completion problem is a worked out solution that falls short of a full solution. It encourages a student to study the partial answer but also contribute to the answer.
Split-Attention Effect	Split attention is when a student must split their attention between two separate mediums in order to understand a lesson and this should be avoided.
Modality Effect	The modality effect argues that presenting information in text, visual and auditory format increases the

	potential channels which a human can absorb information through.
Redundancy Effect	The redundancy effect is the presenting of information that can be understood in isolation with non essential data. It is suggested that a novice learner will require a textual description to compliment a diagram, where as a more mature learner would only require the diagram. The matter of redundancy is subject to the expertise of the learner.
Variability Effect	The more variability within learning, the more a student develops a wider ability of learning styles. This allows students to recognise common components presented through multiple sources.

Table 3: Instructional Design Techniques (Sweller)

The use of E-Learning systems and Learning Management Systems has many benefits, but they are not used on such a wide scale within the work force as are the tools described in this document as Web 2.0. It is for this reason that the use of Wiki's, Blogs, podcasts and RSS has the potential to far out reach E-Learning and LMS's. There are millions blogging each day throughout the world, there are millions actively contributing to Wiki sites throughout the world, there are millions recording themselves on placing videos and audio feeds on websites. These tools are already in the hands of many students. The following sections describe the potential use of these tools and provides real world examples of their use.

3.5 Wikis, Classrooms and Collaboration

There are several possible uses of Wikis in education either in collaborative projects or projects completed by an individual. Wikis can be used by lecturers to publish course notes, handouts and recommended reading lists. Students and research groups can use a Wiki to record the documentation of module projects as centrally available files. Students can also use a Wiki to record in class discussion and in class notes. A student can create their own personal portfolio of documents throughout their college career. Students can use a Wiki as a place to document their views and opinions on recommended readings.

A Wiki can be used for lecturers to share teaching and learning information with other lecturers, a Wiki can be used in brainstorming tasks, a lecturer can ask students to brainstorm a topic previously studied and each contribute to a single Wiki page. A Wiki can be used to create a course document which allows students to comment on the course and suggest ideas that might improve the course from the student's perspective. A Wiki can become a co-construction of information between lecturers and students from separate classes who study the same module. A Wiki can be used to enable students to contribute to bodies of knowledge that are actively seeking new contributions. This can allow students contribute and then monitor their contribution and see how it is edited by others.

Lecturers can ask students to read articles on a Wiki website and ask them critically analyse a topic related to the module with the intent of updating the content on the Wiki. The lecturer could put an emphasis on readability, facts offered in the article, references etc. A lecturer may then review the analysis, select the updates offered by the students that are relevant and update the website accordingly. This provides more to the students; it enables them to see a clear objective and presents an opportunity to engage in practical exercises. Wikis can be used to determine the minutes for meetings which then can be used to serve as a note-taking template. Research students

and PHD students who meet with project supervisors could make use of a Wiki (Duffy 2006; Chao 2007; Richardson 2007; Lamb 2004).

Sharing of information and collaboration is at the centre of innovation and continued success in all fields. The appropriate use of a Wiki can aid the development of students in their collaborative skills, reading abilities, writing abilities and their critical thinking skills. A simple web search using the term 'Wiki' returns millions of websites. There are currently Wiki sites for music interests, sports interests, history, geography, computing, business, medicine, accountancy, science, mathematics. It is difficult to find a topic that a Wiki site has not been created for. Of course the obvious difficultly is identifying the site which is of an academic quality; this can be the lecturer's responsibility if the editing of a Wiki article is part of a project. The most commonly known Wiki site is WikiPedia, in order to combat the problems of information quality, the WikiPedia community actively enforces the ethos that all contributions must be factual and not simply opinion. The use of a Wiki encourages student to become both a reader and a writer. Often it is the case that students tend to only take on the role of a writer and do not think of the structure of the document from the reader's point of view. Collaborative work enforces this and aids in the development of more a rounded student (Chao 2007).

WikiPedia is an excellent resource for information, many students are already turning to WikiPedia for sources in their literature, but many lecturers are forced to explain to students that it is not academically rigorous. Students are actively going to this source of knowledge only to be informed that they can not reference it and should not use it beyond a first step in their research. The use of a Wiki does not require a great deal of technical ability, Desilets (2004) conducted research to test this hypothesis, the experiment involved a fifteen minute training session to a class of fifteen children ranging from eight to nine years of age. The experiment conclusively found that there were minimal difficulties in the students using Wiki Pages.

Bruns (2005) found that students can be reluctant to publish their work on websites in a less than perfect state as they did not want others to scrutinise their work. It was also found that many students do not edit other students work in case of offending fellow students and that some students did not in fact want their work edited by other students. Here the role of the lecturer becomes very apparent, collaborative projects must be designed in a manner to prevent or to mediate potential barriers to collaboration that students may create (Smordal 2006).

The lecturers at the University of British Columbia in Vancouver are using a Wiki tool[5]. The lecturers are contributing towards the creation of reading reference lists, outlines of courses and strategies for teaching. The University has also used Wiki Pages for communications between students and lecturers and also between students themselves. The pages are used for in-class communications and for collaborative project management. Figure 6 display the Journalism Wiki Page at the University of British Columbia which contains course content information.

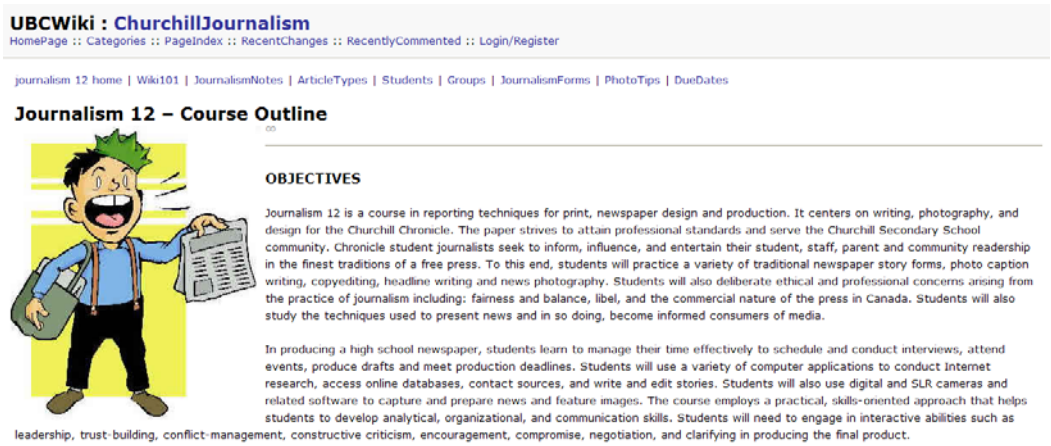


Figure 6 : UBC Jouralism Wiki

[5] http://wiki.elearning.ubc.ca/HomePage

Interoperability is a common desire amongst lecturers when introduced to a new technology. Many lecturers make use of summarised presentation slides in their modules. O'Neill (2005) has researched a new tool called 'slides2wiki' which converts the contents of a presentation file into a Wiki Page. Figure 7 displays a typical slide that is used in the slide2wiki tool.

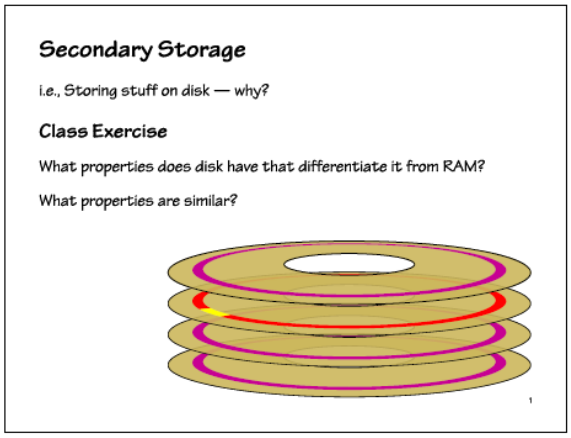
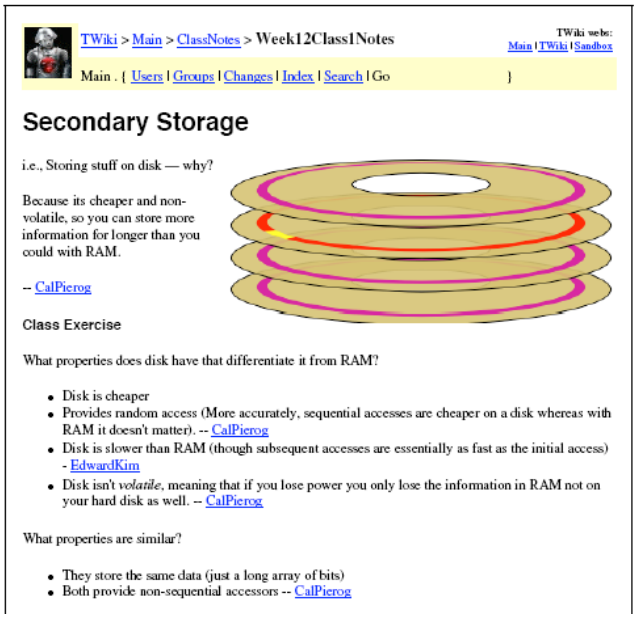


Figure 7: A Single Slide from a Lecturers Presentation (O'Neill 2005)

The system allows students to build upon questions offered by a lecturer within their slides. O'Neill found that a lecturer needs to give clear responsibility to students and therefore nominated two students per class who were responsible for the note taking on that particular day. As with the services offered by any Wiki, other students could review the notes taken on a particular day and offer their own suggestions. The slides2wiki software is publicly available from the author[6]. Figure 8 displays the Slide now developed into a Wiki format by the students.

[6] http://www.cs.hmc.edu/~oneill/freesoftware/slides2wiki/



TWiki > Main > ClassNotes > Week12Class1Notes

TWiki webs: Main | TWiki | Sandbox

Main . { Users | Groups | Changes | Index | Search | Go }

Secondary Storage

i.e., Storing stuff on disk — why?

Because its cheaper and non-volatile, so you can store more information for longer than you could with RAM.

-- CalPierog

Class Exercise

What properties does disk have that differentiate it from RAM?

- Disk is cheaper
- Provides random access (More accurately, sequential accesses are cheaper on a disk whereas with RAM it doesn't matter). -- CalPierog
- Disk is slower than RAM (though subsequent accesses are essentially as fast as the initial access) - EdwardKim
- Disk isn't *volatile*, meaning that if you lose power you only lose the information in RAM not on your hard disk as well. -- CalPierog

What properties are similar?

- They store the same data (just a long array of bits)
- Both provide non-sequential accessors -- CalPierog

Figure 8: Wiki created By students from Lecturer Slides (O'Neill 2005)

A possible barrier to this type of system is that lecturers would feel attendance levels will drop if such detailed class notes are available. Honegger (2005) identified four potential barriers to the use of Wiki's in education which include an educational institution lacking Wiki servers, lecturers lacking ICT skills, students not having exposure to 'what you see is what you get' interfaces and being required to edit Wiki's using html. The reason for resistance as defined by Honegger (2005) are displayed in Figure 9. The use of Wiki's in a classroom requires a new approach to learning and this new culture of learning will be met with obstacles created by students and lecturers alike.

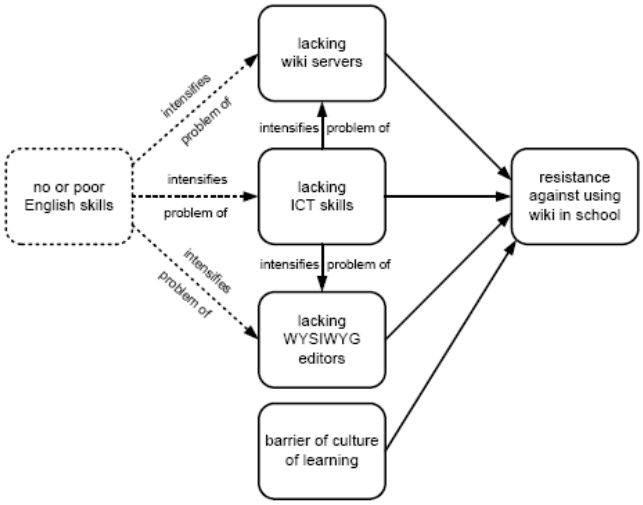


Figure 9: Reason for resistance to the use of wiki's (Honegger 2005)

3.6 Learning and Blogging

Blogs are Socratic in their nature, we recall in section 2.1.1 of this document Golden *et al* (1983) describe the Socratic Method as a technique which employs a chronological pattern, which allows a statement to be made and a question to follow.

Richardson (2006) lists five positive impacts that Blogs have on students;

- Blogs promote critical thinking and analytical thinking,
- Blogs can promote "creative, intuitive and associational thinking",
- Blogs promote analogical thinking,
- Blogs are a powerful medium for increasing access and exposure to information,
- Blogs provide solitary reflection and social interaction.

The blog has a number of potential areas where it can be used in education. The Blog can be used to replace the traditional web page. A Lecture could post the course literature and notes, recommended reading lists, calendars and all commonly offered documents and notifications. This in itself does not present anything new but it does provide a chronological sequence to the added information and makes the effort required to upload the comments easier for a lecturer, it does not require the same level of technical expertise when developing a traditional website. It also allows student to clearly identify information in relation to dates in the academic year (Downes 2004)

Blogs may be used to publish links to articles and websites associated with the module, annotating what is important about the links and allowing students to submit their comments on the websites or articles, A Blog can be used as a place to organise class discussions. Downes (2004) identifies a lecturer at the State University of New York in Buffalo, New York State. The lecturer in his media law class would reward students with course credit for online discussion. Lecturers are also providing Blogs as the area to organise class seminars and to provide areas for summaries of class notes and readings.

Students can be required to complete a blog as part of the module; the blog content would be the student's critical analysis and opinions on content they have read in each class. Students can use a blog as an on-line filling cabinet where students can post and store their documents from the first day they attend the institution until the last. This provides great opportunity for reflection upon work studied and provides an ability to share information. At the end of undergraduate college life a student would have an easily accessible area in which to develop a detailed curriculum vitae or portfolio which could be made available to prospective employers. Educational institutions can also use Web Logs as their web pages, each society and faculty could contribute to the web page removing the fact that many institution web pages are not regularly updated. It would obviously be good practice to designate a web master who would review the content before it is published (Downes 2004; Richardson 2006).

Blogs expand the walls of the classroom; they allow students to communicate with other students and groups with similar interests. Blogging provides students who may be reluctant to ask questions in the lecture hall, the opportunity to ask these questions after the initial lecture. A lecturer could upload the different components of each module and encourage students to ask questions. The linking characteristic of a Blog also promotes the referencing of information to the respective source. Blogs can be used to publish examples of completed assignments either an assignment from a former/current student or example answers created by other persons or the lecturer. Lecturers can offer surveys to students on each topic or class or also ask students for feedback on a lecture. The blog can then be used to present the information and open discussions to ameliorate course content dissemination (Brownes 2004; Richardson 2006; Davis 2004).

An innovative lecturer could use speech to text technology which has been developed to a standard where it can record a textual record of a lecture. This allows for a full transcript of a lecture to be available to students. A lecturer would retain the ability to edit the transcript and then post it to the blog. The point that must be emphasised is that the technology is available for lecturers to present their content in a multitude of learning styles thereby enhancing the broadcasting range of their lecture to cater for a greater number of learning styles.

David (2004) compiled a list of possible uses of a Blog that a lecturer themselves may utilise;

- reflect on their teaching experiences,
- keep a log of teacher-training experiences,
- write a description of a specific teaching unit,
- describe what has worked for them in the classroom or what has not worked,
- provide teaching suggestions for other lecturers,

- write about something they have learned from another lecturer,
- explain teaching insights they have gained from their experience,
- share ideas for learning activities to use in the classroom,
- provide some how-to's on using specific technology in the class, describing how they have used this technology in their class,
- Explore important teaching and learning issues.

Blogging provides students with a space for sharing opinions and learning to develop their constructive analysis of another person's literature. It is a space that allows both students and lecturers to learn from each other. The characteristics of the blog allow learners to see that knowledge is available from multiple sources and is interconnected in many ways. It provides students with the realisation that they are a voice in the learning cycle; that their opinions are valued and can help to create an improved learning environment. If the contents of a blog is available to a worldwide audience students can feel more compelled to write contents for which they believe others will respond to. It also provides students with the potential to connect with experts on a topic and ask questions or link their own blog to an experts blog by providing a comment informing readers of the experts blog, to the existence of the students blog. It allows lecturers to teach students to write publicly available documents and articles thereby learning the possible arguments for and against a topic.

Through the use of Blogging, Lecturers and students have become both the publisher and consumers of information on the Web. This ease of publishing information has contributed to the evolution of web sites where a personalised learning environment may be easily created. The flexibility of the blog allows for innovative lecturers to use the technology in multiple formats.

3.7 Learning through Podcasting, Screencasting and Video Blogging

The audio and video blog are a tool which both the auditory and visual learner respectively will embrace. An audio blog is also known as a podcast although this does contribute a well known mp3 player. A podcast is relatively easy to create and does not require any great level of expertise. Audio editing software has become more and more user friendly and efficient as it has evolved over the last few years. There are many free open source options and commercial options available such as Audacity[7] and Sony Sound Forge[8] respectively. These applications provide a podcast creator with the ability to delete or edit as they wish by simply cutting and pasting audio streams visualised in a wave format. A lecturer can record all or parts of their own lecture and make it available to students or they may offer podcasts which are created by other experts.

The podcast has created new library of knowledge different in medium to the traditional text book library. Indiepodder.org[9] is a website that contains hundreds of podcasts ranging from business to bicycle topics. A second podcast library website is podcastalley.com[10] which hosts over twenty thousand podcasts on topics ranging from science to sports and from computing to television (Richardson 2006).

Youtube.com is the most popular video publishing web site currently available, a simple search in YouTube of many different subjects will return many results of educational offerings from individuals throughout the world. These sites not only provide a source of information for consumption but also provide a website in which the student may publish their own thoughts and opinions in both textual and visual

[7] http://audacity.sourceforge.net/

[8] http://www.sonycreativesoftware.com

[9] http://www.indiepodder.org

[10] http://www.podcastalley.com

formats. Educational institutions can record students or lecturers for their University blogs or web sites welcoming students and can also record tours of the campus in an attempt to attract prospective students. Librarians in Universities can record tours of the library showing students how to access resources and knowledge repositories.

Not only are sites such as those described previously growing in popularity and content, but education specific podcasting websites are growing. Podcasts for education[11] is a UK based website that lists over four hundred carefully selected podcast channels for educational use. This site lists podcast with topics including history, foreign languages, quantum theory, computer science and medicine. The education podcast network[12] provides over five hundred podcast links broken into their respective categories, which includes computer skills, information skills, social studies and mathematics (Richardson 2006).

Screen casting is a relatively new technique which involves recording exactly what is displayed on the computer screen. The lecturer can also make use of a microphone and record their narration if they wish. Imagine the advantage a student has if they can first view the demonstration of a computer application, programming routine or any other topic in class and watch it again when they need to revise for examinations or assignments (Richardson 2006).

There is growing number of educators who are contributing to their own directories of podcasts; many are broken down by subject or level. Quite similar to how file sharing has made a big impact on the manner in which the distribution of media is carried out, podcasting is a new technique in which students will have access to new distribution channels for learning. Experts will begin to take note of this information distribution chasm and begin to embrace it allowing for any lecturer to present to their class a

[11] http://recap.ltd.uk/podcasting/

[12] http://epnweb.org

podcast from worldwide experts whom write the text books that students currently follow closely in their every day studies.

3.8 Social Book marking

With the large amount of Blogs and Wikis and Podcasts available to students and lecturers, a common problem is the identification of high quality and relevant articles. Social Book marking is a recent phenomenon where contributors offer links to articles which are categorised by subjects. For instance if a lecturer is having difficulty finding a high quality document on a topic, they can search for the topic in a website such as del.icio.us[13]. Del.icio.us offers a service to a user that connects them to other users with similar interests. Each user can tag and rate particular bookmarks and this enables a catalogue of websites which are reviewed by people who have an interest in the topic, this is peer review of websites (Richardson 2006). Del.icio.us offer tool bars for users which enable the book marking of web sites with extreme ease. A person merely clicks on the icon in their toolbar and the Website the user is currently visiting is added to the list of sites in their Del.icio.us account.

The pedagogical potential is exposing students to peer reviewed articles, in the same manner that a reference list in a research paper reveals additional sources of information. Students can also contribute by submitting their own links and articles and offering their opinions and ratings on available articles.

3.9 RSS Feeds

[13] http://del.icio.us/

RSS feeds as described in section 2.6.4 allow a person to subscribe to an RSS equipped article. They create the potential for many more techniques for the inclusion of technology in the classroom. If a student has a blog, a lecturer can require that assignments are written on the student's blog which the lecturer is subscribed too. Once the student posts their assignment to their blog, the RSS feed is picked up by the lectures reader and submitted in this manner.

Students can subscribe to a lecturers blog in their RSS reader and are no longer required to visit websites to look for possible updates. How often do we see the disclaimer on module websites *"it is the responsibility of the student to check this site for updates"*, this in many cases is an unreasonable request, students should not have to continuously visit a website which may be updated once in a fortnight. Lecturers will often hear students say that "they did not read that mail". If the notice is delivered straight to their learning page, this no longer can be claimed.

Another scenario in which RSS can be used is for Lecturers whom teach a particular subject and spend time searching for relevant articles. By subscribing to websites they can receive the articles in their RSS reader cutting down on Web browsing times (Harrsch 2003).

The use of an RSS feed allows students to create a personalised learning portal where they can subscribe to their lecturers Blogs, Wikis, podcasts. This is the real advantage of RSS feeds and Web 2.0 tools, there are so many possibilities that a lecturer can use in their modules to offer students a true experience of differential learning.

3.10 Conclusion

In envisioning future learning environments, Jafari (2006) discovered through interviewing lecturers and students that areas such as smart systems, multi-modal/ multimedia communication channels, collaboration tools and mobile computing are highly sought after components of learning environments. Students and lecturers alike need and want learning systems to do some of the thinking, to provide an environment for students that will enhance their learning experiences. Students want an environment that is capable of supporting a variety of different systems and resources.

There is also a clear demand for more avenues of communication and greater choice of learning. The increased range of communication channels would increase pedagogical capabilities and increase engagement in the class room. Students need to have access to course content over their learning period while at college or university; they need access to course content so that they may return to locate material previously studied that may be useful to them for a second time.

The use of collaboration tools is a feature that is attractive to students and lecturers, the current course management systems provide chat systems, forums, and whiteboards, but these are components which are rarely used and promote a type of monoculture in education, there is little scalability or variety on offer.

Web 2.0 tools are used by millions of students every single day in their personal life's, and through this popularity and familiarity, educational institutions can propel themselves into a position that is inviting and extremely familiar to students. Many education institutions talk of open source and are extremely reluctant to avail of services offered by third parties. This position is still quite strong amongst many lecturers but there are small signs where education institutes have begun to avail of the services offered by third parties, an example close to this author is Trinity College Dublin, who have recently set up the use of a Gmail variant as the college mail

servers. The use of third party services of course raises many questions such as, who profits from advertisement campaigns. Is privacy of data guaranteed? Could these commercial groups decide to charge for their service once it becomes established? These are all valid concerns and are enough to prevent some administrators and lecturers from availing of these publicly available services.

In this research, the author could not claim that the use of Web 2.0 tools will transform education over night as traditional learning is still the most commonly used method of learning. In many cases this type of learning rewards silos of knowledge rather than contributors and collaborators, Wiki's present a shift in education where students have the ability to make other people's work their own. The usefulness of peer learning is an important concept that does not fit well in the methods of traditional learning. The use of Web 2.0 tools provides the ability to incorporate personalised, scalable and customisable systems. A student equipped for a knowledge economy needs to be equipped to deal with ambiguity, needs to be adaptable, highly mobile, entrepreneurial and creative. The workforce requires people with these qualities, and therefore the educational institutions need to model environments using the same principles in order to allow students learn to deal with these situations.

"We can't solve problems using the same kind of thinking
we used when we created them"

Albert Einstein

4 Interviews and Surveys

4.1 Introduction

Interviews are a qualitative method of research which seeks to determine meaning and direction of a particular topic. In order to understand and learn about the direction in which technology and education is evolving in Ireland, educational experts were contacted and interviewed. The interviews were particularly useful as they provided the situation where the interviewees could share their experiences and views on technology and education. A survey has also been compiled to quantitatively compile data on the use of Web 2.0 technologies amongst computer lectures in Universities and Colleges throughout the Republic of Ireland.

4.2 Interview Methodology

The interview methodology employed in this research was one of exploratory interviewing. The exploratory interview is essentially heuristic, the objective is to develop ideas and research hypothesis rather than to gather statistics. Each Interview would begin with an introduction to the project and a description of the research objective. This was followed by the question “What is your view of technology in the class room”. This allowed the person being interviewed to answer the question in the manner which they felt was most important. It allowed the experts who were interviewed to speak freely with a degree of insight to their thoughts and experiences. The objective was to encourage a continuous monologue by the respondent. The use of an exploratory interview methodology enabled information to be obtained about the current concerns and difficulties that exist in educational institutions (Oppenheim 2001).

4.3 Questionnaire Design

The primary purpose of the questionnaire, which is given in Appendix B, is to ascertain the opinions of lecturers on the use of technology in the classroom,

specifically Web 2.0 technologies and to establish their opinions on learning styles. The questionnaire also includes questions enquiring about the respondent's position on institution policy with regard to technology and learning styles, and of which specific technologies are used in the respondent's lectures.

The questionnaire was created on a publicly available questionnaire hosting website[14]. The design of the questionnaire ensured that it addressed the needs of the research. In the attempt to improve response rate and reduce ambiguity the questionnaire was designed to include fourteen clear and concise questions. The population of the sample is computer science lecturers throughout third level institutions in Ireland, the sample size is four hundred and twenty two. The number of responses received is one hundred and five, which is a 24.8% response rate.

Closed questions were asked when the objective was to obtain statistical analysis. If a particular question posed potential for extra information in a response, an optional text box was added with an open question. The wording of questions was designed so that questions were not ambiguous or confusing to the respondent (Burgess 2001).

In addition to questions, statements are presented to the respondents where the individual is asked to select which most closely represented their feelings towards the statement the five point Likert Scale. The Likert five-point scale has been selected as it allows a person to select a middle option, a four point scale is a forced choice method as points two and three do not allow a person select a middle option.

[14] www.surveymonkey.com.

4.4 Interview Findings

The interviewee's hold their expertise in many different areas of education and therefore had many conflicting views on the direction in which education should go. The first interview conducted was with educational expert Dawn Duffin. I would really like to thank Dawn for taking her time out to chat with me. It is extremely valuable to speak with an expert and gain their perspective on the direction of education. The topics in the interview explored included, differentiated learning, legislative requirements for disabled learners, the difficulties with traditional teaching methods in high school/secondary school, and how difficult most students find the current model of learning. Many have been in this situation, and it has potential to be tedious, the use of differentiated learning environment following using Web 2.0 technologies can help this. The interview also included discussion of the use of a learning menu which would exist for students and also allow a student to decide if their lecture content is displayed in the form of mind maps or 6-hats or other learning theories.

The second interviewee was Neil O'Sullivan who also discussed the difficulties in teaching and learning in secondary schools. It was considered that students in the secondary schools simply learn off and repeat rather than attempt a level of understanding. He felt that there is little ability to change the current structure in secondary schools and that primary schooling is the more possible area to follow in research and implementation of technology in the classroom. During the interview Neil spoke of a variety of primary schools which are involved in technology initiatives including St. Gabriels in Limerick, St.Marys in Dublin and St. Tiernans in Dublin which are participating in the inclusive learning through technology project. During the interview the use of Web 2.0 and personalised learning environments were discussed and the existence of Moodle was spoke of.

A third individual interviewed was with Dr. Gerald Craddock, the interview was short interview via e-mail, Dr Craddock requested a brief introduction to the topic, Dr. Craddock's advice was too follow the documentation set out at the NCCA and NCTE websites in their publications on technology in the Irish classroom.

4.5 Survey Results

The number of respondents in the survey is one hundred and five, ninety six declared themselves as computer science lecturers. Figure 10 displays that 49.5% of the respondents are lecturers from Institutes of Technology, 41.0% of respondents are from Universities, the remaining 9.5% represents respondents who declared themselves as not being computer science lecturers.

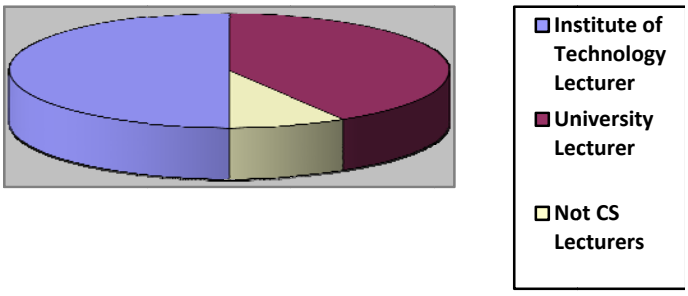


Figure 10 : Survey Respondents

In order to research the potential enthusiasm or barriers, for both the inclusion of technology and the focus on learning styles in the classroom, the following five statements were presented to the respondents, the following statement is identified as statement one.

"I find the use of technology in the classroom motivates students"

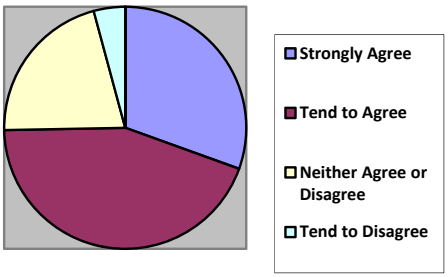


Figure 11 : Cumulative Responses to Statement One

The cumulative reaction to statement one, displayed in Figure 11, was that 30.5% of respondents selected that they strongly agreed with the statement while 44.2% would tend to agree with the statement. 21.1% of the respondents selected that they would neither agree nor disagree and 4.2% selected that they would tend to disagree.

Filtering the responses to show the results of only Institute of Technology lecturers yielded the results depicted in Figure 12. 40.4% of respondents selected that they strongly agreed with the statement while 46.2% would tend to agree with the statement. 13.5% of the respondents selected that they would neither agree nor disagree and most interestingly zero respondents selected that they would disagree with the statement.

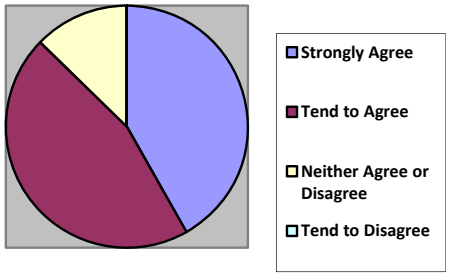


Figure 12: IT Lecturer Responses

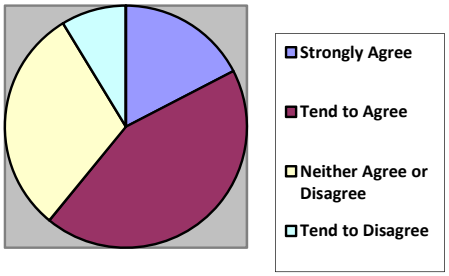


Figure 13 : University Lecturer Responses

Filtering the responses to show the results of University lecturers yielded the results displayed in Figure 13. 19% of respondents selected that they strongly agreed with the statement while 40.5% would tend to agree with the statement. 31% of the respondents selected that they would neither agree nor disagree and 9.5% of the respondents would tend to disagree.

The second statement made in the survey which will be referred to as statement two is

> *"I would like to integrate more technology into my lectures and course material"*

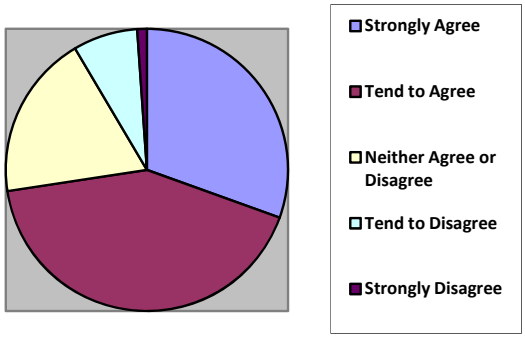


Figure 14: Cumulative Responses to Statement Two

The cumulative reaction to statement two, displayed in Figure 14, was that 30.5% of respondents selected that they strongly agreed with the statement while 42.1% would tend to agree with the statement. 18.9% of the respondents selected that they would neither agree nor disagree. 7.4% would tend to disagree and 1.1% would strongly disagree.

Filtering the responses to show the results of only Institute of Technology lecturers yielded the results depicted in figure 15. 44.2% of respondents selected that they strongly agreed with the statement while 38.5% would tend to agree with the statement. 11.5% of the respondents selected that they would neither agree nor disagree. 5.8% would tend to disagree and zero would strongly disagree.

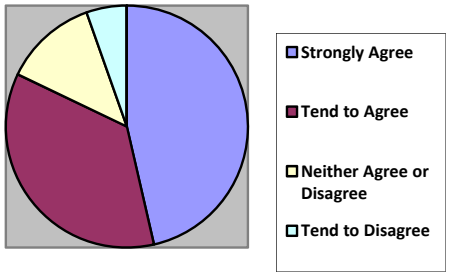


Figure 15: IT Lecturer Responses

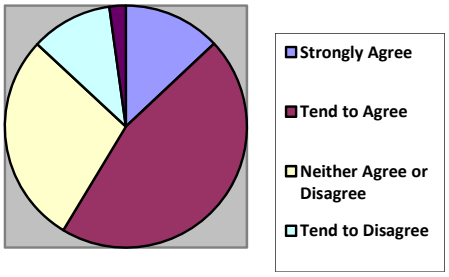


Figure 16 : University Lecturer Responses

Filtering the responses to show the results of University lecturers yielded the results displayed in Figure 16. 14.3% of respondents selected that they strongly agreed with the statement while 45.2% would tend to agree with the statement. 28.6% of the University respondents selected that they would neither agree nor disagree and 9.5% would tend to disagree. Finally 2.4% of the University respondents would strongly disagree.

A third statement presented to the respondents, which will be is referred to as statement three is,

> *"My Institution should provide me with a choice of frameworks for the inclusion of technology into the modules I teach."*

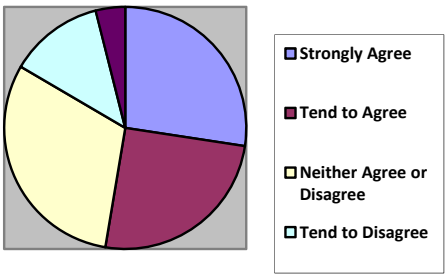


Figure 17: Cumulative Responses to Statement Three

The cumulative response to statement three, displayed in Figure 17, was that 34.0% of respondents selected that they strongly agreed with the statement while 41.5% would tend to agree with the statement. 17.0% of the respondents selected that they would neither agree nor disagree. 5.3% would tend to disagree and 2.1% would strongly disagree.

Filtering the responses to show the results of only Institute of Technology lecturers yielded the results depicted in Figure 18. 37.3% of respondents selected that they strongly agreed with the statement while 43.1% would tend to agree with the statement. 15.7% of the respondents selected that they would neither agree nor disagree. 3.9% would tend to disagree and zero would strongly disagree.

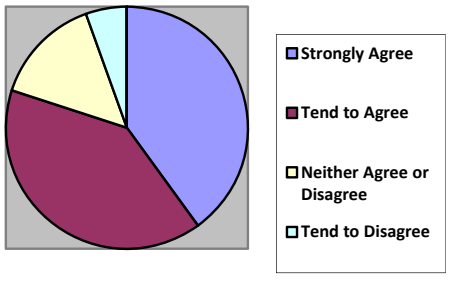


Figure 18: IT Lecturer Responses

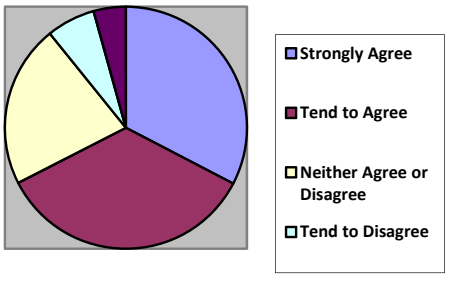


Figure 19 : University Lecturer Responses

Filtering the responses to show the results of University lecturers yielded the results displayed in Figure 19. 31% of respondents selected that they strongly agreed with the statement while 38.1% would tend to agree with the statement. 19% of the University respondents selected that they would neither agree nor disagree and 7.1% would tend to disagree. Finally 4.8% of the University respondents would strongly disagree.

A fourth statement presented to the respondents, which will be is referred to as statement four is,

> *"Institution policy should choose whether or not lecturers include modern technologies in course content",*

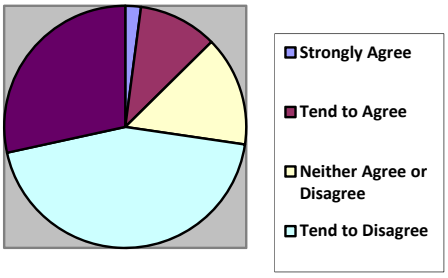


Figure 20: Cumulative Responses to Statement Four

The cumulative response to statement four, displayed in Figure 20 depicts that 2.1% of respondents selected they strongly agreed with the statement while 10.5% would tend to agree with the statement. 14.7% of the respondents selected that they would neither agree nor disagree. 44.2% would tend to disagree and 28.4% would strongly disagree.

Filtering the responses to show the results of only Institute of Technology lecturers yielded the results depicted in Figure 21. 0.0% of respondents selected that they

strongly agreed with the statement while 11.5% would tend to agree with the statement. 15.4% of the respondents selected that they would neither agree nor disagree. 51.9% would tend to disagree and 21.2% would strongly disagree.

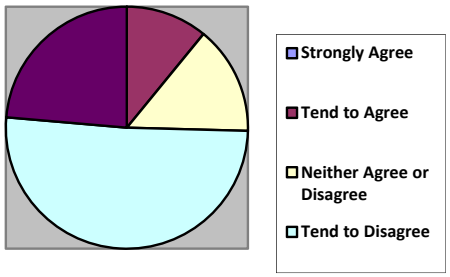


Figure 21: IT Lecturer Responses

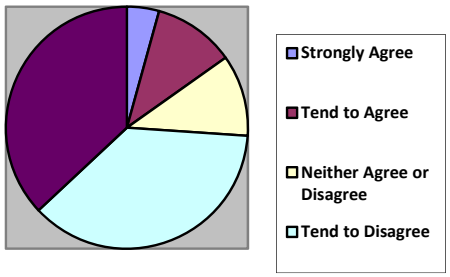


Figure 22 : University Lecturer Responses

Filtering the responses to show the results of University lecturers yielded the results displayed in Figure 22. 4.8% of respondents selected that they strongly agreed with the statement while 9.5% would tend to agree with the statement. 11.9% of the University respondents selected that they would neither agree nor disagree and 35.7% would tend to disagree. Finally 38.1% of the University respondents would strongly disagree.

A fifth statement presented to the respondents, which will be is referred to as statement five is,

> "*Institution policy should determine whether or not a lecturer facilitates a wider variety of learning styles.*"

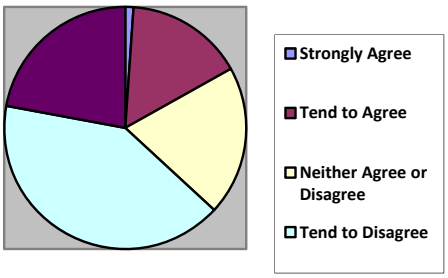


Figure 23: Cumulative Responses to Statement Five

The cumulative response to statement five, displayed in Figure 23 shows that 1.1% of respondents selected that they strongly agreed with the statement while 15.8% would tend to agree with the statement. 20.0% of the respondents selected that they would neither agree nor disagree. 41.1% would tend to disagree and 22.1% would strongly disagree.

Filtering the responses to show the results of only Institute of Technology lecturers yielded the results depicted in Figure 24. 1.9% of respondents selected that they strongly agreed with the statement while 17.3% would tend to agree with the statement. 15.4% of the respondents selected that they would neither agree nor disagree. 48.1% would tend to disagree and 17.3% would strongly disagree.

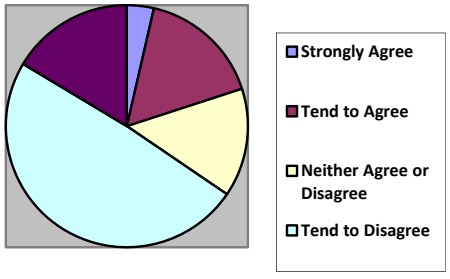


Figure 24: IT Lecturer Responses

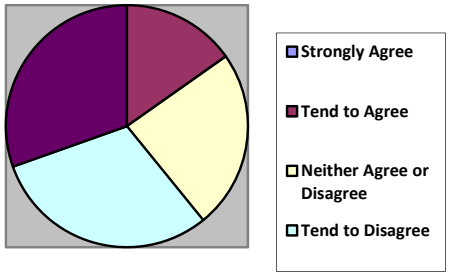


Figure 25 : University Lecturer Responses

Filtering the responses to show the results of University lecturers yielded the results displayed in Figure 25. 0.0% of respondents selected that they strongly agreed with the statement while 11.9% would tend to agree with the statement. 26.2% of the University respondents selected that they would neither agree nor disagree and 33.3% would tend to disagree. Finally 28.6% of the University respondents would strongly disagree.

The fourth question asked in the survey was, "*Which of the following are used in more than 50% of your lectures*". The question was posed in order to determine which particular styles that lecturers in computer science classes are using in their day to day lectures. Figure 26 depicts the results obtained from the question.

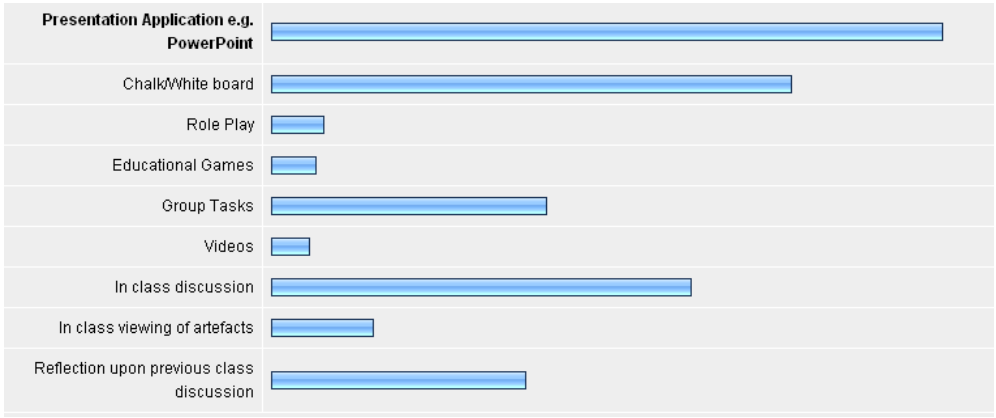


Figure 26: Classroom Techniques

The respondents could select multiple answers, 93.7% of the respondents selected that they use a presentation application, while 72.6% also make use of the Chalk/Whiteboard. 7.4% make use of role play in their class, 6.3% use educational games while 39.0% make use of group tasks. 5.3% of respondents surveyed use videos and 59% encourage class discussion.14.7% respondents have in class viewing of artefacts and 35.8% have periods of reflection upon previously discussed topics.

In addition to the techniques displayed in Figure 26, respondents added that they make use of Guest attendees to visit their lectures. Other respondents added that they make use of the computer screen displaying applications or operating systems in use. One respondent who identified him/herself as a computer programming lecturer noted that the use of a computer programming language compiler dominates content dissemination of his/her lecture. A respondent also noted that they require students to complete short exercises throughout the duration of a lecture. One respondent took the opportunity to comment that it can be difficult to get students to participate during in-class discussion;

> *"I do attempt the discussion bit but students are extremely reluctant to participate. I have developed a variety of computer programs for use in my courses and I have developed word games (in software) and other computer based learning aids particularly for programming"*

Question Number Five in the survey attempts to gather data of which learning styles that the respondents cater for in their lectures. The question "Which of the following learning styles do you accommodate in your lectures? ?(Select as many as applicable)" was presented to the respondents. Figure 27 displays the answers to the questions.

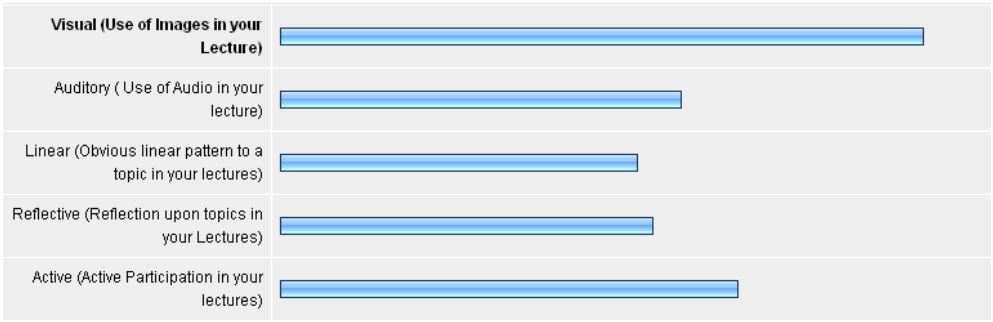


Figure 27: Learning Styles accommodated in Lectures

90.2% of respondents said that they make use of visual aids in their lectures. 56% of respondents said that they offer an auditory style in their lectures while 50.0% responded that there is an obvious linear pattern to their lecture. 52.2% said that they reflect upon topics previously studied and 64.1% said that they require active participation in their lectures. In addition respondents had the option to comment on the use of learning styles. One respondent noted that they do not have the time available to facilitate reflective learning

> *"(I) Cannot with time constraints accommodate much for reflective learners during a lecture. (I) can only offer supplemental material, elearning etc, for them to use outside of class and go through at a reflective pace."*

It is also noted that 95% of those who selected that they use visual aids also selected that they use a presentation application such as Microsoft PowerPoint.

The sixth question in the survey is "*Which of the following do you provide for your students in modules you teach? (Select as many as applicable)"*

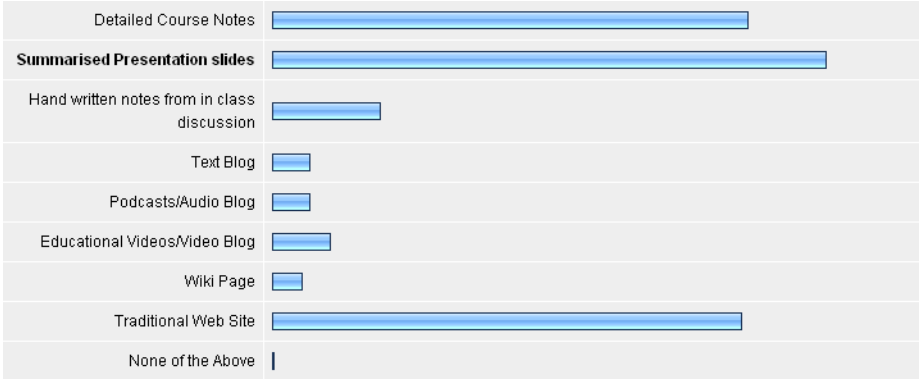


Figure 28: Knowledge Distribution Mediums

It is clear from Figure 28; that summarised presentation slides, combined with detailed course notes and a traditional website are the most commonly offered methods of information dissemination. We can also see an introduction of Blogs, podcasts and Wiki into computer science lectures. Of the ninety four computer

science lecturers who responded to the survey, 5.3% offer a Blog, 5.3% offer podcasts and 4.2% offer a Wiki page.

The next question, question number seven, is *"If the resources were available, would you video record your lectures and make them available to students after each class?"* Three choices were offered; '*yes*', '*no*' or '*I already do*'.

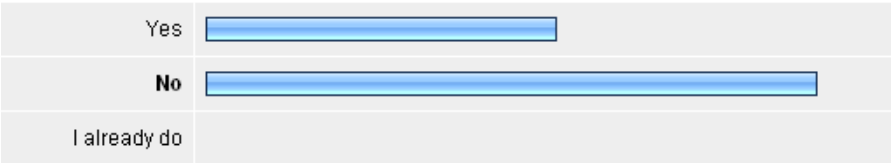


Figure 29: Video Recording Lectures

63.4% of lecturers selected that they would not record their lecturers while 36.6% of lecturers said that they would. This is a higher than expected number of lecturers whom would agree to their lecture being recorded. As part of this question the respondents were also give the opportunity to give their view on the barriers to using this technology. Many respondents noted that class attendance is a major factor that would prevent them from recording their lecture. Some respondents noted that the time required to edit and prepare the recorded content is too time consuming to be feasible. Other concerns offered included, what is the life span of such a recording? Is it only aimed at students whom are attending the class or is it intended to be re-used over the span of the course?

> *"If you are teaching the same subject in consecutive years would you re-video. Or is the intention to video-record once and reuse whenever required for that particular lecture. Why would students ever bother going to a lecture if they have all the resources? Are the lectures now obsolete?"*

Many respondents also noted that the human interaction element of their class is very important and that they could not see how a student would get value by not attending. Respondents also noted that they would feel that students would be reluctant to ask questions in a recorded lecture for the fear of being recorded or asking inept questions.

> *"I believe recording of active participatory lectures, where students are encouraged to contribute even at risk of being "wrong", would substantially inhibit the session."*

One respondent noted that this may be more suitable for fourth year students or postgraduate students rather than first year students.

> *"Probably not for an Introduction to programming course. Maybe for some 4th year course. Most likely for postgraduate courses."*

Another respondent noted that the use of video is a positive technique provided it is for students who attend lectures to revise or if it is for distance learning.

> *"The answer depends on the reason for doing this. If it is used to help people who attended the lecture to review and revise, then I think it is a good idea. If it is to be used by those who genuinely cannot be at the lecture or by those who are studying long distance, that is also OK in my opinion."*

Lecturers also responded outlining their concerns of being recorded during their lectures

> "*(I would not like being recorded because of the) Fear of saying something I might regret"*

> "I would not be comfortable with the idea of footage of my lectures being generally available."
>
> "(I) Don't feel comfortable being filmed during a lecture"

Although there is much reaction to the question and many lecturers where keen to offer their reasons as to why they would not record their lectures, it must be emphasised the 36.6% of the respondents selected that they would video record their lectures. The concern of attendance is a valid concern but the inclusion of video technology into the class room in terms of screen casting or recording demonstrations of software is a possible technique for computer science lecturers which may be presented with lesser barriers than the recording of entire lectures.

Question number eight in the survey is *"If the resources were available, would you record the audio of your lectures and make them available to students after each class?"* Figure 30 displays the results, where 35.1% of respondents answered yes to this question, 59.6% answered no, and 5.3% answered that they already provide audio recordings of their lecture. The 5.3% whom answered 'I already do' equates to five respondents. Three of the five identified themselves as University lecturers while the remaining two are Institute of Technology lecturers.

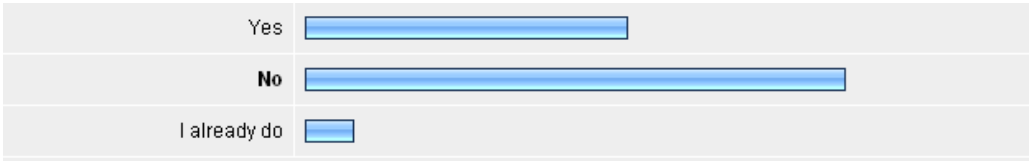


Figure 30: Audio recording Lectures

Question number eight also asked respondents who selected no, to elaborate on the potential barriers to using this technology. Many respondents answered this question with 'as above' declaring that they have the same difficulties with audio as with

video. Respondents also made it clear as in question number seven, that they feel attendance numbers would drop if the lecture was available in an audio file. Other respondents doubt the value of recording the audio of their lecturing styles; three respondents provided the following comments;

> *"I doubt the value of this for lectures with a high visual content….How can you convey a circuit diagram or a flow chart in such cases?"*

> *"I tend to use diagrams a lot during lectures, which could not be recorded in audio form."*

> *"Lectures tend to be a combination of both audio and visual components (e.g. speaking while drawing on a whiteboard or elaborating on slides. Audio only would not suffice, in my opinion"*

The respondents make a valid claim with regard to lectures that have a high visual content. The claim can also be made it is worthwhile if a student feels they will benefit from an audio recording of a lecture combined with in class notes. Another respondent felt that the onus is not on a lecturer to provide audio, and similarly another respondent commented that students have the ability to do this if they choose to already.

> *"I think visual recording presents a particular problem for all but strict podium style lecturing, but audio, being less intrusive, suffers less from this problem. However, I'm unconvinced that the use of this kind of technology does anything other than provide an alternative to attending the lecture. My students have all the technology they need to record whatever they want. What advantage is there really in providing these recordings officially?"*

Again the common theme of a fear of attendance levels is clear in the above comment. The provision of official recordings can benefit students in that the lecturer could determine which particular components of a lecture are more suitable for recording and thus make them available to all students in a course.

Question number nine in the survey is *"Which of the following would you describe as Web .20?"*The results of the question are displayed in Figure 31. The purpose of this question was to determine what computer science lecturers identify as being Web 2.0. The research papers referenced throughout this research displayed the fact that there is little uniformity amongst academics on the name used to identify Web 2.0 tools.

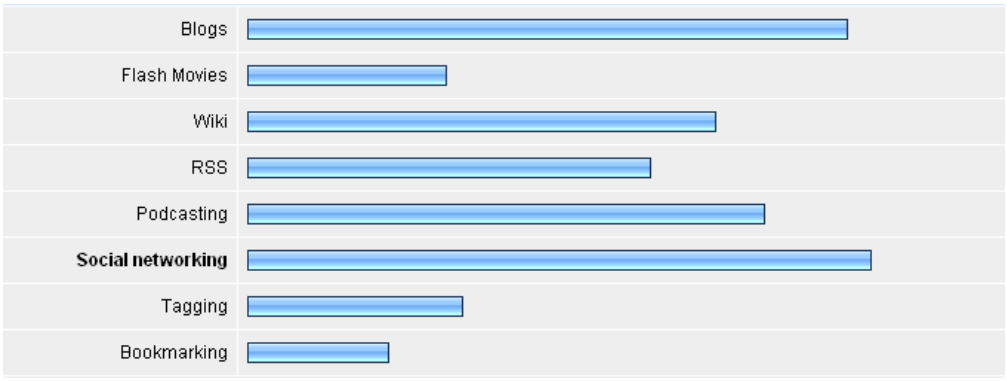


Figure 31: What is Web 2.0?

Figure 31 displays the answer to question number nine, 76.7% selected social networking, 74% selected Blogs, 63% selected pod casting, 57.5% selected Wiki, 49.3% selected RSS, 26% selected tagging, 24.7% selected flash movies, 17.8% selected book marking. These skewed results clearly show that very few agree upon what in fact Web 2.0 is. In addition to selecting their choices respondents had the opportunity to provide 'other' technologies that they would describe as Web 2.0. The respondents further proved the difficulty with the term by the comments offered.

“I'm not interested in "Web 2.0". I use the web tools I find useful. It's up to the web sociologists and journalists to invent names for them.“

“I'm just not interested in what is or isn't web 2.0. It's just a silly name for a bunch of standard technologies.“

“They are what they are ... I don't get this preoccupation with collectively labelling them as Web 2.0“

I'm an engineer, not a marketing droid, I don't describe anything as 'web 2.0'

While the above comments clearly show the disliking for the term, some of the respondents offered the comment that they are unaware as to what Web 2.0 is.

“None require Web 2.0, to my limited knowledge“

“Not sure what you mean here“

“I have no idea“

“I have no direct experience of "Web 2.0", apart from hearing the term being used on an ever-increasing basis.”

It is also important to note that 23.9% of respondents chose to skip this question.

Question number ten is “What percentage of the classes you teach, do you also provide a web site for your students”. The results are displayed in Figure 32. 65% of respondents provide a website for 90-100% of their classes. 6.3% provide a website

for 60%-90% of their classes. 9.4% provide a website for 30-60% of their classes and 18.8% provide a web site for between 0% and 30% of their classes.

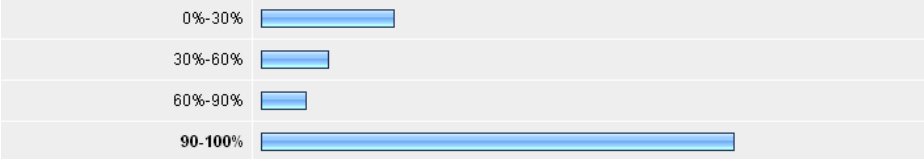


Figure 32: Websites Provided by Lecturers

Question number 11 is "On average how often do you update your web sites?" Figure 33 displays the results provided. 16.1% declared that they update their sites daily. 57% selected that they would update weekly. 6.5% declared that they would update monthly while 20.4% responded that they update their website less often than monthly.

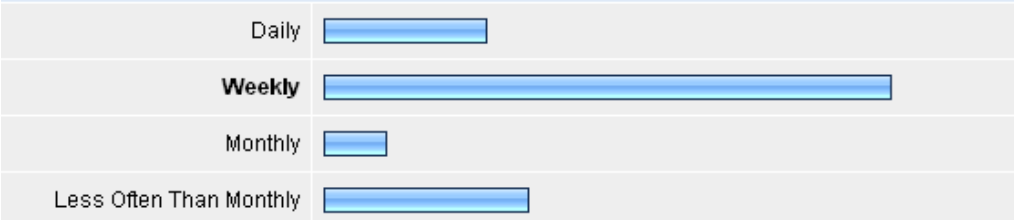


Figure 33: Question 11 Frequency of Web Site Update

Question twelve is "Would you allow a student to submit a suitable assignment in podcast or video blog?" Figure 34 displays the results of the question. Interestingly 64.2% selected that they would allow a student to submit an assignment in such a manner. 35.8% selected that they would not allow it.

Figure 34 : Question 12, Submitting Audio/Video assignments

Question twelve also enabled respondents to elaborate upon the barriers, as they would perceive them, to not allowing a student submit an assignment in a podcast or video form. The respondents reacted in force with the opinion that it is not suitable for the inclusion of diagrams and formal tools required in a module. The comments offered included;

> *"For the modules I teach, and for the assignments I would set, it is hard to see how a podcast or a video blog would be an appropriate medium through which to submit an assignment. Also, to do as assessment of similar standard to a written submission, for example, would probably involve more work for the student in preparation and more work for the lecturer in assessment."*

> *"formal and diagrammatic elements needed in assignments"*

> *"not appropriate for my material"*

> *"Assignments are technical tasks such as programming. Also, textual project reports. podcasts and video blogs are not the appropriate medium for the recording of technical documentation."*

> *"My assignments are highly technical and not amebnable to verbal delivery. eg software code."*

> *"I teach programming courses. I want the students to submit programs, not videos."*

> *"My assignments are generally computer programs, or technical problem-solving, so podcasts or video casts would be an unsuitable format for them."*

The quoted comments show the issues offered by the respondents as to why they would not allow students to submit podcasts or video. The concerns relating to the incompatibility between the pedagogical objectives of a particular assignment and the learning enabled by a video assignment is a valid concern. Similarly, two respondents added the following,

> *"would have to give consideration to the pedagogical issues surrounding the learning outcomes expected from the continuous assessment."*

> *"Inappropriate to the learning objectives of the courses I'm associated with."*

These comments are insightful and are a reflection of the views of the survey respondents but it should also pointed having read these comments that 64.2% said that they would allow students submit suitable assignments using these methods.

Question 13 in the survey is "Have you any additional comments on using technology or Web 2.0 inside or outside of the classroom? The responses obtained from this question made it apparent that the opinions on the use of technology in the class room are extremely diverse and there is little agreement upon its effectiveness. One

respondent added that the ability to use the information is a more important objective than the medium in which it is delivered.

> *"In my view the selection and presentation of information is largely irrelevant, compared to the ability to use information. For example to write a fragment of a program, to construct a proof of a theorem. These would require substantial intelligence to reside in the appropriate learning environment. The things I want from students require a great deal of off-line thinking."*

Another respondent identifies the requirement of maintaining student interest in module content. If students do not have an interest in a topic, then the objective of a deep and critical level of understanding is not easily achieved.

> *"The primary problem I see in students is an inability to (of lack of interest) engage with a problem and take the time to methodically solve it."*

There are also respondents whom would appreciate a learning environment used as an aid to learning. It would act as another source of information from which students could achieve exposure to the course content.

> *"For the lecture format, I am pretty happy with my current combination of slides and whiteboard and interaction with students. At present, I don't think the learning would be improved by additional in-class technology. With regard to course web pages, I would love to have a proper Web 2.0 type engine for driving my course web pages, managing notes, publishing links and extra material, allowing students to submit and discuss assignments, etc. I am not particularly interested in recording my lectures and making them available to students. The lectures require the students' participation, and it is therefore important that they show physically for the lectures rather*

than view them on the web afterwards."

"Alternative modes of interaction can be helpful in delivering course content. However, they are Never an alternative to attending lectures. Multi-modal feedback may encourage student participation off-line. But this must not come at the cost of live lecture-based interaction."

Other respondents offered the view that the set up time frame and also maintenance time frame is too great for the systems to be feasible.

"Seems like a good idea but the setting up and management of these things would take, I imagine a huge amount of time. I use ordinary web pages and am very busy with these alone."

"Nice ideas but difficult and time consuming to get into"

"Technology has a role to play in helping students with their learning but incorporating it with lectures is extremely time- consuming. I am not sure that the work involved leads to significantly deeper levels of student understanding. Lecturers are not rewarded for their efforts in using technology to reach a wider range of students - research output is what counts for promotion."

Respondents also made it clear that they put a huge value upon the human interaction involved in classroom teaching. One respondent felt that too much technology often

"gets in the way". Another respondent voiced their concern that too much technology can lead to rendering a course to distance learning.

> *"Good teaching is far more important, and that is about building a relationship with one's students. I'll use technology where I see it being useful, but much technology simply gets in the way. The electronic whiteboard craze was a good example. What resulted was students getting copies of the lectures view on a subject, rather than building their own through their own notes and visual representations. Pointless in my view."*

> ***".****Again, many 'non- technology' methods of learning have a proven track record. There is always a risk of overkill using technology in class rendering a course basically to distance learning. Students will always require feedback in person, other peers to relate to and a set timeslot that they need to cover material within. The technology should be the servant to this not it's master."*

> *"Technology in the classroom is massively oversold. There is no substitute for classroom teaching by a good, patient teacher. Most of the supposed advantages of technology in learning are equally true of books."*

> *"I would include 'intelligent tutoring and computer assisted learning' systems, in the hope, that it would provide a more comprehensive adaptation of technology and course materials to the individual's strengths, needs and personal preferences and allowing for the different work patterns and particular circumstances, language and location of the individual. I would continue to provide for personal contact, although hopefully to a much reduced degree. It seems that most of us humanoids need the human touch to some extent."*

There are also respondents who displayed a concern of the lack of technology in use in computer science modules. One respondent said;

> *"As a computing lecturer, I feel we don't use Web 2.0 enough (or technology in general)."*

> *"Any tool that increases a students engagement with the topic is useful."*

Other respondents also displayed interest in learning systems which make use of Web 2.0 technology but voiced their concern about the training requirement and the lack of guidelines for their use.

> *"In order for Web 2.0 to be used as an effective teaching tool, the institutes must have guidelines for the use of these things and also training for staff who are not familiar with the technologies, it also should never be seen as a replacement for student contact hours, lecturers need to spend time with their class in order to know what is the best way to teach them"*

> *"Surely use of Web 2.0 technology can be useful in education - always there are advantages and disadvantages, a matter of balancing them out, seeing what's most beneficial."*

Question 14 provided the respondents with an image of a prototype personal learning environment as displayed in Figure 35. A personalised learning environment is offered in this research as the gel between lecturer, student and the Web 2.0

techniques discussed in this document. It is the area in which students access all sources of information provided by their lecturers.

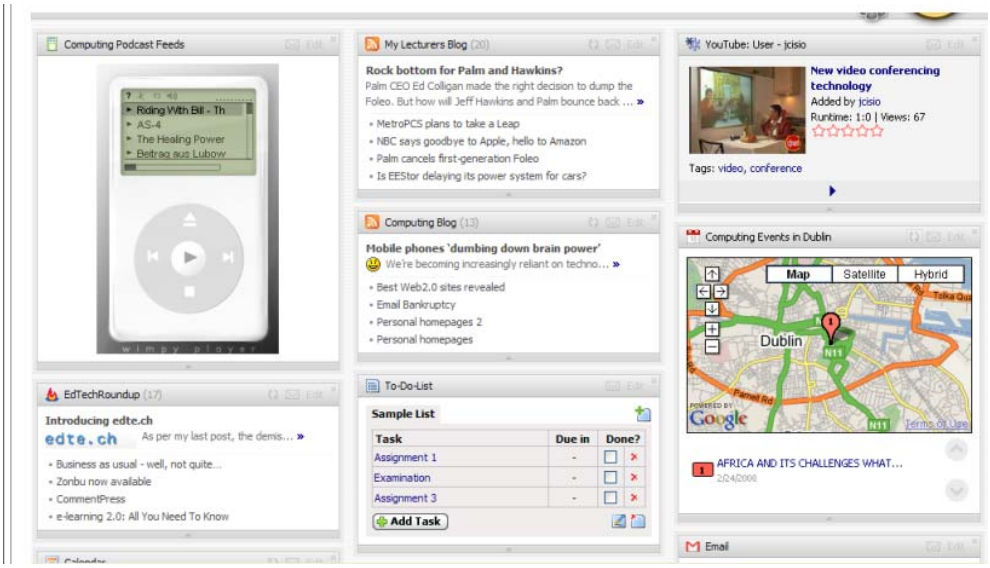


Figure 35: Personalised Learning Environment

Question 14 is "The screen shot below displays a personalised learning environment (PLE) that allows a student to subscribe to blogs, podcasts, videos and other media types that are equipped with an RSS feed. The RSS feed may link to a lecturers module portal or to content created by a third party. The environment allows a student to create multiple pages for each module or one page for all modules if desirable. Although certain components from each module would be compulsory, the student has control over the layout of the PLE and can subscribe to content provided by the Institution or lecturer. If your institution provided a similar learning environment would you encourage your students to use it?"

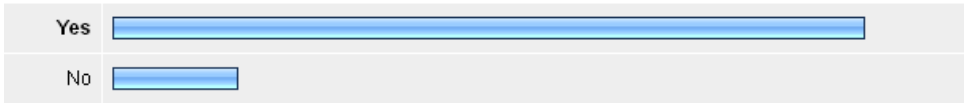


Figure 36 : Question 14, Use of a PLE

As displayed in Figure 36, very positive results are obtained in Question 14. 85.1% responded that they would encourage students to use a personalised learning environment, 14.9% of respondents selected that they would not encourage students to use such as system. A framework for a personalised learning environment is suggested by the author in chapter five.

Question 14 also enabled respondents to offer additional comments on the use of a personalised learning environment. As with the comments offered in question 13, there is a certainly a willingness to make use of tools that aid teaching but also a concern that the technology does not improve understanding.

> *"In general any tool that promotes teaching and learning is good. The danger is that the tool becomes a surrogate for deep learning as the predominance of content is mistaken for understanding. The balance and engineering challenges are still open questions in my mind."*

> *"It would encourage student conversations on particular topics. Would allow students to access missed lectures. Think the interface looks very professional."*

> *"Could be useful tool to facilitate students in organising their work."*

> *"Yes - if the environment showed evidence that it improved learning, that it was reliable and expertly supported."*

> *"Looks clear and contains most of what a student would need, it would appear. I presume that that is a mail client in the bottom-right corner? A mail client would be essential. A browser window might also be useful."*

> *"I am not aware that our institution provides for such an environment. Given the resources, I would be very favorably disposed to an environment similar to what is suggested here together with the ITCAL mentioned above."*

There are also those who are less enthusiastic about such a learning system. One respondent would prefer to continue the use of a traditional web page.

> *"I prefer the freedom of a straight web page."*

One respondent offered the following comments where the respondent does not value technologies over human interaction

> *"I have provided this kind of technology before, expecting to enhance the learning experience with it. However, in my view it simply detracts from the job at hand, which is to build a personal understanding of a subject, built on accessible knowledge (and I've never seen a book being beaten), problem solving (where one-to-one communication with one's students seems to me to be the order of the day), and discussion amongst peers (and where better than the lecture hall and the coffee shop). Much of this kind of technology is a distraction, in my view, that gives the illusion of content where in fact very little challenging material can be presented. Teaching really is a simple process on the surface, which makes it appear relatively easy to augment with this kind of technology, but the skill of teaching is subtle. The better I get the more I realise it's about personal communication, personality and flexibility and I just don't think these technologies cut it. I am reminded of electronic PDAs. God knows I've probably had every incarnation, and all were rubbish, easily beaten by a paper diary and a decent pen. This technology turns students into passive viewers rather than active students."*

Other respondents communicated concerns over the appearance of the prototype and questioned whether these types of systems are in fact proven to be of benefit.

> *"Looks complex and resource hungry. Is there a need for student to being everything together in to one place?"*

> *".I regularly use the Moodle VLE for a broad array of course aspects from uploading notes, student blogs, student comment threads to testing and attendance. Any additional software is only a benefit."*

> *"yuck, the below looks extremely ugly and distracting. it also seems to mandate particular choices and to rely on external and fragile and proprietary infrastructure."*

> *"Has it been established that this type of learning environment is more effective than traditional approaches to study and learning?"*

4.6 Examples of Other Disciplines Using Web 2.0

The uptake in the use of the various techniques discussed throughout this document is increasing every year. More and more education institutes are beginning to make use of audio and video technologies. The California Open source Textbook Project[15], is a project which involves the creation of on line books for K-12 school children in California USA. The project aim is to cut the costs for each child to obtain the required books in California. The project aim is not to replace books but to reduce the cost to an absolute minimum. The Free High School Science Text group[16] is

[15] http://www.opensourcetext.org/

[16] http://www.fhsst.org/

organisation whom is aiming to provide free science and mathematics text books to students in South Africa.

Wikibooks.org [17] is a project in existence since 2003 with the aim of creating a collection of free open content books. This Wiki Site contains a very wide variety of books ranging from Wildlife to Science to Computing. As of October 2007, the Web Site claims over twenty seven thousand book modules.

Harvard University is one of the most innovative Universities in the World when discussing the use of technology in lectures. David J. Malan is a computer science lecturer at Harvard University whom provides an extensive collection of podcasts and flash movies on his website[18]. The site includes lectures on BIOS settings, upgrading PC components, the Internet, PC security, TCP/IP, Web Site development and many more topics. Figure 37 displays the large volume of information in which David Malan provides for his students. He provides the same content in a variety of mediums, including audio, video, flash and presentation slides.

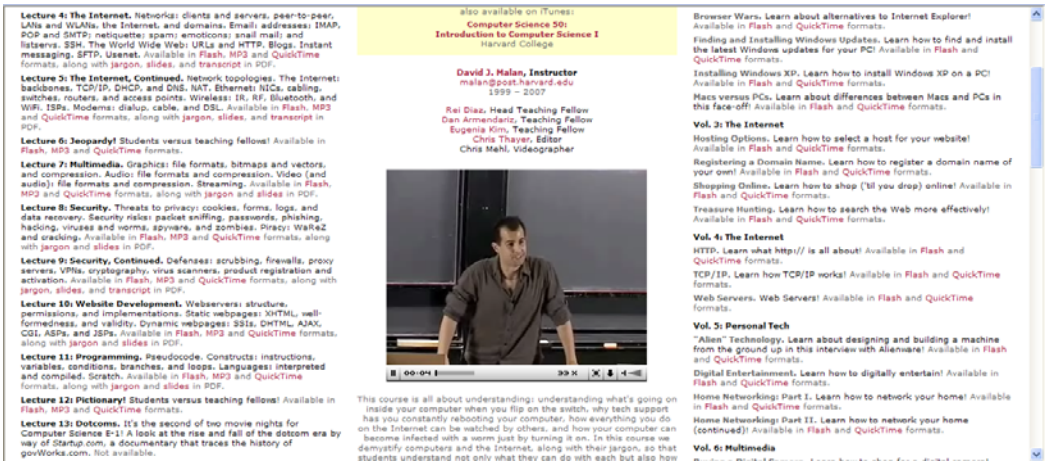


Figure 37: David J. Malans Computer Science Portal

[17] http://en.wikibooks.org/wiki/Main_Page

[18] http://www.fas.harvard.edu/~cscie1/?page=podcast&type=static

In Harvard University, the business schools provide podcasts for their students, marketing modules and economic modules are amongst the subjects being offered via podcasting to Harvard students. Harvard Medical school also provides podcasts of lectures for their students. Videos and podcasts are added to the 'myCourses' portal provided by Harvard University[19].

Stanford University also provides podcasts of lectures via iTunes. Students can subscribe to their choice from a large volume of podcasts which include Science, Computing and business, law, medicine and arts.

Figure 38: Stanford University iTunes

The Journalism faculty at Columbia University in New York City have also made their lectures available via iTunes.

[19] http://mycourses.med.harvard.edu/

The Massachusetts Institute of Technology provides a substantial amount of Video and audio files for each of the faculties they offer. Figure 39 displays courses listed per department.

Figure 39: MIT Audio/Video Courses

PlanetMath.org is a web site which is created using Wiki Technology. The website is a central repository of Mathematical information and covers a huge amount of Mathematics topics with over 7000 topics available.

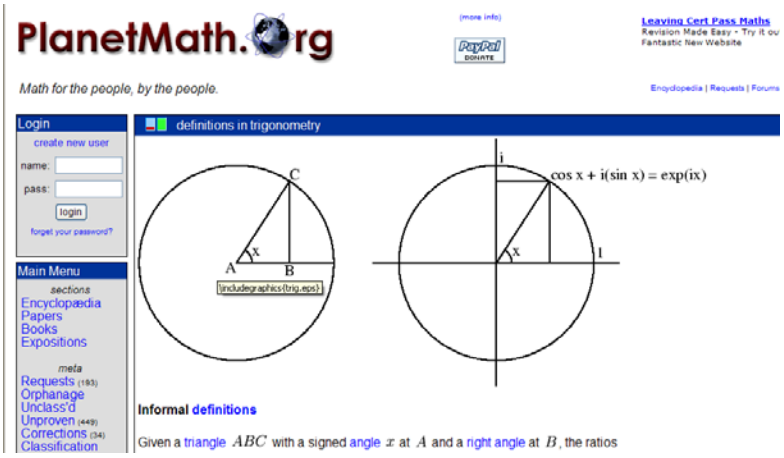


Figure 40: Planet Math Wiki

The Wikiversity is a collaborative community with the objective of creating learning materials available for all. There are a number of specific portals available and within

this community there is a computer science[20] portal. Duke University is a research University in North Carolina, USA. The University[21] has provided a Wiki page which contains information on a whole range of services provided by the college including 'college life', 'campus layout' and 'student organisations'. Brandeis University is a University outside Boston, U.S.A, the University has created a Wiki page for its Biology, Chemistry and Mathematics subjects. The Harvard Medical School[22] also provides Wiki pages for students. Columbia University has also provided a Wiki site[23] for each course in their University. According to the Information Magazine produced at Columbia University, The Columbia Center for new media teaching and Learning, as of September 2007, more than forty Wiki spaces for courses have been activated (ColumbiaNews 2007).

James Bowan is a computer science lecturer at University College Cork, who provides podcasts for each of his lectures.

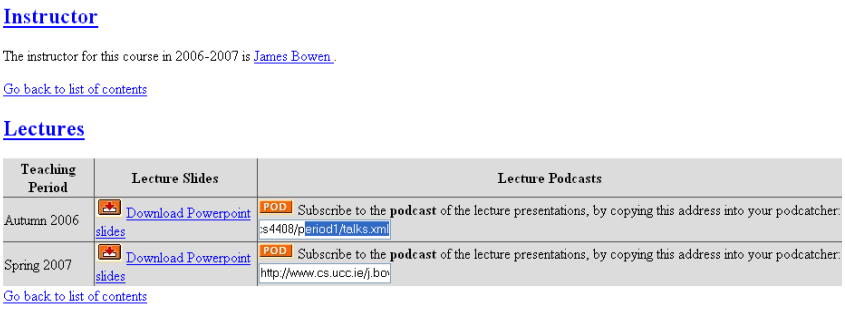


Figure 41: UCC Lecturer

[20] http://en.wikiversity.org/wiki/Portal:Computer_Science

[21] http://www.duiki.com/wiki/Main_Page

[22] http://wiki.med.harvard.edu/

[23] http://www.wikispaces.columbia.edu/

UCC also provides a Service called UCC outreach Television. The service provides a selection of publicly available lectures in addition to lectures only available to students at UCC. The UCC station also includes information for current and prospective students. Figure 41 displays the outreach television page that contains a fourth year computing student offering his opinion on the computer science course he is studying, the video is aimed at prospective students.

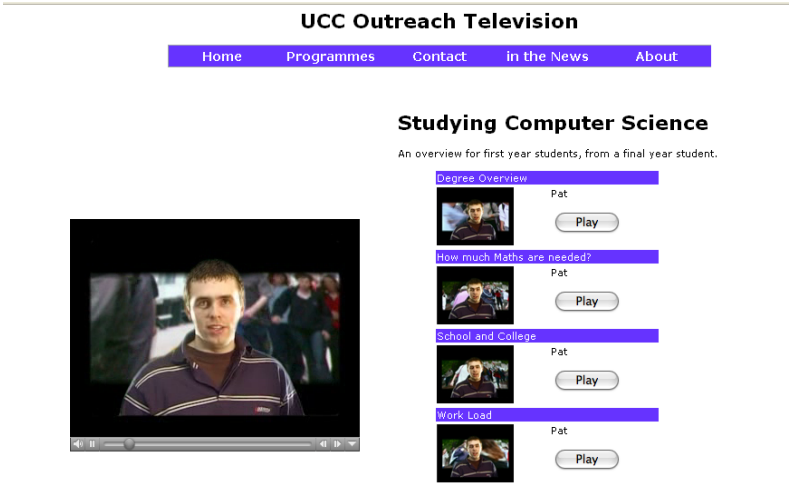


Figure 42 : Fourth Year students View on UCC

UCC also provides blogging software for all students who attend their University; each student has a blog website which they can use to record their blog posts.

Blogs as described already are little more than easy to write Web Sites. It is argued that their ease of use is the main catalyst in their popularity. Many innovative lecturers in the various faculties are making use of Blogs to reach to their students. Andrew McAfee[24] is a Business Professor at the Harvard Business School who maintains a detailed Blog with many Blogs related to business topics. The popular Business Week

[24] http://blog.hbs.edu/faculty/amcafee/

Magazine also have identified the value in Blogging, they have provided an area for undergraduate students to Blog about Business topics. It is of course quite probable that Business Week are probing for young subscribers, but nonetheless student exposure to experienced professionals whom read the magazine is a valuable learning experience. The London Business School[25] also provides an area for their students to Blog. Harvard Law school [26] also provides a site for students to post their blogs. Stephen Laster, Chief Information Officer from Harvard Business School in an article on CIO.com, spoke of the need to prepare students for the workforce. This is the reasoning why he has invested resources into the use of Web 2.0 at Harvard business school. He identified that many businesses are using these technologies and has come quite logically to the conclusion that his students will be better prepared for the workforce if they are trained in the tools the workforce use.

[25] http://mbablog.london.edu/mbablog/

[26] http://blogs.law.harvard.edu/

4.7 Conclusion

The Interviewing processes in this research enabled the identification of much diversity amongst educators within Ireland. There are many groups of students each who require a different method of learning. There are thankfully similarities between the groups but the differences between primary schools, secondary schooling, special needs schooling and University are many. Within the population of computer science lecturers in Ireland, it is a clear that the group value the use of technology within the classroom.

A vast majority of those surveyed agree that technology encourages motivation. A learning objective of any module is the development of an ability to critically analyse course content, many lecturers find that motivating students to participation during in-class discussions is large stumbling block, yet the use of technology is closely identified with improving motivation. The obvious question to ask is why are institutions within Ireland not making use of technology on a grander scale. If there is any faculty that should lead by example, produce the most innovative, smartest and most technologically advanced computer aids, it should be the Computer Science faculties.

Unfortunately there is little evidence found in this research to identify that the computer science faculties' offer a greater amount of technology. Considering the vast amount of companies who are moving to the use of Share point technologies, and Web 2.0 technologies, why are Universities not also moving to these areas. E-Learning was once a valuable tool in the arsenal of Universities and colleges but it has become an overused word associated with didactic computer based programs. Universities and specifically computer science faculties need to re take the front seat in the innovation of improved learning environments. Through the survey results identified in this research, there is a clear wish by computer science lecturers for their institutions to provide frameworks for the inclusion of technology, the following

chapter offers a framework for the use of Web 2.0 tools in education and offers a prototype of a resultant personalised learning environment.

5 Inclusion of Web 2.0 Techniques in Education

5.1 Introduction

The following chapter presents a framework for the inclusion of Web 2.0 techniques in education. The framework consists of a table which lists the contents of a Wiki Web Site. The Wiki site contains each of the possible uses of Web 2.0 techniques in the classroom presented in this dissertation. The Framework also includes a prototype of a personalised learning environment (PLE). The PLE is a web based portal which contains two entry points, one for students and another for lecturers. The PLE enables the use of Web 2.0 techniques and the creation of course information and assignments using Web 2.0. The framework is primarily aimed at Computer science courses as this is recognised by this author as the faculty within Universities and Colleges which is the most appropriate faculty to be the driving force behind the inclusion of technology initiatives in the classroom.

5.2 Design Factors

When designing the curriculum of each of the years in a University or College course, there is a clear aim and objective for students at the completion of each year. The course aim, particularly in Institutes of Technology, is to develop the student to a level where they have the ability to successfully integrate into the industrial organisation in which they begin employment. Each year in the course offers an evolutionary process to reach this level. In a similar fashion to the gradual introduction to topics in a course, it is also essential to use appropriate instructional design methods when designing interfaces for a first year student or a fourth year student.

Behaviourism is addressed in section 2.2.5 of this dissertation and the development of a central repository of potential technologies that lecturers can include in their modules is the stimulus and an increase in motivation through the use of these technologies is the desired response.

The suggested techniques are populated with many constructivist approaches to learning and aim to again increase motivation and skill range of students whom are studying computer science.

The cognitive aspects of the system are that many students are entering Universities having already developed a skill level with Web 2.0 technologies; it would a huge omission on the part of education institutions if they were to ignore this interest displayed by the members of Generation Y and to disregard their skills using this technology.

The PLE is designed to allow students possess an element of control over their learning environment and to minimise the potential cognitive overload by designing the user interface in a clear and user friendly manner.

To emphasise the suitability of Wikis, the following section lists the contents of a Wiki Web site created during this research. The Wiki site contains pages which lists each of the possible uses of Web 2.0 in education. The following table lists the contents of the Wiki Page. An example of the Wiki page is displayed in Appendix D. The contents of each technique offered are as a result of the research documented in chapter three of this dissertation. The various approaches offered in the techniques in the table cover many different learning styles and allow lecturers an area in which they can contribute towards a body of knowledge which can aid to lecturing and enhance levels of motivation through differentiated learning and the inclusion of technology.

5.3 Framework Table For the Inclusion of Web 2.0 Techniques in Education

Technique	Usage	Advantages	Learning Styles	Tools
Text Blog	• Post Links to Lecture Notes • Post Links to Course Literature • Post Recommended Reading Lists • Post Links to Relevant Articles • Post Opinions and Information • Post Information about Events • Encourage Student Questions • Enabling Student Commenting • Space For Student/In-Class Discussions • Space for In Class Note Recording • Complete Assignments on a Blog • College Career Portfolio • Replace Faculty Web Pages (Web Master Recommended) • Network with other students and Universities • Students can offer Feedback	• Promote Critical Thinking • Create Associative Thinking • Promote Creative Thinking • Promote Intuitive Thinking • Chronological Order to Posts • Low Technical Skill Required • Lecturers can subscribe to student RSS Feed • Students can subscribe to Lecturers Feed • Linking Promotes Referencing of Information	• Reflective • Visual • Active	www.blogger.com www.technorati.com www.bblog.com

Technique	Usage	Advantages	Learning Styles	Tools
Wiki	• Publish Course Notes • Publish Course Handouts • Publish Recommended Reading Lists • Record Documentation of Projects • Students in-class notes area • Elaboration Upon summarised presentation slides • Student Portfolio of Documents • Space to record views and Opinions on Recommended Readings • Space to share teaching and learning techniques • Area for Brainstorming (New and recently studied) • Areas for the Course Document • Co-construction of information from students in different classes • Contribute to Wiki seeking new and revised contributions • Critically analyse and update existing articles • Area to record Minutes for Meetings (Students and/or Professors)	• Increasing the external perception of a University • Collaborative Spaces • Student becomes the Reader • Networking with other Universities/Professionals • Practical exercises with publicly exposed Objective	• Active • Visual • Reflective	• www.wikispaces.com • www.pbwiki.com • www.wikipedia.com

Technique	Usage	Advantages	Tools
Podcasting	• Podcasts of a Professors Lecture (partial or entirety) • Podcast of Other Experts Lectures/Seminars • Students assignments delivered in podcasts • Critical analysis of podcasts created by experts	• RSS Feeds straight to a student learning portal • Students learn how to use audio recording technologies • Student learn about audio compression and storage issues	www.indiepodder.org www.podcastalley.com www.podcasting.ie
Screen Casting	• Offering screen cast of program demonstration • Offering screen cast of whiteboard during lecture	• Students have the ability to review demonstrations	
Videos	• Videos of a Professors Lecture (partial or entirety) • Video of Other Experts Lectures/Seminars • Students assignments submitted using Videos • Critical analysis of videos created by experts • Information Kiosks (Student Unions/Faculty Heads/Libraries) • Introducing Prospective Students to A College	• Students can submit assignments in preferred medium • Students gain exposure to the technical issues of compression • Students learn about storage issues with video files	

Technique	Usage	Advantages	Tools
Social BookMarking	• Provides a central area for the list of course related content • Exposes students to sites related to the site offered by the lecturer	• Offer opinions Upon websites • Encouraging critical analysis • RSS Feeds	Del.icio.us

5.4 Personalised Learning Portal

As part of the framework for the inclusion of Web 2.0 in education a personalised learning environment is presented in this section. It is imperative that the aspects of Cognitive Load Theory, as discussed in section 3.4, are followed during the design of such an interface. A large emphasis should be placed on the possible cognitive overload when introducing the environment to first year students. This emphasis should lessen as student's progress through the years of a course.

In many institutions, students are currently required to maintain multiple log-in identities and passwords. This should not be required of students; any additional difficulty in accessing information provides yet another barrier to learning. A student should also have the ability to access modules studied in previous years, a page including the archived content from previous would also be available to students in the PLE.

The personalised learning environment provides the common portal for students to access all bodies of knowledge and areas that lecturers provide. As John Dewey has suggested in his research, as identified in section 2.2.7.1 of this document, students will benefit from an element of control and customisation in their learning environment. Web 2.0 technologies are enabling a personalised method of content delivery with a great deal of simplicity. The PLE is RSS feed driven where the information is presented to the student rather than requiring the student to go to the information. The suggested environment for a PLE is one where students log into campus computers and their operating system log in credentials transport them immediately to their main page in their PLE. The PLE contains a tabbed page for each of the modules in which the student is currently studying. The main page of the PLE for each student is the student's personal page where they can subscribe to available web services, this is a powerful characteristic of web 2.0, scalability and customisability. Figure 43 displays the page that a student would be welcomed by. A

fully developed portal would be fully customisable where a student could define the layout from a list of possible formats. The prototype presents four different design styles that a student could select from, in the four pages labelled ‘myLearning’, ‘Databases’, Artificial Intelligence’ and ‘Music Technology’.

The entry page displayed in Figure 43 named myLearning, contains five collapsible panels which contain a to-do list, access to the students blog, a podcast player, a calendar and an updates list. The to-do list and the updates components are required components. Other than these the student would have the ability to control which components are included in their main page. The blue menu on the right hand side of the screen contains the options that the student can add to their page. The menu includes each of the subjects a student studies and services such as library and administration. The portal would also allow a student to subscribe to and include available third party web services. Above the blue options menu is the student’s avatar. This would add an element of both fun and personalisation to the page allowing a student to create a zany character or attempt to create a mirror image of oneself.

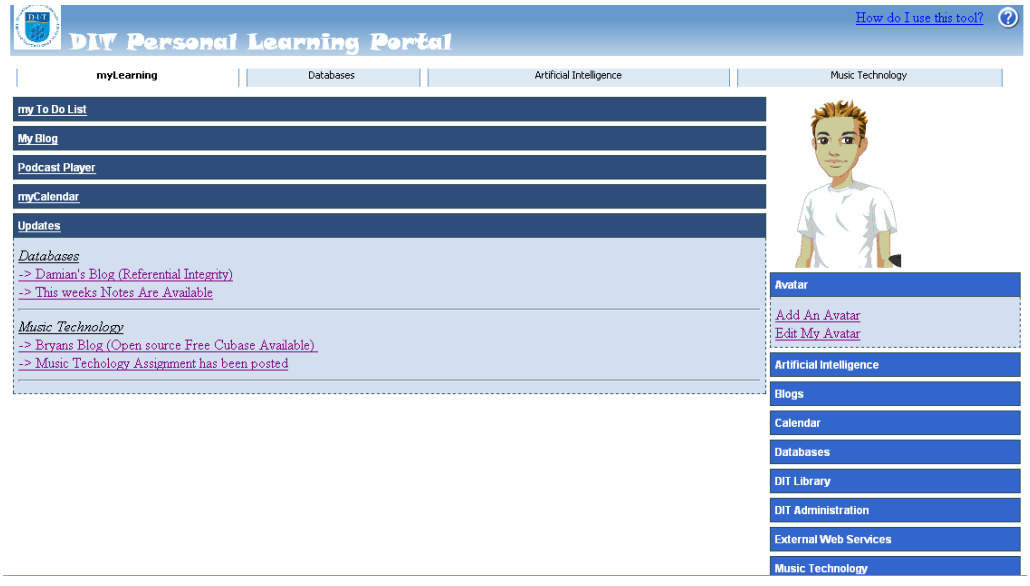


Figure 43: PLE: Entry Page of Student Portal

Figure 44 displays the entry page with two components expanded. The student would have the ability to expand all or expand only the components they wish to view. The page would store the last viewed state for return visits.

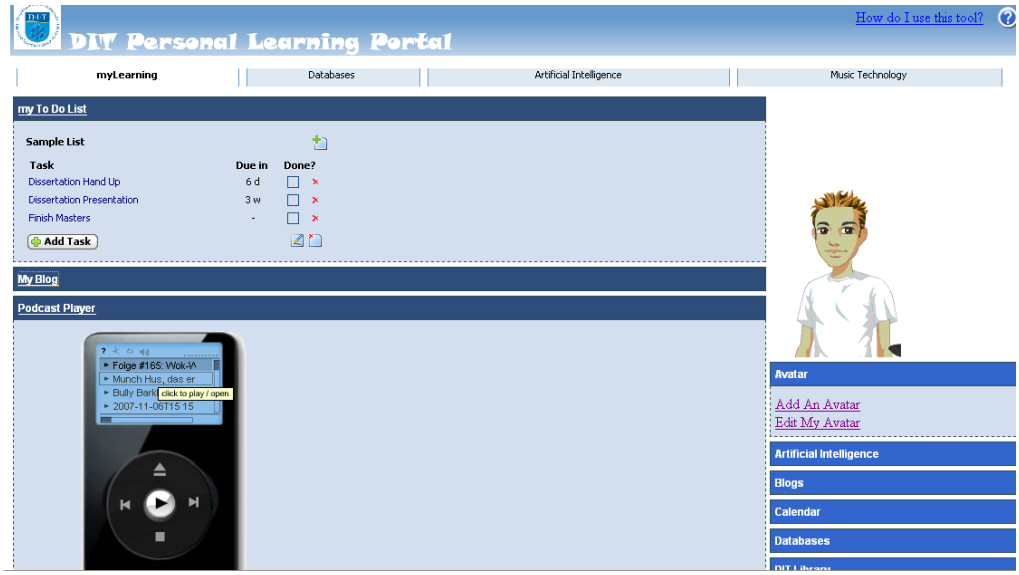


Figure 44: myLearning Page Two Components Expanded

Figure 45 displays the database module page, the database page show a second style which the student could avail of in their pages. The components are static components, i.e. they can not be moved around the page. The components would appear in a sequential manner as the student ads the component. Each component remains open unlike the previously displayed style. The lecturer for a course would set the required components for their class. The components in Figure 45 are the lecturer's blog and the assignment feed. The lecturer's blog would identify course content updates and the second component would contain feeds to assignment information.

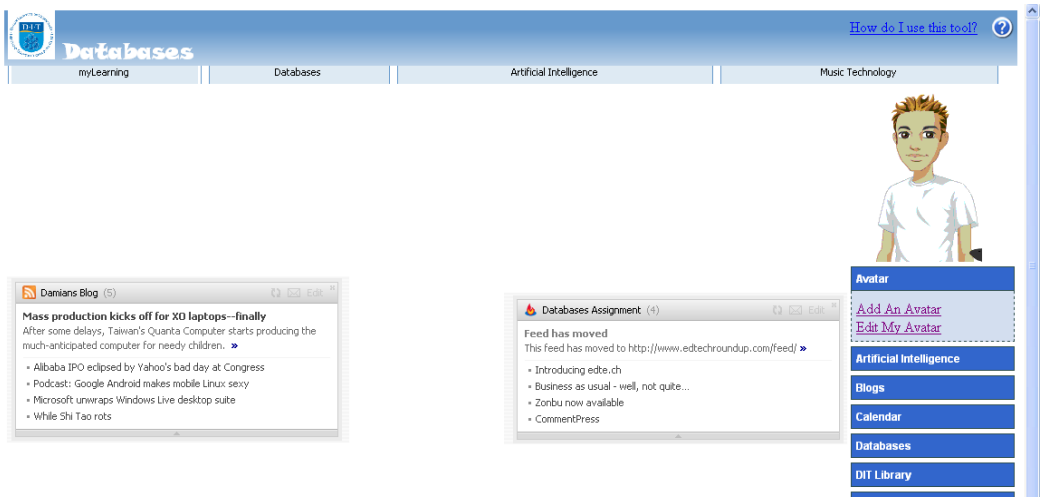


Figure 45: Databases Page

Figure 46 displays another style that a student could select. It allows the moving and arranging of components into any position on their page that the student selects. The components can be dragged and dropped around the screen.

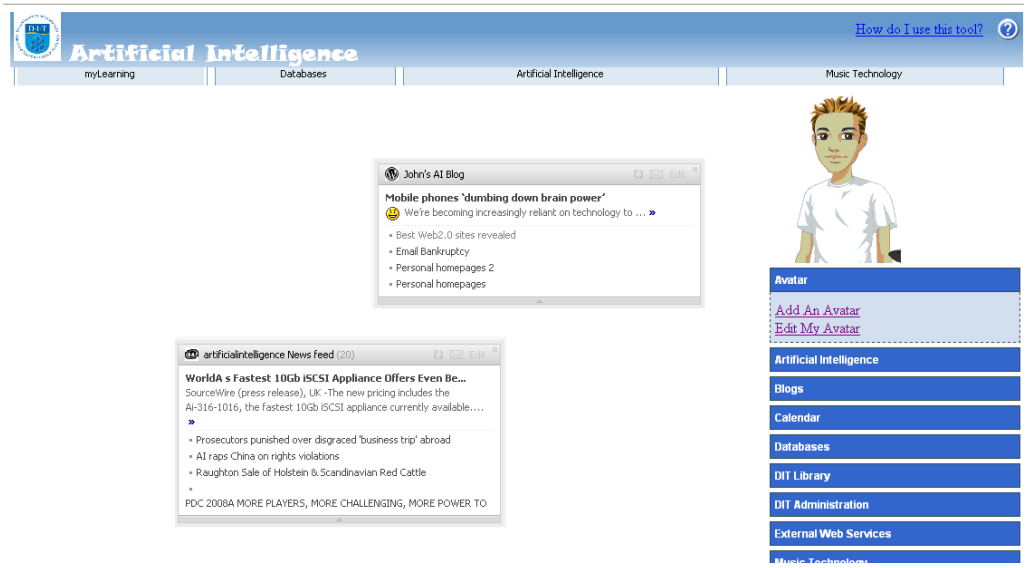


Figure 46: Drag and Drop Components

The final style offered in the prototype is a collapsible component style. This is similar to the entry page except the page will only display one component at a time. If a student attempts to open a component, the page will close the previously open component.

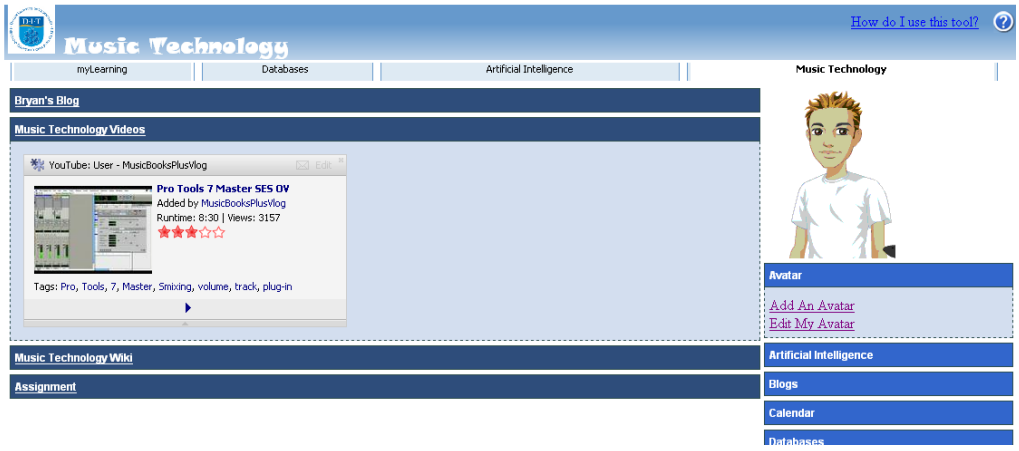


Figure 47: Component View

Figure 48 displays the options menu, the student would have the ability to add or remove components to their page. This customisation and personalization ability would enable differentiated learning portals amongst students and help provide an information source that is technologically advanced, developed using technology that students and organisations are currently using.

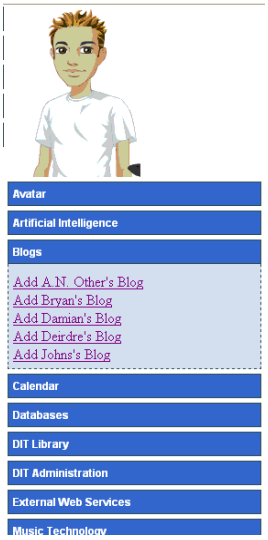


Figure 48: Options Menu

The framework presented in this chapter also presents the 'Professor Portal'. The professor portal is the access point for Professors. The professor portal is designed in the same manner as the student portal. The professor has their own main page which they customise to their taste. The main page includes an update component which could be configured to include updates notifications on students or colleagues components.

Figure 49 displays the professor portal which shows the update component expanded. A professor could select which updates they would wish to include in the component. In the example shown, the professor has opted for the inclusion of databases student blog, music technology Wiki updates and receiving an update when a comment is made on the professor's music technology blog page.

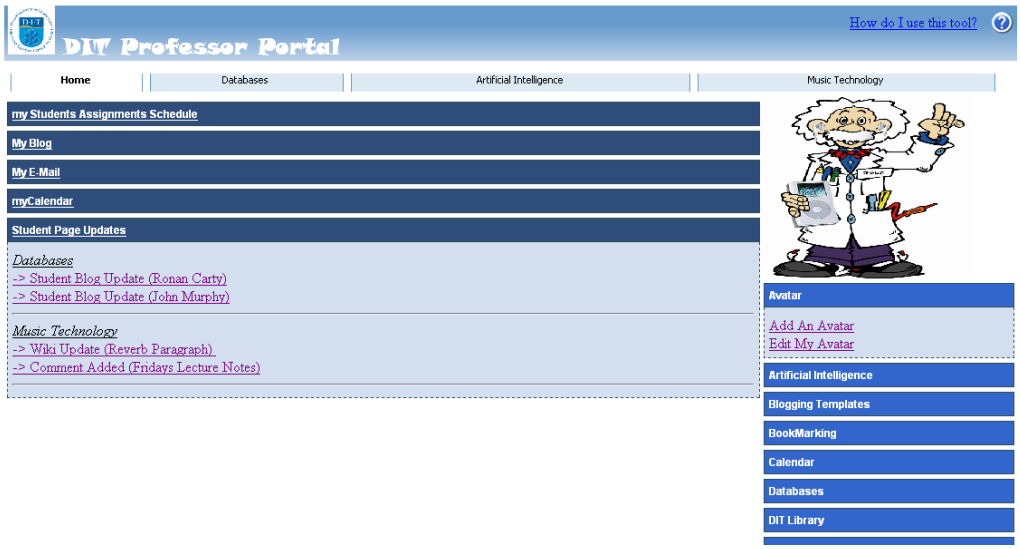


Figure 49: Professor Portal

The professor portal contains options that do not appear in the student portal. During the research carried out in this dissertation, there was clear indication made by computer science lecturers in Ireland that they desire frameworks for the inclusion of new technologies in the classroom. The professor portal offers a prototype for how a

large variety of potential techniques can be shared amongst lecturers. The options menu lists multiple technologies which have a list of possible ways to use the technology in their modules. A fully developed system would allow a professor to use a template for an assignment or task and include it in the module page for student to view.

In the prototype the professor has the ability to view a schedule which contains all assignments due for the students they teach. It allows professors to easily view the schedule and then determine if assignment submissions are more frequent during certain weeks. This can allow professors to view in real time the current status of their student's schedules.

Figure 50 displays the professor options for blogging, the menu includes links to the information presented in section 5.3. The menu includes options for each of the techniques described in section 5.3. It allows the professor to select from the blogging, Wiki, Podcasting, Video, templates and include them in their module.

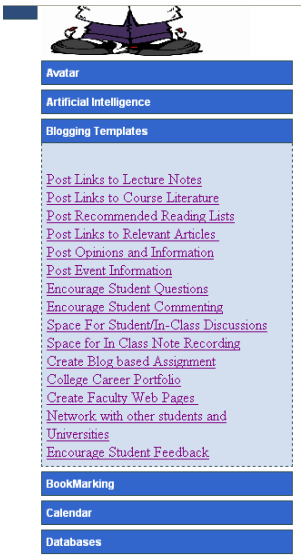


Figure 50 : Professor Options

5.5 Conclusion

The PLE provides a unique and original area for both students and professors to access information to aid them achieve their respective objectives. Students can utilise many easily accessible sources of information through a central access point. This reduces the barriers associated with information consumption when students must access one of many web pages. Students and professors alike can customise their pages adding a quality of personalisation to the environment.

A main concern amongst professors and lecturers is the scalable aspects of a system, Web 2.0 technology has been developed to combat the problems of scalability endured by older technologies. The ability to incorporate new technologies as they develop would be relatively simple. The options menu would receive an additional option allowing the student to add a component listing the required information.

An eLearning researcher had the following comments to make after he explored the prototype system;

> *"Nice friendly and clear welcome page"*
>
> *"it's great that the avatar is configurable"*
>
> *"On the lecturer's page, the friendly picture of professor in the corner makes the portal look more fun"*
>
> *"clear design of the functionality available, with easy access using tags"*
>
> *"excellent range of functionality provided for the learner, to cater for a range of different students"*
>
> *"Nice the there is a separation of concerns between the main*

menu and the menu on the right for adding things in. This is great and adds to the personalisation factor for the lecturers and students."

"I love that the podcast player is on the main menu, which is a sign that all lecturers should be providing some audio/video materials"

"allows students to focus on one course at a time and use the various resources to help them learn"

6.0 Conclusion

6.1 Conclusion

Prensky (2001) said, “Our students have changed radically. Today’s students are no longer the people our educational system was designed to teach, because today’s students are digital natives while the most of today’s teachers remain digital immigrants”.

Learning is improved by exposing students to information in as many ways as possible. This exposure to information in varied formats enables the development of students into individuals whom are equipped to meet dynamic and multitudinous situations. It is generally agreed that each of us learn in different ways, this is dependent upon the knowledge we possess and our current level of expertise in a subject. The traditional methods of teaching where one teaching style fits all are not suitable when teaching large groups of individuals. It is of course extremely difficult for a lecturer to tailor course content to each student, but the use of Web 2.0 certainly facilitates differentiated instruction.

Computer science lecturers in Ireland surveyed in this research displayed a clear indication they have a longing for frameworks to be available to them in order to use technology in the classroom. There are certainly many efforts being made by a range of individuals throughout the educational institutions in Ireland, but it is very apparent that more needs to be done. Students are being prepared to successfully integrate into the workforce but much of the technology currently used in the workforce for the sharing of information are not utilised within the education system.

The work place in which the author of this dissertation is currently employed have vast bodies of knowledge in many disciplines, the dissemination of information is carried out using a multitude of learning styles. Whether the content an individual is learning is delivered using a PC based application or an in-person seminar, the content

is delivered using truly differentiated design. Learners have the ability to read content while listening, they have the ability to carry out the tasks they are shown, the learner has ability to review content that have just seen. Every possible method available for an individual to absorb the message being delivered is utilised to gain the maximum potential for the learning objective to be met.

When creating a blueprint or framework for a next stage of learning environments we must determine the needs of learners, lecturers and the educational institutions. The current strengths and disadvantages of current learning systems need to be identified. This research project has presented a framework for a system which scalable, which is customisable and which is familiar to millions of students throughout the world. Lecturers must embrace the fact that students can not learn everything in a first attempt. Students must have the ability to re-visit past lectures, to re-visit daily lectures and the fact those student do not attend should be a reason not to do this. Many lecturers surveyed in this research mentioned that they would not record their lecture because of fear of attendance being affected. Should those students who need to review everything a lecturer said in a recent class, be hampered because of the fear that some students do not attend a class. Students already are not attending lectures and in this authors education experience, attendance often relates to the style and content of a lecture, so one must ask why are students not motivated to attend lectures?

We have all sat in front of lecturers, friends, family members, politicians, priests and other public speakers, and we find ourselves unable to sustain a 100% attention level. Students are no different and technology now allows us to easily record parts of lectures, and students can be presented with this information through tools such as those described in this dissertation. We are in a transitional period, the youth of today often known as generation y, will soon become the 30 something’s and 40 something’s and they will have each grown and developed surrounded by technology.

Students, parents and groups associated with education expect third level educational institutes to develop students for the real world, to be in a better position to take command of projects and groups of people. The use of Web 2.0 tools the will aid a team to complete a task more efficiently. The work place in particular for those completing computer science courses is a work place built on information and transfer of information. How can we expect students to become experts in the use of information when they are trained in an institution that does not transfer information in the same manner as the work place?

A supervised personalised learning environment governed by the learner, a environment to meet their needs and allow them learn using the methods that they enjoy and also covertly using methods required by an institution is a tool that demonstrates the efficient transfer of information. Behaviourism conditions people to a particular outcome, if students are consistently taught in one standard way; the result of this quickly becomes disillusionment. Many lecturers may not think of their lecture as an experiment in behaviourism but essentially it is. Students enrol in college and attend with the utmost enthusiasm, finally entering an education system where they expect to be treated as adults in contrast the stage they have just completed. The difficulty is that students attend lecture after lecture and soon the indifferent lecturing styles is the stimulus and a lack of motivation is the response.

The survey results in this research profusely show that there is little differentiated learning in existence. This is not because many lecturers are unwilling to include innovative ways to learn but because there are insufficient frameworks in existence for lecturers to use. It is hoped the framework offered in this dissertation is a starting point for a real movement towards the inclusion of current technology in the classroom. Students are conditioned to associate lectures with one method, chalk and talk and examinations at the end of the semester. By amalgamating the bodies of knowledge that are freely editable into the education environment,

students can now see why articles need to be back up with qualitative evidence and why articles need to have logical structure.

The next generation of learning environment needs to be a place where students can network with other students and experts, where students can place their portfolios and can present their knowledge to potential employers. Students spend years in class rooms listening to lectures but more needs to be done by institutions. These learning environments need to excite those in the business world; they need to be accessed by those in the professional and technical worlds, where students can access all types of information and exchange knowledge and information with everyone who is willing to contribute.

My view of learning styles is providing more for students than 1 or 2 hours a week in a lecture hall. It is using a personalized learning environment that is developed based on the various styles of learning. Blogs are discussion tools, they help a reflective learner who may wish to read, digest and question, a video will help a visual learner who wants to watch while learning, podcasts are suitable for auditory learners and Wikis or flash movies can be suitable for active learners.

There are over 90 different learning theories which attempt to pigeon hole learners, this author would conclude that learners develop and therefore their learning style also develops with them. The cognitive knowledge possessed by a learner can influence which particular learning style a person prefers. If a person knows a subject to any great degree they will be more likely to be active in a class discussion and contribute, whereas the person who does not know the content and lacks the confidence in their ability is less likely to contribute and there needs to be a different model of learning for each person.

One of the most famous of all scientists in human history is Albert Einstein. Einstein attended a German secondary school were he was disillusioned with the teaching and learning methods. He wrote in his biography that the spirit and creative thought were lost in such a strict environment. How many students are losing their interest and creative thought because of the lack of a learning environment which suits their individual learning style?

In more recent times many industries have relocated their unskilled labour operations to developing economies, thus the availability of employment in unskilled industries within established economies is lessening. In order to deter students from becoming disillusioned with the learning system in place, the need to develop a personalised learning environment in as apparent as it has ever been.

Overall, it is concluded that the implications for teaching and learning from incorporation of Web 2.0 tools in education are many. They enable the delivery of many techniques of learning and teaching. They provide lecturers with the ability to differentiate their lecturing styles, they allow lecturers to encourage students to complete assignments using different types of technology and different ways to thinking. They above all improve motivation within students and encourage an adaptable mindset which is a stark contrast to the education system where tens of faces stare blankly at each lecturer as they rotate through lecture halls. The objective of all educational institutions is to create skilled individuals who are well rounded, can think for themselves, can critically analyse, can participate in social, economic and political processes, can offer logical opinions backed up by hard evidence, have a deeper understanding of fellow human beings and can adapt to each scenario presented to them. Web 2.0 has created networks throughout the world, it has provided an area where students can learn in brand new environment and network with groups of students and experts from many corners of the world. An education system, particularly for technology students, which enables the maturity of students with a much greater ease than the traditional learning methods is at our finger tips.

6.2 Future Work

The characteristics of Web 2.0 create endless possibilities of future work. The use of a personalised learning environment also reduces the potential for a knowledge silo. There are many theorists who have created learning and teaching techniques. In the same manner that many social software web sites have provided an open source API where developers can create new and innovative web services which are easily incorporated in the software portals, the system presented in this document is no different.

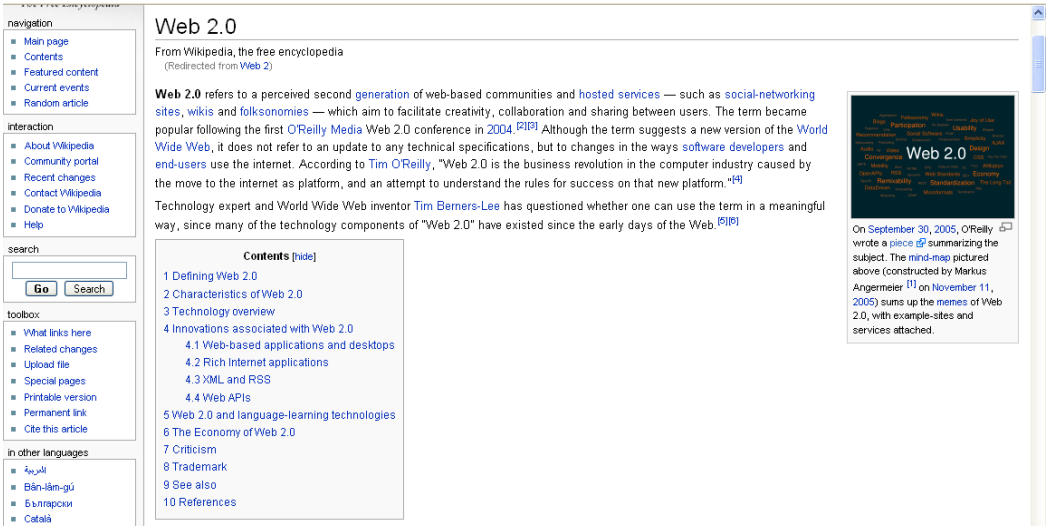
The creation of a web service to arrange course content using De Bono's Six Hats technique would be an excellent project. The project would include the conversion of presentation slides or course documents into the Six Hats technique.

Another potential area for future work is the development of smart software that analyses the behaviour of a student in their day to day activities and suggests particular resources using the medium which the student uses most often. The software could also identify for the student that they are perhaps neglecting particular methods of learning and encourage them to read articles more often or to complete constructive tasks such questionnaires attached to document. The possibilities are only restricted by one's imagination.

If student information is stored in one location from the first day of college to the last, it provides a great area of knowledge in which students could develop web sites to display their skills for potential employers. A service could be developed which gathers the information from the student's portfolio and aids the creation of web sites detailing a student's accomplishments and skills. Students could then allow an employer to view a comprehensive listing of their skills when they begin their search for employment.

Another possible area for future work, this suggestion is more a strategic suggestion than an individual or small group project. It is the development of a group which is comprised of individuals from each education institute in Ireland. The group could organise the sharing of information amongst Universities whom are using a system such as the Personalised Learning Environment. The group could set up an arrangement which contains every web service tool offered by all lecturers and institutions and enable the subscription of these services in all Universities whom are members of the group. This would be a pioneering project and would promote educational institutions in Ireland to the top of innovative projects incorporating technology in education.

Appendix A: Wiki Peer Review



The Screenshot above displays the Web 2.0 article that appears in the WikiPedia website. The following screenshot displays part of the discussion page for the Web 2.0 article. The discussion has over forty discussion threads where members of the WikiPedia community discuss the contents of the Wiki page. If the members feel the contents must be adjusted then it is corrected accordingly.


Quick PDF to Word Converte...
Talk:Web 2.0 - Wikipedia,...
Page
Tools
navigation
Main page
Contents
Featured content
Current events
Random article
interaction
About Wikipedia
Community portal
Recent changes
Contact Wikipedia
Donate to Wikipedia
Help
search
Go
Search
toolbox
What links here
Related changes
Upload file
Special pages
Printable version
Permanent link
Talk:Web 2.0
From Wikipedia, the free encyclopedia
This page has been cited as a source by a media organization. The citation is in:
Zbigniew Domaszewicz. "Czy Web 2.0 to rewolucja w internecie?", Gazeta Wyborcza, 2006-03-06. (details)
Contents [hide]
1 Web 2.0 Awards
2 Another Web 2.0 Definition
3 Confused
4 Origin of term Web 2.0?
5 Web vs web
6 Neologism?
6.1 VOTE: WP:NEO Violation?
7 Web-based Communities Section
8 Time's usage
9 The introduction
10 "Notable experts, in particular Tim Berners-Lee, see the term as a needless and poorly-defined buzzword"
11 "Web 1.0" Vs Web 2.0
12 Web-based communities
12.1 Web-based communities
13 Merge content from World live web
14 O'Reilly Radar document
15 Amusing Web 2.0 Mockery Sites
16 Web 2.0 is a Web phenomenon
17 VOTE: Mentioning Tim Berners-Lee's Opinion in Lead Paragraph
18 Web 3.0
19 Frontiers-man in web2.0
20 MySpace per se is not Web 2.0
21 Web 2.0 graphs, charts and the effect it is/will have on business
22 Editors persistently removing portions of the lead paragraph
23 Web 2.0 Lingo
24 History of Web 2.0
Archives
1. March 2005 – February 2006
2. March 2006 – May 2006
3. June 2006 – September 2006

Appendix B: Research Survey

The following section contains the research survey presented to computer science lecturers in this research.

Before you begin this survey, I would like to explain that your contribution will be treated with complete confidentiality. Your survey answers will contribute towards quantitative survey data. Neither I, the Dublin Institute of Technology nor any other third party will identify your name, email address or any other personal details, nor will it be possible to identify you in any way from the report I will publish as part of my MSc dissertation. I would like to thank you personally for your time and efforts in taking part in this survey.

1. Which of the following most closely represents the Institution in which you teach?

Institute of Technology
Institute of Further Education
Secondary School
Primary School
Special Needs School
University
None of the Above

ence Professor/Lecturer?

2. Are you a Computer Science Professor/Lecturer?

Yes
No

3. Please Indicate your view on the following statements.

	Strongly Agree	Tend to Agree	Neither Agree or Disagree	Tend to Disagree	Strongly Disagree
I find the use of technology in the classroom motivates students.					
I would like to integrate more technology into my lectures and course material.					
My Institution should provide me with a choice of frameworks for the inclusion of technology into the modules I teach.					
Institution policy should choose whether or not lecturers include modern technologies in course content.					
Institution policy should determine whether or not a lecturer facilitates a wider variety of learning styles.					

4. Which of the following are used in more than 50% of your lectures?(Select as many as applicable)

- [ ] Presentation Application e.g. PowerPoint
- [ ] Chalk/White board
- [ ] Role Play
- [ ] Educational Games
- [ ] Group Tasks
- [ ] Videos
- [ ] In class discussion
- [ ] In class viewing of artefacts
- [ ] Reflection upon previous class discussion

Other (please specify)

5. Which of the following learning styles do you accommodate in your lectures? ?(Select as many as applicable)

- [ ] Visual (Use of Images in your Lecture)
- [ ] Auditory (Use of Audio in your lecture)
- [ ] Linear (Obvious linear pattern to a topic in your lectures)
- [ ] Reflective (Reflection upon topics in your Lectures)
- [ ] Active (Active Participation in your lectures)

Other (please specify)

6. Which of the following do you provide for your students in modules you teach? (Select as many as applicable)

- [ ] Detailed Course Notes
- [ ] Summarised Presentation slides
- [ ] Hand written notes from in class discussion
- [ ] Text Blog
- [ ] Podcasts/Audio Blog
- [ ] Educational Videos/Video Blog
- [ ] Wiki Page
- [ ] Traditional Web Site
- [ ] None of the Above

7. If the resources were available, would you video record your lectures and make them available to students after each class?

- ◯ Yes
- ◯ No
- ◯ I already do

If No, what would you perceive as the barriers to using this technology?

8. If the resources were available, would you record the audio of your lectures and make them available to students after each class?

- ◡ Yes
- ◡ No
- ◡ I already do

If No, what would you perceive as the barriers to using this technology?

9. Which of the following would you describe as Web 2.0? ?(Select as many as applicable)

- ☐ Blogs
- ☐ Flash Movies
- ☐ Wiki
- ☐ RSS
- ☐ Podcasting
- ☐ Social networking
- ☐ Tagging
- ☐ Bookmarking

Other (please specify)

10. What percentage of the classes you teach do you also provide a web site for your students?(Select one answer)

- ◡ 0%-30%
- ◡ 30%-60%
- ◡ 60%-90%
- ◡ 90-100%

11. On average how often do you update your web sites? (Select one answer)

- ◡ Daily
- ◡ Weekly
- ◡ Monthly
- ◡ Less Often Than Monthly

12. Would you allow a student to submit a suitable assignment in a podcast or video blog?

- ◡ Yes
- ◡ No

If no, What would you perceive as the barriers to allowing this method of submission?

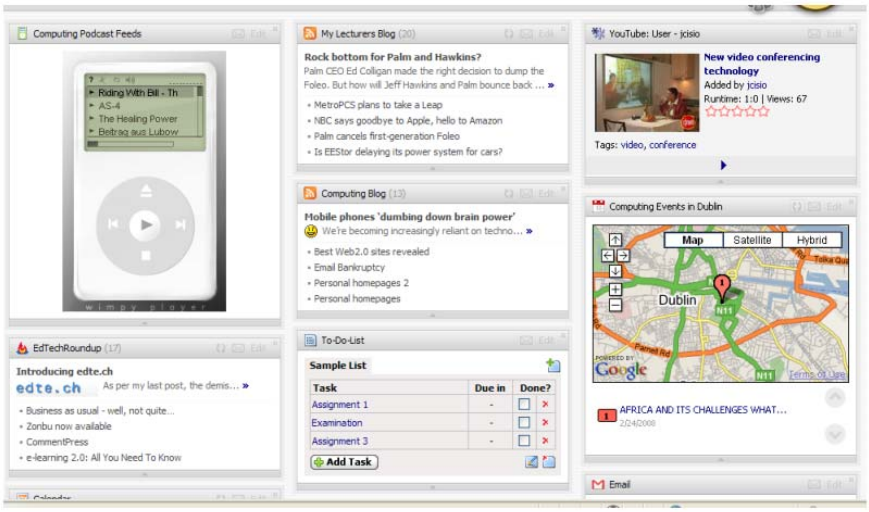
14. The screen shot below displays a personalised learning environment (PLE) that allows a student to subscribe to blogs, podcasts, videos and other media types that are equipped with an RSS feed. The RSS feed may link to a lecturers module portal or to content created by a third party.

The environment allows a student to create multiple pages for each module or one page for all modules if desirable. Although certain components from each module would be compulsory, the student has control over the layout of the PLE and can subscribe to content provided by the Institution or lecturer.

If your institution provided a similar learning environment would you encourage your students to use it?

- ◡ Yes
- ◡ No

Have you any additional comments on such a learning environment?


Computing Podcast Feeds
Riding With Bill - Th
AS-4
The Healing Power
Beitrag aus Lubow
My Lecturers Blog (20)
Rock bottom for Palm and Hawkins?
Palm CEO Ed Colligan made the right decision to dump the Foleo. But how will Jeff Hawkins and Palm bounce back ...
MetroPCS plans to take a Leap
NBC says goodbye to Apple, hello to Amazon
Palm cancels first-generation Foleo
Is EEStor delaying its power system for cars?
YouTube: User - jcisio
New video conferencing technology
Added by jcisio
Runtime: 1:0 | Views: 67
Tags: video, conference
Computing Blog (13)
Mobile phones 'dumbing down brain power'
We're becoming increasingly reliant on techno...
Best Web2.0 sites revealed
Email Bankruptcy
Personal homepages 2
Personal homepages
Computing Events in Dublin
Map
Satellite
Hybrid
Dublin
AFRICA AND ITS CHALLENGES WHAT...
EdTechRoundup (17)
Introducing edte.ch
edte.ch
As per my last post, the demis...
Business as usual - well, not quite...
Zonbu now available
CommentPress
e-learning 2.0: All You Need To Know
To-Do-List
Sample List
Task
Due in
Done?
Assignment 1
Examination
Assignment 3
Add Task
Email

Done >>

Appendix C: My Blog

During this dissertation the author kept a blog of his thoughts on technology in education. The following pages present the Blog.

Tuesday, August 28, 2007

Use of Blogs in Education

I am currently writing the section of my thesis on the use of blogs in the classroom. I feel that blogs have so much to offer both a lecturer and a student.

A blog is a tool that is Socratic in nature and it is attractive to an active student, to a visual student and also to a reflective student. It promotes a chronological pattern of reading information and questioning that information.

I have compiled the following shortened lists as uses in the classroom.

- A lecturer could replace the standard class portal, the main advantage over the traditional page is the ease of publishing and the use of a interface which is familiar to students.
- The culture of using links in a blog encourages students to back-up their findings.
- Blogs also allow all types of learners to interact on a level playing field, some learners are quicker to articulate their opinions and views whereas some need to read and reflect upon their thoughts.
- A blog can also act as a web page to allow students

Sunday, August 26, 2007

Interactive White Board

I was watching tv this evening and I seen a show about a secondary school (high school) here in Ireland, where they have embraced technology in the class room. The school uses an interactive white board in the classroom. The link to the 5 minute segment of the tv show can be found here. Hopefully this footage is available to all net users but it may be restricted to Ireland.

It really seems that Universities are not the driving force behind innovation in the lecture hall, and they should be.

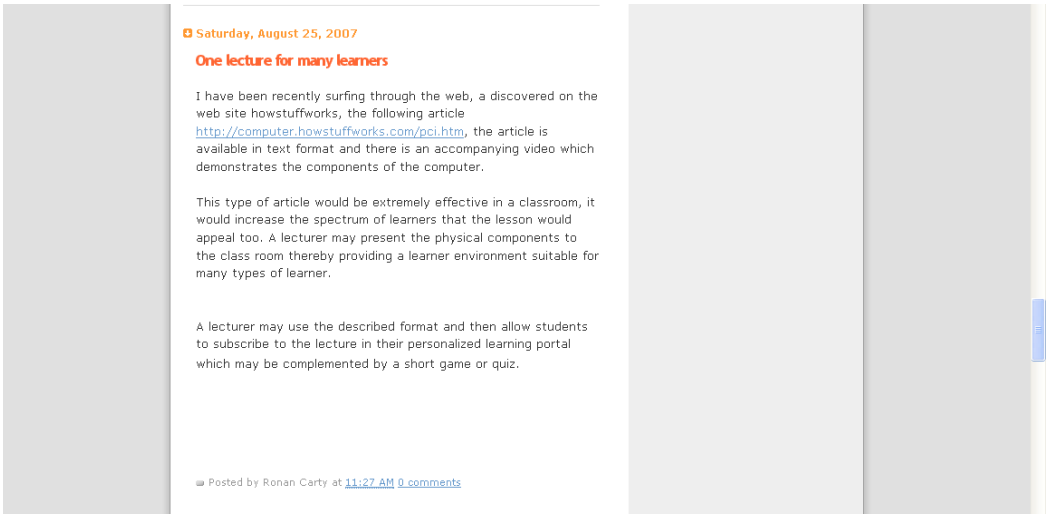
If anyone has links to universities who are incorporating innovative technologies, I would love to hear about it.

Posted by Ronan Carty at 2:55 PM 0 comments

Saturday, August 25, 2007

One lecture for many learners

I have been recently surfing through the web, a discovered on the web site howstuffworks, the following article http://computer.howstuffworks.com/pci.htm, the article is available in text format and there is an accompanying video which demonstrates the components of the computer.



Saturday, August 25, 2007

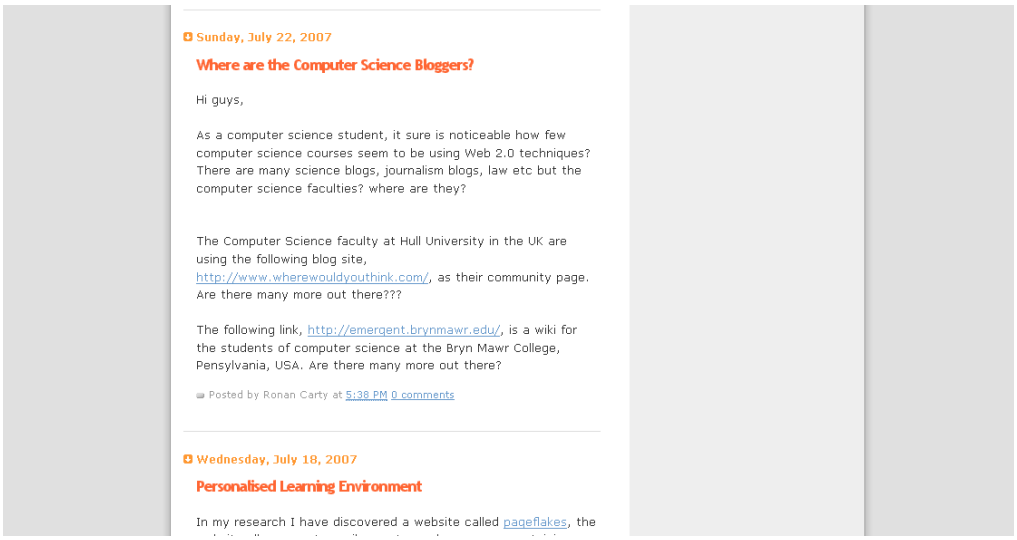
One lecture for many learners

I have been recently surfing through the web, a discovered on the web site howstuffworks, the following article http://computer.howstuffworks.com/pci.htm, the article is available in text format and there is an accompanying video which demonstrates the components of the computer.

This type of article would be extremely effective in a classroom, it would increase the spectrum of learners that the lesson would appeal too. A lecturer may present the physical components to the class room thereby providing a learner environment suitable for many types of learner.

A lecturer may use the described format and then allow students to subscribe to the lecture in their personalized learning portal which may be complemented by a short game or quiz.

Posted by Ronan Carty at 11:27 AM 0 comments



Sunday, July 22, 2007

Where are the Computer Science Bloggers?

Hi guys,

As a computer science student, it sure is noticeable how few computer science courses seem to be using Web 2.0 techniques? There are many science blogs, journalism blogs, law etc but the computer science faculties? where are they?

The Computer Science faculty at Hull University in the UK are using the following blog site, http://www.wherewouldyouthink.com/, as their community page. Are there many more out there???

The following link, http://emergent.brynmawr.edu/, is a wiki for the students of computer science at the Bryn Mawr College, Pensylvania, USA. Are there many more out there?

Posted by Ronan Carty at 5:38 PM 0 comments

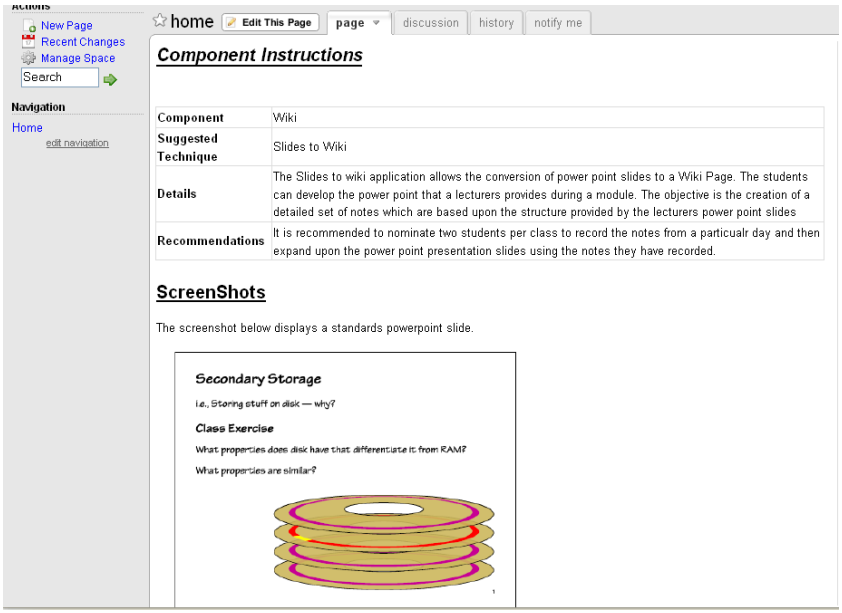
Wednesday, July 18, 2007

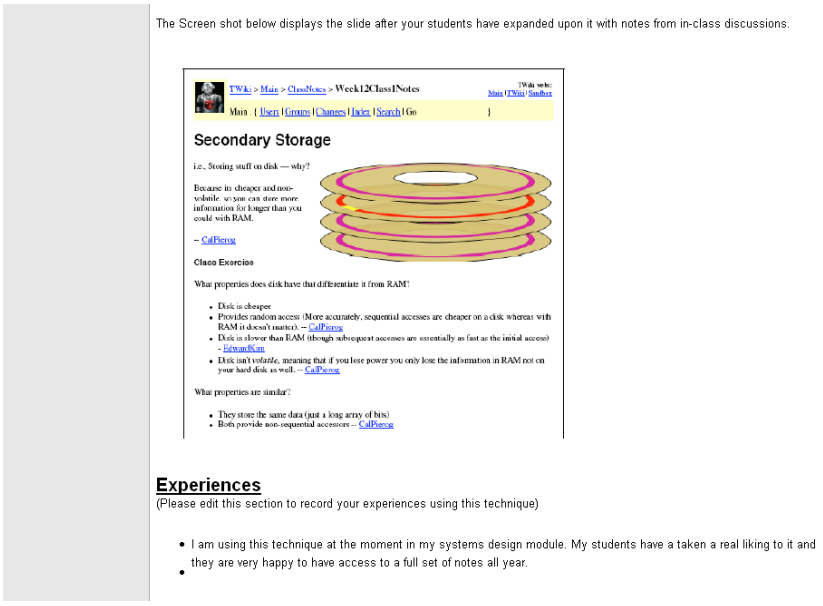
Personalised Learning Environment

In my research I have discovered a website called pageflakes, the

Appendix D: Web 2.0 Classroom Techniques Wiki Page

Appendix D displays screen shots from the Wiki Web site that lists the possible uses of Web 2.0 in education. The Wiki Page(s) would be freely editable by lecturers who are given access by the administrator. Lecturers would be encouraged to offer suggestions and provide feedback for the techniques. This example contains the details of the Slides to Wiki technique along with screenshots and a paragraph for user experiences/feedback.





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