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An Investigation into the Use of Learning Management Systems by Third Level Faculty.

Proposal for Dissertation Project

An investigation into the use of Learning Management Systems by third level faculty

I hereby certify that this material, which I now submit for assessment of the programme of study leading to the award of Master of Science in Learning Technologies is entirely my own work and has not been taken from the work of others save and to the extent that such work has been citied and acknowledged within the text of my work.

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An investigation into the use of Learning Management Systems by third level faculty

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Abstract

The moodle learning management system is developed in line with'social constructionist' pedagogy. Social constructionism is concerned with the idea of a social group constructing things for one another, collaboratively creating a small culture of shared artifacts with shared meanings. Is this social constructionist pedagogy reflected in the way lecturers actually use the system? This dissertation examines how and why lecturers use the moodle LMS in NCI.

A sample of NCI lecturers were sent a questionnaire to ascertain their teaching style, their reasons for using moodle, the manner in which they use moodle and their personal preferences in relation to the system. Results of this questionnaire were cross-referenced with actual moodle usage statistics which were obtained using the moodle reporting tool. Course modules which have high and varied levels of moodle usage were also examined and benchmarked against other modules.

It is found that many lecturers have not yet fully exploited the constructivist potential of moodle, but rather use it as a repository for course notes. They use moodle for pragmatic rather than pedagogical reasons. A disproportionately small number of lecturers use a large proportion of model tools to create a socially meaningfully collaborative learning environment.

It was not possible to prove that teaching style is a primary factor in the way lecturers use moodle, as other factors such as experience with technology, resources available, culture of department and moodle expertise have a significant influence.

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1. Introduction

Learning management systems are rapidly growing in popularity. The trend toward consolidation and providing a single, common infrastructure to manage learning and training initiatives is well served by the functionality of an LMS. Does this cause the teaching and learning experience to 'take a back seat' to the management functions? This dissertation investigates whether the availability of an LMS has an impact on third level lecturers' teaching techniques in general, and whether its use promotes constructivist and constructionist teaching techniques in particular. It examines whether a lecturer's 'teaching style' affects the manner in which he or she uses a learning management system and seeks to identify other factors which influence the frequency and nature of lecturer's use of an LMS.

The constructivist view maintains that people actively construct new knowledge as they interact with their environment. Constructivist teaching techniques can enhance instruction by providing a careful sequencing of materials to allow learners to build upon what they already know and go beyond the information they have been given to discover the key principles by themselves. The teacher facilitates a process of learning in which students are encouraged to be responsible and autonomous and there is a focus and emphasis on social and communication skills, collaboration and exchange of ideas.

NCI introduced the moodle open-source Learning Management system in 2005. The design and development of the moodle LMS is guided by a social constructionist pedagogy. Social constructionism extends the ideas of constructionism into a social group constructing things for one another, collaboratively creating a small culture of shared artifacts with shared meanings. When one is immersed within a culture like this,

one is learning all the time about how to be a part of that culture on many levels (www.moodle.org, 2008)

According to the moodle website, moodle can enable the role of 'teacher' to change from being 'the source of knowledge' to being an influencer and role model of class culture, connecting with students in a personal way that addresses their own learning needs, and moderating discussions and activities in a way that collectively leads students towards the learning goals of the class.

It is not enough, according to the theory of social construction, to explain a technology's success by saying that it is "the best" - researchers must look at how the criteria of being "the best" is defined and what groups and stakeholders participate in defining it.

This dissertation investigates the extent to which lecturers incorporate moodle as a constructionist tool into daily academic life. The theory of social construction of technology holds that those who seek to understand the reasons for acceptance or rejection of a technology should look to the social world. This study examines evidence of the acceptance or rejection of the moodle LMS at a practical level in NCI, and examines the influence of the lecturer's 'social world' on this process.

Background

NCI

The National College of Ireland was established in 1951. It is a not for profit, third-level College whose mission is to provide a centre of academic excellence, to create opportunities for students to succeed and to facilitate access to education for all groups. According to NCI's college-profile: 'NCI identifies educational needs and responds to them through innovative and flexible delivery systems, including distance education and

online learning technologies, which provide educational access regardless of geographical location' (NCI, 2008).

A key strategic goal is to 'Provide a high quality, innovative and supportive learning environment '. Through its three schools, the School of Business, the School of Computing and the School of Community Studies, NCI offers wide range of full-time and part-time programmes at different levels from certificate to diploma, degree and postgraduate level.

The college's educational philosophy and operational structure embody participation, collaboration and applied problem solving strategies – these complement moodle's guiding philosophy of constructivism and social constructionism.

NCI's student profile is unique, over 75% of its students are working adults. It hosts 11 full time courses, 33 part time courses, 3 online courses, 2 distance learning courses, 15 Educational Opportunity programs and a range of in-company programmes.

The current enrolment is over 4,350 students. NCI employs approximately 300 staff, 163 of whom are teaching faculty. Of the teaching faculty, 129 currently use moodle.

Prior to the introduction of a Learning Management system in NCI, the college made extensive use of the NCI intranet to provide learning materials such as course notes and presentations, to its students. The intranet was HTML-based and required expertise in editing HTML for staff to upload their content onto their web pages.
Each member of staff was entitled to create a web page for their own use, and the use of their students. Students could then access the relevant web pages to download course material as directed by a lecturer. This process proved to be cumbersome and resource intensive, in addition, the pages were static and allowed for no management or tracking of student activity. The nature of each Lecturer's web and course pages usually depended on their own competency with a HTML editor such as FrontPage. Lecturers who did not have the necessary skills to edit HTML pages usually got a colleague or a member of the

IT Department to do the work for them. While the intranet was password protected, any student could access course material from any lecturer or any course. Some members of academic staff made use of a commercially available LCMS, BlackBoard, in a very limited capacity. (O'Loughlin, 2005).

In 2005 a working group was set up to evaluate potential learning management systems and to recommend the most appropriate solution for the college's needs. The project team consisted of faculty members (mainly from the school of computing), the NCI IT Department, external consultants and management. This process resulted in the recommendation and subsequent implementation of the open-source LMS, moodle, in 2005.

Initially the system was partially integrated with the Oracle-based student management system, QuercusPlus. Moodle is now also fully integrated with Microsoft Active Directory, the HR system and the Microsoft Identity Lifecycle management suite. This facilitates the seemless amalgamation of student data and authentication details into moodle which enables the streamlining and simplification of management, maintenance and delivery. In practical terms this allows moodle to access moodle using their computer login. It also automatically assigns appropriate roles (ie. Student, lecturer or administrator) and populates each module with appropriate users.

Moodle usage by NCI faculty is not compulsory, however, it has been adapted by a majority of academic staff and is now part of daily faculty life. To date, it has received over 1 million hits. There are currently 2,168 registered users and over 1,400 modules. There are approximately 64 courses currently running in NCI. In 2007 NCI upgraded moodle to version 1.8.2.

Moodle is widely used to post lecture notes, however, advanced collaborative functions are only used by a handful of faculty members. This dissertation investigates the extent

and nature of moodle usage by lecturers in the NCI. In doing this, it examines whether teaching style or other factors have an influence on its uptake as a constructivist teaching and learning tool.

2. Literature Review

The literature provides extensive and varied insight into the nature of teaching, pedagogies, strategies and methods and techniques which can be used to harness the benefit of online technology in education.

Teaching

Teaching is defined by Krueger as the purposeful imparting of knowledge or skills to an individual or group. Learning can occur without a teacher, but teaching cannot occur without a student. Historically, teaching has been defined in terms of the quantity and quality of the material covered and the method in which it was presented. Learning was seen as the responsibility of the student. Recently, however, more responsibility for student learning has been placed on the teacher. (Krueger et al, 2000)

Teaching Strategy

For many years, the lecture method was the most widely used instructional strategy in college classrooms. Other teaching strategies include the case method, discussion groups, active learning and teaching, discovery based learning and teaching, co-operative learning and teaching, scaffolding, constructivism and collaborative learning and teaching. Litynski advises that educators must proactively engage the mind of learners to receive, to process, to analyze, to synthesize, and to eventually generate new knowledge. (Litynski, 2006).

Huba and Freed claim that there are many other teaching methods that have been proven to be more effective than the lecture method. The authors ask instructors to rethink their role and the role of their students in the learning process. They posit that a paradigm shift is needed on assessments as well as the use of rubrics to provide feedback and portfolios

to support learning. They recommend ways to shift the focus from individual change to organizational reform, creating an institutional mindset that values learner-centered, constructivist teaching. (Huba & Freed, 2000)

Lage et all believe that only great orators should lecture, while others should consider using a variety of teaching methods to actively engage students. Variety in the pace and format of undergraduate classroom instruction - across different class periods and even within a particular class - may well be the missing element of good teaching and enthusiastic learning. (Lage et al, 2000).

Talbert and McLaughlin stress that the interdependent needs of improved content, student supports and sustained learning activities need to be considered when addressing education goals. (Talbert & McLaughlin, 1993)

Mayer and Weinstein believe that good teaching includes teaching students how to learn, remember, think, and motivate themselves. Teachers enter the classroom with two distinctly different kinds of goals, these are: teaching students 'what' to learn and teaching students 'how' to learn. Many current approaches to classroom learning emphasize the role of the learner in creating, monitoring, and controlling a suitable learning environment. (Mayer & Weinstein, 1983).

Wilhem et al discuss the teacher's role in various teaching models. In a curriculum centered model the teacher's role is to transmit the curriculum. In a student centered model the teacher's role is to create the environment in which the individual learner can develop in set stages. In the teaching and learning centered model the teacher's role is to observe learners closely as individuals and groups, to scaffold learning within the zone of proximal development, to match individual and collective curricula to learners' needs and to create an enquiry environment. (Wilhem et al, 2001).

Scaffolding in an educational context is a process by which a teacher provides students with a temporary framework for learning. This structuring encourages a student to develop his or her own initiative, motivation and resourcefulness. Once students build knowledge and develop skills on their own, elements of the framework are dismantled. Eventually, the initial scaffolding is removed altogether; students no longer need it. (Lawson, 2002)

Paulsen describes pedagogical technique as '*a manner of accomplishing teaching objectives*'. He organises these techniques according to the four communication paradigms used in computer-mediated communication, they are: information retrieval, electronic mail, bulletin boards, and computer conferencing. (Paulsen, 2005). Additional support for this classification is found in a paper by Harasim. In 'The Collaborative Learning Horizon', she distinguishes one-to-one, one-to-many, and many-to-many learning approaches. (Harasim, 1989).

Bielaczyc and Collins emphasize four characteristics of learning communities: Diversity of expertise among its members who are valued for their contributions and are given support to develop, a shared objective of continually advancing collective knowledge and skills and an emphasis on learning how to learn and mechanisms for sharing what is learned. (Bielaczyc & Collins, 1999).

Teaching Style

The literature offers many interpretations and frameworks for defining and classifying teaching styles.

Parker Palmer maintains that learning is supported and enhanced by teachers who have the capacity to generate community between themselves and their subject, between

themselves and students, and ultimately between students and the subject. Parker maintains that the key to good third-level teaching is not that it is student-centred but that it is subject-centred. In a subject-centred classroom, teachers succeed in conveying to students not only their enthusiasm for the subject but also how and why the subject matters. (Palmer, 1998).

Farhad Analoui compares teaching styles to management styles. He assumes that lecturers and trainers who are working in third level educational establishments are also managers who manage their own work and the learning situations in which they are involved. He hypothesises that the quality of their management determines the extent of their effectiveness, success or failure as role performers and career seekers. Analou's matrix maps 'Concern for subject' against 'concern for learners', from this matrix he groups teaching styles into five categories; the soft, hard, run down, effective and so-so teacher. (Analoui, 1995).

Yin Cheong Cheng studies teachers' leadership style and investigates its relationship with the use of power, social climate and student-affective performance. He concludes that a teacher's leadership and use of power are inter-related. Furthermore, leadership style correlates to classroom social climate and student-affective performance. Cheng posits that a leadership style of '*high initiating structure and high consideration*' should be preferable and more effective. (Cheng, 1994)

Anthony Grasha proposes five teaching styles:

(1) Expert. Possesses knowledge and expertise that is communicated effectively to students to insure they are challenged and well prepared for future experiences.

(2) Formal authority. Relies on position and power to engage students in a structured, acceptable program of learning.

(3) Personal model. Will model behaviour that students should emulate in order for learning to occur.

(4) Facilitator. Encourages student-teacher interactions and develops independent learning activities in a consultative fashion.

(5) Delegator. Acts as a consultant and resource person as students develop into self-directed, independent learners. (Grasha, 2000).

Unfortunately, students do not explicitly select classes based on instructor teaching style; and it would be impractical to expect instructors to change their personality types to accommodate all students. Consequently, teachers who use a variety of teaching styles are more likely to increase student interest, diversity, and performance. By varying the ways in which subjects are taught, they can be made approachable for more types of learners. (Becker & Watts, 1995).

Constructivism

Constructivism is an epistemology of how people learn and incorporate new knowledge. Humans assimilate new knowledge by producing cognitive structures which are similar to the experiences they are engaged in. They then accommodate themselves to these newly developed knowledge structures and use them as they interact with their surroundings.

Gold distinguishes between two major instructional frameworks - objectivism and constructivism. Within objectivism, the designer sets the performance objectives and creates a systematic approach to the learning content. The instructor's role is to teach the students an unambiguous body of information within a well-defined learning environment. Constructivism is more learner-centered; the designer goal is to create a socially meaningful, communication and collaboration filled learning environment. The

facilitator creates authentic tasks and helps the learner integrate other understandings of multiple perspectives. (Gold, 2001)

Bruner's Constructivist Theory asserts that learning is an active process in which learners construct new ideas based upon their current knowledge. Instruction can be made more efficient by providing a careful sequencing of materials to allow learners to build upon what they already know and go beyond the information they have been given to discover the key principles by themselves.

According to Audrey Gray, the characteristics of a constructivist classroom are as follows:

- The learners are actively involved
- The environment is democratic
- The activities are student-centered and interactive
- The teacher facilitates a process of learning in which students are encouraged to be responsible and autonomous
- There is a great focus and emphasis on social and communication skills, collaboration and exchange of ideas. (Gray, 1997)

Jonassen has proposed a model for developing constructivist learning environments (CLEs) around a specific learning goal. This goal may take one of several forms, from least to most complex:

- Question or issue
- Case study
- Long-term Project
- Problem (multiple cases and projects integrated at the curriculum level)

(Jonassen, 1999)

Short et al approach constructivism from the instructor's viewpoint. They posit that just as all learners construct knowledge for themselves in their own minds, teachers must also determine how to make connections between their actual experiences and their knowledge of teaching. They examine how strongly influenced prospective teachers are by their own teachers' teaching styles and believe that effective constructivist teaching cannot be put together in a 'how to' manual for constructivist teaching. It is based on a core belief system about how people learn and comprehend their own personal world. They believe that failure should be welcomed in the classroom for the sake of learning and that teachers would benefit from failure experiences by becoming more conscious of their students, their relations with their students, and should become more conscious of the learning phenomenon in order to begin to understand what happens to students. They advocate risk taking in order to explore new ideas, regardless of the outcome.
As lecturers, they claim they have worried exclusively about their performance as instructors in the classroom; however, when they accepted their failures and began to examine their teaching within the framework of their beliefs of how students learned, they believe their teaching changed for the better (Short et al, 2001).

Gold also approaches constructivism from the instructor's viewpoint. He believes that in order to achieve greater assimilation and accommodation, teachers must learn to recognize and understand the strategies students use to perform tasks and ask questions to elicit better comprehension and reflection. Skills and strategies used by students are representative of some deeper, underlying understanding they possess. While practice and reinforcement are necessary for skill mastery, constructivism is meant for deep understanding. So, while practice should not be neglected, teaching and course content should be less about a superficial review of knowledge and more about creating new experiences. (Gold, 2001)

Arguments against constructivist based teaching instruction include the following:

- One possible deterrent for this teaching method is that, due to the emphasis on group work, the ideas of the more active students may dominate the group's conclusions.

- Zhu and Simon state that because the emphasis is not based on acquiring and practicing basic skills, students in constructivist classrooms tend to lag behind those in traditional classrooms in these areas. (Zhu & Simon, 1987).

Constructionism

The constructionist view is concerned with how knowledge is formed and transformed within specific contexts, shaped and expressed through different media, and processed in different people's minds. (Ackerman, 2001).

Social constructionism refers to the development of phenomena relative to social contexts. Berger and Luckmann argue that all knowledge, including the most basic, taken-for-granted common sense knowledge of everyday reality, is derived from and maintained by social interactions. (Berger & Luckmann, 1967).

According to Boghossian, at its best social constructionist thought exposes the contingency of those of our social practices that we had wrongly come to regard as inevitable. However, he maintains that it goes astray when it aspires to become either a general metaphysics or a general theory of knowledge.

> '*As the former, it quickly degenerates into an impossible form of idealism. As the latter, it assumes its place in a long history of problematic attempts to relativize the notion of rationality.*' (Boghossian, 2001)

Social Construction of Technology

Social construction of technology, (SCOT), is a theory within the field of science and technology studies. Advocates of SCOT argue that technology does not determine human action, but that human action shapes technology. SCOT holds that those who seek to understand the reasons for acceptance or rejection of a technology should look to the social world. It is not enough to explain a technology's success by saying that it is 'the best' - researchers must look at how the criteria of being 'the best' is defined and what groups participate in defining it. In particular, they must question who defines the technical criteria by which success is measured, why technical criteria are defined in this way, and who is included or excluded. (Bijker et al, 1987).

Knobelsdorf and Schulte investigate the way in which computing experiences shape attitudes towards computer science They observed that computing experiences have impacts on several dimensions: They affect the self-image with regard to computing, the world-image with regard to conceptions of the subject, and habits in computing. (Knobelsdorf & Schulte, 2007)

A core concept of social construction of technology is interpretative flexibility. This means that each technological artifact has different meanings and interpretations for various groups. (Pinch & Bijker, 1986). The most basic relevant groups are the *users* and the *producers* of the technological artifact, but other subgroups can be delineated. The groups can be distinguished based on their shared or diverging interpretations of the technology in question. The first stage of the SCOT research methodology is to reconstruct the alternative interpretations of the technology, analyze the problems and conflicts these interpretations give rise to, and connect them to the design features of the technological artifacts. (Bijker et al, 1987).

Technology and Learning

Globalization has changed the profile of the online learner population from that of adult, employed, place-bound, goal oriented, and intrinsically motivated to one that is heterogeneous, younger, dynamic, and responsive to rapid technological innovations. (Dabbagh, 2003).

Paulsen lists several future trends that affect online teaching strategy now and in the future, they are:

- The large-scale mega trend,
- The systems integration trend,
- The standardization trend,
- The market trend,
- The mobile trend,
- The broadband and multimedia trend,
- The globalization trend.

(Paulsen, 2003)

Hiltz and Turoff see online learning as a new social process and enumerate several driving forces for digital substitution:

- The value to the student is the flexibility of being able to integrate education with the demands of work and family
- Learning effectiveness in online or blended courses is equal to or better than in entirely face-to-face courses
- The value to the instructor is being able to treat all students equally, and to prepare and deliver the materials of the course as a single entity.
- The value to the organization is not having to duplicate any administrative or support function as a separate entity.

- The growing competitive environment in higher education and the need to provide quality online instruction as a matter of long-term survival.

(Hiltz & Turoff, 2005).

Jones and Buchanan suggest that traditional teaching methods are proving "ineffective and inefficient for the diverse student population" which institutions must contend with today. (Jones & Buchanan, 1996). Flexible modes of delivery can provide an effective means of addressing the problems of increasing student demands, decreasing funds, the need to establish a presence in the international market place and rapid technological change. (Corderoy & Lefoe, 1997)

Salter examines the conditions that promote learning and asks whether these can be provided in an online environment. He views learning as a path to wisdom and suggests that technology has the potential to enhance and transform teaching, but conversely, can also be used inappropriately or in ways that interfere with learning. He warns that we need to be careful not to have our teaching practices dictated by the available technology. (Salter, 2003)

Gold claims that teachers must have the actual experience of online learning before they can be expected to be online teachers; otherwise, they simply map traditional practices onto the new medium with little of the transformation necessary in the teaching process. He maintains that a technological change does not guarantee educational transformation or reform. (Gold, 2001)

Gold adapted the table below to map the four processes involved in the construction of knowledge, the principles involved and how they correspond to an Online Learning Network, (See table 1).

Table 1: Constructivist within an Online Learnin Environment

es	Instructional Principles	Online Components
ation	Gauge the learner's previous knowledge and experience. Orient the learner to his learning environment.	Pre-test Introductory Posts Broadcast Emails Syllabus Resources To Do lists Glossary Course Information FAQ Synchronous Chat
	Solicit problems from the learner and use those as the stimulus for learning activities, or establish a problem such that the learners will readily adopt the problem as their own.	Course Testing and Revision Class Content Synchronous Chat Online Lectures and Readings Non-graded, Starter Activities Facilitative Questions
Assimilation	Support the learner in developing ownership for the overall problem.	Discussion Forum feedback by other students and facilitator
similation	Anchor all learning activities to a larger task or problem. The learner should clearly perceive and accept the relevance of the specific learning activities in relation to the larger task.	Individual Unit Activities leading to Team Project
Accommodation	Design the learning environment to support and challenge the learners' thinking.	Modularize Content so as to scaffold learning Behavior Modelling by facilitator Quizzes for reinforcement Compare and Contrast Activities Facilitative Questions Discussion Forum feedback by other students' and facilitator
Accommodation	Design the task and the learning environment to reflect the complexity of the environment in which they must function after the has occurred.	Online Course Delivery Modelling of Course Structure and Components Team Project

Accommodation	Encourage testing ideas against alternative view and alternative contexts.	Discussion Forum Modularize Content to introduce new concepts quickly Compare and Contrast Activities Interactive Essay Facilitative Questions
	Design an authentic task. An authentic Learning Environment is one in which the cognitive demands are consistent with the demands in the environment for which the learner is being prepared.	
Equilibrium	Provide an opportunity for reflection on both the learning content and process.	Facilitator Evaluation of Team Projects Auto-marked Quizzes Open Student Evaluation to instructor
Disequilibrium	Provide an opportunity for changing and enhancing, drafting, and redrafting.	Unit Summaries of student discussions
Disequilibrium	Challenge misconceptions.	Students' and Facilitator's feedback Project Gallery Post-Test

(Gold, 2001)

Paulsen's framework for analysis of pedagogical technique categorises various teaching methods according to the following methods: one alone, one-to-one, one-to-many and many-to-many. The techniques are organized according to the four communication paradigms used in computer-mediated communication: information retrieval, electronic mail, bulletin boards, and computer conferencing.

Table 2: Methods techniques and devices of an online education system

Methods:	**one-alone**		**one-to-many**	**many-to-many**
				Debates Simulations or games Role Plays
echniques	Online databases Online journals Online applications Software libraries Online interest groups Interviews	Learning contracts Apprentice ships Internships Correspond-ence studies	Lectures Symposiums Skits	Discussion groups Transcript based assignments Brainstorming Delphi Techniques Nominal group techniques Forums Project groups
	resources	e-mail	board	conferencing

(Paulsen, 2003)

In the application of Bruner's constructivist theory to a practical online learning situation, Fahy lists the following ways to attract attention:

- To draw attention, use novelty, differences, motion, changes in intensity or brightness, the presence of moderate complexity and focused displays.

- To increase attention and maintain learner focus, create moderate uncertainty about what is about to happen next or what the eventual outcome of a presentation will be.
- To sustain attention, maintain variety and change in the learning environment.
- To focus attention, teach learners to interpret certain cues such as specific colors, sounds, symbols, fonts, screen or display arrangement, also, use captions in pictures, graphics and illustrations.
- Improve retention by sequencing screens and presenting related materials together.
- Arrange information in a non-threatening manner through techniques such as chunking, overviews, advance organizers, maps, and a fixed-display format. The consistent placement and style of section titles is an important cue to the structure of information. (Fahy, 1999).

Burd and Buchanan caution that the use of a specific teaching style or set of styles must expand in order to address different learning styles when teaching online. Successful teaching and learning depend on all participants possessing the attitudes necessary to succeed in the online environment. (Burd & Buchanan, 2004).

In *Implementing the Seven Principles: Technology as Lever*, Chickering and Ehrmann suggest using technology to support online instruction through the following "good practices":

- encourage contact between students and faculty;
- develop reciprocity and cooperation among students;
- use active learning techniques;
- give prompt feedback;
- emphasize time on task;
- communicate high expectations; and

- respect diverse talents and ways of learning.

(Chickering & Ehrmann, 1996).

When an online instructor is fully equipped with proper technical skills, familiarity with the online learning environment, and most importantly, a true awareness of effective online pedagogies and teaching strategies, the online learning experience that he/she creates has the highest potential to succeed (Bedore, et al, 1997).

The majority of third level institutions now use online technology in place of or to augment traditional teaching methods. The department of education, Botswana, implemented a gradual transition from a full-time, face-to-face traditionally delivered course to an e-learning lab delivery method, which they term a 'SMART classroom' approach. The researchers posit that it resulted in a more student-centered e-learning package (Bose, 2003).

Barriers and Impediments to Online Learning

Impediments to online teaching and learning can be situational, epistemological, philosophical, psychological, pedagogical, technical, social, and/or cultural (Berge, 1998) and include:

- "faceless" teaching
- fear of the imminent replacement of faculty by computers
- diffusion of value traditionally placed on getting a degree
- faculty culture
- lack of an adequate time-frame to implement online courses
- many learners lack independent learning skills and local library resources
- lack of formalized agreements to sustain program commitment though difficulties and problems

high cost of materials

taxpayer ignorance of the efficacy of distance education

lack of a national agenda, funding priority, and policy leadership

increased time required for both online contacts and preparation of materials/activities

- the more technologically advanced the learning system, the more to go wrong
- non-educational considerations take precedence over educational priorities
- resistance to change
- lack of technological assistance

Hew & Brush identify the general barriers typically faced by educational institutions when integrating technology into the curriculum for instructional purposes, these are: (a) resources, (b) institution, (c) subject culture, (d) attitudes and beliefs, (e) knowledge and skills, and (f) assessment. They list several strategies to overcome such barriers: (a) having a shared vision and technology integration plan, (b) overcoming the scarcity of resources, (c) changing attitudes and beliefs, (d) conducting professional development, and (e) reconsidering assessments. (Hew & Brush, 2006).

Berge concludes that many barriers to learning and teaching online are caused by lack of access to resources and people. Further, the most critical obstacles reported in his survey are related to learners' resistance to or fear of the many changes that must occur at the individual and organizational level. This fear, combined with the lack of support for the changing roles of students and teachers could yield significant impediments to success in online education. Other barriers arise over difficulties in assessment: whether it involves evaluating students' online work, or the rewarding, compensating, valuing, and supporting of faculty members' teaching online and as they develop technologically-mediated learning environments. (Berge, 1998)

Neal posits that academics create and update classes based on the wealth of knowledge they have accumulated in their field. Even within computer science, these people excel because of their research and/or their lecturing, not their computer skills. He believes that a mandated use of computers by a university makes no sense; but if such a course of action is backed up with documented benefits and technical support then it is entirely appropriate.

Neal claims that technological support for academics using online teaching technology is, in many institutions, either inadequate or not readily available. He lists incentives and training for teachers, combined with sufficient material development time as essential requirements if teachers and students are to go beyond a preoccupation with the delivery vehicle for online courses and focus on the knowledge that needs to be imparted. (Neal, 1998).

Learning Management Systems

A Learning Management System is a multi-user environment where learning developers may create, store, reuse, manage, and deliver digital learning content from a central object repository (EdTechPost 2005; Greenberg 2002).

Bonk et al. advocate a ten-level continuum for integrating the web into instruction in higher education in an attempt to clarify the pedagogical choices that instructors should consider when using Learning Management Systems. Levels 1 through 4 of the continuum examine tools for information–distribution:
Level 1–Marketing the course and the course syllabus,
Level 2–Student exploration of web resources,
Level 3–Student-generated resources posted on the web, and
Level 4–Course resources on the web

These first four levels provide students with alternative sources for course information rather than provide features of the course that cannot be acquired elsewhere. Levels 5–10 of the continuum are distinguished from the first four levels in that the learning activities and tasks embedded in these higher levels contain requirements of the course that are not provided elsewhere. These levels include:
Level 5–Repurpose web resources,
Level 6–Substantive and graded web activities,
Level 7–Course activities extending beyond class,
Level 8–web as an alternative delivery system for resident students,
Level 9–Entire course on the web for students located anywhere, and
Level 10–Course fits within larger programmatic web initiative.
Most CMSs possess the capabilities to provide instructional experiences at all ten levels of Bonk's continuum. However, the most commonly used component of a CMS is its content presentation features, that is, Levels 1 though 4 of the web-integration continuum. (Bonk et al, 1999)

Judith Boettcher maintains that we are in the 'fourth wave' of learning management systems. The second wave saw the rise of the now common hybrid course or web-enhanced campus courses in which the best of the web interactions were integrated with the best of the campus interactions. The third wave created new systems that support efficiency in administration and delivery at the infrastructure and enterprise level. These systems are complex and relatively expensive, requiring ongoing support, upgrades, and maintenance for integrating into campus systems.

This fourth wave includes the design standards from the Open Knowledge Initiative and its spin-off open source products such as Stellar from MIT, CHEF from the University of Michigan, CourseWork from Stanford, and Visual Understanding Environment (VUE) from Tufts. This new wave includes the IMS/SCORM design standards, the APIs of OKI,

and related content and learning object initiatives such as MERLOT, Reusable Learning Objects project at the University of Cambridge, and many more.

Boettcher examines the interaction between learning systems and pedagogical values. She outlines ten core learning principles from ongoing research on learning theory, instructional design, and the diffusion of technology and relates them to learning management systems.

Learning Principle 1: Learners and learning, faculty mentors and teaching, are shaped by available tools and resources.
Our tools are important to our work. We are "shaped by the tools and instruments that we use and that neither the mind nor the hand alone can amount to much." (J. Bruner in Vygotsky, 1962).

The principle that we are shaped by our tools, referred to as technological determinism, has the corollary that users can shape their tools. The implication is that users should be proactive in the design of their tools.

The learning management systems and the learning experiences that are designed for students shape students' learning. A focus on exploration, problem solving, collaboration with other students, challenging ideas, can cause students to engage and develop concepts, or disengage and retreat.

A collection of communication tools was one of the primary features of the second wave of learning management systems and the flexibility of e-mail, group chat, bulletin boards, and web sites is one of the major strengths of these tools. These tools also support efficiency in that the faculty member no longer needs to serve as the hub of the communications wheel.

Learning Principle 2: Every structured learning experience is theatre—with four actors: the learner, the faculty mentor, the knowledge/skill or attitude to be learned, and the environment in which the learning is to take place. Effective learning management

systems address the actions and responsibilities associated with each of the roles played by these four variables or actors.

Learning Principle 3: Learners bring personalised and customised knowledge to the learning experience, and develop personalized and customized knowledge.
All learners start with a unique knowledge representation and end with a unique knowledge representation. The ideal LMS supports customized learning for students. In the LMS, discussion boards, postings, and other communication tools provide multiple channels for exploring and expressing ideas and issues. These tools can support experiences that challenge students to accomplish complex, contextual learning.

Learning Principle 4: Faculty mentors have the responsibility of designing and structuring the course experience.
The faculty mentor defines the structure and content of a course and determines 'what is to be learned'. Faculty write, select, and assemble materials and design, select, and present learning experiences. The faculty mentor also manages the delivery of the course, including the daily interactions and assessing of students.

Learning Management Systems can help faculty be efficient in these tasks by providing support for teaching strategies, content management tools, and assessment tools.

Learning Principle 5: All learners do not need to learn all course content/knowledge.
All learners do need to learn the core or base concepts and to develop useful knowledge. In all learning theories, the task of learners is to acquire the knowledge, skill, and attitudes that are needed or desired. Learning management systems can structure tools for knowledge manipulation and experimentation that supports problem solving in context.

Learning Principle 6: Every learning experience has a context or an environment in which the learner interacts.
This principle reminds us that learning is rooted in time and place. The environment for

learning is a fundamental 'actor' in the process of learning. Effective learning management systems support the interaction of a specific learner with specific environments so that the learning of both core concepts and practical concepts can be customized.

Learning Principle 7: Every learner has a zone of proximal development that defines the 'space' that a learner is ready to develop into useful knowledge.

Collaborative and peer learning activities fit well within this theory. Learning management systems to include support for experiences in which more capable peers support the Zone of Proximal Developments of their fellow students - and can also support the creation of new ZPDs for all learners

Learning Principle 8: Concepts are not words. Concept formation occurs as a series of intellectual operations between the general and the particular with ever-increasing differentiation.
Words are not equivalent to concepts. As concepts are developed initially, they resemble mere seeds of more mature thought and understanding. Thus the practice of 'making a learner's thinking visible' is a powerful practice in revealing the stage of maturity of a learner's concepts. Interactive media involving learners graphically and dynamically clearly plays a role in the concept formation process.

Learning Principle 9: Different instruction is required for different learning outcomes. This design principle (Gagne, 1965) reminds us of the interdependency of outcomes/assessment and the instructional experiences we design for learners. Outcomes are dependent on the specific conditions of the learning experiences and the cognitive and physical readiness and abilities of learners. Tools for customization that would help link experiences to outcomes could enhance this relationship.

Learning Principle 10: Everything else being equal, more time on task generally equates to more learning.

This principle argues persuasively for the design of engaging, efficient learning resources and experiences. If learning can be as engaging as games and socially rewarding as well, students will choose to be learners more of the time.

The new generation of open source learning management systems are responding to the complexity of the learning experience and the teaching and mentoring role. Remembering that we shape our tools and our tools shape us underscores the need for being proactive and thoughtful about the design of these tools. (Boettcher, 2003)

In an analysis of blended and online courses across eight countries (including Ireland) a Socrates/Minerva project aimed at exchanging experiences of using Web-based learning in higher education institutions concluded that 92 percent of the courses they analysed used Learning Management systems. (Cardoso & Bidarra, 2007)

DeNeui and Dodge examine the relationship between the frequency of use of various utilities of a Learning Management System and student performance in a hybrid class. Results reveal a significant positive partial correlation between overall usage and students' exam scores (DeNeui & Dodge, 2006).

George Siemens, however, posits that the very notion of a Learning Management System conflicts with how people are actually learning today. Outside of school, most learning falls into the "topping up what we know" category. As a result, he claims that new tools are needed to allow for rapid creation and breakdown. Examples include: Searching Google, blogs, and wikis which have very quick learning structure creation and breakdown. An LMS has a long creation/breakdown process (and once the learning structure has been broken down (at the end of the course), it is no longer accessible to learners). LMS' still view learners as canisters to be filled with content – this is particularly relevant in light of the heavy emphasis on object repositories for learning. Seimens claims that most LMS platforms are attempting to shape the future of learning to

fit into the structure of their systems, even though most learning today is informal and connectionist in nature. (Siemens, 2004).

Parkin agrees, he does not view an LMS as a universal solution for a corporation's e-learning problems. In fact, an LMS '*is often the albatross around the neck of progress in technology-enhanced learning.*' He uses a music analogy to illustrate this point, equating the LMS to a CD collection, whereas modern students collect music, not CDs. According to Parkin, learning software vendors still pursue their vision of reusable learning objects that integrate via a central LMS which conforms to certain standards, however, trainers who want to encourage experience-sharing and dynamic content, created by learners, are scrambling to understand RSS, wikis and blogs (Parkin, 2004).

Phil Long, senior strategist for the Academic Computing Enterprise at MIT maintains that the ultimate innovation for a Learning Management System is its absence altogether. He envisions a future where there is a series of core services that work together but are not necessarily wrapped into a single software program. "Those core services will provide an infrastructure on which to build and attach very specific software tools for specific disciplines and problems. I think we're moving in that direction, but we're not there yet." Long maintains that "services should be provided separately, so that you use the best grouping of them that makes sense for your particular need." He sees a scenario in the course management environment in which "people can build, add, and aggregate tools independently for a collection of the functions that, at the moment, are thought to be the best combination of things you see in this environment." (Heid, 2006)

An analysis by Paulsen of 113 experts in 17 European countries quantified 13 features which those experts would like to see included in their future LMS systems. They are:
1. A need for better integration between LMS systems and other related systems,
2. An interest in standardization of content and tools that could be applied in online education,

3. A request for local presence, language support, and special characters,
4. A concern about cost-effectiveness,
5. An urge for multimedia and broadband capacity,
6. A potential for improvements with regard to tests, assignments, and evaluations,
7. A request for improved communication and collaboration tools,
8. A need for better administrative tools,
9. A potential for simpler and more user-friendly solutions,
10. A request for more flexible systems,
11. An interest in mobile learning and e-commerce,
12. A request for better systems for content management and development,
13. A wish for systems with more features.

(Paulsen, 2003)

Moodle

Moodle is an open-source learning management system. It has been designed to support modern pedagogies based on social constructivist theory. It includes activity modules such as forums, chats, resources, journals, quizzes, surveys, choices, workshops, glossaries, lessons, and assignments. It has been translated into over 70 languages, with more on the way, and supports the popular SCORM standard for content packaging. Moodle offers an alternative to commercial software such as WebCT or Blackboard, and is being used by a growing number of universities, schools, and independent teachers for distance education or to supplement face-to-face teaching. (Farmer, 2007).

Moodle emerged in 1999 from the Australian higher education community. Moodle has a small core team of permanent staff and an army of volunteer contributing developers.

The central premise of open source allows one to read, redistribute, and modify source code, encouraging rapid evolution as people improve it, adapt it and fix bugs. Code in public view is exposed to extreme scrutiny and becomes highly reliable and secure.

The number of installations and users served by the main LMS vendors are shown in the following table:

LMS	Installations	
otal	1,500	17m
aba	1,100	15m
Blackboard/WebCT	3,700	12m
	19,000	7m
killport	1,200	5m

In Further Education, 56% of UK institutions now use moodle. Many Further Education moodle users cite Blackboard and WebCT (now acquired by Blackboard) as being too slow to respond to changing customer requirements. (Aberdour, 2006)

Sabine Graf and Beate List conducted an evaluation of Open Source Learning Management Systems, with a focus on adaptation issues as well as adaptability, personalization, extensibility and the overall functionality of the platform. They used the qualitative weight and sum (QWS) approach to evaluate 36 platforms. After a pre-evaluation phase, nine platforms were analysed in detail. Moodle obtained the best results in the general as well as in the specific adaptation evaluation. The authors outlined the strengths of moodle as; the realization of communication tools, the creation

and administration of learning objects, the comprehensive didactical concepts and the tracking of data and outstanding usability. (Graf & Beate, 2005).

In a list 0f 2008's top 100 tools for online learning, compiled from the contributions of 184 learning professionals (from both education and workplace learning), moodle is rated number 13 by the Centre for Learning and Performance Technologies (Top 100 Tools for Learning, 2008).

3. Research Question

What impact, if any, does the presence of a Learning Management System have on constructivist teaching methods? Does a Learning Management System facilitate conditions for more 'effective learning' by providing: greater access to information, multiple representations of content, a learning environment rich in resources, active engagement and tools for communication and collaboration? Gold claims that many teachers simply map traditional practices onto an online medium with little of the transformation necessary in the teaching process. This reflects the principles of objectivism. Within objectivism the instructor's role is to teach the students an unambiguous body of information within a well-defined learning environment. Within the framework of constructivism however, the facilitator creates a socially meaningful, communication and collaboration filled learning environment. Gold maintains that a technological change does not guarantee educational transformation or reform. (Gold, 2001).

The moodle LMS was introduced to NCI in 2005. Prior to this college's internal intranet was the only institutional tool available to host course materials for students. Microsoft Word and Powerpoint comprised the bulk of course material posted by lecturers. In a survey conducted before the introduction of moodle, 92% of lecturers said they would definitely use an LMS post course notes, however, there was a less emphatic response to learning activities such as forums, blogs and wikis.

Moodle has been available as an integrated learning system in NCI for over three years. This dissertation investigates the extent to which NCI lecturers incorporate moodle as a constructionist tool in their daily academic life. It examines whether the moodle LMS is

used as a mirror of traditional, 'face-to-face' teaching practices, or whether it has brought about genuine educational transformation and reform. Factors which influence its usage are also examined.

The theory of social construction of technology holds that those who seek to understand the reasons for acceptance or rejection of a technology should look to the social world. In order to examine evidence of the acceptance or rejection of the moodle LMS at a practical level, this study examines the influence various aspects of the lecturer's 'social world' have on the frequency and nature of usage in NCI. Elements of a lecturer's social world are categorised under the following headings: teaching style, 'online' technical expertise, experience using moodle, gender, department membership, type of teaching contract, location and subject matter taught. LMS usage is evidenced by the frequency, nature and 'sophistication' of utilisation of the moodle Learning Management System.

Does a lecturer's individual teaching style influence his or her use of the learning management system? What are the other influential factors at play? Anthony Grasha's framework is used for categorising teaching styles. Under this framework four main styles are classified, however, lecturers may use a combination of styles or change their style to suit situational needs such as time pressure, college norms, subject matter, grade level of students and resources available.

A study of twenty one NCI lecturers was conducted. The study comprised a questionnaire which assessed these lecturers' teaching styles by posing multiple choice questions which were scaled using using Grasha's evaluative framework. The lecturers were also asked to estimate the extent and nature of their usage of the moodle Learning Management system, to appraise certain aspects of the system in addition to their level of technical expertise, their previous experience with technology, their reason for using (or not using) moodle and their personal experience with the system. (See appendix 6).

Teaching styles are categorised as:

- Expert/Formal Authority. The instructor possesses knowledge and expertise that is communicated effectively to students to ensure they are challenged and well prepared for future experiences. The instructor relies on position and power to engage students in a structured, acceptable program of learning.
- Personal model. The instructor will model behaviour that students should emulate in order for learning to occur.
- Facilitator. The instructor encourages student-teacher interactions and develops independent learning activities in a consultative fashion.
- Delegator. The instructor acts as a consultant and resource person as students develop into self-directed, independent learners. (Grasha, 2000).

The actual extent and nature of moodle usage was investigated by a detailed analysis of Moodle usage logs. These logs were then cross-referenced with average exam result statistics and course details from NCI's student data repository (Quercus Plus). Moodle activities by survey respondents were compared to those of the wider NCI faculty group, and data on the most frequently used courses and courses which exploit collaborative and interactive features were also examined with a view to isolating influential factors. Informal interviews were also conducted with a cross-section of faculty to gauge attitudes towards moodle and to clarify responses to certain questions in the survey.

It is found that the availability of a learning management system does have an impact on pedagogical technique and the extent of LMS usage in a third level environment, however, the nature of the usage of an LMS is based on factors such as experience with technology, culture of the faculty department, willingness to experiment, moodle expertise level and the learning objective involved. In most cases the LMS is

predominantly used to make course material available to students, only a small percentage of lecturers fully exploit its collaborative, constructivist potential.

4. Method

The sample group for this investigation comprises National College of Ireland's academic staff. Members of this group are of mixed gender, have third level qualification, are aged over eighteen and are employed as lecturers by the NCI.

A questionnaire was sent to all full and part-time lecturers in NCI (see appendix 6). The questionnaire was deployed via e-mail using the online tool: Survey Monkey. Of a total of 120 e-mails sent, twenty one responses were received (19 of which could be identified).

Upon receipt of the completed questionnaires, moodle data were downloaded using the moodle reporting tool. Moodle usage statistics were categorized according to quantity and nature of moodle usage. Quantity of moodle usage was classified as Moodle hit-count. Gold's framework for mapping principles of constructivism to elements of online education was used as a framework to classify 'Advanced' moodle usage (See table 2).

Moodle data were cross-referenced with questionnaire responses and data from NCI's student record system (Quercus Plus). Moodle usage statistics of questionnaire respondents and moodle data regarding generalised moodle usage in NCI were also analysed and cross referenced with average module exam results.

A brief, telephone interview of some questionnaire respondents was conducted to clarify responses where needed.

4.1 Data Collection

A questionnaire of 21 NCI lecturers (19 of whom are identified) was conducted using the online surveying tool, SurveyMonkey.

The layout of the questionnaire was designed as follows:

- Question two to six ascertained the respondent's age group, duration of teaching, department and level of students
- Question seven to fourteen evaluated the respondent's teaching style
- Question sixteen evaluated the respondent's expertise with online technology
- Question seventeen evaluated the frequency of the respondent's moodle usage
- Question eighteen and twenty six evaluated reasons why faculty do or do not use moodle
- Question nineteen asked the respondent to rate moodle's instructional features
- Question 20 asks the respondent to rate their moodle expertise.
- Question twenty one evaluated whether the faculty member thinks moodle suited their teaching style?
- Question twenty two asked the respondent whether moodle had changed their teaching style
- Question twenty three elicited further comments on moodle
- Question twenty four asked respondents to describe how moodle had changed their teaching style

Survey responses were analysed and cross referenced with actual moodle usage statistics. These were also cross referenced with statistics from the student records system, QuercusPlus.

4.1.1 Moodle Data Collection

Moodle Activities:

The following is a list of moodle activities which are available to NCI lecturers:

Assignment

Assignments allow the teacher to specify a task that requires students to prepare digital content (any format) and submit it by uploading it to the server. Typical assignments include essays, projects, reports etc. This module includes grading facilities.

Chat

The Chat module allows participants to have a real-time synchronous discussion via the web. This is a useful way to get a different understanding of each other and the topic being discussed - the mode of using a chat room is quite different from the asynchronous forums. The Chat module contains a number of features for managing and reviewing chat discussions.

Choice

A choice activity is very simple - the teacher asks a question and specifies a choice of multiple responses. It can be useful as a quick poll to stimulate thinking about a topic; to allow the class to vote on a direction for the course; or to gather research consent.

Database

The Database module allows the teacher and/or students to build, display and search a bank of record entries about any conceivable topic. The format and structure of these entries can be almost unlimited, including images, files, URLs, numbers and text amongst other things.

Forum

It is here that most discussion takes place. Forums can be structured in different ways, and can include peer rating of each posting. The postings can be viewed in a variety for formats, and can include attachments. By subscribing to a forum, participants will receive copies of each new posting in their email. A teacher can impose subscription on everyone if required.

Glossary

The glossary activity allows participants to create and maintain a list of definitions, like a dictionary. The entries can be searched or browsed in many different formats. The glossary also allows teachers to export entries from one glossary to another (the main one) within the same course. It is possible to automatically create links to these entries from throughout the course.

Hot Potatoes

This module, the "HotPot" module, allows teachers to administer Hot Potatoes quizzes via moodle. The quizzes are created on the teacher's computer and then uploaded to the moodle course. After students have attempted the quizzes, a number of reports are available which show how individual questions were answered and some statistical trends in the scores.

Lesson

A lesson delivers content in an interesting and flexible way. It consists of a number of pages. Each page normally ends with a question and a number of possible answers. Depending on the student's choice of answer they either progress to the next page or are taken back to a previous page. Navigation through the lesson can be straight forward or complex, depending largely on the structure of the material being presented.

iPodcast

This activity allows participants to create and maintain a RSS feed for an entire course not just an activity. Included in this feed is a more streamlined way of adding video and audio Podcasts. Many additional iTunes extended tags are available with this RSS feed. Attachments download are also iTunes compatible.

Quiz

This module allows the teacher to design and set quiz tests, consisting of multiple choice, true-false, and short answer questions. These questions are kept in a categorised database, and can be re-used within courses and even between courses. Quizzes can allow multiple attempts. Each attempt is automatically marked, and the teacher can choose whether to give feedback or to show correct answers. This module includes grading facilities.

SCORM/AICC Package

A package is a bundle of web content packaged in a way that follows the SCORM or the AICC standard for learning objects. These packages can include web pages, graphics, Javascript programs, Flash presentations and anything else that works in web browsers. The Package module allows you to easily upload any standard SCORM or AICC package and make it part of your course.

Survey

The Survey module provides a number of verified survey instruments that have been found useful in assessing and stimulating learning in online environments. Teachers can use these to gather data from their students that will help them learn about their class and reflect on their own teaching.

Wiki

A Wiki enables documents to be authored collectively in a simple markup language using a web browser. It is the speed of creating and updating pages that is one of the defining

aspects of wiki technology. Generally, there is no prior review before modifications are accepted, and most wikis are open to the general public or at least to all persons who also have access to the wiki server. The Moodle Wiki module enables participants to work together on web pages to add, expand and change the content. Old versions are never deleted and can be restored.

Workshop

A Workshop is a peer assessment activity with a huge array of options. It allows participants to assess each other's projects, as well as exemplar projects, in a number of ways. It also coordinates the collection and distribution of these assessments in a variety of ways.

Moodle data were obtained from the moodle reporting tool using the moodle administrative interface GUI (See appendix 7). This GUI facilitates access to reports on general moodle usage categorised by user, activity, module and time period. From the Administration Reports GUI the 'Logs', 'Statistics' and 'Course Overview' functions were used to elicit data. The 'Activity Reports' function was also accessed on a per-user basis to elicit granular information.

- The Logs function gives access to specific module logs – this information can be downloaded or displayed on screen and filtered by time period or action (see appendix 8).
- The Statistics function displays graphs of course activity for a time period of up to six months. It also displays hits per student and per lecturer. This information is not available for download.
- The 'Course Overview' option gives information regarding the most heavily used modules in moodle (see appendix 9). Course information in this format is available for a time period of up to six months. The reports available in this section are: Most

active courses, most active courses (weighted), most participatory courses (enrolments), and most participatory courses (views and posts). Information can be filtered by time period or amount of courses listed.

- The Activity Reports function allows access to statistics on a per-user basis. These statistics include total hits per user, views per user, posts per user and graphs of activity per user (see appendix 10).
- The Modules function lists a count of modules which use each activity type (see appendix 11).

Statistics were obtained for the top ten courses in each of the Course Overview categories. These course statistics were cross referenced with other data for each module obtained, ie. The number of participants, the subject, the lecturer, the lecturer's school membership and gender, the module type, average results per module, moodle hits per lecturer and advanced moodle activity per lecturer and mean hits per user (this statistic is only available for the most active modules - weighed -statistics).

Details on each survey respondent's moodle activity were obtained by downloading usage data from each of their allocated moodle modules into a Microsoft excel spreadsheet and combining each module's spreadsheet into a 'master-file' per respondent.

Broad range statistics were obtained via direct manipulation of the database via SQL commands. Statistics from the student records system were obtained using Discoverer (an Oracle reporting tool). Records were imported into Microsoft Excel spreadsheets and then uploaded into the stastical tool, SPSS, for manipulation and analysis. Brief telephone interviews were also conducted with available survey respondents

4.1.2 Limitations of the Study

Other Higher Educational Institutions were considered as target groups and ruled out as direct access to moodle statistics for those HEAs is not available, so cross-referencing could not be completed.

The report on all module activities since moodle's inception caused the moodle LMS to crash so this data was not available.

It is possible to count the number of moodle modules which use activities, however, deeper analysis of activity usage, such as activity count per course or per user, is not available via the moodle administrative GUI.

Learning objectives and actual course content per module were not examined as they are outside the scope of this investigation.

Each NCI student is required to complete a survey evaluating their satisfaction with each of their course modules. It was intended to cross reference student survey results with moodle usage data for module lecturers, however permission to access this information was denied due to its confidential nature.

Lecturers may use a wide variety of online educational tools not native to moodle. Usage of these tools was not examined due to time and resource restrictions.

The quantity and nature of IT support calls made was also collected from the IT department online helpdesk system. This data was not used as part of this dissertation. It was not deemed to be relevant to the nature of the study as helpdesk logs could not be cross-referenced with other available data and moodle calls had been incorrectly categorised on the helpdesk system.

4.1.3 Pre-moodle Faculty Survey

A survey of NCI lecturers' online resource usage had been conducted by an NCI faculty member prior to the introduction of moodle (O'Loughlin, 2005). The project investigated how the web-based student intranet was used by NCI academic staff. Part of the investigation was also to determine what types of content were uploaded to the student intranet with a view to gauging academic staff opinion on the possible introduction of a new LMS and to determine what features available in an LMS (but not in the intranet) they might use. This gave the NCI's LMS working group a stronger indication of academic staff experience in online systems. It also helped to involve Academic staff in the decision to introduce an LMS.
The terms of reference for that project were: A survey of use of student intranet and a survey of Academic staff on the introduction of an LCMS The results in appendix 2 show 100% Intranet usage rates in the School of Computing. In the School of Business & Humanities, only 6 out of 15 Lecturers (40%) who had web pages used them. Finally, 11 out of 30 Associate Faculty Lecturers (37%) who had web pages used them.
Each Lecturer Web Page was examined and the different files types present on each page were recorded. Appendix 3 shows a break down of the eight different files types found. The results show a clear domination of Microsoft PowerPoint and Word documents comprising 74% of all files types.

A survey to evaluate how Faculty used the existing intranet and how they might use a new LCMS was also conducted. The response rate was very high for the School of Computing, and somewhat lower for the associate faculty and the school of Business and Humanties (See appendix 2). Interestingly, the moodle LMS is correspondingly more widely used by the school of computing than the school of business.

The final question in the survey, question 6: "Learning Content Management Systems allow Lecturers to manage their own modules so that they can make several different types of learning activities available to students Please select from the pull down menus the level of use for each activity that you might use in future modules:" was asked to determine what other content types to match learning activities would Lecturers use. All of the listed Learning Activities are available in the moodle Learning Management System (See appendix 5). There is a consistent high response rate for all activities in either the "Definitely will use" or "Might use" responses. Only the response rate of 40% for "I don't know what this activity is" for wikis breaks this trend.
Based on responses in appendix 3, PowerPoint and Word were expected to make up the bulk of content types used where 92% of Lecturers stated that they would like to "Upload course notes". The results also showed that there was a low level of knowledge about 'recent' technologies used in learning such as wikis and blogs. Despite an elapsed time-span of three years since this study has taken place, wikis and blogs are still among the least-utilised functions in the moodle LMS.

4.2 Analysis

The tools employed for analysis of data collected were; SPSS, a statistical analysis tool, Microsoft Excel, a spreadsheet application tool, and Oracle Discoverer, a data analysis and reporting tool.

For the purposes of this study, lecturers' usage of the moodle LMS was categorized by frequency and nature of operation. Nature of usage was further classified as basic usage and 'Advanced usage'. Basic users provide students with access to information. Advanced users utilise moodle to provide one or many of the following conditions for learning: multiple representations of content, a learning environment rich in resources, active engagement and tools for communication and collaboration (Paulsen, 2003).

Advanced or 'sophisticated' usage of the LMS was categorised by using Gold's mapping of constructivist learning processes to Instructional Principles and their component Learning environment activities. Corresponding moodle activities have been offset against learning components, however, this list is not exhaustive (See table 2)

Table 2: Map Online Learning Components to moodle functionality:

Processes		
		Moodle Activities
Assimilation	Gauge the learner's previous knowledge and experience.	Quiz . hot potatoes
		Resource, lesson, ipodcast
Assimilation	Orient the learner to his learning environment.	Resource
		Resource. database
		Resource
		Glossary
		Database. glossary
		Chat
		Forum, ipodcast

Assimilation	Solicit problems from the learner and use those as the stimulus for learning activities, or establish a problem such that the learners will readily adopt the problem as their own.	Resource, SCORM/AICC, database. lesson Chat Resource General Resource, Database activities, lesson, workshop, quiz, choice Facilitative Questions Quiz, hot potatoes, survey, choice
Assimilation	Support the learner in developing ownership for the overall problem.	Forum, survey, choice, workshop
Assimilation	Anchor all learning activities to a larger task or problem. The learner should clearly perceive and accept the relevance of the specific learning activities in relation to the larger task.	Resource, wiki, workshop, lesson
Accommodation	Design the learning environment to support and challenge the learners' thinking.	Lesson. resource Behavior Modeling by facilitator Quizzes for reinforcement Compare and Contrast Activities Facilitative Questions Forum, survey, choice

Accommodation	Design the task and the learning environment to reflect the complexity of the environment in which they must function after the learning has occurred.	Online Course Delivery Resource, inodcast ure and Lesson. database Wiki, workshop,
Accommodation	Encourage testing ideas against alternative view and alternative contexts.	Discussion Forum Forum, chat ntroduce Lesson, resource Activities Wiki. choice Interactive Essay Wiki. blog Quiz, hot potatoes, survey
Equilibrium	Design an authentic task. An authentic Learning Environment is one in which the cognitive demands are consistent with the demands in the environment for which the learner is being prepared.	Wiki, workshop, resource
Equilibrium	Provide an opportunity for reflection on both the learning content and process.	Wiki, workshop, resource Quiz, hot Survey, choice

Disequilibrium	Provide an opportunity for changing and enhancing, drafting, and redrafting.	Chat, forum Forum
Disequilibrium	Challenge misconceptions.	Survey, choice Project Gallery Blog, workshop, wiki Assignment, quiz

(Gold, 2001)

Survey Response Analysis

The Survey Monkey Results Analysis tool was used to analyse results received from survey respondents. Using this tool graphs and statistics for all responses received could be examined. Results were displayed according to response count, response percent, rating averages and open answers. Bar charts were used to display multiple choice results and tables were used to display scale rating results. The SurveyMonkey integrated filtering tool was also used to filter results based on various criteria.

Cross Referencing

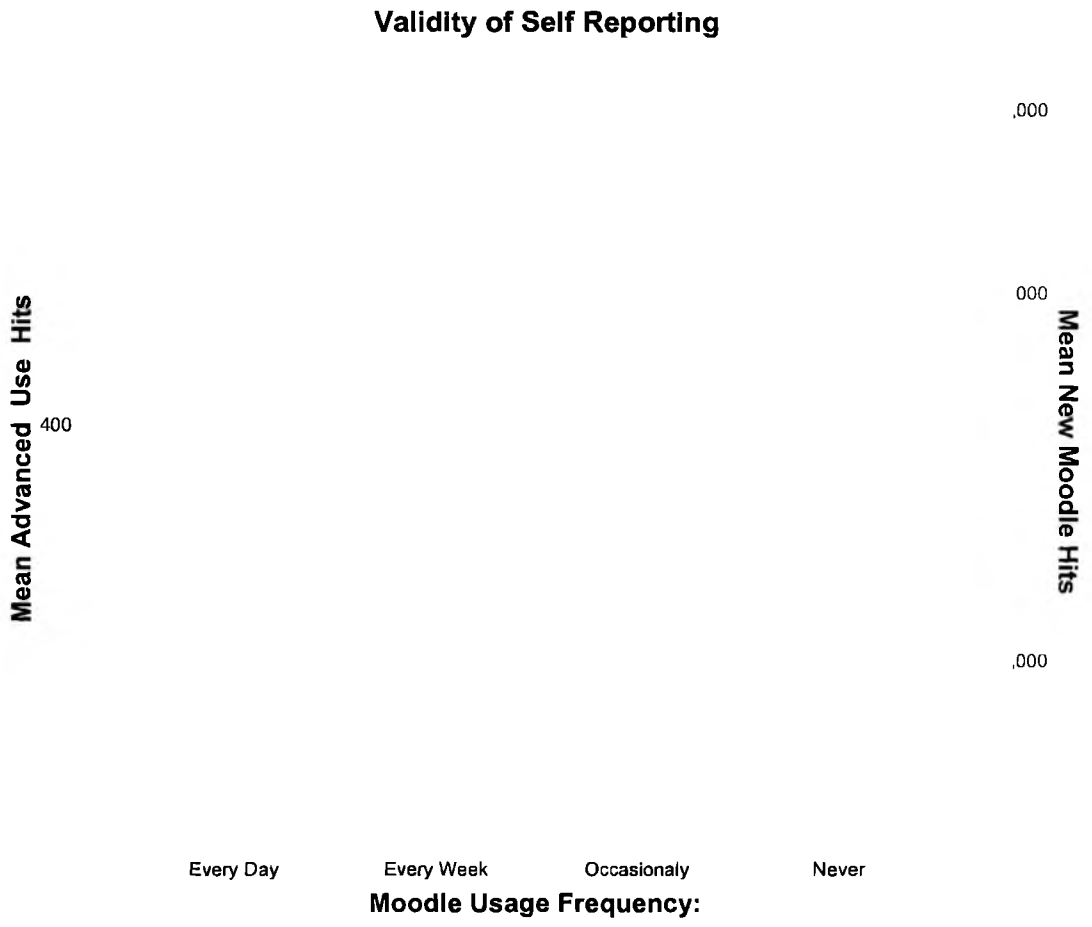
The survey respondents actual activity in moodle was ascertained (as the survey results are self reported and may be biased). The Moodle reporting tool was used to obtain advanced moodle usage statistics on each individual survey respondent (who gave a name). The data were downloaded to Excel format and combined into one master spreadsheet (of 38,900 records). The columns it contains are: Course Module Code, Time of access, IP address, Full Name, Action Type and Further Information on Action type.

This spreadsheet was then imported into SPSS and some of the variables were re-coded for clarity. Further columns were then added, ie: School, gender and average module result for each module. These data were obtained from the student records system: QuercusPlus.

A similar process was completed for the top ten most active moodle modules, the top ten most active modules (weighted) and all modules which contained advanced moodle activities.

A variety of SPSS statistical functions were employed to analyse data. These include the t-test for equality of means, analysis of variance, correlations between variables, general descriptive statistics, comparisons of means and tabulations, in addition to visual representation in the form of graphs.

To ascertain whether survey respondent's self evaluation of their moodle usage frequency and the actual moodle usage frequency, their personal ratings were compared to their moodle usage statistics. The self evaluations roughly correspond with actual moodle usage statistics. (See graph A).



Graph A: Survey respondents evaluation of their moodle usage versus their actual moodle usage statistics.

Teaching Style

Questions 7-14 were designed to ascertain the respondents' teaching styles based on Anthony Grasha's framework. The four main teaching styles are: Expert/Formal Authority, Delegator, Demonstrator and Facilitator. The questions were adapted from online teaching website: http://members.shaw.ca. (The Grasha-Riechmann questionnaire

contains 40 questions. These were deemed to be too time consuming for the respondent given that other data would also be collected).

Teaching styles were evaluated by matching each answer from question 7-14 with an associated teaching style. Answers were then imported into Microsoft Excel. Each user's primary teaching style was evaluated by selecting the style with the highest percentage of weighted answers for each user.

5. Results

Questions 1-7 were designed to ascertain the respondents' profile. The profile of questionnaire respondents was as follows:

- 19% of respondents were aged 20-29, 57.1% were aged 30-39, 14.3% were aged 40-49 and 9.5% were aged 50-59.
- Eight respondents were female (38.1%), 11 were male (55%) and two respondents were of unknown gender.
- 12 respondents (60%) were members of the school of business and humanities and 11 (55%) were from the school of computing.
- 19% have been lecturing for less than one year, 23.8% for two to three years, 19% for four to six years, and 31.8% for over six years.
- 47.6% teach certificate level, 28.6% teach diploma level, 81% teach degree level and 19% teach post-graduate level.
- An equal number of respondents, 33.3%, teach full time, part time, or both.
- 19% of respondents teach 2-4 hours per week, 19% teach 5-8 hours per week, 52.4% teach 9-13 hours per week and 9.5% teach 14 hours or more per week.

Question 18 evaluated the respondent's reason for using moodle. The primary reason cited by 88% of survey respondents for using moodle was 'Convenience'. In answer to question 24, 'How has moodle changed your teaching style?', the majority of survey respondents, (58%), reported that moodle had affected their teaching style by giving

increased control over the provision and flow of content. These answers do not align with the constructionist principles upon which moodle is based.

Using the SurveyMonkey filtering tool, the request: '*Please rate the following moodle functions*' was examined. This question comprised a Likert scale from one to five. Ratings for responses were filtered by various response categories. The most significant differences are shown below: Results were filtered by: membership of school (See table i and table ii) and also for those respondents who rated themselves 'Expert' online technology users and 'Expert' moodle users (See table iii and table iv).

Table i: School of Computing

Moodle Function	Rating Average
Post course notes	**4.88**
Post assignments	**4.43**
Post assessments	**3.86**
Link to external internet resources	**4.14**
Create blogs	2.00
Create wikis	2.00
Create glossaries	1.57
Create online quizzes	**2.86**
Use online chat	1.14
Create an RSS feed	1.43
Use the online forum	**2.86**
Use the calender	**3.00**

Table ii. School of Business

Moodle Function	Rating Average
Post course notes	**4.60**
Post assignments	**4.56**
Post assessments	2.78
Link to external internet resources	**3.44**
Create blogs	2.00
Create wikis	2.00
Create glossaries	**2.89**
Create online quizzes	2.50
Use online chat	2.22
Create an RSS feed	1.67
Use the online forum	2.13
Use the calender	**2.75**

Table iii. Advanced Technology User

Moodle Function	Rating Average
Post course notes	**4.71**
	4.29
	3.86
Link to external internet resources	**3.71**
Create blogs	2.43
Create wikis	2.43
Create glossaries	2.14
Create online quizzes	**3.00**
Use online chat	
Create an RSS feed	1.71
Use the online forum	**2.83**
Use the calender	**3.14**

Table iv. Expert moodle user

Moodle Function	Rating Average
Post course notes	**4.75**
	4.50
	4.25
Link to external internet resources	**3.50**
Create blogs	**2.75**
Create wikis	**2.75**
Create glossaries	**2.25**
Create online quizzes	**3.50**
Use online chat	1.75
Create an RSS feed	2.00
Use the online forum	**4.33**
Use the calender	**3.25**

It can be seen that respondents who rated themselves 'Expert moodle users' placed a higher rating on the collaborative and constructivist features of moodle, those who rated themselves as users who had advanced technology skills also rated the collaborative and advanced features highly, while the school of business placed a higher rating on posting course notes and assignments.

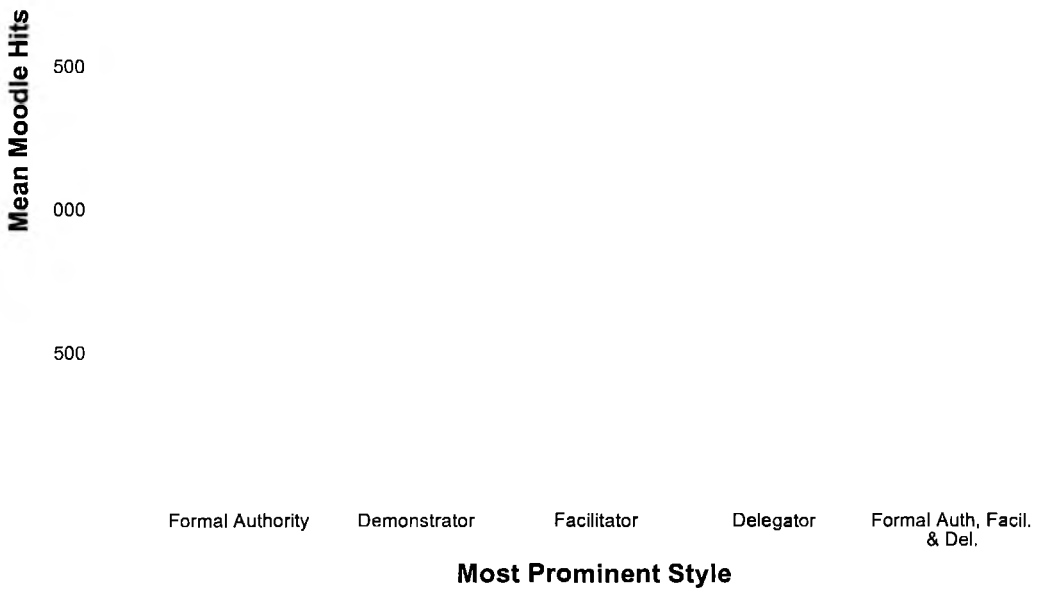
5.1 Teaching Style

Twelve of the respondents had a primary teaching style of formal authority (50%). One had facilitator style, (4.2%), seven had delegator style, (29.2%), one had a combination of formal authority, facilitator and delegator styles (4.2%) and none of the respondents had a principle style of demonstrator.

76.5% of respondents claimed that moodle suits their teaching style, while no respondents claimed it does not suit their teaching style, 23.5%, (four respondents), were unsure.

76.5% of respondents claimed that moodle had not changed their teaching style. 17.6% (3 respondents) claimed it had changed their teaching style - these respondents have a primary teaching style of Formal Authority - while 5.9% were unsure. As access to online teaching data prior to the introduction of moodle in 2005 is unavailable, it is not possible to cross-reference these responses.

When survey respondents' teaching styles are matched with the frequency of their actual moodle usage, it can be seen that users with principle styles of formal authority and delegator have an average of over 2,239 moodle hits, the respondent with a principle style of facilitator has a average of 1,062 hits, the respondent with a principle style of delegator has a mean of 2,273, while the respondent with a combination of all three styles has a mean of 73 hits. (See graph B)



Graph B: Survey respondent's most prominent teaching style / survey respondent's mean moodle hits

An analysis of variance was conducted to determine whether the means differ significantly. It is determined that the distribution of respondent styles and the large standard deviations make it impossible to conclude that the influence of teaching style upon moodle hit-rate is not due to chance. The very wide confidence interval may indicate that more data should be collected before anything more can be said.

In this case, we can not conclude that teaching style had a significant influence on moodle hit-rates, $F(3, 15) = .535$, $p > .05$. (See table 3)

Table M le Hits – Learni

					95% Confidence Interval for Mean			
			Std. Dev	Std.	Lower	Upper	Min	
Formal Authority	11	2238.09				3626.04	700	
Facilitator		1062					1062	1062
	6	2273.33		556.772	842.1		516	4315
Formal Auth, Facil. & Del.		73					73	73
Total	19	2073.37	1788.006	410.197	1211.6	2935.16	73	7266

Anova

	Sum of Squares	df	Mean Square		Sig.
Between Groups	5562724.179	3	1854241.393	535	665
Within Groups	51982654.242	15	3465510.283		
Total	57545378.421	18			

When survey respondents' teaching styles are matched with the frequency of their 'advanced' moodle usage, ie. usage of activities such as blogs, wikis, forum, podcasts, quizzes and chat, it can be seen that survey respondents with the most prominent teaching style of delegator used advanced features 545 times on average, whereas individuals with a formal authority teaching style used advanced features 165 times. Individuals with other styles used advanced features less than 20 times. (See graph C)

There does, initially, appear to be a correlation between survey respondent's actual usage of advanced moodle features and their teaching style (see graph C). Survey respondents who have a delegator teaching style tend to place much control and responsibility for learning on individuals or groups of students. This type of teacher will often give students a choice designing and implementing their own complex learning projects and

will act in a consultative role. Upon further investigation, however, these correlations prove to be inconclusive (see table 4.)

Graph C: Survey respondents most prominent style / actual mean advanced moodle usage

An analysis of variance was conducted to determine whether the means differ significantly. It is determined that the distribution of respondent styles and the large standard deviations make it impossible to conclude that the influence of teaching style upon advanced moodle usage is not due to chance. The very wide confidence interval may indicate that more data should be collected before anything more can be said.

In this case, we cannot conclude that teaching style had a significant influence on advanced moodle usage by lecturers, F (3, 15) = .599, p > .05. (See Table 4).

Advanced Moodle / Teachi

	N			Std Error	95% Confidence Interval for Mean Lower	Upper		Max
Formal Authority	11				134.83			1503
Facilitator	1	2.00						2
Delegator	6			366.257	396.16	1486.83	2	
Formal Auth, Facil. & Del.		4.00					4	
Total	19	267.79	611.456	140.278	-26.92	562.50	1	2257

ANOVA Advanced Usa / Teachin

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	719665.097	3	239888.366	.599	.626
Within Groups	6010140.061	15	400676.004		
Total	6729805.158	18			

rity

5).

Table 5: Moodle & Suitabi * Most Prominent Crosstabulation

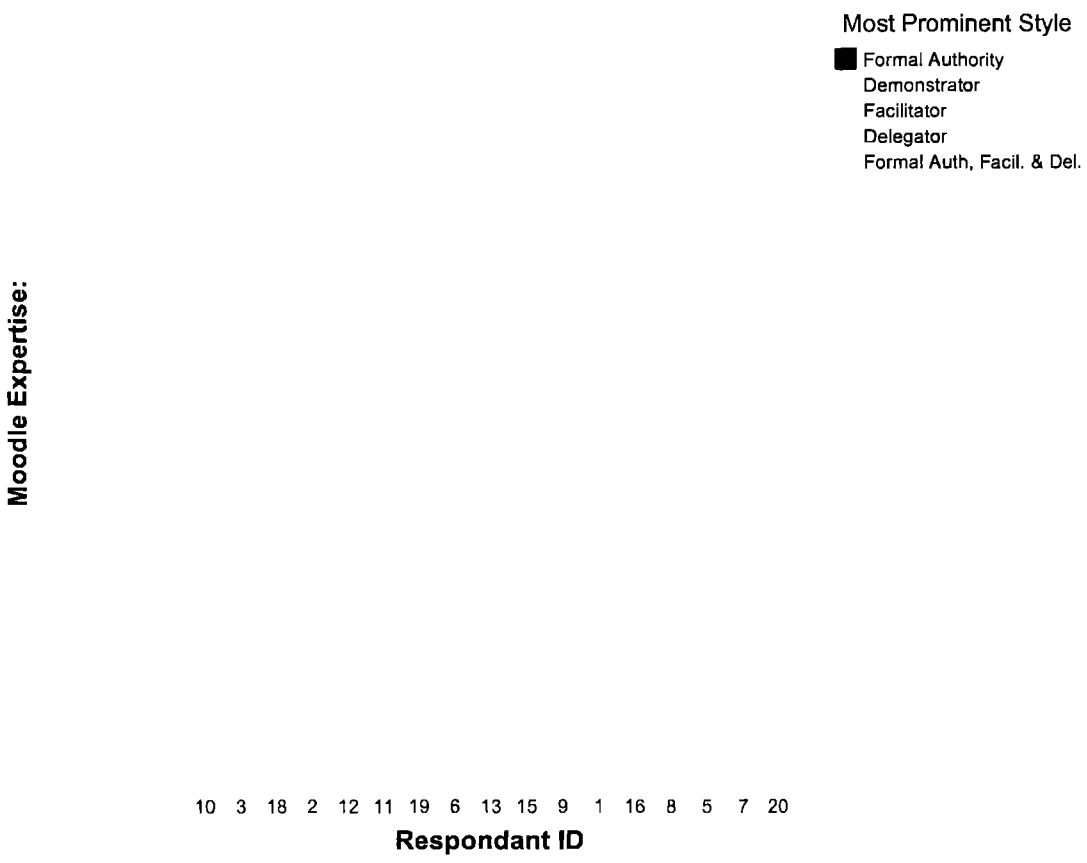
		Most Prominent Style				
		Formal Authority	Facilitator	Delegator	Formal Auth, Facil. & Del.	Total
Do you think moodle suits your teaching style?	Missing	**1**	1	1	1	4
	Unsure	**3**	0	1	0	4
	Yes	**8**	0	5	0	13
Total		**12**	1	7	1	21

In response to the question: 'Do you think moodle has changed your teaching style?', the majority of respondents answered 'No', however, three respondents with a primary style of formal authority answered 'Yes' and one respondent with delegator teaching style was unsure (See table 6).

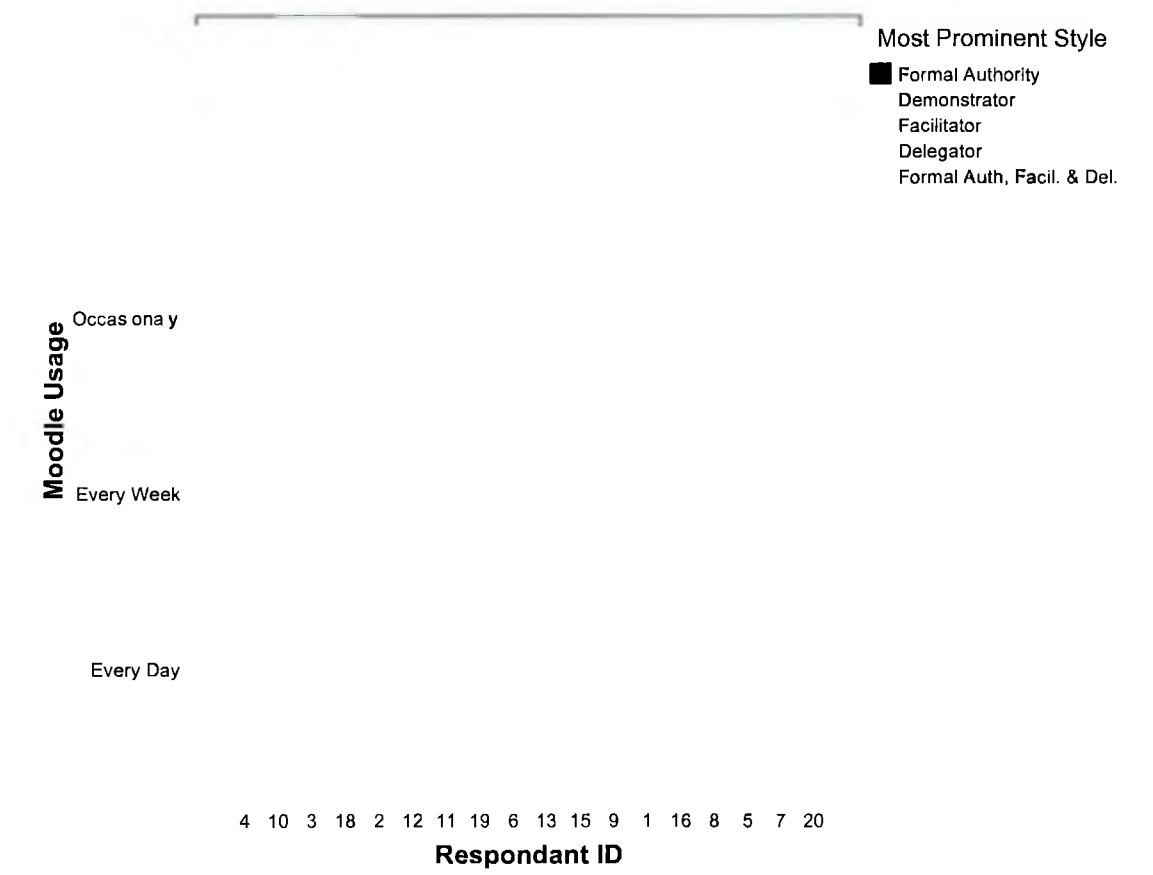
Table 6:' Do you think moodle has changed your teaching style?' * Most Prominent Style Crosstabulation

		Most Prominent Style				
		Formal Authority	Facilitator	Delegator	Formal Auth, Facil. & Del.	Total
Do you think moodle has changed your teaching style?	Missing	**2**	0	1		4
	No	**7**	1	5	0	13
	Unsure	0	0	1	0	1
	Yes	**3**	0	0	0	3
Total		**12**	1	7	1	21

When each survey respondent's most prominent teaching style is cross-referenced with their self-reported moodle expertise level, there appears to be no direct correlation between the two (See graph D). There is also no direct correlation between survey respondent's most prominent style and their self-reported frequency of moodle usage (See graph E).



Graph D: Survey respondents teaching style / self-reported moodle expertise



Graph E: Survey respondent's frequency of moodle usage / teaching style (self reported)

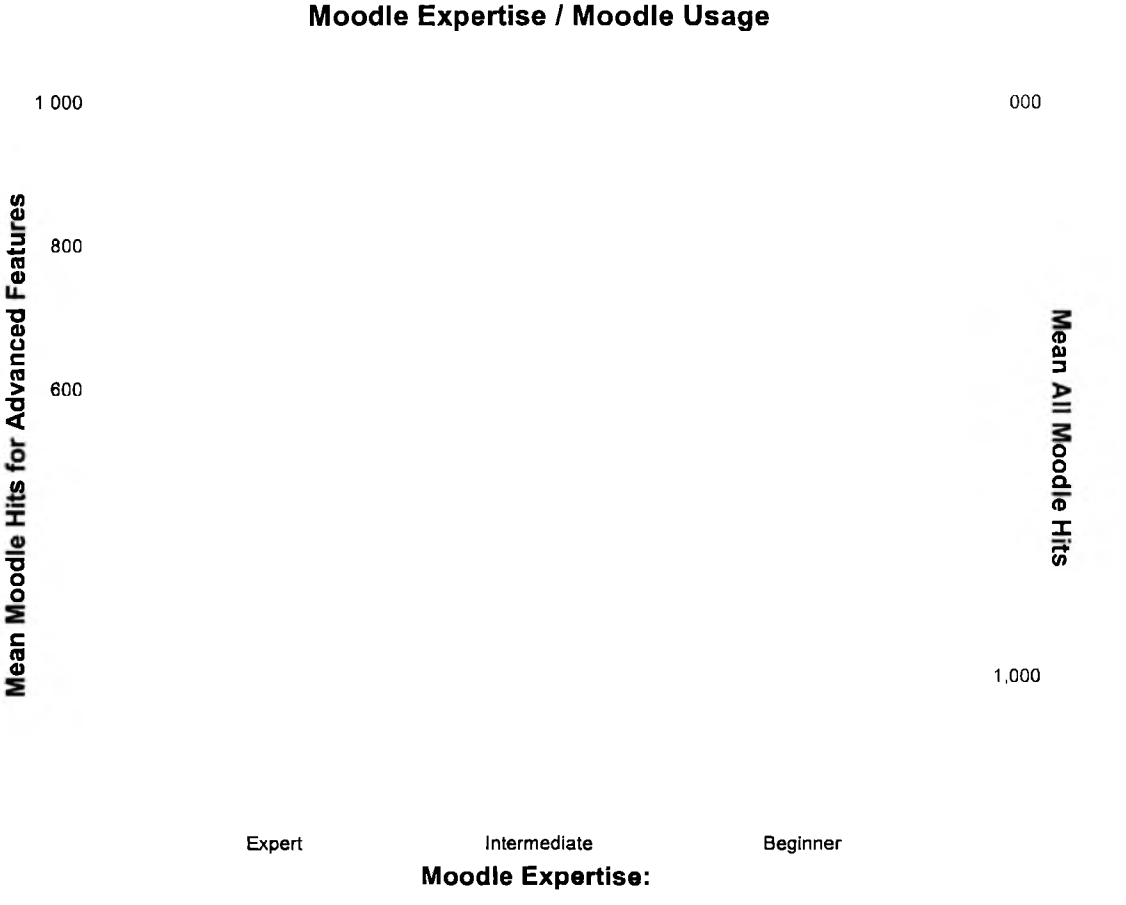
5.2 Moodle Expertise

Survey respondents who rated themselves as 'Expert' moodle users had a higher level of moodle hits for advanced and 'standard' moodle functions than those who rated themselves 'Intermediate' or 'Beginner' level.

The mean hit rate for advanced features for expert users is 870 and the expert user's mean hit rate for all moodle hits is 4,600. This contrasts with a hit rate for beginner and intermediate users of less than 50 for advanced moodle activities, and less than 100 for all

moodle funtions. Moodle expertise may be a factor of training, previous experience using online technology, previous experience using LMS and duration of experience (See graph F).

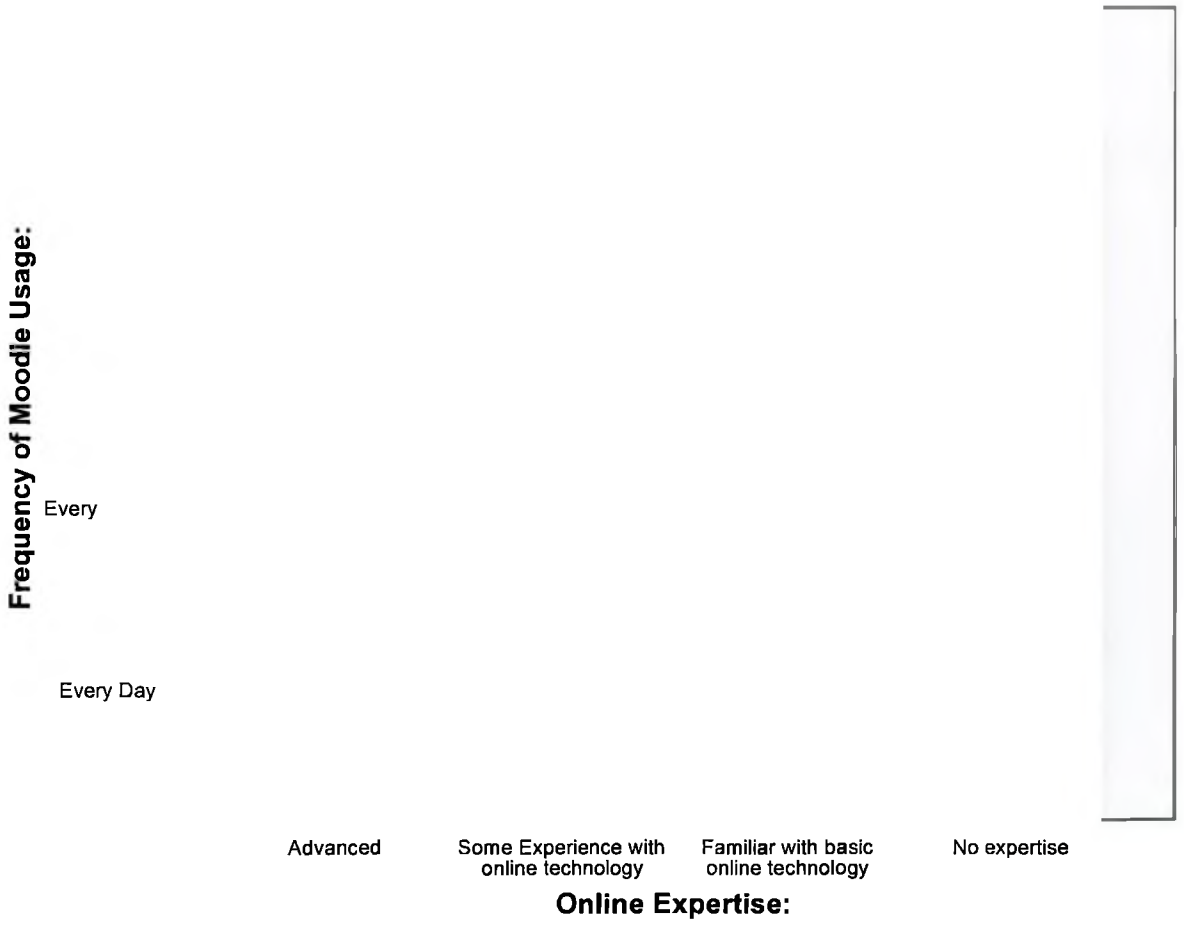
An analysis of variance test was completed to compare means for each group. In this case, it appears that self-reported moodle expertise level has a significant influence on moodle usage, $F(2, 16) = 16.54$, $p < .05$. In addition, self-reported moodle expertise level has a significant influence on usage of advanced moodle features, $F(2, 16) = 7.14$, $p < .05$, (See appendix 17).



Graph F: Moodle expertise / standard and advanced hit-rate

5.3 Online Expertise

Survey results were analysed to compare survey respondent's self-reported online expertise with the frequency of their moodle usage. 71% of users who reported an advanced level of online expertise use moodle every day, 29% use it every week and 0% do not use it, however 100% of survey respondents who have no online expertise also report that they do not use moodle. There is a positive correlation between self-reported online expertise and self-reported frequency of moodle usage, $r = .617$, $p < .01$, (see table 7).



Graph G: Survey respondent's online expertise / moodle usage (self-reported)

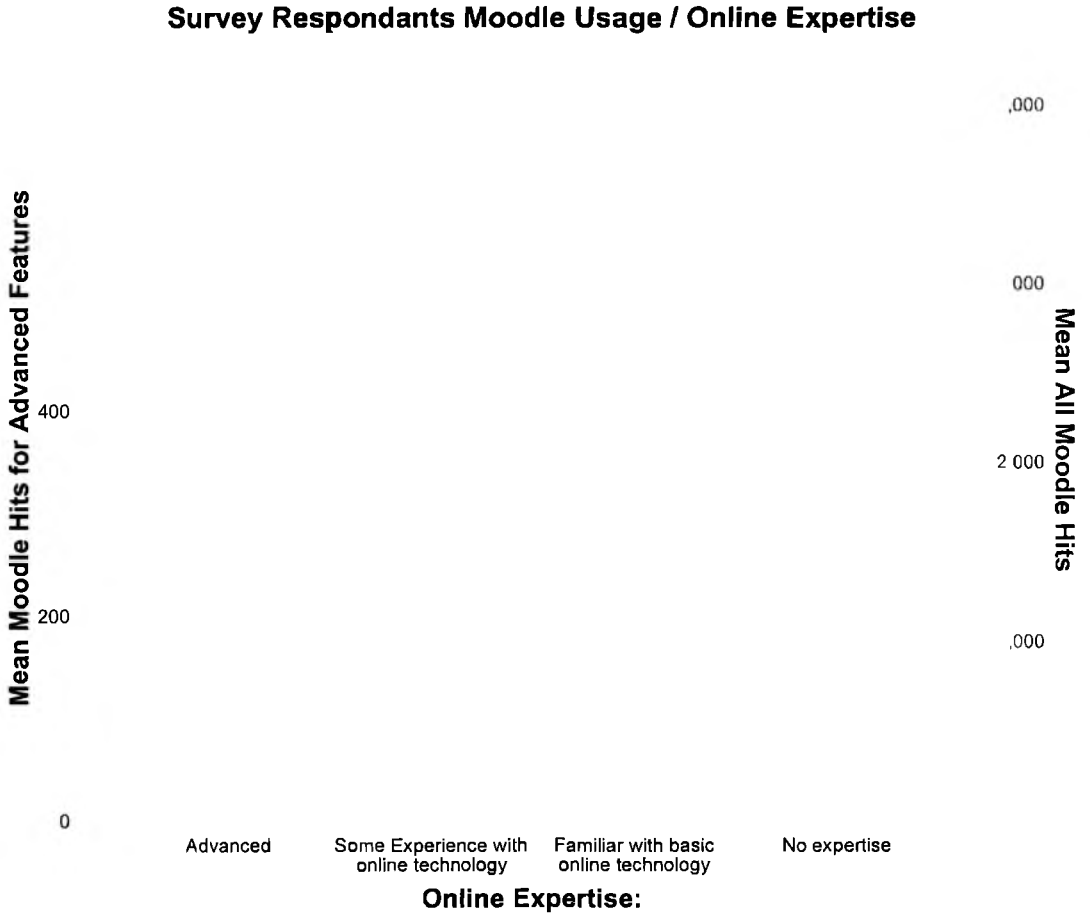
Table 7: Correlation between self F of use and online expertise level

			Moodle Usage:
Online Expertise	Pearson Correlation		**.617(**)**
	Sig. (2-tailed)		.005
	N	19	19
Frequency of Moodle Usage:	Pearson Correlation	**.617(**)**	1
	Sig. (2-tailed)	.005	
	N	19	20

** Correlation is sign at the 0.01 level (2-tailed).

The mean number of actual moodle hits for survey respondents who claimed to be advanced in online technical expertise is over 3,767, this contrasts with mean moodle hits of under 100 for respondents who reported no online expertise. (See appendix 73)

Mean hit count for 'advanced' moodle features was measured against self-reported online expertise for survey respondents. It is found that respondents who rate themselves as 'Advanced' level online technology users have a considerably higher mean hit-count for moodle's advanced features, almost 700, compared to less than ten for respondents with no online expertise. (See graph H)



Graph H: Survey respondent's online expertise / mean moodle advanced usage / mean moodle usage

There is a correlation between online expertise level and amount of moodle hits, $r = .648$, $p < .01$.

The correlation between online expertise level and advanced moodle usage is not apparent from table 8 as advanced moodle hits are made almost exclusively by users with advanced online expertise (See graph H).

Table 8: Correlation between online expertise, moodle hits and advanced moodle for

		Online Expertise:	Moodle Hits	Advanced Usage
Online Expertise:	Pearson Correlation	1	**-.648(**)**	**-.445**
	Sig. (2-tailed)		.004	.064
		19		
		-.648(**)		
		.004		
		18	19	
		-.445	**685(**)**	
		.064	.001	
		18	19	19

** Correlation is significant at the 0.01 level (2-tailed).

A test of variance of means was used to compare means based on online expertise groupings (See table 9). It is found that online expertise has a significant influence on moodle hit quantity for survey respondents, $F\ (3, 14) = 6.167$, $p < .05$.

We could not conclusively prove that online expertise has a significant influence on advanced moodle usage for survey respondents, $F\ (3, 14) = 1.85$, $p > .05$.

Table 9: ANOVA – Online users / Moodle Hits / Moodle Advanced U

		Sum of Squares	df	Mean Square	F	Sig
Moodle Hits	Between Groups	32377361.171	3	10792453.724	6.167	.007
	Within Groups	24498581.107	14	1749898.651		
	Total	56875942.278	17			
Advanced Usage	Between Groups	1900863.849	3	633621.283	1.849	185
	Within Groups	4797426.429	14	342673.316		
	Total	6698290.278	17			

There is a positive correlation, $r = .685$, $p < .01$, between all moodle usage and moodle usage for advanced features for survey respondents, ie. Those who heavily use advanced moodle features also use other features of moodle heavily, whereas those who do not use moodle heavily do not use advanced features heavily either. (See table 10).

Table 10: Correlation between survey respondents moodle usage and advanced moodle usage

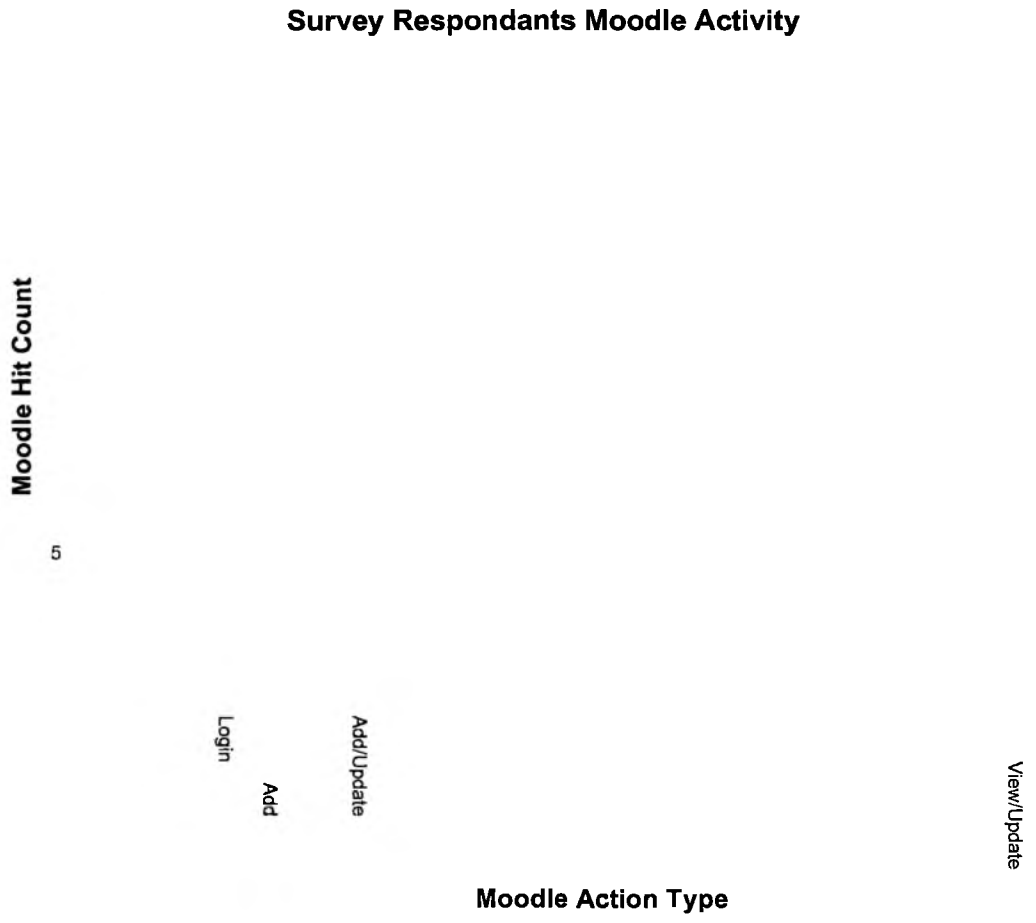
		Moodle Hits	Advanced Usage Hits
Moodle Hits	Pearson Correlation	1	**.685(**)**
	Sig. (2-tailed)		.001
	N	19	19
Advanced Usage Hits	Pearson Correlation	**.685(**)**	1
	Sig. (2-tailed)	.001	
	N	19	19

Correlation is significant at the 0.01 level (2-tailed).

5.4. Moodle Activities

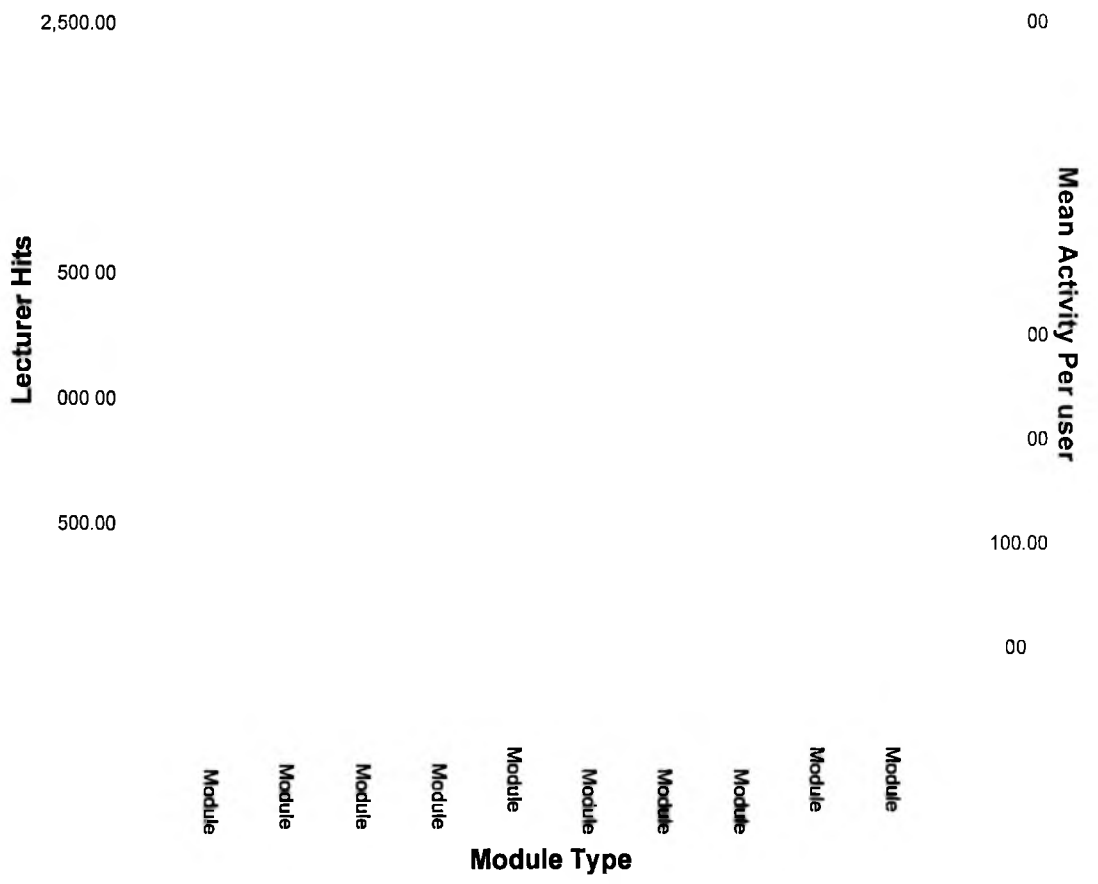
The most widely used moodle function by survey respondents is the View function (See graph I) – this pattern is also reflected by the wider NCI faculty group. The hit count for views is almost 20,000. The second most widely used function is the Add/Update function, followed by upload, course add and login. The 'advanced' and collaborative features are proportionally less frequently used, although the assignments activity has over 2,000 hits. In total there are 33,669 hits for 'less advanced' moodle functionality such as views and posts, (87% of the total hit-count), and there are 5,232 hits for 'advanced' moodle functions such as online quizzes, wikis and assessments, (13% of the total hit-count). This illustrates that moodle's power as an instructional tool is not being fully harnessed by all lecturers in NCI. (See appendix 15). Of the 19 respondents whose moodle use was analysed, 10% have an average advanced feature hit-count of over one

thousand, whereas 84% have an average advanced feature hit-count of less than 100 (see appendix 16). This illustrates that only a small proportion of lecturers use a large proportion of moodle's advanced features.



Graph I: Moodle hits per function for survey respondents

There appears to be a strong correlation between moodle activity by lecturer and hits by user when the top ten weighted moodle usage modules in the NCI are analysed, ($r = .793$, $p < .01$). As the lecturer's activity increases on these modules, so too does the students' activity. (See graph J and table 11). Unfortunately, activity per user is not readily available for other modules.



Graph J: Top ten weighted courses lecturer hits v activity per user

Table 11: Top ten weighted courses Correlation between lecturer hits & activity per user

		1	.
	Sig. (2-tailed)		.006
	N	10	10
Activity Per user	Pearson Correlation	**.793(**)**	1
	Sig. (2-tailed)	.006	
	N	10	10

Descriptive Statistics

	Mean		N
All Lecturer Hits	769.2000	600.24140	10
Activity Per user	260.2860	116.37142	10

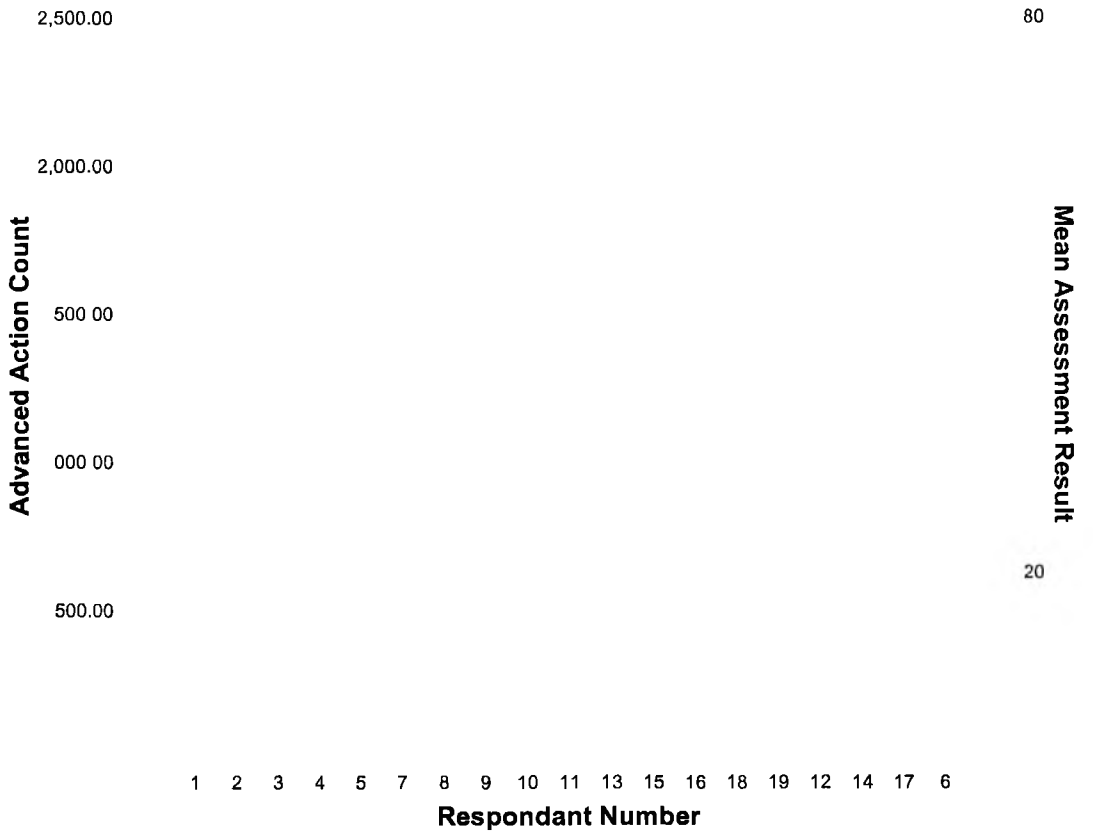
5.5 Moodle Advanced Functions

Advanced usage actions for the purposes of this dissertation are classified as follows: Assignment, reporting, forum, blog, chat, quiz, forum, scorm, wiki, podcast, choice, survey, question, SCORM/AICC, lesson and/or workshop. Advanced usage hit-count was calculated by counting the number of hits per advanced functions per lecturer.

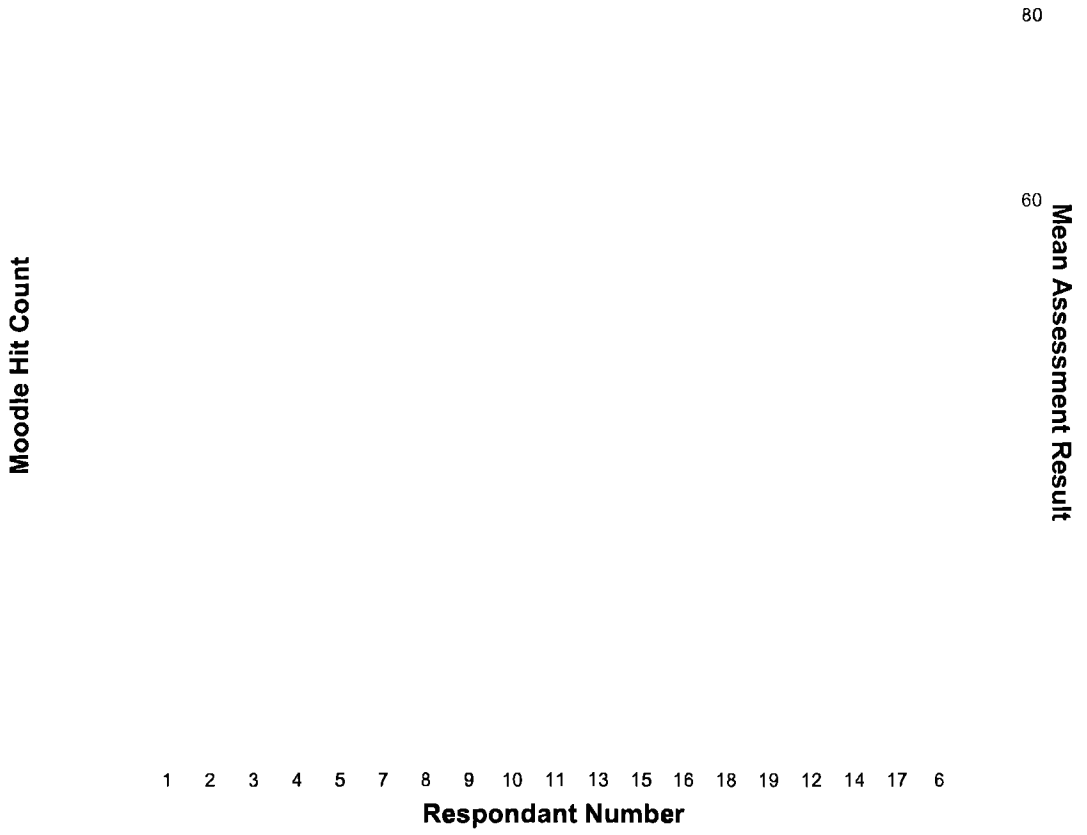
Of all 406 modules used in moodle:

11 modules use survey	2.7%
1 module uses workshop	0.24%
23 modules use scorm	5.66%
110 modules use question	27.09%
15 modules use quiz	3.69%
3 modules use podcast	0.73%
0 modules use lesson	0%
10 modules use hotpotatoes quiz	2.46%
198 modules use forum	48.76%
18 modules use chat	4.43%

There appears to be no direct correlation between survey respondents' advanced moodle function hit-count and their students' mean exam results – various other factors such as student ability, subject matter, variation between classes, classroom teaching technique, grading scheme and level of exam have an influence on overall module results (See graph K). There is also no direct correlation between survey respondent's mean moodule hit-count and their students' mean exam results (See graph L). The factors listed above may be influential.



Graph K: Survey respondents' students' mean average module result / advanced moodle usage hit count (per survey respondent)



Graph L: Survey respondents' students' mean average module result / moodle usage hit count (per respondent)

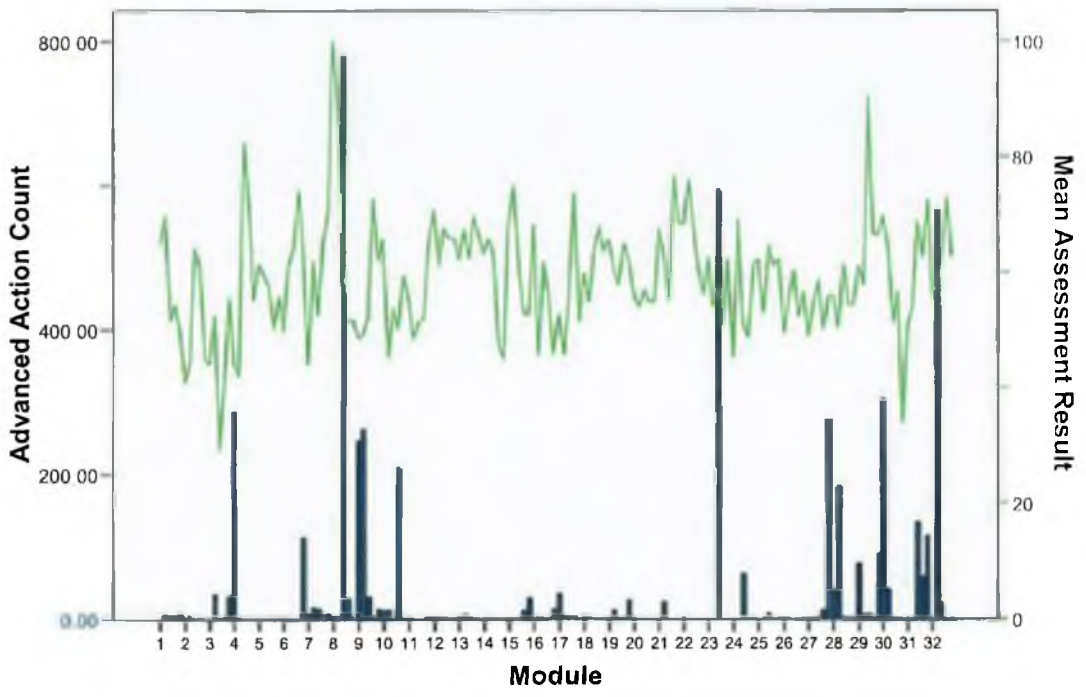
There is no *significant* correlation between the count of advanced actions in moodle per module and the average result received per module. ($r = .019$, $p < .01$), (See table 12)

Table 12. Correlation between moodle advanced action count per module and average result per module

			Advanced Action Count
Avg_Result	Pearson Correlation		-.019(**)
	Sig. (2-tailed)		.000
	Sum of Squares and Cross-products	2478049.836	-1928.714
	Covariance	70.773	-.055
	N	35015	35015
Advanced Action Count	Pearson Correlation	-.019(**)	1
	Sig. (2-tailed)	.000	
	Sum of Squares and Cross-products	-1928.714	4422.522
	Covariance	-.055	.114
	N	35015	38901

** Correlation is significant at the 0.01 level (2-tailed).

There appears to be no direct correlation between the average assessment results for the modules which survey respondents teach and their moodle advanced action count (See graph M). This may be related to the other influential factors listed above.



Graph M: Moodle advanced action hit-count and mean result / course code for modules which survey respondents lecture

Nineteen of the survey respondents teach a total of 160 modules. Advanced action types are used on 79 of those modules (49.3%). The average module result for all modules which survey respondents teach is 57.5. The average module result for modules whose lecturers use advanced action types is 57.52 – this is not a significant difference.

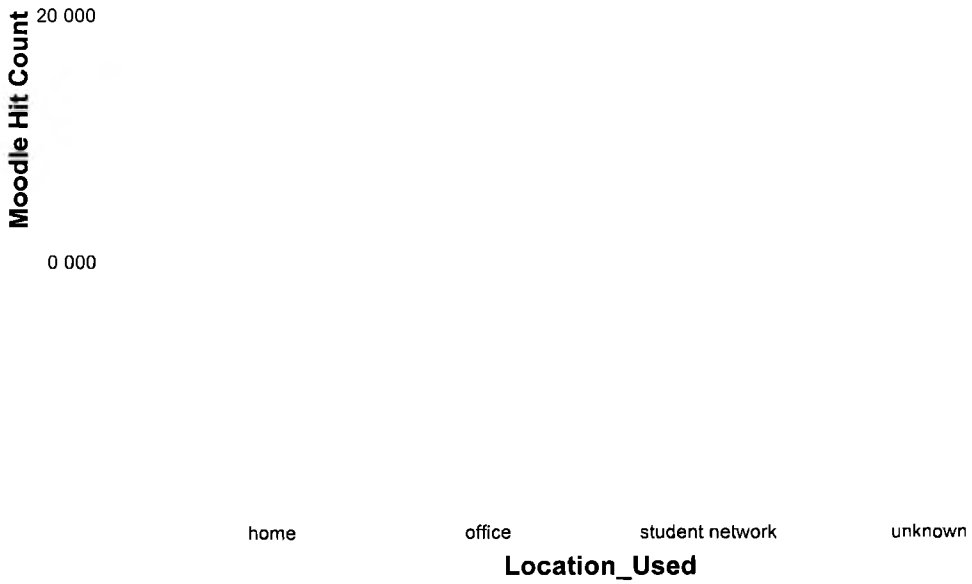
5.6 Location

Although it was not a question in the survey, respondents' moodle hit count was measured against their location for each function used (NCI IP addresses were classified as office or student network, whereas external ISP addresses were classed as 'home'). It

is found that the most popular location for moodle activity for survey respondents is 'Office' (See graph N and table 13).

This was then compared to the most popular location for usage for lecturers of the highest usage courses in the NCI (See graph O and table 14). These lecturers engage in more moodle activity from home than from the workplace.

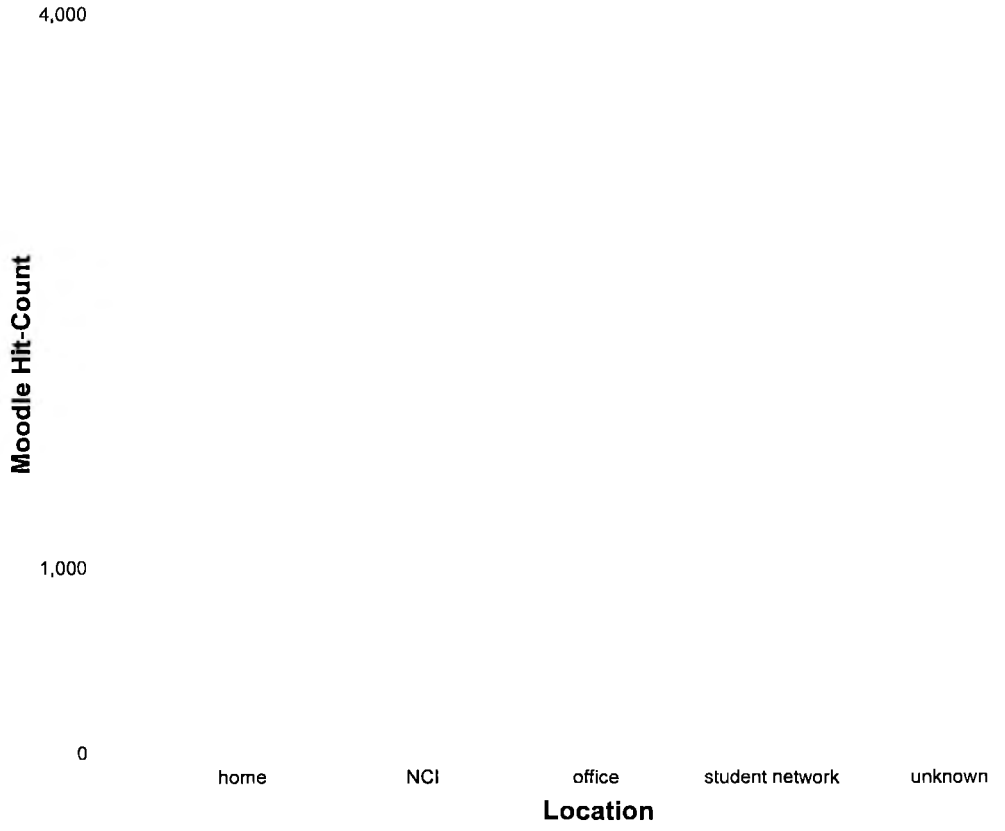
This finding may be a reflection of the nature of usage for different groups, lecturers who are more familiar with online technology may be comfortable using it from home as it is integrated into their personal life, whereas lecturers who do not use online resources as frequently may not have access to a home PC or laptop, or may be more comfortable using online technology in their place of work.



Graph: N Location of moodle usage for survey respondents

Table 13: Location of moodle use for s respondents

Location	Frequency	Percent
home	5106	13.1
office	28618	73.6
student network	5070	13.0
unknown	107	.3
Total	38901	100.0



Graph O: Location of moodle usage for lecturers of the ten moodle modules with heaviest weighted usage.

Table 14: Location usage statistics for top ten (weighted) courses

Location	Frequency	Percent
Home	3915	50.9
NCI	715	9.3
Office	2851	37.1
student network	127	1.7
unknown	84	1.1
Total	7692	100.0

5.7 NCI moodle statistics

Broad-spectrum moodle statistics for all NCI lecturers were also analysed. 51% of courses have files attached and 49% of courses do not have files attached. 71% of courses have a lecturer assigned 29% have no lecturer assigned. There are a total of 924 modules assigned to lecturers. There are 212 lecturers listed in Moodle – 129 actually use the system so at least 34 do not use it. There are a total of 1,443 modules setup on moodle.

Out of 1,443 modules hosted on Moodle there are currently only 406 which contain data.

There are 2245 users, 238 of whom have never logged in- so a lot of students may be logging in to find no notes there for them. (NCI Moodle LMS, 2008).

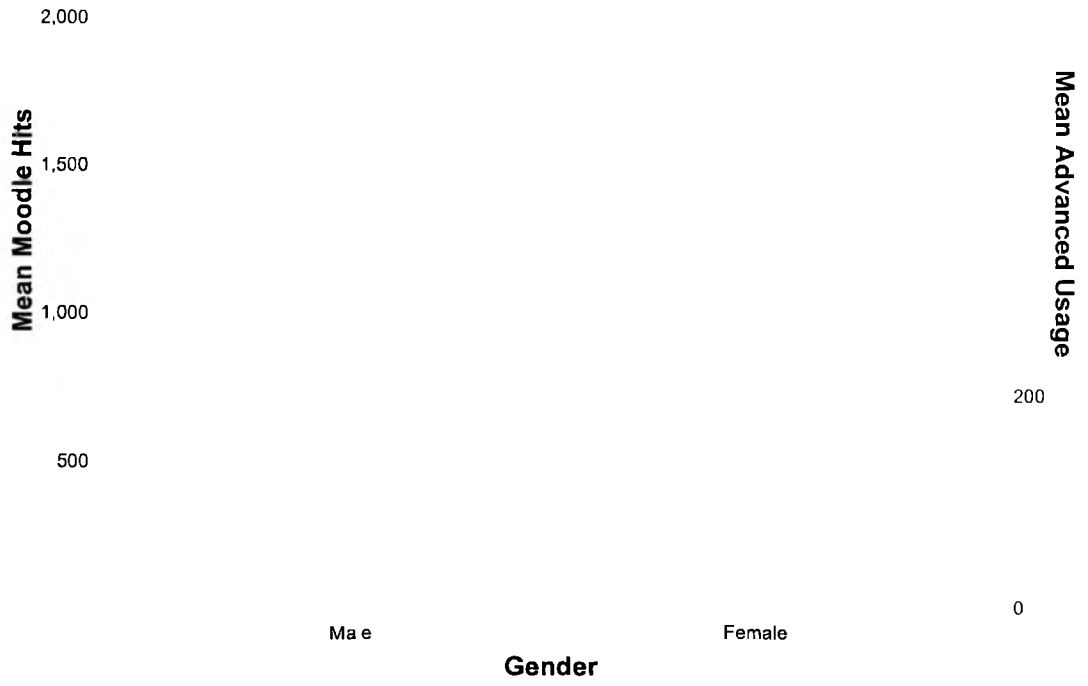
The average number of hits by NCI lecturers who actively use moodle totals 213.05 (for the current academic session). There is a standard deviation from the mean of 251. This indicates that the quantity of hits for each lecturer varies significantly. (See table 15)

Table 15: Hits and Adds Per NCI Lecturer (20 lecturers of a total of 285 modules)

	N	Minimum	Maximum	Mean	Std. Deviation
Hits by Lecturer	285		2137	213.05	251.276

5.8 Gender

The survey respondant's gender appears to have a significant influence on the nature and frequency of their moodle usage. Within this group, there is a higher occurrence of moodle hits and advanced moodle usage for males than for females. (See graph P).



Graph P: Moodle usage per gender for survey respondents

A t-test was conducted to test for equality of means (See table 16). The width of the confidence interval gives us some idea about how uncertain we are about the difference in the means. The very wide interval may indicate that more data should be collected before anything definite can be said.

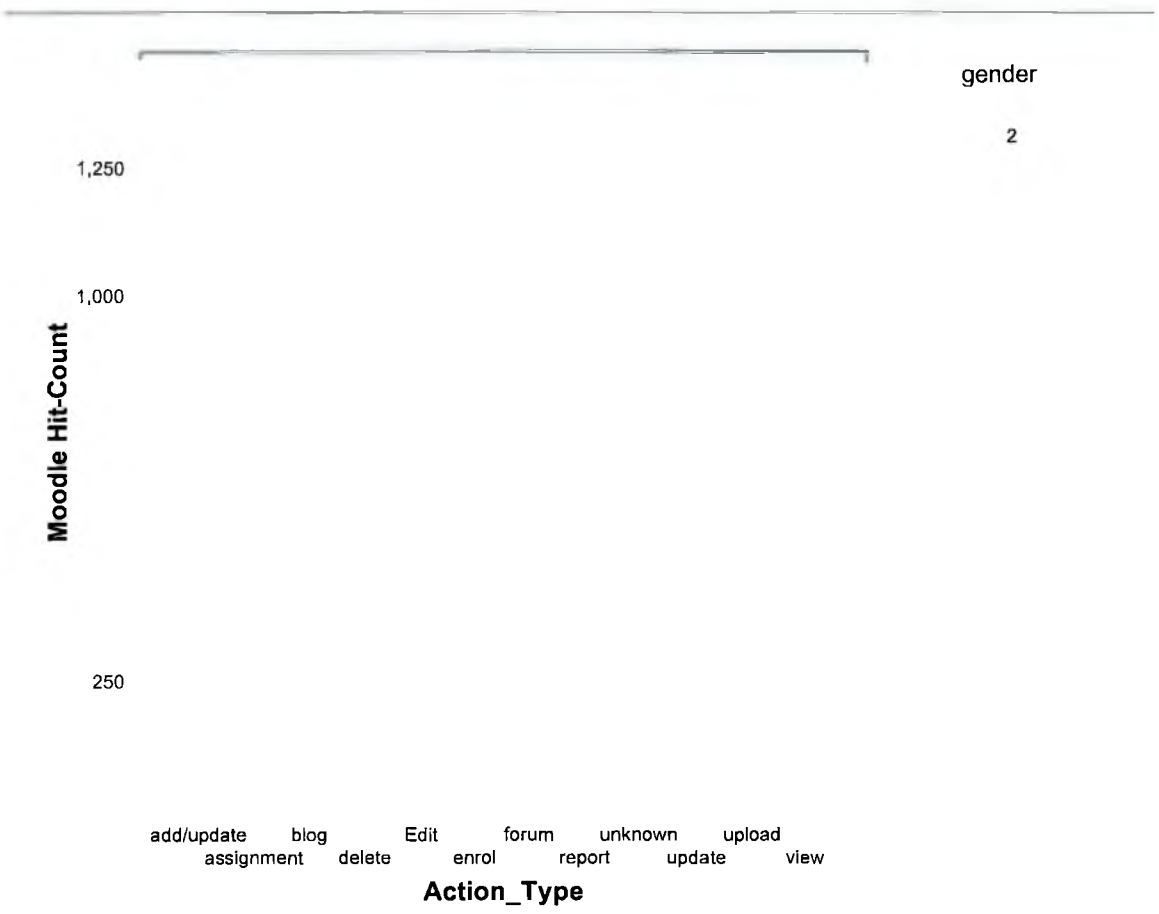
In the first table, (moodle hits), we have not violated the homogeneity assumption, therefore equal variances are assumed. Our data show that gender does not have a significant effect on moodle hit-count, **$t(17) = .872, p > .05$.**

In the second table, (Advanced usage), the assumption of homogeneity of variance has been violated, thus equal variances are not assumed. Our data show that gender does not have a significant effect on moodle advanced hit-count, **t(7.016) = 1.943, p > .05**.

	Gender	N		
Moodle Hits	Male	8	2495.75	2417.602
	Female	11	1766.18	1190.232
	Male	8	608.00	855.158
	Female	11	20.36	33.738

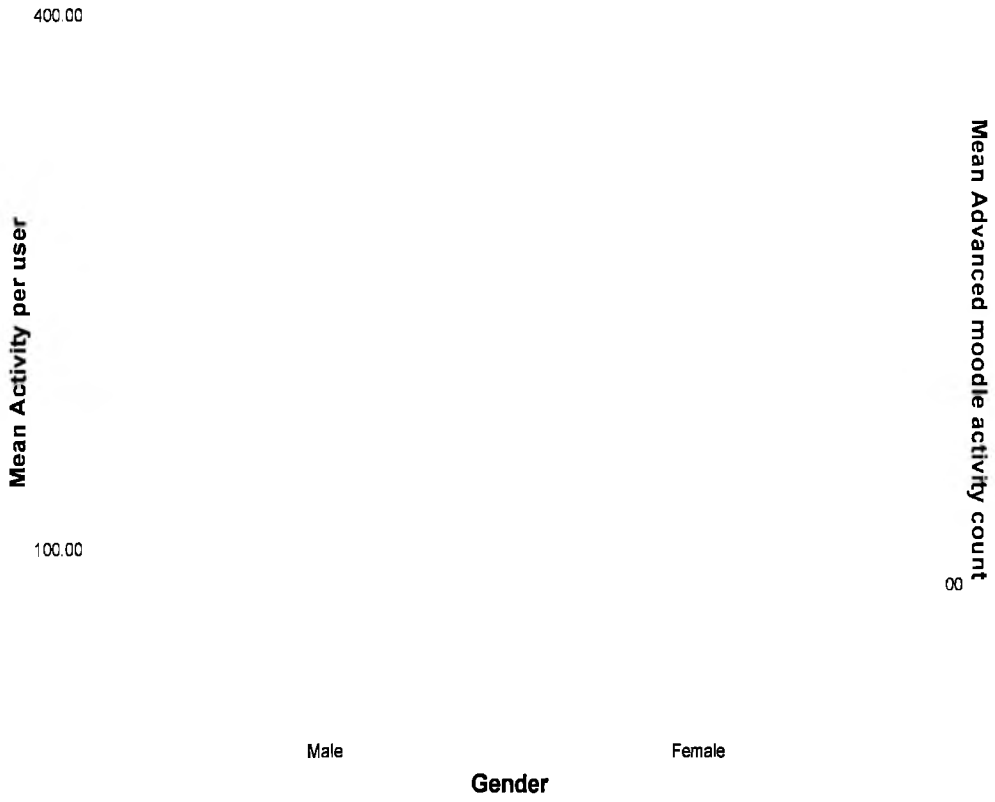
		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
			Sig	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Differenc		Lower
	Equal variances assumed	4.19		0.87	17		729.568	836.389	-1035	2494.2
	Equal variances not assumed			0.79	9.48	0.451	729.568	927.031		2810.61
Advanced Usage	Equal variances assumed	27.44	0	2.3	17		587.636	255.263	49.078	1126.2
	Equal variances not assumed			1.94	7.02	0.093	587.636	302.515	-127.4	1302.64

This trend is not reflected in the top ten most active (unweighted) NCI modules however. These courses exhibit a higher occurrence of moodle hits for females than for males (See graph Q).



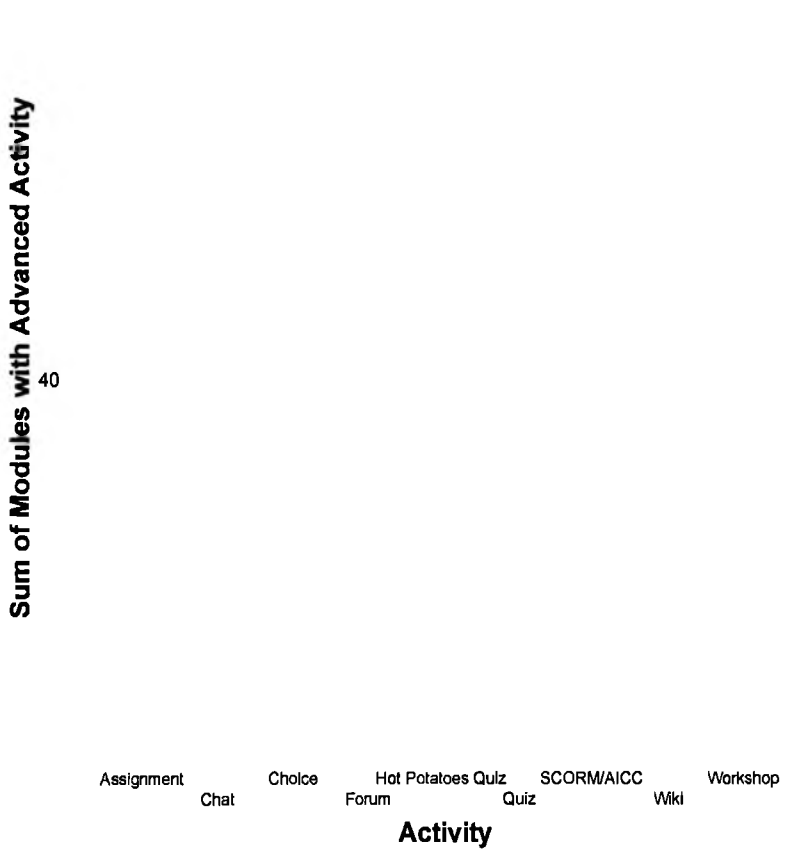
Graph Q:Top ten course lecturers actions by gender (1=male, 2=female)

When NCI's top ten weighted modules are examined, using the moodle Course Reporting tool, it is can be seen that eight of those modules are taught by males, and two by females. However, although there are only two out of ten females lecturing on ten most heavily weighted moodle modules in the NCI, there is a higher mean activity per user on the modules taught by females than on the modules taught by males. (See graph R)



Graph R: Moodle activity per gender on NCI's top ten weighted moodle modules

Also, there is a higher occurance of modules with activities for male lecturers than for female lecturers. (See graph S and table 17).



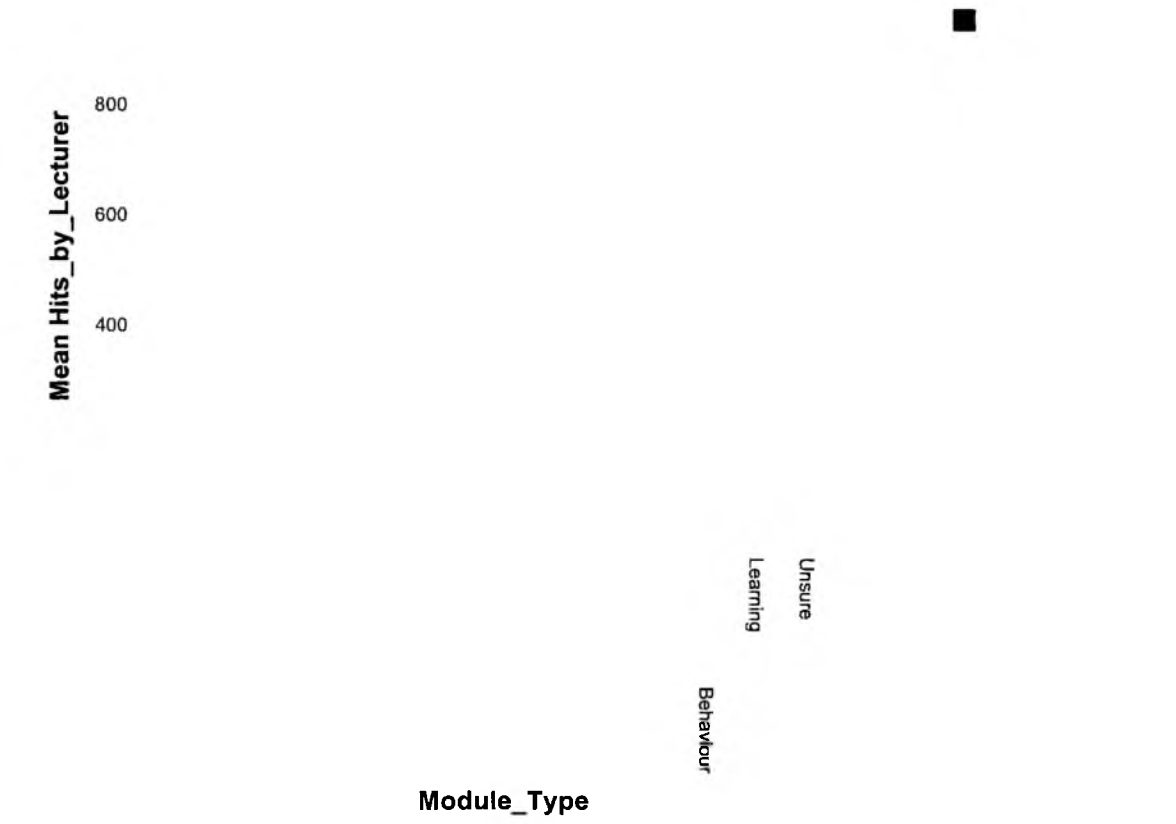
Graph S: Number of modules with advanced moodle activity/ by gender

Table 17: Moodle M which contain activities

Gender		Frequency	Percent
Unknown		5	5.3
	Assignment	7	7.4
	Chat	15	16.0
	Choice	9	9.6
	Forum	29	30.9
	Glossary	1	1.1
	Hot Potatoes Quiz	3	3.2
	Journal	1	1.1
	Podcast	3	3.2
	Quiz	5	5.3

	SCORM/AICC		5.3
	Survey		5.3
	Wiki		6.4
	Total		100.0
Male	Assignment	56	33.1
	Chat	25	14.8
	Choice	1	.6
	Forum	75	44.4
	Hot Potatoes Quiz	2	1.2
	Quiz	5	3.0
	SCORM/AICC	2	1.2
	Wiki	2	1.2
	Workshop	1	.6
	Total	169	100.0
Female	Assignment	9	17.6
	Chat	5	9.8
	Forum	37	72.5
	Total	51	100.0

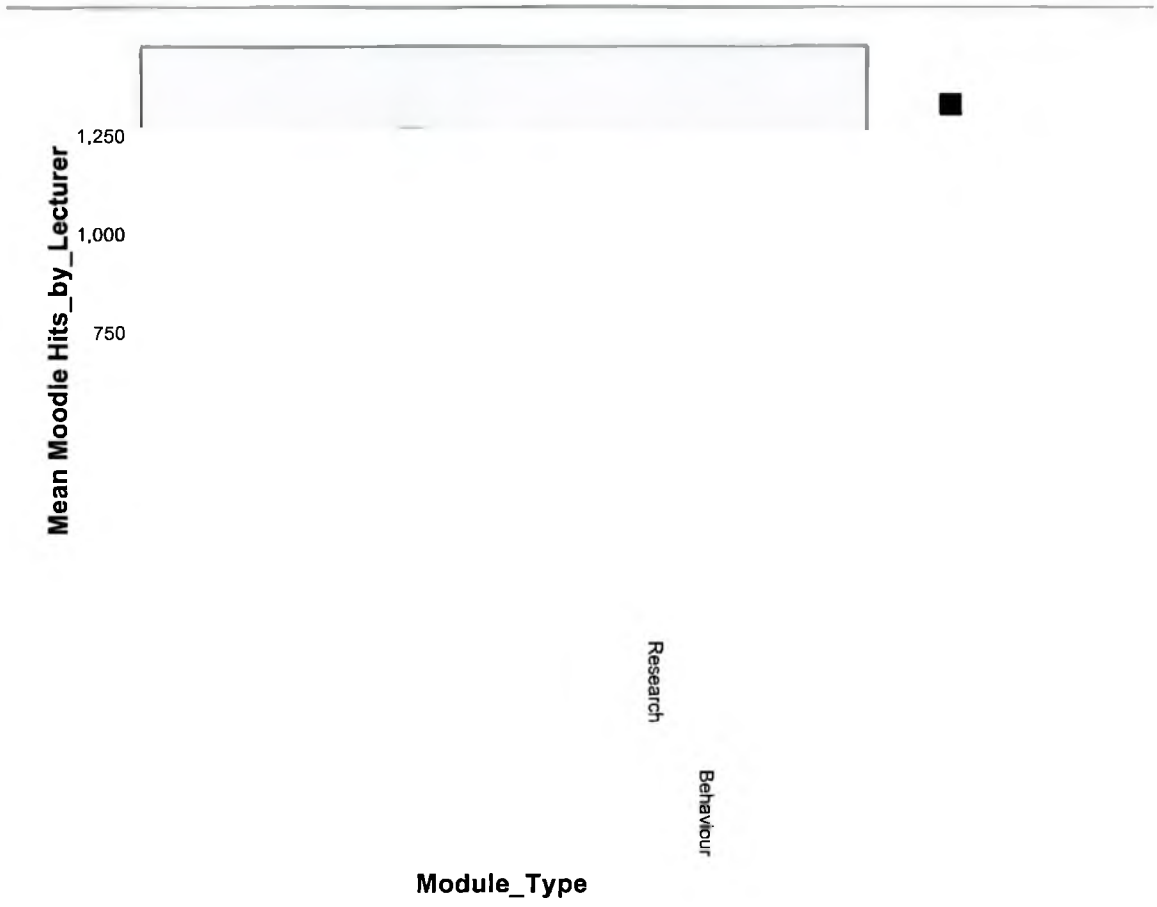
At an overview level, female lecturers have a higher hit-rate than male lecturers, however, the subject type also influences the number of moodle hits, with a higher number of hits for subjects such as e-learning, statistics and technology. (See graph T)



Graph T. Moodle hits per module type and lecturer gender

5.9 Employment Type

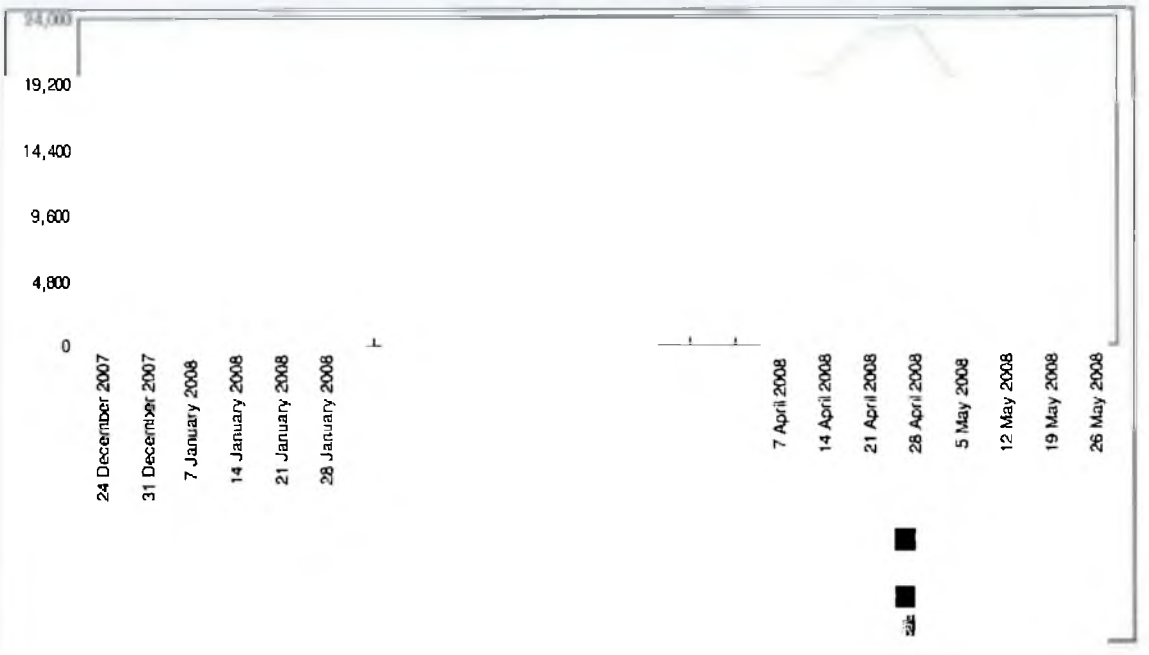
There is a higher average number of moodle hits per member of associate faculty (part-time lecturers) than per member of full time faculty. (Graph U). Again, lecturers of modules concerned with statistics and e-learning have the highest hit-count.



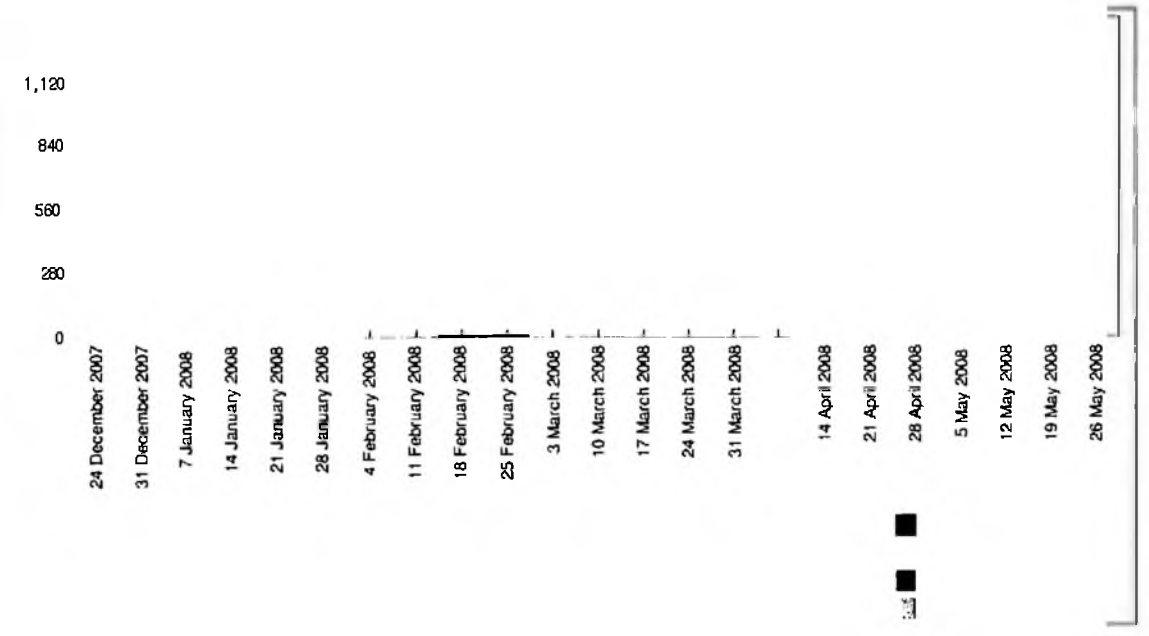
Graph U: Moodle hits per employment type

5.10 Moodle Usage by Lecturers and Students

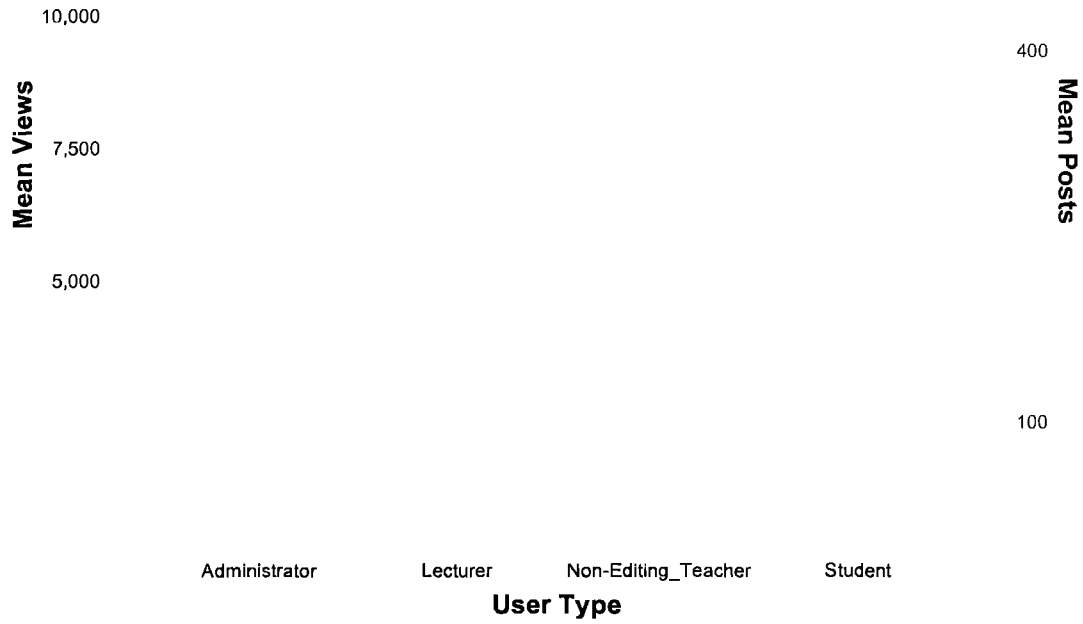
The ratio of posts to views is significantly higher for members of staff than for students. (Graph V, W and X) This evidence, collected directly from the Statistics GUI in moodle, supports the theory that moodle is commonly a reflection on face-to-face class activity. In general, lecturers post and students view data. This reflects the objectivist theory that learners are 'vessels' waiting to be 'filled' with knowledge.



Graph V: Moodle Views (D

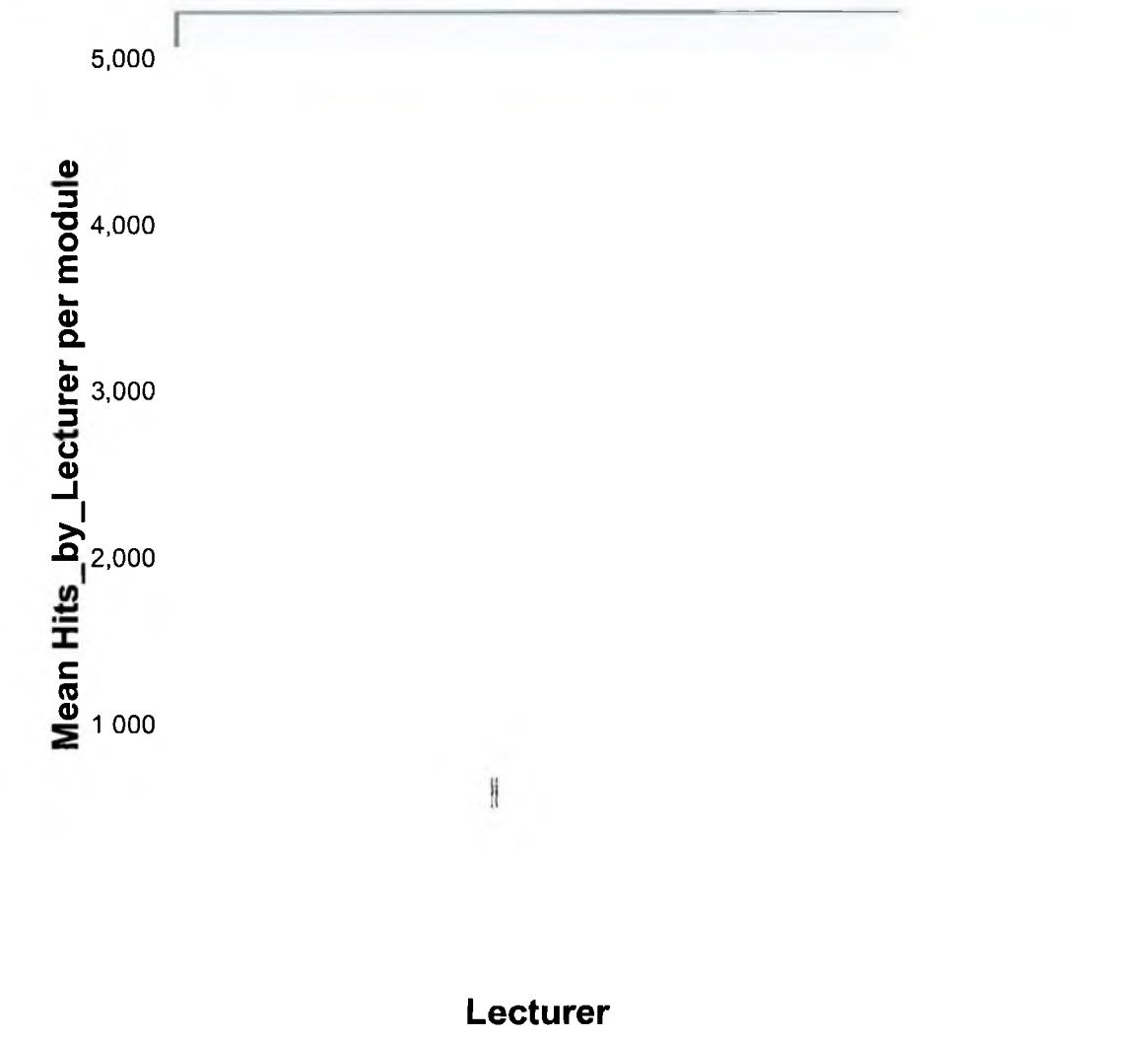


Graph W: Moodle Posts (Dec 2007-May 2008)



Graph X: Moodle views and posts per user type.

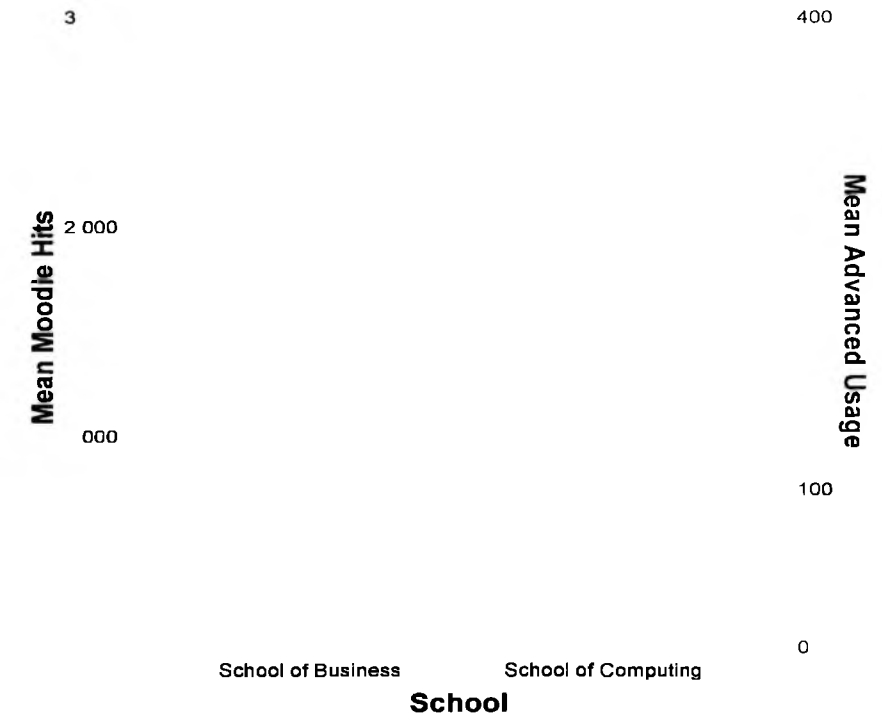
In graph Y, each lecturer is represented by a bar, and each of that lecturer's modules is represented by a colour. Individual lecturer's hit rates vary greatly depending on the different modules they lecture on. This indicates that lecturers may tailor their moodle usage to suit individual class requirements on a module by module basis



Graph Y: Hits by lecturer by colour coded module type (module names and lecturer identities have been removed for confidentiality purposes)

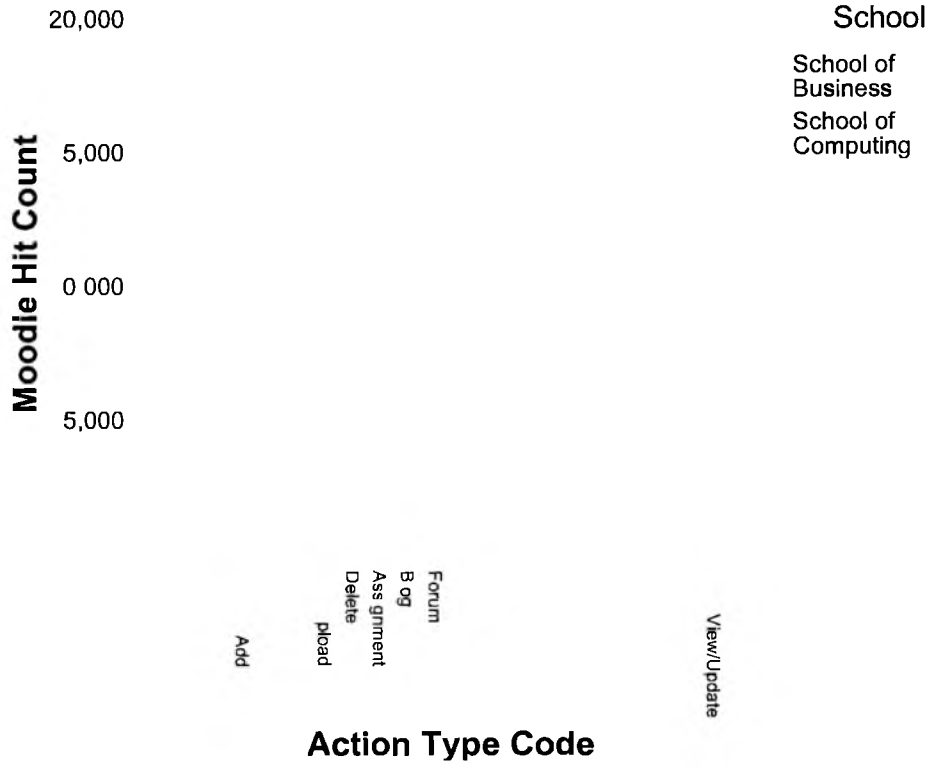
5.11 Membership of School

Amongst survey respondents, members of the school of computing have higher mean moodle hit rate and higher mean advanced usage rate than members of the school of business and humanities. (see graph Z).



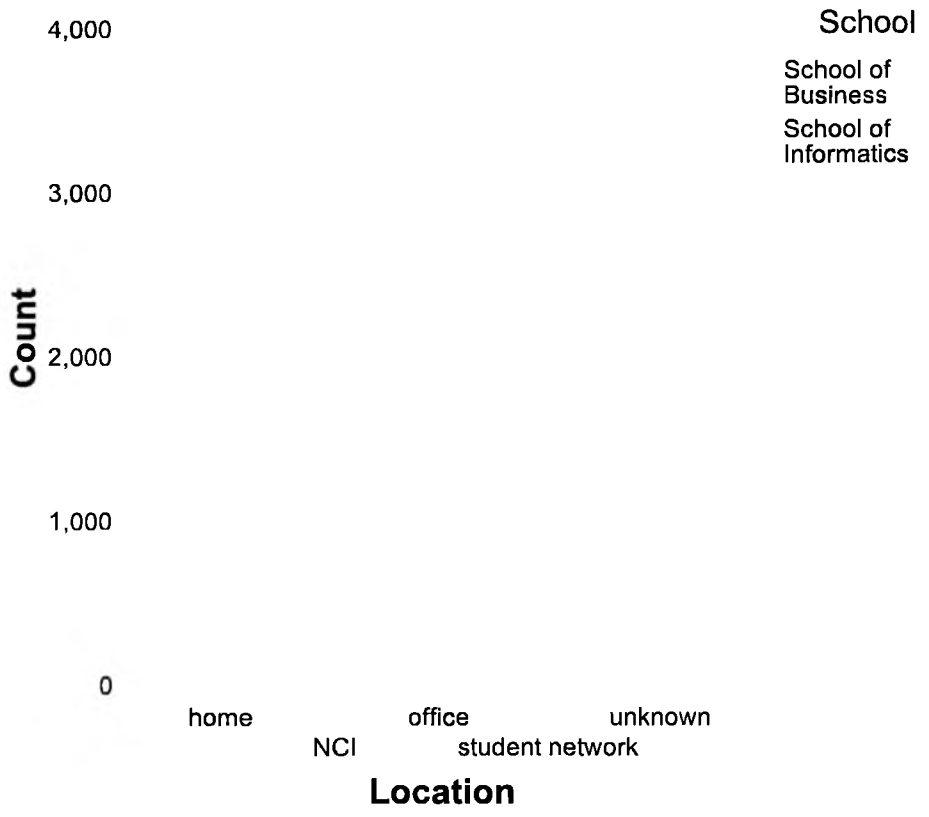
Graph Z: Membership of School and Moodle Activity

For survey respondents, members of the school of computing have a higher moodle hit count for all activities except the forum (see graph Ai).



Graph Ai: Hit count per school/action type

For the top ten weighted moodle modules, lecturers from the school of computing have a higher hit count than lecturers from the school of business. Computing lecturers also use the system more frequently from home, whereas members of the school of business and humanities use the system more frequently from their NCI office (see graph Bi).



Graph Bi: Moodle hit count, school membership and location of use

As chart Ci shows, 74% of all modules which contain advanced activities are taught by faculty members from the school of Computing.

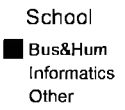


Chart Ci: Percentage of modules which contain advanced activities per School Membership of lecturer

5.12 Advanced Moodle Activity and Exam Results Statistics

It is found that students on courses which use moodle collaborative activities and/or use advanced moodle features have a higher mean assessment mark than the overall average of 57.45 (for 2007), (See tables 18-23). However, this only applies for courses that use advanced moodle features and activities. The mean assessment mark for the ten most active (non-weighted) moodle courses is actually marginally lower than the overall mean module result for 2007, this may imply that modules in which moodle's constructivist tools are fully embraced score more highly than other modules, (although other factors may also influence this result).

Tables 18 – 23: Mean module results related to moodle activity

	N	Minimum	Maximum		Std. Deviation
Avg_Module_Result	675	0	100.0	57.454	14.4674

Statistics - All NCI 2007 Module Results (Average)

N

66.97

2007

N	Minimum	Max mum		
	42.00	100.00		8.36668
	5.00	37.50	27.2235	7.88847
	46.32	100.00	62.9976	6.41654
	5.50	38.00	28.1394	6.55170

Descriptive Statistics - Courses which use Moodle 'Collaborative' Activities

	N	Minimum	Maximum	Mean	Std. Deviation
Avg Result	10	46		62.38	8.082

cs - le Results for Most Active Moodle Courses (Weighted)

	N	Minimum	Maximum	Mean	Std. Deviation
Avg Module Result	10		68.00	61.3110	4.15011

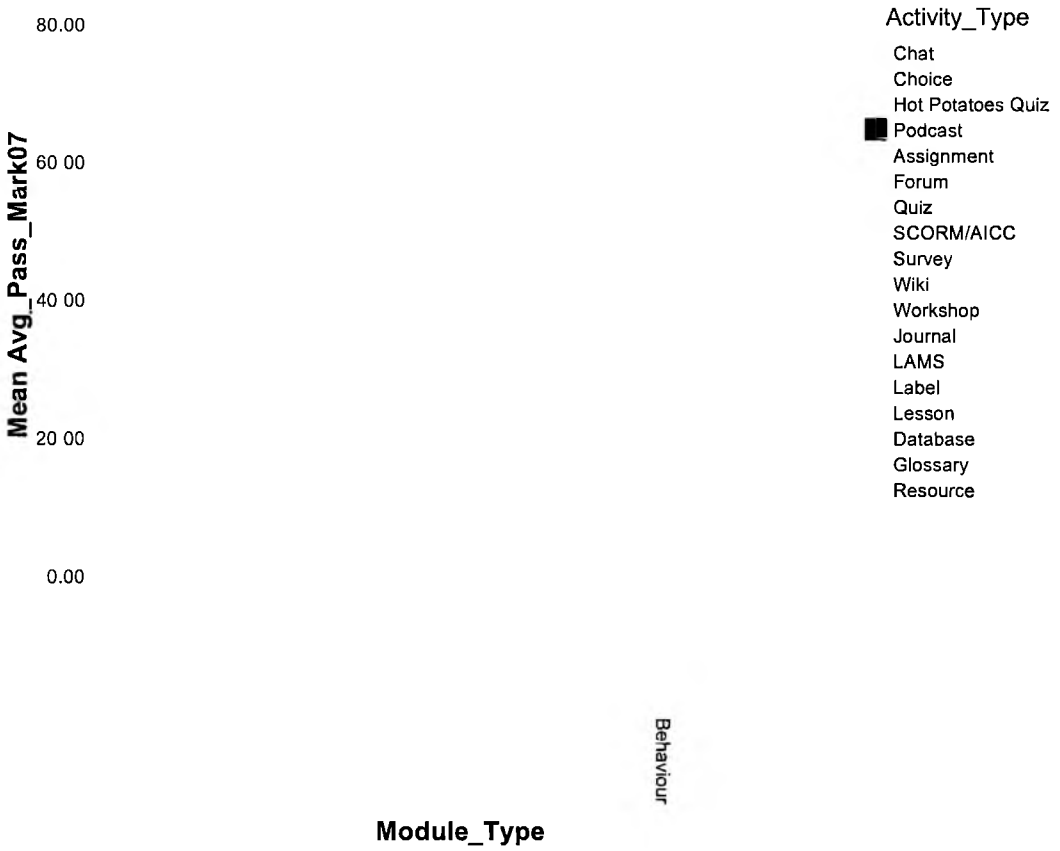
cs - le Results for top ten most participatory Moodle Courses (Views & Posts)

	N	Minimum	Maximum	Mean	Std. Deviation
Avg Module Result	11	58	87	66.66	8.020

Descriptive Statistics - Module Results for Most Participatory M Courses

ies

Modules with subjects of e-learning and technology use the widest range of advanced activity types. Modules with a subject type of e-learning also has the overall highest average assessment mark, (however this may be related to other factors).

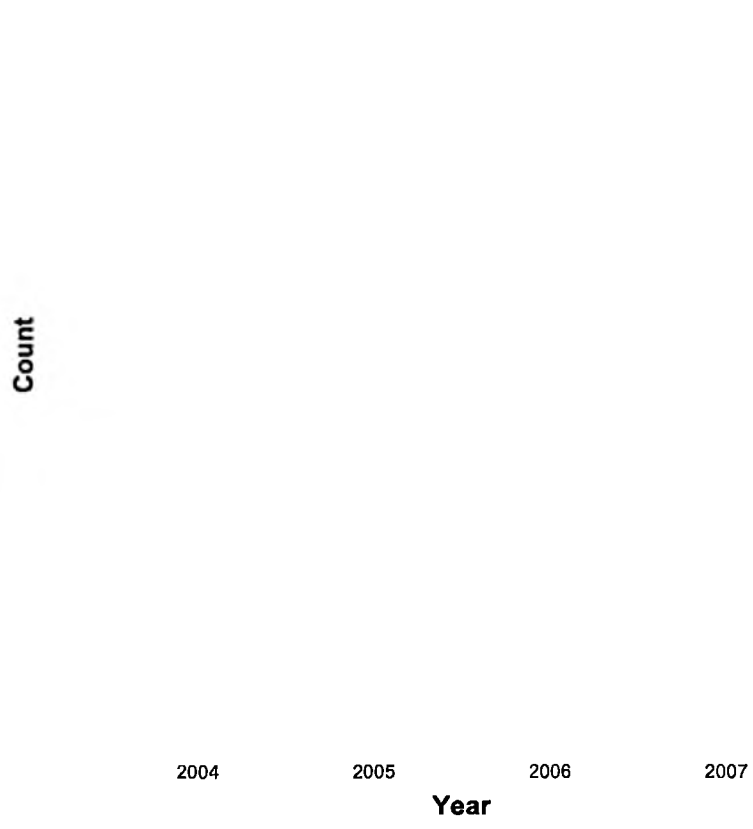


Graph Ci: Mean pass mark for module subject type grouped by Moodle activity type.

5.13 Exam Results

Moodle was introduced to the NCI in 2005, the overall pass count for students over the years since its introduction has not increased (See graph Di and Ei). At a high level, there appears to be no direct correlation between the presence of an LMS and overall pass/fail

rate, in addition, the average assessment result per module has not increased correspondingly. (See tables 24-27). However, moodle is designed to be a constructionist learning tool to enhance deeper understanding and as such, traditional summative exam results may not necessarily reflect its true purpose.



Graph Di: Quantity of Pass and fails per academic year

Tables 24-27: Exam averages per year

2004 Ave Result Module

	N	Minimum	Maximum	Mean	Std. Deviation
Average Module Result	441	.00	154.66	52.4359	17.02044
Valid N (listwise)	441				

2005 Module

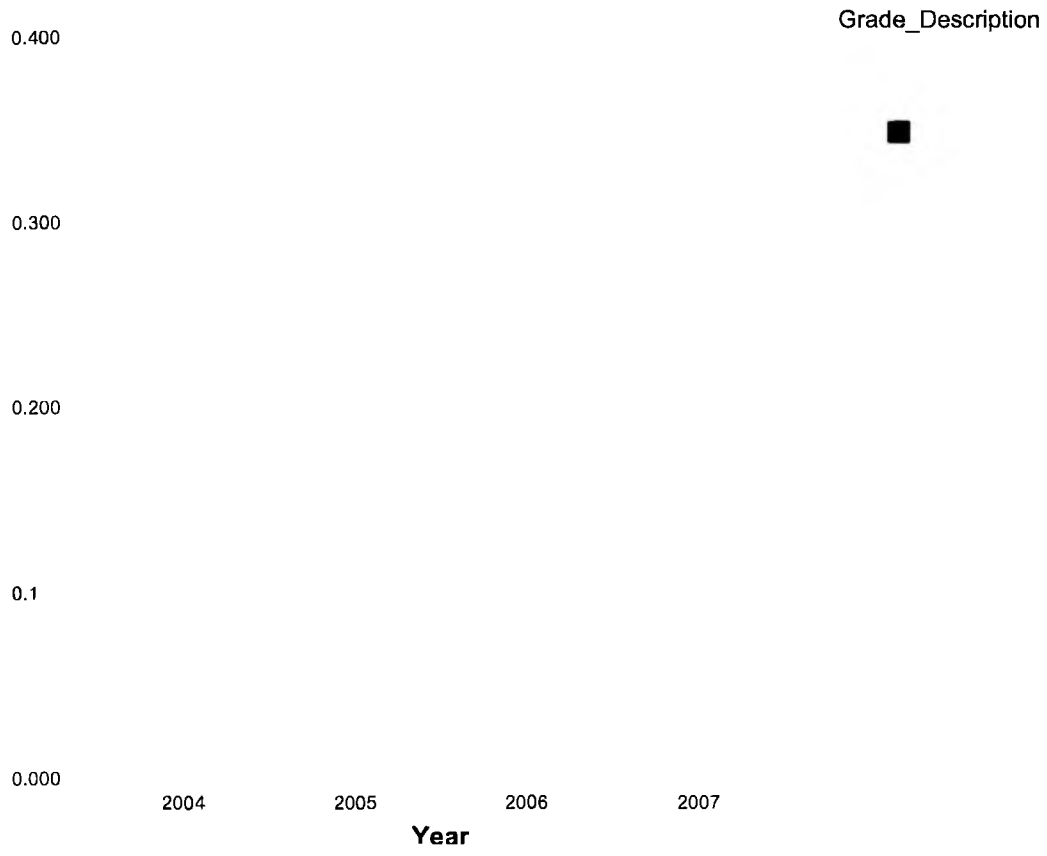
N	Minimum	Maximum	Mean	Std. Deviation
	00	100.00		12.13950

2006 Result Module

	N	Minimum	Maximum	Std. Deviation
Avg_Module_Result	598	0	100	
Valid N (listwise)	598			

2007 Ave Module

	N	Minimum	Maximum	Mean	Std. Deviation
Avg_Module_Result	675	.0	100.0	57.454	14.4674
Valid N (listwise)	675				



Graph Ei: Results Statistics

5.13 Qualitative Analysis

Interviews were also conducted with survey respondents to ascertain their personal experience of moodle and learning management systems in general. Those who rated themselves 'Advanced moodle users' had the following comments:

'I've some years of experience using virtual teaching environments. I have to admit that Moodle is the best one I've come across and the simplest one to use too.'

'Moodle has changed my teaching style for the better. It is a fantastic tool, which allows me to reach the students in ways I couldn't before.'

'One advantage is that Moodle was really useful for keeping track of crossword scores.'

'Moodle is part of everyday work. Apart from occasional technical hitches, I could not work without it.'

'I have never witnessed, a coordinated approach to technological and academic development. Usually what happens is that technological developments take place at a considerable speed and only a couple of people would be able to keep up; while academic developments take a different direction, and a different pace, forcing the majority of people to stick to what they consider to be their core activity (lecturing), and disengaging from the technological developments which, in their opinion, seem to be in the way. I wish that the NCI's attempt to institutionalise Moodle had been much better orchestrated to allow both faculty and students to make the most of it.'

'Moodle is now an essential resource to aid teaching. I would like to see it used more widely and for different purposes (other than simple posting of course notes).'

'Our faculty department were strongly encouraged to use moodle, this has influenced me personally, however, this may not be the case with other faculties'

Advanced users reported satisfaction with the moodle LMS and claim that they have fully integrated moodle collaborative features into their daily teaching life – however, some faculty members report that its inherent value as a constructivist tool has not been realised by the wider faculty body. Other faculty members claim that the culture of their department, and department leadership has an influence on their moodle usage. It is also claimed that the attempts to institutionalise moodle were poorly orchestrated.

Novice moodle users had the following comments:

'I do not think that features such as the chat and blog are as important or useful to certain domains.'

'I have never been trained in moodle so I don't feel I'm using it or exploiting it to it's full capacity. A standard training course for all staff should be mandatory in my view.'

'My use of Moodle is limited to posting my lectures/notes and the online forum to pass messages. Would like more training to get better use of Moodle but no time for it in my schedule at the moment.'

'I'd love to provide additional learning opportunities through Moodle, but preparation is time consuming; also I wonder whether providing lecture notes and other material on-line reduces attendance'.

'It is important to limit the information in the handout as provided on moodle. Otherwise students will not attend as they believe that they 'have everything'. I usually provide notes which I expand upon considerably in class.'

'I find that I have to put less in to my notes as students use access to moodle as a reason not to come to class - that is to say, if they feel they can download a full set of notes they are less likely to attend lectures. This has been a problem'

These sentiments are echoed by many users who do not use moodle and/or who do not rate themselves as technically advanced – it appears that the lack of training, time and resources adversely affect moodle usage. Some lecturers also see moodle as a competitive factor rather than a complementary tool in the education of students.

6. Discussion

Statistics measured by LMS logging instruments may not give an accurate reflection of actual usage and value gained from LMS tools. Statistical analysis can capture the functionality that is used, as well as when where and how often it is used, however, it cannot capture course material, teaching strategy, staff and student attitudes, pedagogy, or educational value of moodle usage – these elements were outside the scope of this study but have a significant impact on teaching and learning.

Gold claims that teachers must have the actual experience of online learning before they can be expected to be online teachers; otherwise, they simply map traditional practices onto the new medium with little of the transformation necessary in the teaching process. He maintains that a technological change does not guarantee educational transformation or reform. (Gold, 2001). In NCI, despite its wide uptake by the majority of lecturers, the introduction and integration of the moodle LMS has not brought about a deep and significant educational transformation for all users. Many lecturers simply map their traditional teaching practices onto moodle. This does not harness the full benefits the system could bring to the teaching process.

Various factors affect the frequency and nature of LMS usage. In the NCI these factors include: expertise in moodle usage, familiarity with online technology, previous experience with technology and a willingness to experiment with technology, membership of particular department, departmental culture, training and time and resources available. It was also evident that, for the modules with the most weighted activity by lecturer, user activity was correspondingly high.

This dissertation could not conclusively prove that teaching style affects the frequency and nature of moodle usage. There was insufficient evidence of a direct correlation between teaching style and the nature and frequency of moodle usage for survey respondents, however it is found that survey respondents with the delegator style use the highest number of advanced and collaborative features of moodle, whereas those with the demonstrator style use moodle's advanced features the least. This does not correspond with the literature and may be due to the influence of other factors or the fact that the survey did not contain all 40 questions posed by the Grasha Reichmann teaching styles evaluation tool.

This survey identifies that despite moodle's presence in the NCI for over three years, many lecturers simply use it to post course notes or online links. They use it for pragmatic rather than pedagogical reasons. Several NCI interviewees voiced a concern that publishing course material through moodle is acting as a disincentive to students attending class – they fear that moodle could be a competitive rather than a complementary factor in the provision of education. This fear must be addressed.

The most critical obstacles to online learning tools reported in a survey by Berge (1998) are related to learners' resistance to and fear of the many changes that must occur at the individual and organizational level. This fear, combined with the lack of support for the changing roles of students and teachers could yield significant impediments to success in online education.

.In NCI, a majority of lecturers use a minority of features – however, a minority of lecturers use a variety of enhanced collaborative and constructivist tools such as fora, blogs, wikis and online assignments. Perhaps these moodle 'champions' could be used to promote moodle's innovative features to those who are not fully benefiting from them.

Although it is outside the scope of this study, lecturers in the NCI employ e-learning tools which are independent of the LMS. Tools such as igoogle, interactive messaging, external blogs, wikis and forums are used in addition to, or in place of, moodle. Their use may have a significant impact on the nature and frequency of moodle usage.

LMS tools can enhance collaboration techniques and make it easier for lecturers to communicate with students and to assign collaborative tasks and group projects that foster innovation and co-operation. This can engender deeper understanding and learning, however, the mere presence of an LMS such as moodle does not guarantee that online collaboration will take place.

In order to establish constructivist pedagogy inside an LMS, it is necessary to come into the course design process with a well-developed sense of what is possible in the online environment. Yet many instructors do not have this perspective when they start using moodle. When presented with a set of options, it is far more usual to select the distribution of course materials and links to further data sources than to question the list of options. According to Lohman, the most commonly used feature of an LMS is its content presentation feature, this holds true in the NCI. (Lohman, 2007)

Lack of knowledge about technology can also make it difficult for instructors to tailor an LMS to meet their needs. Many faculty members who use moodle are not technical experts. Most do not use the web either extensively or intensively in their own work (Lane 2007).

A number of studies have indicated that certain factors are necessary in order to encourage technology adoption on the part of faculty. One study notes that the significant factors most influencing the level of technology adoption are the pre-existing

use of data tools in their own work, use of self-directed informational sources, and collegial interaction (Sahin 2007). Thus two of the three top factors for successful adoption are dependent on the faculty member already being well-versed in technology uses for education. (Lane, 2007). This fact is reflected in the findings of this dissertation.

NCI faculty members who report themselves as having an high level of online expertise, and whose department actively encourages use of moodle and/or who report an 'Expert' level of moodle skill appear to use moodle tools to provide a rich learning environment which encourages multiple perspectives and social interaction, and to create knowledge and enable students to have ownership of their own learning (Chen, 2007). Although other faculty members may use such techniques successfully in their face-to-face classroom situations, it is not reflected in their moodle 'presence', which is primarily used to distribute course information or provide access to further information.

The reasons certain lecturers may not have a strong moodle 'presence' can include: lack of training, unfamiliarity with technology, fear of technology, comfort with the status quo, lack of guidance or impetus to change current teaching practices and fear that moodle will act as a disincentive to students to attend class.

In NCI, the moodle LMS is used by the majority of lecturers as a 'one-to-many' tool, ie. one lecturer-:-many students. However those lecturers who use 'many-to-many' functionality such as wikis, blogs, forums and wokshops report enhanced collaboration and learning amongst students.

A similar study was done by the University of Wisconsin. This study (involving 740 faculty members) concluded that the majority of LMS use is concentrated on the content presentation tools within the system, however, faculty members are slower to adapt the more complex or interactive parts of the LMS such as discussion or quiz tools. Another survey of faculty use of learning management systems in the State of Georgia (involving

3,228 faculty members spread across 33 institutions) reported that the top reason faculty used a LMS in their teaching was to supplement or provide access to course materials. (Morgan, 2003). This dissertation demonstrates that the introduction and implementation of a learning management system does not, of itself, lead to a change in teaching pedagogy or technique, regardless of lectuer's teaching style. As is outlined in the literature, many lecturers use online learning tools to mirror their face to face teaching practice. In some cases lecturers view moodle as a negative presence.

Moodle learning management system is posited as a social constructionist learning tool. It can facilitate a student-centered, interactive collaborative learning environment. Discussion boards, forums, blogs, wikis, online chat and other communication tools provide multiple channels for problem solving, exploring and expressing ideas and issues. These tools can support experiences that challenge students to accomplish complex, contextual learning. It gives the student the flexibility to integrate education with the demands of work and family. The value to the instructor is being able to treat all students equally, and to prepare and deliver the materials of the course as a single entity and to facilitate self-directed and collaborative activities outside the traditional classroom boundaries.

Society is rapidly changing, competition for students is fierce and student populations are constantly evolving. An LMS can provide cost-effective, innovative learning solutions at a time pace and place to suit the student. Moodle, as an open-source LMS is proving an increasingly popular system of choice for third level institutions in Ireland. However, as this study illustrates, it is important to bear in mind that the presence of an LMS alone will not guarantee the realisation of its full potential for all users.

7. Future Perspectives

The constructivist model places students at the centre of the educational process - actively participating in thinking and discussing ideas while making meaning for themselves. The lecturer facilitates learning in less directive ways. How do we move from transmission of information to construction of meaning? Such a change can entail a considerable shift in roles for the lecturer who must move from being a facilitator who has all the answers and does most of the talking toward a being a facilitator who orchestrates the context, provides resources, and poses questions to stimulate students cognitive processes. Moodle is well placed to provide resources for this task – the challenge will be changing the mindset of its users.

The moodle LMS is developed based on the principles of social constructionism. These principles, when applied to technology, maintain that it is not enough to explain a technology's success by saying that it is 'the best' - researchers must look at how the criteria of being 'the best' is defined and what groups participate in defining it.

The criteria which will enable for the integration of online technology into the daily life of the instructor and the student need to be investigated to ensure that the full benefits can be obtained by all stakeholders.

Hew & Brush identify the general barriers typically faced by educational institutions when integrating technology into the curriculum for instructional purposes, these are: (a) resources, (b) institution, (c) subject culture, (d) attitudes and beliefs, (e) knowledge and skills, and (f) assessment. They list several strategies to overcome such barriers: (a) having a shared vision and technology integration plan, (b) overcoming the scarcity of resources, (c) changing attitudes and beliefs, (d) conducting professional development, and (e) reconsidering assessments. (Hew & Brush, 2006).

Neal (1998) lists incentives and training for teachers, combined with sufficient material development time as essential requirements if teachers and students are to go beyond a preoccupation with the delivery vehicle for online education and focus on the knowledge that needs to be imparted.

In order to maximise online learning tools in a third level environment, institutional leadership needs to ensure that lecturers are educated in online pedagogy, and that they are exposed to more general debates and questions surrounding online LMS. Institutional leaders need to develop support for LMS users by developing best practice models and setting up fora in which staff can share ideas and discuss their experience with the systems. It is important that steps are taken to identify how online LMS can be used to augment and complement an institution's core teaching objectives.

Phil Long, senior strategist for the Academic Computing Enterprise at MIT maintains that the ultimate innovation for a Learning Management System is its absence altogether. He envisions a future where there is a series of core services that work together but are not necessarily wrapped into a single software program. '*Those core services will provide an infrastructure on which to build and attach very specific software tools for specific disciplines and problems.*' (Heid, 2006)

Siemens (2004) believes that web 2.0 applications which encourage social construction of knowledge may provide more creative instructors with alternative options to LMS currently available and are freely available. Such programs make possible 'component-based learning environments', which cobble together a number of mini-applications and Personal Learning Environments, where students take the lead in creating their own learning experience. Remembering that we shape our tools and our tools shape us underscores the need for being proactive and thoughtful about the design of these tools.

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9. Appendices

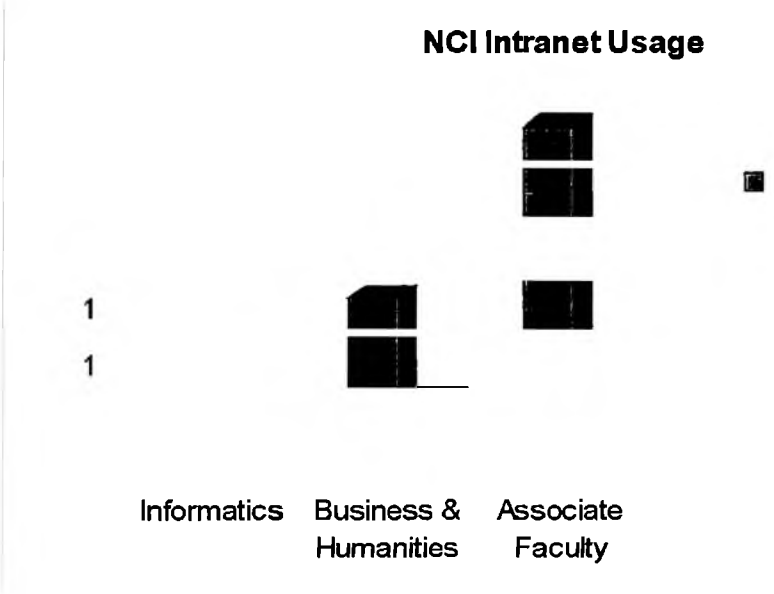
Appendix 1: Pre Moodle Survey– Data gathered for NCI intranet file

		PowerPoint	Word Documents	Java files	External Links	HTML files	Adobe PDF	Excel worksheet	Flash	
A	4		3			5	1			56
B	4		47		5		8	1	10	
C	2	3								3
D	3									0
	5	39				2				103
					1		1		1	182
			24							59
	3									
					17					56
										12
	6							5		93
	8									
M	6									220
	5									
	2									58
P	6	1								
R	6									1
	4	5								
		3								
W	6	4								
X		1								
Y	2	1								
Z										
AA										2
										0
CC										19
			1							
EE	2									
FF	2									
GG										
	2									

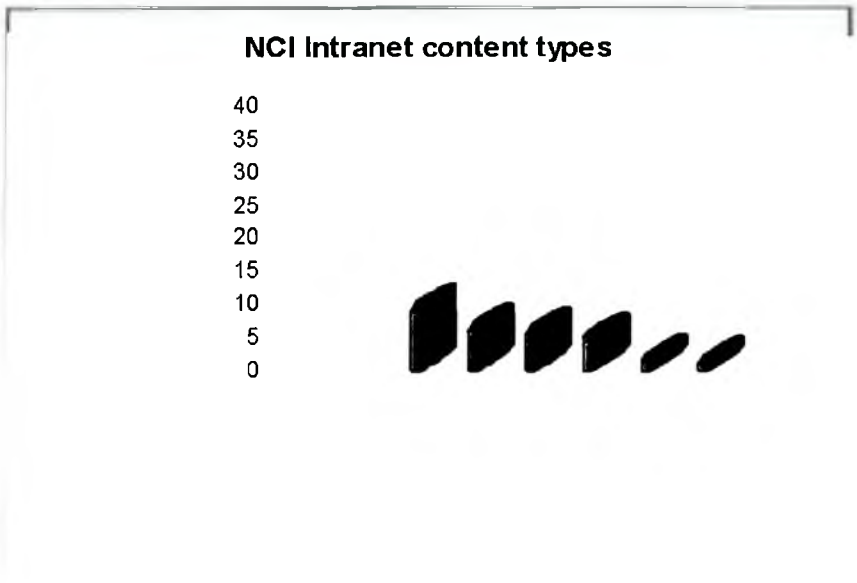
II		0
JJ		0
KK	4	0
LL	5	0
MM	2	0
NN	3	0
	1	
	1	
		0

Note: Names of all Lecturers have been removed from the "Lecturer" column for reasons of confidentiality.

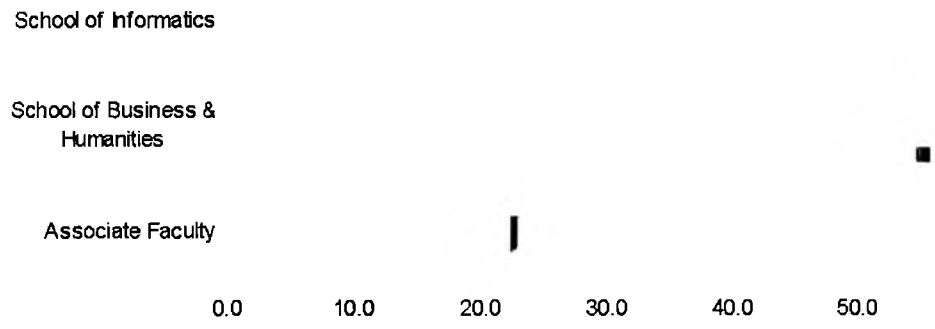
Appendix 2: Pre-Moodle Survey: Comparison of numbers of Lecturers in each of three Faculties/Schools in NCI with number using College intranet.



Appendix 3: Pre Moodle Survey: Breakdown of the different types of files on NCI intranet.



Appendix 4: Pre Moodle Survey. Bar chart for breakdown of Faculty answering Survey.



Appendix 5: Pre Moodle Survey Response data for possible uses of different Learning Activities by Faculty.

Learning Activity	Definitely will use	Might use	Definitely will not use	I don't know what this activity is	Response Total
Compose a text page	**58% (15)**	31% (8)	8% (2)	4% (1)	26
Add links to other web sites	**69% (18)**	31% (8)	0% (0)	0% (0)	26
Upload course notes	**92% (24)**	8% (2)	0% (0)	0% (0)	26
Create an Assignment	**58% (14)**	38% (9)	4% (1)	0% (0)	24
Create a Chat	12% (3)	**64% (16)**	24% (6)	0% (0)	25
Create a Forum	33% (8)	**58% (14)**	4% (1)	4% (1)	24
Create an On-line Quiz	33% (8)	**58% (14)**	8% (2)	0% (0)	24
Create an On-line Survey	28% (7)	**68% (17)**	4% (1)	0% (0)	25
Use Wikis	16% (4)	40% (10)	4% (1)	40% (10)	25
Use Blogs	17% (4)	46% (11)	17% (4)	21% (5)	24
				Total Respondents (skipped this question)	**26** **2**

Appendix 6: Questionnaire e-mailed to all NCI Lecturers

The following questionnaire is part of a Dissertation Study on the Moodle Learning Management System and it lecturers. Completion of the questionnaire will take approximately five minutes collected will be used for scientific purposes only and will not be disclosed to greatly appreciate your contribution.

1. Your Name:

2. Your age group:

◯ 20-29 ◯ 30-39

3. Your department:

☐ School of Business

Other (please specify)

- [ ] Self-interest or motivation
- [ ] Convenience
- [ ] Economic/cost reduction
- [ ] As a result of previous experience with online instruction

19. Please rate how important the following Instructional features of Moodle are to you I can:

	Not Important	Somewhat Important	Important
Post course notes			
Post assignments			
Post assessments			
Link to external internet resources			
Create blogs			
Create wikis			
Create glossaries			
Create online quizzes			
Use online chat			
Create an RSS feed			
Use the online forum			
Use the calender			

20. How would you describe your overall expertise or skill in using moodle?

◯ Beginner ◯ Intermediate User ◯ Expert User

21. Do you think moodle suits your teaching style?

◯ Yes ◯ No ◯ Unsure

22. Do you think moodle has changed your teaching style?

◯ Yes ◯ No ◯ Unsure

23. Please provide other comments on your using Moodle in NCI.

Other (please specify)

25. Please provide any other comments on your experience using Moodle in NCI.

26. What is the primary reason you do not use Moodle?

- ☐ I have no teaching or pedagogical reason to use Moodle
- ☐ I have not received adequate training in its use
- ☐ Moodle is too time consuming to use
- ☐ I use other web-based tools
- ☐ Moodle is unreliable
- ☐ There is a lack of technical support
- ☐ There is a lack of functional support
- ☐ I may use Moodle in the future

Other reason (please specify)

27. Please provide any additional comments on your preference not to use Moodle (This section is optional)

Appendix 7: Moodle Administration Interface

Courses
Location
Language
Modules
Security
Appearance
Front Page
Server
Networking
Reports
Miscellaneous

Appendix 8: Moodle Reports Graphical User Interface

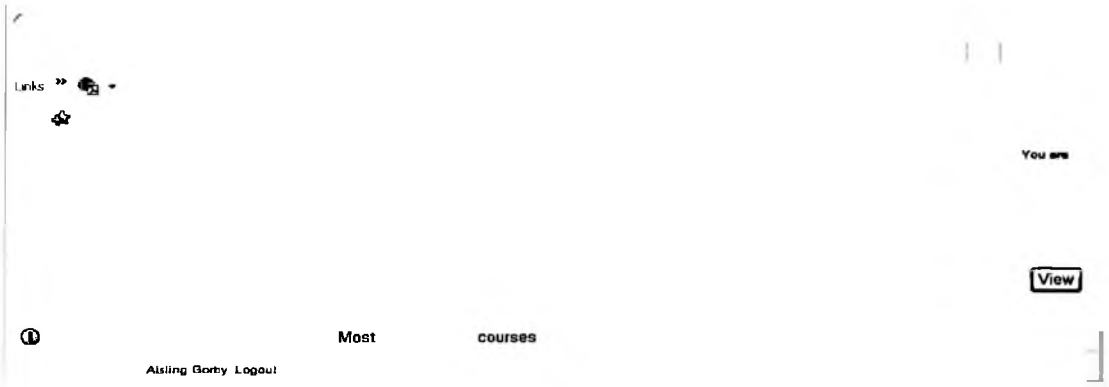
Aisling Gorby (Logout)

Strategic business Environment - PDGDHRMNCI1: Al

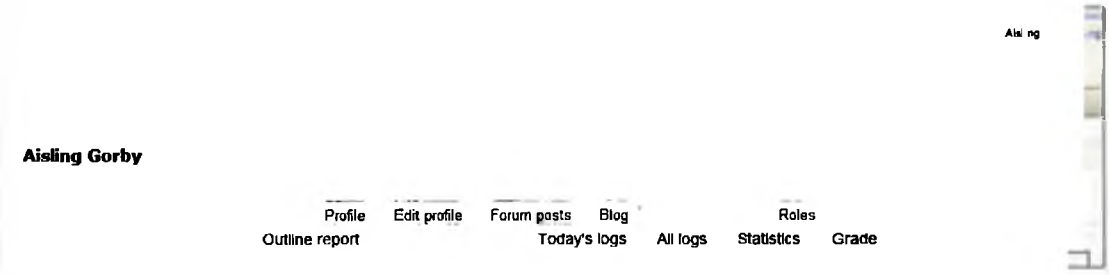
1

Time				
Tue 12 August 2008, 03:20 PM	192.168.51.204	Aisling Gorby		
Tue 12 August 2008, 03:27 PM	192.168.51.204	Aisling Gorby	course report log	
Tue 12 August 2008, 03:27 PM	192.168.51.204	Aisling Gorby	course report stats	
Tue 29 July 2008, 06:22 PM	192.168.51.204	Aisling Gorby	course report log	
Tue 29 July 2008, 06:22 PM	192.168.51.204	Aisling Gorby	course report stats	

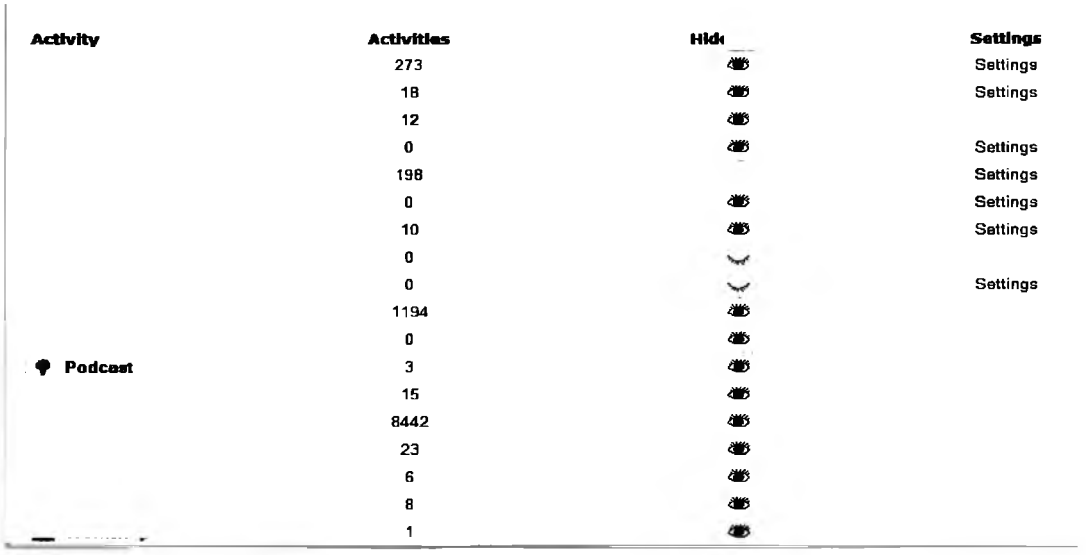
Appendix 9: Moodle Course Overview Graphical User Interface



Appendix 10: Moodle Activity Re



Appendix 11: Moodle Module Activity Graphical User Interface



Activity	Activities	Hide	Settings
	273		Settings
	18		Settings
	12		
	0		Settings
	198		Settings
	0		Settings
	10		Settings
	0		
	0		Settings
	1194		
	0		
Podcast	3		
	15		
	8442		
	23		
	6		
	8		
	1		

Appendix 12: Survey Results for Teaching Style Questions

21. Do you think moodle suits your teaching style?

	Response Percent	Response Count
Yes	**76.5%**	**13**
No	[illegible]	[illegible]
Unsure		

22. Do you think moodle has changed your teaching style?

	Response Percent	Response Count
Yes	17.6%	3
No	**76.5%**	**13**
Unsure	5.9%	1
	answered question	**17**
	skipped question	**4**

Appendix 13: Statistics for Online Expertise and Moodle usage

Online Expertise:		Moodle Hits	Advanced Usage
Advanced	Mean	3767.14	684.71
	N	7	7
	Std. Deviation	1920.353	893.132
Some Experience with online technology	Mean	1077.50	23.00
	N	6	6
	Std. Deviation	467.271	47.091
Familiar with basic online technology	Mean	1302.25	14.50
	N	4	4
	Std. Deviation	653.284	8.660
No expertise	Mean	73.00	4.00
	N	1	1
	Std. Deviation		
Total	Mean	2117.61	277.39
	N	18	18
	Std. Deviation	1829.110	627.708

Appendix 15: Survey Respondents Action

Action Type	Count
View	19322
Add/Upload	7954
Login	2402
Assignment	2120
Forum	2009
Update	1747
User View/Update	961
Label	668
Delete	538
Quiz	489
Report	129
Podcast	94
Message	88
Enrolment	77
SCORM	68
Blog	63
Mailer	56
Wiki	53
Choice	39
Chat	10
Glossary	10
Survey	3
Workshop	1

Appendix 16: Survey Respondents

Respondent	Mean Advanced Hits
A	8.00
B	1.00
C	4.00
D	14.00
E	2.00
F	1503.00
G	2257.00
H	4.00
I	10.00
J	17.00
K	2.00
L	4.00
M	95.00
N	153.00
O	22.00
P	831.00
Q	17.00
R	119.00
S	25.00
Total	**267.79**

Appendix 17: Analysis of variance - Self reported Moodle Expertise

			95% Confidence Interval for Mean	
Mean	Std. Dev		Upper Bound	
4461.6	1796.56152		6692.325762	96
1310.16667	619.759443		1960.564314	26
1153.125	748.946009		1779.259533	54
2073.36842	1788.006		2935.159729	96
951.6	940.679435		2119.607789	57
12.1666667	10.4195329		23.10129588	25
32.125	46.9146261		71.34660896	19
267.789474				57

ANOVA

		Sum of Squares		Mean Square	F	Sig
Moodle Hits	Between Groups	38787895.513	2	19393947.756	16.543	.000
	Within Groups	18757482.908	16	1172342.682		
	Total	57545378.421	18			
Advanced Usage	Between Groups	3174344.250	2	1587172.125	7.142	.006
	Within Groups	3555460.908	16	222216.307		
	Total	6729805.158	18			