

# **USING SITUATED LEARNING THEORY TO EXPLORE TABLET PC USE IN ACADEMIC WORK: PERCEPTIONS OF STAFF AND STUDENTS**

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## **ABSTRACT**

Increasing numbers of studies are starting to evaluate the usefulness of Tablet Personal Computer (PC) devices in teaching and instruction (Weitz et al., 2006, Hulls, 2005, Mock, 2004, Theys et al., 2005). In some instances Tablet PC use is combined with other mobile technologies (such as laptops ) to support classroom interactivity in computer science courses (Berque and Thede, 2006). This paper presents the results of one year of data collection and analysis undertaken by the School of Computing and Intelligent Systems, Faculty of Computing and Engineering, Magee Campus of the University of Ulster, Northern Ireland. This study investigated student and staff perceptions of a Tablet PC initiative. The theoretical lens of situated learning theory (Lave and Wenger, 1991) is used to interpret these findings, which indicate that staff and student engagement in the School's Tablet PC initiative has been generally positive, and enhanced teaching and learning both inside and outside of the classroom.

## **KEYWORDS**

Situated Learning, Tablet PCs, Staff, Students.

## **1. INTRODUCTION**

Tablet PC use in third level education provides educators with the option to engage in many different ways of technology mediated interaction, in classrooms which support their use (Hulls, 2005). Tablet PC use in the classroom, provides academic staff and students with the

option to engage in electronically mediated instant forms of online communication such as online assessment and online quizzes, without sacrificing the nature of feedback (Theys et al., 2005). Engagement in Tablet PC enabled academic programs is perceived as positive educational experience (Mock, 2004). However, the above studies pay little attention to some of the issues that staff and students have encountered whilst learning to use, and then operate Tablet PCs in academic work. There is a pressing need to understand what issues faculty and students encounter in using Tablet PC portable devices in everyday academic work. Tablet PCs use on campus takes many forms. For example the Tablet PC is reported as aiding the completion of academic tasks such as the grading of assignments, project work, creating lecture material, and capturing meeting notes which may occur outside of the classroom (Mock, 2004). The physical nature of portable devices means that their use is not solely restricted to specific locations, like lecture halls or classrooms (Theys et al., 2005). In today's universities, technologically configured environments now support varied types of connectivity to electronic systems and resources and support extended use of mobile devices. At present, there is a pressing need to understand how Tablet PC's support active instruction within specifically designed, technologically enhanced classroom environments (Berque and Thede, 2006). By conducting this pilot, exploratory study we hope to extend our understanding of the role that Tablet PC's play in academic work and make an initial assessment on their use to find out how educators / faculty and students integrate Tablet PC's into daily tasks (Weitz et al., 2006).

## **1.1 Purpose of Research**

This study sets out to explore academic staff and student perceptions of Tablet PC use in education within the School of Computing and Intelligent Systems (SCIS), Faculty of Engineering, Magee Campus of the University of Ulster, Northern Ireland. At present studies are limited which examine the implementation point of a Tablet PC program, then track user perceptions, over one academic year. Initial pilot research has revealed that Tablet PC's support faculty and student engage in a mixture of tasks such as electronic flow charting activities, drawing based activities, and enhanced note taking – all of which can then be emailed, printed or graphically enhanced for use during class time then shared with physical or virtual colleagues (Fisher and Scott, 2007). We hope that by documenting our experiences of working with academic staff and students in a Tablet PC program, this will be of interest to others and make a small contribution to further understanding perceptions and experiences of using Tablet PCs in third level education.

## **2. LITERATURE REVIEW**

There are many assumptions associated with the perceived benefits of infrastructure and mobile device use for teachers and students in third level education. Tablet PC's are one such mobile technology which can improve student/instructor interaction in traditionally large lecture classes; enable students to pay more attention to the instructor, and allow students to create a richer set of course notes (Theys et al., 2005). Tablet PC use is also perceived to increase collaboration and communication in small group exercises (Theys et al., 2005), and can address issues which surround interaction and spontaneity (Hulls, 2005), such as process

flowing, or scripting ad-hoc diagrams. Limitations of Tablet PC use include not having access to a keyboard, which in some cases would support programming or writing assignments (Theys et al., 2005). From a teaching perspective, constructing then projecting graphical and pictorial images, from Tablet PCs to display devices can distort images and suffer from rendering issues such as illegibility and loss of colouration (Hulls, 2005). Studies have also started to question what role Tablet PC's play in academic instruction.

Although a recent examination of academic faculty perceptions of using Tablet PCs reported feedback as being extremely positive (Mock, 2004), we do not at present know what wider implications may surround the use of Tablet PCs within our own organisation. Increasing numbers of studies are examining the environments within which wireless technologies are used, in an attempt to understand what role they play in academic work (Beasley et al., 2005). Studies continue to focus research on both faculty and student experiences of wireless tools within instruction, in an attempt to assess their role in supporting the academic experience (Savey and Reed, 2006). Although research continues to assess faculty and student perceptions of online work within the academic curricula (Wilkes et al., 2006), we are still no closer to understanding what impact Tablet PC use has on faculty and student engagement in academic tasks and educational work. Research is therefore needed to examine staff and student perceptions in more depth (Weitz et al., 2006).

### **3. THEORETICAL APPROACH**

Lave and Wengers' (1991) theoretical lens of Situated Learning (SL) will help us explore staff and student perceptions of Tablet PC use within our own organisation. Situated Learning theory is a useful lens through which to explore social forms of learning (Lave and Wenger, 1991: 30). From this perspective "learning is not merely situated in practice" (1991: 35) rather, it is influenced by the social environment in which it takes place. There are many critiques of situated learning theory, especially because defining "situatedness" and what constitutes the situations in which learning takes place is a complex concept (Ciborra, 2006). In this paper, we refer to Situated Learning (SL) in its broadest sense. We argue that SL is an informing lens, through which we have looked to make sense of the role social participation plays in shaping how we learn technological skills, techniques and work practices associated with using Tablet PCs.

### **4. METHODS OF ANALYSIS**

Descriptive case studies are common tools used to study and interpret findings which emerge from the detailed analysis of information systems (Walsham, 1993). Case study research is also becoming an increasingly useful approach in helping to explain how mobile technologies are used in university settings (McKimmy, 2005, McVay et al., 2005). Case studies are limited by the very nature of the approach, they are bounded to time and place, findings are often context specific and limited in generalisability (Creswell, 1998). In addition, issues surrounding the representation of context, i.e. what to include and exclude, and definition issues around what constitutes a case, renders this technique as highly subjective (Creswell, 1998). To help focus and bound this study to a specific time and place, we describe the socio-

historical background of the Tablet PC pilot funding, initiation and roll out procedures. We then present empirical case study findings, which include survey results obtained from staff and student participants in the Tablet PC pilot.

Survey methods of analysis are useful in helping to explore perceptions on the technology in academic instruction and virtual forms of education (Song et al., 2004, Kumar et al., 2001). In this context of this study, a survey was carried out in April 2006 (approximately 15 months after Tablet PCs were distributed) ensuring sufficient time for familiarity with the platform and for usage patterns to emerge. Over 80% of the staff responded to the survey providing a representative sample. Over 100 Tablet PCs were distributed to first and foundation year students attending designated courses in the School of Computing during semester one (October) of the 2005/6 academic year. The student survey was carried out in May 2006 (approximately 8 months after the Tablet PCs were distributed) ensuring sufficient time for familiarity with the platform and for usage patterns to emerge. Limitations of this approach include the categorisation of data into different cases, making sense of initial questionnaire responses in the context of the case study, and relating findings to higher level concepts emerging from the field (Creswell, 1998). Administration of a survey during the first year of the pilot Tablet PC program was issued at specific time and within a specific place, to help further shape questions of inquiry, which are being explored in the School.

## **5. DESCRIPTIVE CASE STUDY**

Section 5.1 describes how researchers at the SCIS secured funding and initiated a pilot Tablet PC program. This pilot project secured funding from many different agencies and the Tablet PC program is currently in its second consecutive year of operation. Given the European scope of the project, and western European placement of the University involved in the program, it is important to outline which funding bodies supported the initiation of this program, and detail, which elements of the program are currently in place to facilitate academic staff and student use of Tablet PC's.

### **5.1 Wireless Campus Initiative**

The School's Tablet PC program funding was secured through the European Union's Building Sustainable Prosperities Programme in partnership with Derry City Council and the North West Institute of Further and Higher Education (NWIFHE). These public and government bodies awarded the University £400k under the umbrella of the Department of Enterprise, Trade and Investment (DETI) Broadband Flagship project. The wireless campus aspect of the Broadband Flagship project has three distinct areas and the following project deliverables, the Wireless Campus Initiative, the piloting of a Tablet PC Mandate initiative and the development and installation of Smart Classrooms across the Campuses of the University and NWIFHE. The wireless campus initiative is now in place providing near ubiquitous wireless network coverage. Wireless connectivity facilitates enhanced, more flexible access to computing resources and the Internet. A number of technologically advanced Smart Classrooms were equipped with the latest in wireless connectivity, interactive Smart boards, audio, video and educational technology, which are now in use by academic staff and students.

## 5.2 Piloting of a Tablet PC Mandate initiative

The roll out of the initiative, centred on providing staff and students with Tablet PC's and all academic and teaching-related staff were provided with Tablet PCs. A wireless-support working group was also set up in the School to investigate, evaluate and disseminate effective pedagogical methods. The remit of the working group was to specifically investigate modes of teaching delivery facilitated by the enhanced learning opportunities offered by the new technology. Table 1 below provides a summary of the number of academic staff and students involved in the roll out Tablet PC's.

Table 1. Number of Student Participants in Tablet PC Pilot Study

Tablet PC User Base	2005/2006	2006/2007
Staff	<ul style="list-style-type: none"> <li>General issue to academics and teaching members of staff.</li> </ul>	<ul style="list-style-type: none"> <li>Continued general issue to academics and teaching members of staff.</li> </ul>
Students	<ul style="list-style-type: none"> <li>New student entrants issued with a free of charge tablet PC for duration of study.</li> </ul>	<ul style="list-style-type: none"> <li>New student entrants issued with a free of charge tablet PC for duration of study.</li> </ul>
<b>Number of Tablet PC users</b>	<b>130 (approx)</b>	<b>130 (approx)</b>

In parallel, incoming first year students undertaking the majority of their degree within the School in the academic years 2005/6 and 2006/7 received, free of charge, a Tablet PC for the duration of their studies. This process created a user base of approximately 260 over the 2 years. The uptake and usage of the facilities and computing resources by staff and students was widespread and rapid.

## 5.2 Development of Smart Classrooms across Campus

The refurbished and enhanced laboratories/Smart classroom facilities have being used extensively with excellent feedback. The environment created greatly increases student participation during lecture and computer laboratory sessions, permitting high levels of interaction between students and the lecturer through the combined utilisation of the wireless network, Tablet PCs, bespoke educational software and smart interactive boards. The network is utilised on a regular basis, with high levels of persistent and continuous usage recorded. Staff and students have been observed using the Tablets PCs in the classrooms, laboratories, offices, canteens, learning resource centres, student residences and external spaces, for a diverse range of individual and collaborative activities.

## 5.3 Key Strengths of Pilot Tablet PC program

The strengths of the pilot project relate to the flexibility of the learning environment created, allowing alternative pedagogical models to be trialed and implemented. Two specific examples relating to the modules COM158M1 Algorithmic Programming and COM419M1

Object-oriented Systems Development were evaluated. COM158M1 is a traditionally challenging programming module requiring a high level of practical work. The enhanced infrastructure implemented has enabled a quite radical new approach to the teaching of this subject, which are outlined in Table 2 below.

Table 2. Modules Evaluated in Tablet PC Pilot [Entry Level Year Course]

<b>Evaluated Module</b>	<b>COM158M1 Algorithmic Programming</b>
Course Module Restructure	<ul style="list-style-type: none"> <li>Previously course content delivered in a traditional format of a three-hour lecture with a two-hour practical. The new delivery method piloted used the idea of ‘punctuated practicals/tutorials’. This approach allows lecturer to address and demonstrate specific details of programming and then stop the lecture while the students implement these elements on Tablet PCs.</li> </ul>
Teaching Approaches	<ul style="list-style-type: none"> <li>The enhanced teaching environment then allows the lecturer to present a student’s work to the class while providing immediate feedback, instruction or clarification. This approach allowed lecture times to be reduced to one hour per week with additional two 3-hour sessions “punctuated practicals” introduced in the Smart classroom.</li> </ul>

Similarly, delivery of teaching on the second-year undergraduate module COM419M1 has benefited greatly from the enhanced learning environment. Table 3 below outlines major changes, which have been made to this course to accommodate that use of Tablet PC’s in the classroom.

Table 3. Module Evaluated in Tablet PC Pilot [Second Year Courses]

<b>Evaluated Module</b>	<b>COM419M1 Object-oriented Systems Development</b>
Course Module Restructure	<ul style="list-style-type: none"> <li>In the traditional classroom, this would have involved constant alternating between the data projector, the overhead projector and the white board; a process, which tended to delay proceedings and reduce concentration levels.</li> <li>Using the advanced inking capabilities of the Tablet PC and wireless data projector, annotations and diagrams were added directly in real time onto the lecture PowerPoint slides.</li> <li>Additionally the lecturer uploaded the new annotated version of the slides to the teaching website through the Wireless LAN, and students were immediately able to wirelessly download the material to their Tablet PCs.</li> </ul>
Pedagogical Changes	<ul style="list-style-type: none"> <li>In terms of new pedagogic practice for the learner, this technique enhances interactivity, and flexibility, while preserving the traditional advantages of face-to-face contact. This was achieved by improved access to rich learning materials augmented with student feedback, providing a faithful outline record of the lecture proceedings.</li> </ul>

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- Usage of this rich material has been high, as evidenced by web statistics, which recorded user visits to the repository where the augmented material was stored.

Two specific examples above illustrate and capture changes which have been made to course module content, approaches to teaching and details some of the issues which surround more pedagogical concerns which arouse out of the study of Tablet PCs, in academic practice.

### 5.3 Academic Staff and Student Perceptions

Survey research has specifically explored academic staff and student perceptions of Tablet PC use. In this exercise, staff and students were asked to assess the effect of the project on their experiences as lecturers using the technologies/environment to teach, and as students using the technologies/environment to learn. Table 4 below presents, high-level findings from the administration of this questionnaire and draws attention to key responses obtained from staff and student participants of the Tablet PC pilot program, at mid point in the 2005/2006 academic year. Academic staff perception responses were selected by the research team using a process of reading and re-reading survey results. Key student perception responses were selected from the student survey using the same process. These specific results have been selected by the research team to draw attention to initial perceptions and issues raised by academic staff and students. We acknowledge the following limitation that in conducting research in such a technologically rich setting, lecturers and students are likely to be technology-friendly and competent, and thus more likely to have positive attitudes towards the new technology.

Table 4. Perceptions of Tablet PC Use – Survey Results April 2006

Area of Investigation	Key Findings
Academic Staff Perceptions	<ul style="list-style-type: none"> <li>• 80% of teaching staff indicated that the use of this technology had a positive impact on the lecturer/student experience.</li> <li>• The vast majority of teaching respondents indicated that they had adapted very quickly to this technology and used it in a range of teaching and administrative-related tasks.</li> <li>• Many teaching respondents observed large numbers of students using their Tablets PCs as their main PC in laboratories and a high level of student usage was also noted outside of formal scheduled teaching activities e.g. group work sessions in the learning resource centre (LRC) and in on-campus catering provision areas.</li> <li>• Tablet PC use enhanced the process of storing teaching materials.</li> <li>• Teaching staff indicated that not having to print notes out before class (wirelessly downloaded instead) resulted in a substantial reduction in printing costs and preparation time for class.</li> </ul>

- Student Perceptions
- 94% of student respondents felt that Tablet PC use had improved the quality of their overall University learning experience.
  - When asked how it was improved student respondents replied, Tablet PC use encourages study (60%),
  - Tablet PC facilitates access to online resources for assignments (97%),
  - Tablet PC encourages and facilitates collaboration between students (46%).
  - Tablet PC allows flexibility by not having to queue for fixed laboratory resources (90%),
  - Tablet PC provides a convenient storage/management facility for work (93%) and it allows flexible annotation of lecture material (90%).
  - 90% of student respondents felt strongly that the removal or absence of the Tablet PC would have a detrimental effect on their studies.
  - Reasons cited included reduced flexibility by restricting the ability to work at home or on the go, loss of benefits of note annotation stored on the Tablet PC, reduced access to campus-based and complementary online resources and less opportunity to collaborate with peers.

Initial survey results presented in Table 4.0 indicate that a high percentage of staff and students have embraced the use of the Tablet PC and wireless access in the context of their teaching and study. At this point in the research process, initial consensus is that the use of this technology has had a positive impact on teaching, as it offered opportunities for new modes work-related activities. Key findings gathered from analysis of descriptive case study and survey work is now discussed.

## 6. DISCUSSION OF FINDINGS

In conducting this initial exploratory investigation into academic staff and student perceptions of Tablet PC use, specifically at the early stages of technology adoption, we have found that there are many issues to consider when using this technology in practice. SCIS staff and students have not only had to learn how to use the Tablet PC's for in class assignments, and electronic forms of work, but also had to devise new work strategies and practices. Such changes have emerged from having access to a wireless infrastructure around campus, which provides Tablet PC users with extended electronic access to both engage offline with Tablet PCs, but also use them to communicate with others, share electronic forms of work, and use them in campus wide situations. The wireless campus initiative underpins Tablet PC use both on site in the School and also around campus, in different physical situations – opening up electronic access for staff and students.



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Piloting of a Tablet PC Mandate initiative, across campus, and the study of Tablet PC use within two specific modules in the School has influenced the way in which academic staff now prepare for teaching. Tablet PC use has also promoted staff to consider strategies around how to deliver lectures, structure tutorials and engage in new forms of electronic work, such as real time electronic marking of assignments, digital display and manipulation of content and restructure tasks which are undertaken in complex technological learning environments such as Smartrooms which enable Tablet mediated work. Working in such technology rich environments enables staff to physically manipulate electronic teaching materials in real time, save notes, upload diagrams and support engagement in more ad-hoc forms of electric working, such as capturing process flows, work diagrams or ink-scribbling. In terms of pedagogy – face-to-face communication is open, and exposed; not hidden and restricted by physical barriers such as laptop screens, or personal computing monitors. Technological infrastructure which supports Smartroom Tablet use prompts open communication within an environment and situation which is conducive to active and open educational experiences.

Smart classrooms have provided academic staff and students with the ability to engage in many different types of physical and social forms of participation, where Tablet PC's become notebooks, scribble pads and support electronic forms of "doodling, scribbling and picture drawing". Full access to internet, and networked services, whilst in smart classrooms, also provides academic staff and students with instant access to a broad range of support notes, materials and content in a format that can be manipulated and saved for future reference or use. The creation of "rich" content, and continued use and reference in academic work, is a core benefit in using Tablet PCs. Tablet PC use also support group and individual activities. Work is shared, commented on, distributed and displayed in pictorial format. This may become a format that academic staff and students adopt as a preferred approach in the organisation and distribution electronic work. Tablet PC's use in academic work supports staff and students to jointly engage in technological work.

Academic staff and student perceptions to electronic forms of Tablet PC work have in general been positive. Where academic staff had selected to use Tablet PC's in teaching, staff reported picking up technical skills needed to support use of this technology, in a relatively quick period. Staff used Tablet PCs as both teaching tools and administrative devices – using them for note taking and the physical manipulation of student work, such as grading assignments electronically, or manipulating electronic with annotations, comments or diagrams. Electronic notes could be amended, corrected, then displayed during class and support staff during teaching. Amendments to notes could be captured in real-time, posted to a central electronic repository for student access either during or after class. Students also reported positive perceptions towards the use of Tablet PC use in academic forms of electronic work. Access to content, resources and flexibility to amend notes were reported as time saving mechanisms, such as access to online resources, facilitated by access to a wireless infrastructure, and networked Tablet PC front end.

## 7. CONCLUSION

The main issues we have found in this paper include a need to adapt module content and educational materials, and a need to re-address teaching approaches and strategies, to support the incorporation of Tablet PCs into modular programs of study. Focus on the teaching

experience is core, if third level institutions which incorporate Tablet PC's into academic programmes, are to integrate their use successfully into educational work (Mock, 2004). Whilst we have found that in some cases, content needs to be re-written and designed in such away that Tablet PC's can be used in a focused way, more thought needs to be given to constructive techniques that support pedagogical practices. Tablet PC's use within the academic classroom requires planning, technical support and time to both design then use specific course content on Tablet PC's (Hulls, 2005). Tentative survey results point to a general positive uptake in the use of Tablet PCs in both teaching, and student based activities. There still exists a strong need to conduct more in-depth research over the coming year to further understanding of approaches used by teaching / lecturing staff in using Tablet PC's in practice, both inside and outside of the classroom. Brining Tablet PC's into the 'traditional classroom' requires faculty and students to make some significant changes to the way they engage with colleagues and faculty (Theys et al., 2005). Although results presented in this paper indicate a positive uptake, we still know little about what changes academic staff and students are making in their daily lives.

Mobile and portable forms of computers, including use of Tablet PC's present us with many challenges and choices regarding when to use, or when not to use technology in academic tasks (Berque and Thede, 2006). We intend to use this paper as a discussion document within our own institution over coming months, and further explore the themes raised in this paper. We have argued that situated learning theory is an insightful lens though which to explore the movement of "analytical focus from the individual as learner to learning as participation in the social world, and from the concept of cognitive process to the more-encompassing view of social practice" (Lave and Wenger, 1991: 44). We have found that Tablet PC's are being used in the School to support many different social processes. This pilot study has also revealed that further research is required to assess how Tablet PC's support students' and faculty engage in academic work (Weitz et al., 2006). We hope this paper will strengthen the argument that social theories, and in particular, theories of situated learning guided by interpretive research practices, contribute, in a more in-depth way, to the study and understanding of mobile technologies in institutions that choose to adopt such initiatives.

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