In this issue:

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Keywords: systems development review, web-based, administrative support, information system.

EDSIG activities include the publication of ISEDJ, the organization and execution of the annual ISECON conference held each fall, the publication of the Journal of Information Systems Education (JISE), and the designation and honoring of an IS Educator of the Year. • The Foundation for Information Technology Education has been the key sponsor of ISECON over the years. • The Association for Information Technology Professionals (AITP) provides the corporate umbrella under which EDSIG operates.

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1. INTRODUCTION

Online student and staff support systems are becoming increasingly popular for higher education institutions. The internet as a medium has attracted over half a billion people worldwide to obtain access (February 2003, www.nua.ie). Such adoption has seen the range of online system options grow, creating an opportunity to explore the behavior of a business school in a web-based system development setting. Thus, this study focuses on the processes influencing overall system selection, design and integration, which are particularly relevant for higher education decision makers interested in improving or upgrading similar student and administrative support systems.

The business school featured in this study experienced catalysts for change in the year preceding the ExtraNet system development period. Such change factors included a 22% growth in 'Equivalent Full-time Students' (EFT's) which resulted in more pressure on infrastructure; a competitive tertiary education market; and increasing student expectations to access and acquire information on demand. In addition the current system environment was fragmented with databases that had evolved over time, such as different intranets for staff and student information, Microsoft Excel spreadsheet for marks and grades, and a Microsoft Access database for course, assessment, timetabling and staff work plans. These fragmented systems contributed to increasing administrative costs (compiling and entering data to and from more than one system); data integrity; and security risks such as system access and knowledge of key operational processes residing with a limited number of staff. Furthermore, the current institution-wide student information system did not have the facility to store specific assessment results only final grades.

Increased reporting requirements meant a flexible, easy to use reporting tool was also

necessary. Essential reporting requirements included information for senior management, external agencies such as New Zealand Qualifications Authority (NZQA), as well as internal reporting for international student progress in order to meet the New Zealand Ministry of Education (MoE) Code of Practice for the Pastoral Care of International Students. As Chae and Poole (2005) discuss, requirements and accountability have become more stringent and require better reporting for higher education. Additionally, mechanisms for evaluation and reporting have a growing role in university management (Teichler, 2003).

The vision for the ExtraNet was a web-based system integrating core functions and possessing a flexible design that allowed for new initiatives to be incorporated in the future. This paper reflects and reviews the process of selecting the right system for the business school. As Hoban, Schelesinger, Fairman, and Grimes (2003) suggest from an e-learning context, global internet growth incorporation of the World Wide Web into educational settings has been accompanied by very little assessment on methods of how this process has been conducted. Michele and Petkov (2004) also note that little attention has been paid to the systematic post implementation review of systems in teaching institutions. This paper attempts to address this issue by evaluating the system development process.

2. LITERATURE REVIEW

Technology Trends

Catalysts for organisational change include new technologies such as (the internet and intranets); new consumers who are more discriminating and individualistic; and new geographic markets worldwide (Kemelgor, Johnson & Srinivasan, 2000). With an ever growing internet population, demand for increased convenience and better access and timely information, are becoming standard customer requirements. Most societies are embracing information technology (Jones & Berry, 2000); with half a billion people worldwide having internet access by February 2003 (www.nua.ie). Technology trends, and the decreasing costs of internet services, coupled with availability and convenience are likely to accelerate adoption of

internet based technologies (Beller & Or, 2003). Such technologies include e-learning and student information systems.

Alongside these societal trends of technology adoption, higher education institutions are becoming more commercialised and must respond to customer requests. As Coates, James and Baldwin (2004) declare "in the increasingly competitive higher education marketplace in which students are increasingly perceived as some type of client, expectations need to be matched or exceeded (p.6)." Subsequently, universities are now driven by expectations from students with an information-age mindset, computer skills and technology expectations (Coates, James & Baldwin). Havelka (2003, p. 1) states, "the use of computers in university classrooms is now commonplace and becoming ubiquitous," and business students have positive attitudes towards information technology in general. Studies discussed by Coates, James and Baldwin (2004), found widespread incorporation of online technologies in Australian Universities, with the highest penetration being in commerce, education and health.

Technology as a Business Strategy

In general, public sector organisations tend to be more cautious and more concerned with rules and regulations, whereas private organisations tend to be more comfortable with risk (Bozeman & Kingsley cited in Chae & Poole, 2005). Yet technology is being used as a vehicle for "changing the way business schools acquire, create and disseminate knowledge" (Kemelgor, Johnson & Srinivasan, 2000, p.135). Reasons to go online include increasing access, reducing costs, enhancing knowledge management, unifying fragmented information technology initiatives, expediting information access and improving quality and assurance procedures (Coates, James & Baldwin, 2004).

Another motivation for online technologies as emphasized by Kemelgor, Johnson and Srinivasan (2000, p. 136) is that "to attract good students, educational institutions must continue to innovate." Technology is a tool recognised by many institutions that can be utilised to improve levels of service while aiming to personalise and extend the relationship with students (Savarese, 2004). Therefore effective student systems need to

be student oriented and designed so administrative requirements don't negatively impact on the student. Thompson reminds us that higher education organisations "have to remember that people come here to be students, not to jump through bureaucratic hurdles" (quoted in Savarese, 2004, p. 47). A customer-led approach is important in applying new technology (Prashantham, 2005).

In addition to customer preferences, "the budgetary constraints under which universities and colleges throughout the world have been operating in recent years are prompting them to integrate flexible and effective learning procedures" (Beller & Or, 2003, p. 24). One part of this integration is more flexible and effective administrative student management tools. Yet institutional requirements are also important and internal systems need to complement each other (Savarese, 2004). Therefore interfacing as seamlessly as possible with existing institutional student management systems is an important part of any new system selection process. Further, as suggested by Savarese, attention must be paid to the overall system process to develop a plan, a personality, a philosophy, and a communication strategy fit.

Technology to Meet Diverse User Information Needs

Many education institutions have chosen web-based student information systems to facilitate a range of operations such as grading, attendance, demographic data and reporting (Kitchens, 2004). Advantages of such a system is that information is accessible anywhere by using a standard internet browser; instructional management such as tracking student performance and monitoring progress can be handled through the online tool; teachers can define each assessment used in their courses and; the system makes individual student data available (Kitchens). A centralised web-based system also enables educators to collect, analyse and communicate student information through desktop computers (Trefny, 2002). However good databases also require data integrity so the information is consistent and valid (Ugboma, 2004).

Along with providing real-time access to performance data (Sausner, 2003), another significant objective should be maintaining student history in a system, as longitudinal data provides more meaningful information to both teaching and administrative staff when compared to a snapshot of student performance (Levine, 2003). As expressed by Georgia Kedrowski, the system needs to "provide more data to more people in a more efficient fashion. If done correctly, more people can ask and answer their own questions" (Sausner, 2003).

Assessing the Options

There is a variety of student information system options available in the education marketplace. These range from add-on modules to complete alternatives to the institution's existing student management system. System characteristics vary but common features include internet access, report functionality, integration, email facilities, student demographic access (useful for staff because they do not need to go via the office to contact students), exporting and importing to and from other systems, and tracking student performance tools (Kitchens, 2004; Trefny, 2002; Threet, 2001). Other key aspects of a successful student information system is the ability to customise (Levine, 2003; Trefny), and allow real-time access to data (Trefny).

Internet technologies can reduce the time burden and provide easy-to-use and helpful information to the end user (Levine, 2003). Also data does not have to be located on separate onsite servers, as information can be accessed by users via a web browser (Trefny, 2002). Student information system technology developments also come in the form of add-on functionality (Sausner, 2003). Systems need to guide and support students as participants in learning (Hoban, Schelesinger, Fairman, & Grimes, 2003).

Determining the Benefits

The benefits of web-based systems (versus web-enabled systems) include accessibility - resides on a web server, web browser is the interface, access is available worldwide; deployment – occurs on the server with minimum time cost; application – any platform that supports a web browser; infrastructure – uses existing IT infrastructure; and usability (van As, 2003). Some systems also feature management of user access privileges (Trefny, 2002), and as Ugboma (2004)

points out, the effectiveness of a system is determined by both data integrity and security measures such as password authentication.

It is suggested that utilisation of a system can be determined by the extent to which the system is integrated into staff work routines (Goodhue and Thompson cited in Rai, Lang & Welker, 2002). Some institutions do not mandate system use assuming that if alternative traditional channels to obtain information are time consuming and cumbersome, eventually efficiency gains and social pressure may encourage use (Rai, Lang & Welker).

Usefulness of a system can be determined in part by the effect it has had on the organisation (Rai, Lang & Welker, 2002). Such effects can be considered by determining their congruence with organisational goals. One of the goals for the introduction of a new system is to achieve strategic change and staff commitment (Ringwood, et al., 2005). The application of a system is to generate required information, increase productivity, improve performance and gain control of decision outcomes (Ugboma, 2004). The U.S. Department of Education when updating its reporting methods, found the majority of time savings were via electronic reporting and acquisition of data from existing databases, rather than filling out written forms or re-typing data in disparate software (Bailey cited in Levine, 2003). Due to the heightened need for accurate student information in a competitive market, such time saving assists with identification of key information for administrative, teaching, and compliance functions.

3. METHODOLOGY

This paper has an ethnographic viewpoint as the authors were involved in the project from its inception. As such they were responsible for searching for alternatives, identifying the system requirements, testing, implementation and training. Using an evaluative approach, the ExtraNet development process is reviewed, revealing a hybrid of techniques undertaken by the business school. As discussed, the ExtraNet was created in response to catalysts for change including growth, increased external agency compliance pressures and customer expectations. The project methodology used once

these needs were identified include; the School management agreeing to resource the project, selection of a software developer, preparation of desired outputs, definition of necessary inputs, detailed specification documents written, risk analysis audit conducted, consultation with staff and students, prototyping, testing, full system development and review. This paper results from a recent system review, whereby a literature search was conducted to provide a benchmark for comparison to assist with evaluation of the business school's system choice and development process.

4. DEVELOPMENT OF THE EXTRANET

After determining a requirement for system change, key aims and objectives were developed. Overall aims of the system were to improve the business through more robust accurate and secure systems; informative reporting and monitoring while being responsive to customer/ student needs and; where possible to achieve a point of difference. These objectives and aims were achieved by forming a consultative team comprised of a project manager, the School Director, the Head of Information Systems and Computing Department, the Academic Dean and a lecturer. This core team sought feedback from wider staff and students through channels such as department meetings, student forums, sessions with the IT department, and cross-institutional discussions e.g. with the Database Manager.

The main objectives determined for the ExtraNet project were to:

1. Develop a robust, accurate and secure system, which 'fit' with the overall strategy of the School (and wider institution)

2. Meet customer expectations (largely around timely information and access) and support student learning

3. Improve staff productivity

4. Take a holistic, integrated approach to key School functions e.g. assessment

5. Meet compliance and reporting requirements

Development of a new system was seen as an opportunity to revisit and assess the strategic direction of the School while recognising the necessity to operate within the con-

straints of the institution resourcing policy (Ringwood, et., al, 2005). Therefore the first stage of the project was to review the overall School information requirements and ICT strategy. A fit between the School's mission and goals was necessary to ensure staff and students would view the system as both an extension of the customer service strategy, and a match to the flexible delivery approach of the applied business education programmes. A personal customisable approach was the preferred option to meet the needs of individuals (both staff and students). School branding also needed to be a feature of the final system to ensure students viewed the system as a part of the overall School communication strategy. Given the advantages of web-based technology and that the literature shows systems need to guide students to participate in their learning, the decision was made that the business school ExtraNet would pursue an internet path to encourage students to take ownership of their system access from anywhere.

After determining the appropriate ICT direction for the School the next objective was to resolve how the system could take a holistic approach for integrating all key functions within the School. These were defined as: assessment record keeping, professional short course programmes, open entry and community courses, timetabling, staff workplans, partnerships with other schools, enrolment and course evaluations. All existing systems supporting these functions were investigated to determine what role they performed, with the view of integrating these into the ExtraNet. This process clarified the scope of the ExtraNet system and assisted with risk analysis especially regarding knowledge access, staff disseminating information and unintuitive systems. Another key function of the ExtraNet was to provide longitudinal system data, to enable staff to view a student's history e.g. when approving applications for assessment reconsideration, or reviewing a case of dishonest practice. To address this holistic requirement and in line with the literature the ExtraNet was designed with add-on functionality to the existing central student management system, as well as with the ability to allow modules to be added onto the ExtraNet itself in the future.

Developing ways to support students learning and meet their expectations regarding timely information and increased access, were the next system objectives considered. The ability for students to check their assessment marks; compare their performance with others in the class statistically; and view grade distributions for each assessment seemed appropriate to keep students informed, while thus motivating them for achievement. The 24/7 availability of a web-based system was determined to be the best way to fulfil student requirements for increased and timely access.

Increasing staff productivity was also a key objective for the system. Staff frustration existed around current systems with some extreme instances including; staff overwriting another lecturer's course marks; and being repeatedly 'locked out' of the system due to too many users accessing at one time. Academic staff expressed interest in a web-based system in order to enter data when working off-site; reduce risk of inaccurate data; obtain better information on students academic history; and being able to contact students without needing office staff assistance e.g. for phone numbers or email addresses. Administrative staff interest in a web-based system centred on improved reporting options, easier viewing of information/ history and a one-stop-shop of information about a student (useful in providing course advice).

Internal systems need to complement each other (Savarese, 2004), therefore an important element of the project team's decision making process was centred on ensuring the system developed would interface seamlessly with the institution's existing student information management system. This objective also assisted with the identification of key reports and information for administrative, teaching, and compliance functions by highlighting desired information that was unavailable due to current system constraints. Given the need for internal systems to complement and connect with each other was acknowledged as a key factor for the ExtraNet; email alerts, links to StudentNet (course management tool), and integration with the central student management system were included. Email was the preferred alert method as students consider email to be personal to them, perhaps because the current generation of students have become

used to online encounters and therefore "don't necessarily view e-mail as a cold, businesslike medium" (Savarese, p. 47).

After a consultative period the options for system design included:

- Do nothing at all

- Improve the current system

- Install a system currently used at a similar institution

- Design and develop a new system in-house (with IT department)

- Create a new system in partnership with a software developer.

The above alternatives were considered by the core project team, resulting in 'doing nothing at all' and 'improving the current system' being quickly discarded. The environment had changed, so doing nothing at all was unrealistic in a business sense, and improving the current system was seen as a 'band-aid' solution unacceptable from a risk point of view. Installing a system used by a similar institution was investigated among the user-group of institutions that employed the same student information management system. Interestingly, other institutions contacted were using similar systems to the existing business school's system. In-house development was then explored, but not selected as the IT department were pursuing a departmental strategy of outsourcing services they deemed non-core or not centred on support.

Developing a system in partnership with a software engineer was determined as the best option, given the constraints of information searching (bounded rationality) and time limitations. The advantages of developing the system in a partnership included a customised solution to meet School requirements, very few concessions in system design, as well as not having to employ the software capability in-house. The ExtraNet system was developed in partnership with Web Engineers Ltd, who was selected due to their skill and relationship with the School (they had built a smaller-scale system for the School the year before). Web Engineers Ltd provided the technical expertise and prototype testing, and the business school completed system specifications, implementation and live testing phases of the project.

A pilot of the system was launched in the summer school programme, November 2003 and acted as a live test environment for the system. The final stage of the project saw the ExtraNet going live for all staff and students in February 2004.

5. THE EXTRANET SYSTEM

The ExtraNet assessment module is a robust, functional, user friendly and customisable system providing considerable benefits to staff and students. Academic staff gain flexibility and better information enabling them to deal with all aspects of course management more efficiently. Head of Departments and administration staff are assisted with managing and tracking dishonest practice, exam special arrangements and poorly performing students. Students have access to 'information at their fingertips' e.g. assessment results for each of their courses, marks required to achieve a higher grade, downloadable forms and links to other relevant institutional systems, such as course lecture notes and other teaching materials. The student ExtraNet system homepage is shown in Figure 1.

Similar to other higher education institutions that let students register themselves online, look at courses, and check grades and holds (Savarese, 2004); the ExtraNet was designed to be easy to use and intuitive. For access to the ExtraNet, currently enrolled students apply their user name and password. They can check grades, individual assessment marks as well as review their student information and result history with the business school (including results and grades for study prior to the ExtraNet launch). To achieve this historical data was imported from the central student information system. Although a time-consuming task, this was deemed important to enhance system relevance and provide a tool for students to review their academic progress and plan future study. All student assessment marks are stored in the ExtraNet system indefinitely. Final course marks and grades are exported from the ExtraNet into the central student management system. Therefore each student's history is maintained even after they graduate. Even though some institutions do not mandate systems use, ExtraNet use is compulsory at this business school with no alternatives offered for creating assessment
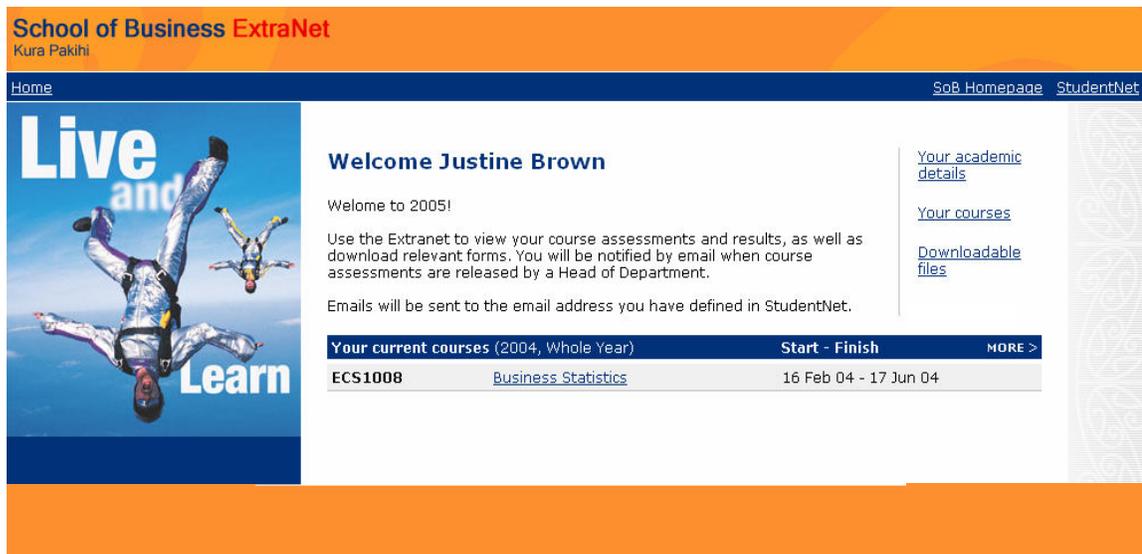
Figure 1: ExtraNet Student Homepage
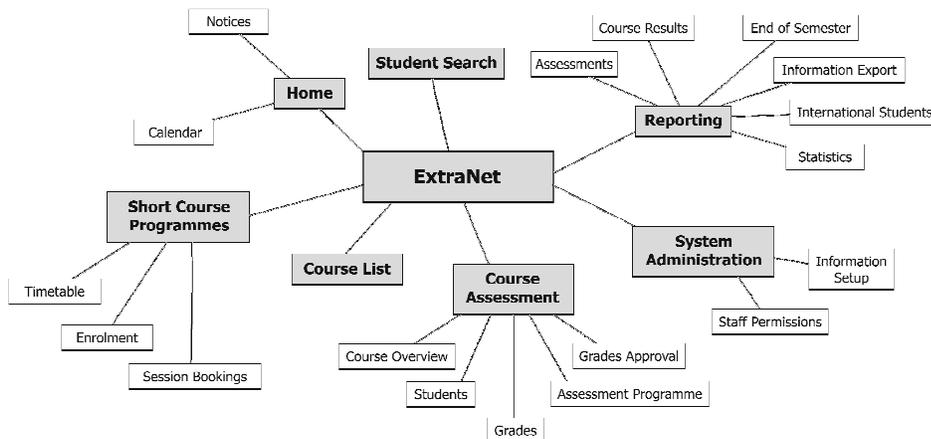
Figure 2: System Functional Overview

details or storing student assessment results.

To encourage ExtraNet adoption and staff buy-in to the system, a competition was run to coincide with the system launch. Competition details were available on the system homepage and involved staff naming the new system. Interestingly, ExtraNet was the winner as the connotations of something 'extra' on the 'internet' proved popular. However the software developer has recently branded the ExtraNet to be called "aPlus+", allowing for name copyrighting and on-selling of the system to other higher education providers.

The key functions available through the ExtraNet are illustrated in Figure 2. These in-

clude reporting, system administration, course assessment, course lists, short course modules, homepages and student search.

The ExtraNet system allows staff to efficiently manage course information for different activities. These main activities are listed in Appendix A, along with details of system architecture.

6. LIMITATIONS AND FUTURE RESEARCH

Limitations associated with this study include the lack of generalisability, as this paper focuses on the system development process at one higher education business school. Also

given that a review of literature was done as part of the system review/ critique stage it is not possible to determine the industry benchmark when the project commenced in 2003. There has been recent interest in the ExtraNet from other higher education institutions, which may provide an interesting future research opportunity to triangulate staff and student experiences at the different institutions. Future research will also include staff and student user perspectives and system behaviour, as this will assist with system critiques and improvements. A discussion of the partnership process between the software developer and the business school is also warranted. A further area of interest is the usage and adoption rates of the ExtraNet between different student groups such as full-time versus part-time, or international and domestic.

Practically, this research provides insight into the complex process of system development which may assist other higher education providers with similar projects. Highlighted are the external and internal influences that act as catalysts for system change and the subsequent organisational response which reflects a discord between systems development theory and practice. This research also blends the integration of an online systems medium with historical organisational system objectives of strategic fit, data integrity, convenience and security.

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Appendix A: ExtraNet Activities and Architecture

Activity Area	Details
Assessment	▪ Creating assessment programmes ▪ Recording 'special' assessment notifications such as aegrotat applications, reader/writer requests, change of assessment time, or dishonest practice ▪ Entry and approval of term and final results ▪ Notification of results to students
Monitoring and Compliance	▪ Monitoring of student performance and achievement ▪ Course statistics for making useful comparisons between: individual students, courses and selected student groups ▪ Quality control parameters to ensure assessment complies with academic quality systems
Information and Reporting	▪ Email notifications to staff and students when course results are released ▪ Confirmation of 'special' assessment requests ▪ Automatic upload of results from ExtraNet to the centralised student information system ▪ User defined reports such as: top student, unsatisfactory progress causing concern, international students, etc
Application Architecture	The solution is a Microsoft .NET web application (ASP.NET using the C# language) and Microsoft SQL Server database, deployed as a virtual site on Microsoft IIS web server. The ExtraNet application sources existing college data (qualifications, courses, enrolments etc) from a Borland Interbase Database, and some additional student information from MySQL and SQL Server databases.
Application Framework	The ExtraNet application is based on Microsoft ASP.NET. A large proportion of the application consists as business logic compiled into several assemblies. The interface components exist as pages and controls within an IIS virtual site. Core lower level functions of the application including interface components, data object management and application level security are provided by the Web Engineers Europa Framework.
Security	Microsoft IIS web server provides NTLM authentication of staff and students. Authorisation is managed at the application level. Effectively all staff and student users have to authenticate by entering their username and password before logging on to the ExtraNet. Regular server backups are performed daily as part of the institution's core backup programme.
Application Technologies	At the application level the following technologies are employed: SOAP web services, XML (for flexible data management), extensive use of object orientation, Microsoft Office Web Components (to visualise information).
Interaction with Existing Systems	The central student database stores all its information in a Borland Interbase database. This is made accessible to the ExtraNet and other institutional applications via a Gemini ODBC (Open DataBase Connectivity) driver. The ExtraNet has read only access to the central database at this time. Final grades are imported back to the central system via a CSV file the ExtraNet creates.