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# Using enterprise level software for a large scale compulsory course in an Information Systems undergraduate program: An example from Singapore

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## Citation

# Using enterprise level software for a large scale compulsory course in an Information Systems undergraduate program – an example from Singapore

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*Abstract*— This conference contribution describes the design and delivery of a course on enterprise portal implementation at the senior undergraduate level at the School of Information Systems (SIS), Singapore Management University (SMU). In this course (entitled Enterprise Web Solutions), the focus is put on the design, development, deployment and governance of an enterprise portal as a way to understand the full life cycle of a complex enterprise-level solution. The Bachelor of Science (Information Systems Management) degree program offered at SIS has been designed to contextualise the study of information systems and business management and to acquire practical competencies and skills though learning by doing in real world business settings. Thus, exposing students to complex enterprise level software systems has become a very essential component of the SIS education. However, the preparation of courses based on such software requires a non-trivial amount of background work. Using the Enterprise Web Solutions course and Microsoft SharePoint 2010 as an example, this contribution analyses the challenges which arise due to the complexity of the infrastructure requirements, it also describes the difficulties involved in preparing the laboratory exercises and elaborating the project requirements. Finally, several suggestions are offered for those who are designing undergraduate level information systems courses involving enterprise level software packages.

*Index Terms*— course design, enterprise level software, enterprise portals, undergraduate curriculum

## I. Introduction

Enterprise portal server solutions are generic "off-the-shelve" software packages which provide comprehensive functionalities to deliver a unified, personalised and collaborative experience for both employees and customers of a company. An enterprise portal complements and adds value to the data warehouse of the company, it enables effective document and records management, the portal extensively supports workgroup and team collaboration within an organization [1]. Thus, an enterprise portal can become a pivotal tool to manage the meaning, organization and flow of information throughout the entire enterprise. Already in 2002, an analysis published by Gartner Inc. stated: "By 2004, smart enterprise suites will emerge as an aggregation of the functionality offered today by portals, team collaboration support and content management." [2]

Although these packages have been widely accepted in the industry as platforms for integrating information, data and business processes [1, 3], the academic research in this area is still scarce. Most of the papers which have been published on the adoption of enterprise portals have been theoretical in nature [4-7].

Consequently, academic research addressing the question of how and why enterprise level software packages should be incorporated in education curricula (particularly focusing on higher education) is almost non-existent.

This paper will unfold as follows.

In the next section, it will discuss the complexities involved in implementing an enterprise portal and will present several components which enterprise level systems education should entail. Moreover, this section will also discuss the difference between enterprise level systems training and enterprise level systems education.

The paper will then describe the syllabus of the Enterprise Web Solutions course and discuss the issues and challenges in the design and delivery of the course.

Finally, the paper will offer several suggestions to those who are designing undergraduate level information systems courses involving the use of enterprise level software systems (in particular, enterprise portal packages).

## II. What Should Enterprise Level Systems Education Entail?

### A. Review of enterprise portal implementation

An enterprise portal has the potential to transform the key business processes of a company, it can break down the communication barriers in a company and increase its operational efficiency, an enterprise portal is capable of transforming the way of how an organization is doing its business [8]. However, despite the comprehensive and powerful portal tools currently available on the market the implementation of an enterprise portal is frequently ending in a disaster. Why?

The main issue here is that, principally, the promise of an enterprise portal is not provided by the technology itself. It is driven much more through having a clear vision, objective, understanding of end-users and their needs and understanding of the underlying business processes and operations in a company. Which means that implementation of an enterprise portal is much more than setting up the necessary infrastructure and installing the portal software package.

The first, most essential step in an enterprise portal implementation is the planning phase. In this phase, the

companies need to understand their strategic objectives and targets and then critically examine how portal technology could help reach those targets. To build a good business case, the portal solutions are not "sold" as stand-alone applications but as part of a larger set of enterprise level applications which are apt to deliver benefits to the company.

The next step is user needs and requirements analysis. During this analysis phase, a content usage study for all involved user communities has to be undertaken while keeping an eye on business benefit. This analysis is concerned with questions such as which roles users perform, what content they use to perform the tasks, what devices they use to access the content, how they collaborate with other users in sharing the content.

The following step is concerned with building enterprise portal architecture and selecting and integrating tools and features. This phase lays out the basic structure of the enterprise portal and examines of how all services to be implemented on a portal fit together. During this phase, the final selection of the enterprise portal package vendor is carried out.

After the integration and portal set up phase, the user training needs to be conducted. The (phased) rollout of the system is followed by a careful and on-going governance of the solution.

### B. Components of enterprise level systems education using an enterprise portal as an example

The brief sketch of the enterprise portal implementation above clearly indicates that a course focusing on enterprise level system implementation and deployment is far more than a set of technical instructions or a short vocational training. Rather than that, it is an exploratory journey through the full life cycle of such an implementation. What value can, thus, university-based information systems (IS) programs involving enterprise-level applications contribute to the acquisition of enterprise level systems (in particular, enterprise portal) capability in adopter organizations? Why do information systems or information technology programs need to bring enterprise level systems into their curricula?

The arguments might be various. Holistically exposing IS/IT students to state-of-the-art enterprise systems and tools might increase their employability, teaching personnel might benefit from increased professional development and research opportunities, schools and universities might benefit from the increased demand for their graduates.

The skills and practical abilities in using those systems might be acquired through professional or vocational training. Such training is frequently offered by the vendors of enterprise portal packages (e.g., Microsoft, IBM, SAP, Oracle and others). In such trainings, the participants usually are following step-by-step exercises with clearly defined problem statements (similarly to operational manuals of software).

The problem here is that this type of training enables the users of the system to perform isolated tasks or operations but imparts no understanding of the underlying business processes, involved resources or participating roles. In short: the users do not understand why those tasks are performed and what broader goals are underlying those tasks.

Consequently, the main difference between enterprise level systems training and enterprise level systems education is the distinction between "know-how" and "know-why". While the "know-how" component is essential for a university-level course on enterprise systems, most of the effort should be put into making the student understand why a particular action is carried out, how does it benefit the business, how does it affect the underlying business processes and how does it support the business strategy of the company. The Enterprise Web Solutions (EWS) course which is briefly described in the following section has been explicitly designed to produce the kind of business-savvy IT graduates who do not only care about excellent technical implementation but who also make their efforts to understand the underlying strategic and business value of their IT implementations.

### III. ENTERPRISE WEB SOLUTIONS COURSE

In the Enterprise Web Solutions course (the course which is been used in this paper as an example to demonstrate the challenges of bringing enterprise level systems into university-level programs) the focus is put on the design, development, deployment and governance of an enterprise portal as a way to understand the full life cycle of a complex enterprise-level solution. The course is equally both – technology-oriented as well as business-focused. It contains two major pars: while the first part is concentrating on concepts and theories (using lectures, readings, discussions and in-class activities as the principle teaching and learning methods), the second part is a hands-on laboratory component in which the students are planning, designing, building and configuring their own portal solutions for a fictitious case company. Figure 1 represents the basic structure of the Enterprise Web Solutions (EWS) course:
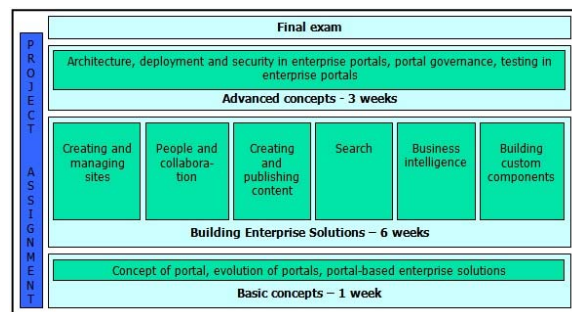


Fig. 1. Structure of the Enterprise Web Solutions (EWS) course.

The EWS course is a senior undergraduate course and it is taught in the third year. The course is compulsory to all School of Information Systems students and is delivered in three contact hours per week over a period of thirteen weeks. The course is taught in both terms of the academic year – in the first term (August to December) the course has four sections (encompassing 160-170 students in total) and in the second term (January to Aril) the course has three sections (encompassing 120 students in total). Around one and a half hours are devoted to the theory and concepts, and the remaining class time is used to perform labs and hands-on exercises.

The course evaluates the students' performance in the following areas: midterm assignment (individual hands-on

in-class exercise), laboratory exercises (in-class hands-on collaborative tasks), a final course project (group project with individual elements), and final exam (written on-site analysis of a business case). While the laboratory exercises are graded on the weekly basis, the outcome of the final exam and final project are announced at the end of the term. The results of the midterm assignment are released one week after the assessment. Table 1 shows the course schedule summary:

| Wk. | Focus | Activity |
|---|---|---|
| 1 | Course Introduction, introduction to portals | |
| 2 | Creating and managing sites in enterprise portals | Lab Exercise (Lab 1) |
| 3 | Creating, publishing and managing content in enterprise portals | Lab Exercise (Lab 2) |
| 4 | Extending enterprise portals through custom built components (1) | Lab Exercise (Lab 3) Quiz 1 |
| 5 | Extending enterprise portals through custom built components (2) | Lab Exercise (Lab 4) |
| 6 | User-driven and application driven personalisation in enterprise portals | Lab Exercise (Lab 5) |
| 7 | People, collaboration and communities in enterprise portals (1) | Midterm Assignment |
| 9 | People, collaboration and communities in enterprise portals (2) | Lab Exercise (Lab 6) Quiz 2 |
| 10 | Setting up and using business intelligence in enterprise portals | Lab Exercise (Lab 7) |
| 11 | Architectural and deployment considerations in portals | Work on project |
| 12 | Management and governance of enterprise portals | Work on project Quiz 3 |
| 13 | Submission of the project , project presentation | |
| 15 | Final Exam | |

TABLE I: THE COURSE SUMMARY FOR EWS

## IV. COURSE DESIGN AND DELIVERY CHALLENGES

### A. Designing and delivering the laboratory component for the course

The laboratory component for the course was designed specifically for this course. While there are many vocational-level courses and training packages available, it was difficult to adapt those training solutions for a higher education institution. One of the difficulties lied in the fact that those training solutions were principally designed for short-term training (usually measured in days rather than weeks) and not for long-term exploratory education. Another difficulty was the focus of those training packages on plain technical skills rather than holistic understanding. Moreover, since the EWS course is a part of an undergraduate program, it was necessary to integrate contents of this course with the overall strategy of the program and to align the course with the program-level learning outcomes. Consequently, adopting content from a vocational or professional training program did not seem to be a viable option.

When developing the laboratory component, the principle aim was to create a holistic and integrated learning experience for students taking this course. Thus, the laboratory component was designed based on a single case study on a fictitious company. A case description was created, separated into 8 parts and subsequently released to students. In other words: for each laboratory session (as discussed above, each session of 3 hours contained a laboratory component of approximately one and a half hours duration) the students received a segment of the case study. In addition to the case study, the students also received a laboratory document (describing what needs to be done in the course of this laboratory) and a set of videos demonstrating techniques, approaches and concepts which were covered in the particular laboratory component. The laboratory document also included a set of problem exercises which – to be fully executed – frequently required additional research.

The main reason for using videos as one of the instructional instruments was the highly visual environment of enterprise portals. To explain the way how such complex environments as enterprise portals are working, to demonstrate tools incorporated into enterprise portals, to explain how those tools, techniques and concepts relate to each other and how they support business operations and business processes of a company only visual instruments of instruction can be used. The very initial attempt was to use live demos – the professor teaching this course was demonstrating and explaining live in the class the techniques covered in the particular laboratory component. This approach, however, soon proved to be unfeasible. The main problematic issue here was the pace at which students cover the laboratory material. It is highly individual. Some students prefer to read the case study material for several times and study it carefully before embarking onto the technical implementation. Some students prefer to skim the case study first, do a first-attempt-exploration of the tools in question, and then again return to the case study. Thus, the behavior is highly individual. For this reason, a set of video-based material was developed and complemented by written documentation. This enabled the students to work at their own pace and in their own preferred manner.

Another challenge in designing the laboratory material was to test how successful the students were in acquiring the techniques and methods taught in a particular laboratory session. Moreover, not only the ability to use specific techniques or methods or tools needed to be tested but also the understanding of students of the underlying business processes and business operations. The difficulties here arose, again, from the nature of the environment. Building an enterprise portal and using tools embedded into enterprise portals is a process which can be *observed*, but there is no outcome or tangible result (in form of a document, piece of software code etc.) which can be *submitted* for assessment. In the initial phases of the course, a live inspection of the outcomes of the laboratory component by the teaching professor was implemented. This, however, soon proved to cause enormous overhead and cause severe disruptions to the course itself. As discussed above, an average size of the class is 40 students. At the end of session, a "visual check" of the completed laboratory exercise took about 4 to 5 minutes for each student. This type of assessment was, thus, soon replaced by a rather innovative type of submission, namely, a video recording. To capture the outcomes of their laboratory work and to demonstrate that they had fulfilled the requirements of the particular laboratory session, the

students were asked to create a brief screenshot video showing the outcomes of their work. This proved to be a very suitable means for creating an assessable and gradable submission for this specific type of course work – as the videos not only showed that a particular technique had been acquired by a student (i.e., the student was, for example, able to create a document library), but it gave the opportunity to assess how well the work the student had done was integrated into the overall structure of the enterprise portal and how well the structure and the purpose of this document library addressed the needs of the case company.

### B. Creating the infrastructure for the course

The infrastructure requirements for the course proved to be very cumbersome. The following section will provide some insights in the infrastructure definition and development for the Enterprise Web Solutions course.

Due to the nature of the course it was necessary to provide the students with a 360-degrees view to the particular enterprise portal package used in the course (as mentioned above Microsoft SharePoint 2010 was used to design and deliver this course). The main problem here is that an enterprise portal has two principal perspectives which the students need to deal with: the IT personnel perspective and the end-user perspective. While the IT personnel perspective is exposing the students to the "backoffice" view of the system (maintenance of servers, web applications, storage quotas, custom solutions, middle ware integration etc.), the end-user perspective is asking the students to change their hats and to look at enterprise portals from the "frontoffice" perspective (using content management tools, collaboration features, social networking capabilities etc.) to facilitate all kinds of business processes and operations in an organisation.

Technically seen, enterprise portals are web-based systems. An enterprise portal can be accessed via a browser from any computer having internet access. Thus, an initial idea was to use university's own infrastructure to set-up a demo version of an enterprise portal on one of the server machines of the internal IT department. Two major problems emerged when evaluating this option. Firstly, installing the administrative interface of an enterprise portal on a remote machine without external access deprives the students of the possibility to explore the technical environment where an enterprise portal has been set up. Thus, no laboratory exercises can be developed and used to introduce the students to the IT professional's perspective to enterprise portals. Secondly, when using a common enterprise portal interface for all 160 students of the respective term, it would inevitably happen that students – knowingly or unknowingly – damage, delete or copy each other's work. Consequently, the idea of using one enterprise portal instance for all students of the course was dropped.

The next explored possibility was to use virtual machines. Since all students when enrolling at the School of Information Systems at SMU are required to purchase a notebook or laptop, it seemed to be a viable option. Before each term, a virtual machine containing all software packages required for the course is prepared (the virtual machine contains Microsoft SharePoint 2010, Microsoft Visual Studio 2010, Microsoft SQL Server 2008 and several other tools which are needed to execute all laboratory components). This virtual machine uses VMWare technology, it is of approximately 30 GB in size and requires 6 GB RAM (Random Access Memory) allocated to it.

The use of virtual machines solved both problems as described above. Firstly, the students are free to inspect and explore the technical environment where the enterprise portal has been installed. They can experiment with tools, settings and techniques which IT personnel uses to set up and maintain an enterprise portal. And, secondly, the students "own" individual copies of enterprise portal environments and installations. They perform their laboratory work independently, there is no risk anymore that students will be deleting, damaging or even copying each other's work.

Despite their obvious advantages, the virtual machines, however, created additional problems. As mentioned above, EWS course uses Microsoft SharePoint 2010 as the enterprise portal package to design and deliver the course contents. A virtual machine containing Microsoft SharePoint 2010 requires at least 6 GB RAM allocated to it in order to perform effectively. Consequently, the hardware requirements for the students' laptops needed to be raised – which led to the fact that a number of students could not execute the virtual machines on their laptops. Currently, the hardware requirements for a laptop or notebook to be used in the EWS course is at least 6 GM RAM (8 GB RAM preferred), Windows 7 64 bit edition (or Macintosh using virtualisation tools such as BootCamp or others) and a good mid-range CPU. Out of the current 160 students of the course, the laptops of 25 students are not fulfilling the above requirements. For those students, an extra arrangement has been developed – using the school's internal laboratory room to complete the EWS course exercises (which, in turn, creates additional organisatoric burden onto the teaching team of the course).

### C. Designing the theoretical part of the course

Similarly to the lab component, the design of the theory part of the course was very much driven by the desire to create a holistic and integrated learning experience for students taking this course. While the lab component was primarily intended to expose the students to the practical use of the underlying tools, the theory part was aiming at providing the understanding of the linkages between those tools, systems, processes and people. As already mentioned in the introduction part, the value of an enterprise portal (as of any complex, enterprise level software) is not driven by the underlying technology. Purchasing and setting up an expensive portal server package does, thus, not guarantee the success of the implementation. The success (and business value) of such an implementation will be driven by how carefully a business case for this implementation has been built, how thoroughly the implementation has been planned, how the solution has been designed and how the end-users needs have been incorporated into this solution. And, last but not least, it will depend on the subsequent governance and support of this solution.

Awareness of this has guided the design of the theoretical part of this course. Finally, the structure of the theoretical part was set to closely follow the life cycle of an enterprise portal – initiation and planning phase, design phase, implementation phase, rollout and training phase and governance phase. While the lab components were concerned with introducing the students to the tools and approaches used in each of those phases, the theory part placed particular focus on making the students understand the impact of such an implementation on an organisation as a whole.

While the design of the theory part did not create any major difficulties, particularly challenging was the assessment part of the theory component. As described above, the lab components were primarily graded based on submitted videos. The theory could not be assessed this way. To assess the theory part, a final exam component was introduced. The final exam asks the students to perform an analysis of a case study and to evaluate possible scenarios for an enterprise portal implementation in a given company. The final exam is a closed-book exam – as it is exclusively focusing on students' abilities to analyse a complex situation and to judge how a particular concept (i.e., the concept of enterprise portal) might be of use and value in a given situation and how implementation of such a complex environment would deliver benefits for an organisation.

The final project component was designed following the same spirit. In the final project, students are tasked with planning and development of a complete portal solution for a case study company. While in the initial stages of the course different companies were used for the laboratory exercises and the group project, at a later stage a decision was made to perform all practical exercises in the course based on one and the same case study company. Thus, during the course, the students are subsequently building an integrated, large-scale application addressing needs and requirements of one particular company. Due to this focus, the understanding becomes more contextualized and the solutions suggested for the described problems and issues of the company become more and more sophisticated, integrated and holistic.

## V. SUGGESTIONS AND RECOMMENDATIONS

The description of the challenges and difficulties encountered when designing and delivering the Enterprise Web Solutions (EWS) course has already pointed to some of the suggestions and recommendations which could be made to any instructors aiming at using enterprise level software packages in their courses. This section will summarise those suggestions and briefly comment on them.

Enterprise level software is not only about technical skills. Rather than that, it is about underlying processes, involved people and about business value. Thus, a university course involving the use of enterprise level software must be more than a vocational or professional course or training: in addition to offering the students the possibility to practice and to use those systems in a "real-world"-like environment a clear linkage needs to be established and shown between those systems and the organisational capabilities, structures and strategies. Thus, it is advisable to design such courses to have two major components – the theoretical and conceptual part as well as the practical part.

Designing such courses around the life cycle of enterprise level systems (such as enterprise portals) might be a useful way of showing how such a system is slowly but steadily changing a company – examining the company before the implementation, during the implementation and after the roll out of the system.

The laboratory component should be designed around easy-to-grasp, "real-world"-like problems and issues. Thus, case based laboratory exercises (either based on continuous cases or "mini-cases" for each laboratory) might be a suitable approach. In addition, those "scenarios" for each laboratory exercise should be relatively short and quickly to read and examine. Large portions of text or descriptions would possibly cause major disruptions during the laboratory session.

Due to the nature of enterprise level systems, the students need to be made aware of two perspectives – the perspective of the end-users to those systems and the perspective of the IT personnel to such systems. To enable this, a suitable technical environment (respectively infrastructure) needs to be created. Use of virtual machines might be explored.

## VI. CONCLUSION

This paper attempted to describe some of the major challenges and difficulties which arise from the use of enterprise level software packages in university-level courses. While there are certainly many different approaches to designing such courses, some of the suggested ways of proceeding represent the result of a year-long experimentation and might be of interest to many an instructor attempting to bring enterprise level software (such as enterprise portals) into university curriculum.

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