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Integrating Theory and Practice in Education with Business Games

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Abstract

The meaningful integration of theoretical knowledge and industrial practice in Masters level programmes is now more than ever vital to ensure that graduates have the required competence in IT and that they are ready to contribute to the organisations that hired them within a short timeframe. It is also crucial in ensuring ongoing industrial support for academia because Information technology (IT) is regar ed as a fundamental component in the success of organisations. This has led to a growing demand for IT specialists, sometimes with hybrid skills, to design, develop, implement, and support IT infrastures in both the public and private sectors. However, in recent years there has been a shortfall of IT graduates, with essential experience entering the job market. In order to keep up with demand, educational institutions must adopt innovative programmes to increase the skill-set and knowledge base of their IT graduates.

One such programme, under the auspices of University College Cork, is a Masters course in Management Information and Managerial Accounting Systems (MIMAS). The programme focuses on IT to suit the needs of industry while also combining IT with other theoretical subjects like managerial accounting and the design of management control systems. One key element of the teaching experience is a business simulation where students create software companies and bid for a large scale development project. As part of this, they experience of broad range of tasks and problems inherent in commercial software development. The business game is designed to encourage students to make use of as much of the theoretical elements taught in the degree as possible and is mediated by the teaching staff through the intermediary of a purpose-designed computer system. Our experience indicates the immense value of such practical components in an IT oriented degree programme. It also shows that the application of new technology in training and education will only truly benefit students when it is associated with high quality material and a high degree of student motivation.

Introduction

Organizations face enormous difficulty in trying to achieve successful training programmes to facilitate the transition from the classroom to the boardroom. As a result, industry and academia must collaborate to a greater extent to produce graduates with increased practical skills in IT and project management as well as the more theoretical sides of traditional IT topics. This research study involved the construction and implementation of an IT educational programme for business graduates (Masters), with little or no prior IT training, to exploit tacit as well as explicit knowledge. Based on our experiences in industrial environments, we have introduced a complete business case study where

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students play the role of practitioners and are therefore thrown into the proverbial 'deep-end'. Classes are divided into teams with all of the dynamics of a group of developers and form consultancy companies with a tender to win. The teams compete with one another to develop a system for a customer, Hans Ltd, which is a represented by staff teaching in the degree.

The evaluation of the success of the programme was determined through on-going monitoring of our students' performance over the last five years based on interviews with and mandatory reporting by the participants, and it is intended that the model we developed for our business game can inform other Masters programmes. This study's contribution is both theoretical and empirical in that the experiences of the educators and the students involved in the programme are employed to extend the traditional educational model in order to help understand how to maximize students' learning experiences in IT and therefore help them to become future practitioners.

Theoretical Foundation

The traditional classroom environment has always incurred criticism (Relan and Gillani, 1997). Academics are of the opinion that despite huge advances in technology, the traditional model will always remain the same, that is, dysfunctional (Banathy, 1994; Reigeluth, 1994). Thus, in the area of education, it is often claimed that technological progress has had comparatively little impact. Negroponte (1995) makes the comparison between two time travellers from the 19th century visiting our times: the first one is a surgeon who finds himself unable to practice his craft because he cannot recognise any of the tools presented to him. The second one is a teacher who just walks into the classroom and goes on to lecture his pupils on English grammar. According to Tapscott (1996), educationalists will not be able to ignore new technology any longer and it is clear that education at all levels faces serious obstacles if it fails to keep pace with the reality and needs of a changing workforce.

Many believe that the conventional approach to teaching encourages passive learning that does not develop problem-solving skills and ignores the individual needs of the students (Hannum and Briggs, 1982). Such approaches ignore the requirements of their end users—the students, whereas a dynamic approach is required to solve today's business problems. Cuban (1993) identified two models in the traditional structure—the first a teacher-oriented curriculum, the second a student-oriented curriculum. Cuban also argued that the teacher model has been in place since the early 1900's and nothing has changed since. Traces of the student model can be found in private schools where student numbers are smaller and individual thinking is encouraged. The widely accepted criticism of the teacher-centered model is that the 'what' (explicit knowledge) rather than the 'how' (tacit knowledge) of the instruction (Goodlad, 1984) is encouraged. However, it is also argued that problem-solving and other intellectual skills are difficult to incorporate into the traditional environment due to the very nature of the educational system (McCormack and Jones, 1997). Factors such as space, the grouping of students according to grades and the duration and size of classes all hinder the implementation of alternative models (Harassim, 1990; Harris, 1994). IT and specifically the WWW, is regarded by many as the solution to the problem (Crossman, 1997), as both educators and students alike can increase their practical skills and knowledge through the use of IT and the utilization of media such as the Web (Harasim, 1990; Teles and Duxbury, 1992; Kahn, 1997; McCormack, 1997 and Driscoll, 1998).

Groups Dynamics and Software Development

The study of people as individuals and in groups started as early as the 19th century with Lebon (1896) noting that the behaviour of individuals changes in the presence of other individuals (Argyle, 1994). It has long since been established that individuals can be expected to perform better or worse when they are observed or supported by others (Baron and Byrne, 1977). However, while it is well established that groups are "the instrument through which much work gets done in organisations," the role that groups come to play in organizations or universities cannot easily be tied down to simple models (McGrath,

1984 p. 6). The notion of group has often been used to imply co-operation and collaboration in any environment, however, specific research has revealed as many examples of conflicts as co-operation (Easterbrook, 1991). Easterbrook argued that chaos and anarchy are more reliable models for human interaction than any other to provide a basis for the design of a computer supported communications network. Also, communication doesn't necessarily encourage collaboration: for example, discussion forums can, if not properly structured, result in information overload and therefore structural chaos; ten threaded replies can result in ten thousand unstructured responses and queries (McCormack and Jones, 1997).

Computer Supported Collaborative Work

DeSanctis and Gallupe (1987) defined GDSS (Group Decision Support Systems) as combining "*communication, computing and decision support technologies to facilitate formulation and solution of unstructured problems by a group of people*". In this context, GDSSs aimed at improving the process of decision making within the group by "*removing common communication barriers, providing techniques for structuring decision analysis, and systematically directing the pattern, timing or content or discussion*" as would for instance a Web-based Educational Systems (WBES). The benefit of networked communication emanates from its potential to provide structure to the human communication process within groups (Hiltz and Turoff, 1985). An Educational or simulated learning environment, using for example, discussion forums or expert portals (tacit knowledge) where a communication structure is not specifically designed and imposed on the learners will, to be successful, need to result in an emergent structure. Increases in student or employee numbers necessitates structuring in both the virtual and the traditional classroom. Structured communication provides both the educator and learner with the following advantages: (1) access to expertise; (2) anonymity; (3) opportunity to participate in a large group; (4) feedback; (5) a mediator to assure the flow of the discussion; (6) rules to govern the communication process and (7) some type of motivation, either academic or for promotion purposes. If these are incorporated into any learning or communications network the system will succeed in supporting the learner.

Web-based Educational Systems (WBES)

Web-based instruction can no longer be regarded as an innovative approach to support the learning needs of educators and learners. Indeed, it has become a valuable tool to the provision of most undergraduate and Masters level education programmes. Web-based Education (WBE) is defined as "*…as the application of a selection of intellectually stimulating lessons implemented within a creative and collaborative learning environment that utilizes the resources of the World Wide Web*" (McCormack & Jones, 1997). The approach offers numerous benefits to learners (Lebow, 1993; Perkins, 1991), such as: a distribution tool, group communication to facilitate 'live' discussion, assessment and class management (McCormack & Jones, 1998). The role of WBE is to provide a useful environment where skills are developed and learners are supported (Ritchie and Hoffman, 1996). WBE systems can and do facilitate group collaboration, provide graphically enhanced material, and enable the learners to control the environment, as they can lead or start discussions (Kaye, 1991; Dede, 1996). The attributes of the Web can enable the teacher to redesign the classroom to incorporate what the traditional classroom lacks (Reeves and Reeves, 1993). However, WBE operates under a number of assumptions. The first is that it is assumed that the student has access to the Internet and that the learner can work independently. Given this assumption of the system the following are some of the numerous advantages gained through the incorporation of WBE into an education model or programme (Relan and Gillani, 1997):

- The classroom or lab is no longer bound by space and time; the learners have constant access to the learning material, regardless of geographic location.
- WBE can be used to promote experimental learning, for example students can view real world examples of what they are studying.

- The environment encourages social interaction that is geared towards learning (Johnson and Johnson, 1990).
- The content of the information under study becomes more dynamic. For example, students learning about information systems can view and operate examples of these systems through the WBES environment.
- Students can also, through the environment, contribute to the class by using resources such as discussion forums (Driscoll, 1998).

Damarin (1993) states that, "*…knowledge is no longer simply an individual acquisition, but resides also in groups or communities that share a situatedness"*. The World Wide Web, unlike the traditional environment, is a rich and creative environment that can facilitate the creation of *"learning communities"* (Lin et al., 1996). The WWW can enable instructors to generate new environments to cope with the limitations of the old (Reeves and Reeves, 1993; McCormack and Jones, 1997). The two approaches are different, however both requiring careful planning to deliver effective training (Dick and Reiser, 1989). The traditional approach requires much thought in its design, as does the Web-based format (Relan and Gillani, 1997), however it is limited by both time and space as more and more students and employees require training. Web-based education (WBE) cannot replace the traditional approach but it can provide a necessary balance to its limitations (Driscoll, 1998) as well as support the needs of both the individual and the group and develop the capacity of traditional teaching to cope with ever increasing numbers.

The objective of this research was, therefore, to draw on the theoretical foundation and the potential benefits presented in the previous paragraphs in order to integrate a WBE element in any academic course. To be successful, we needed to design an education programme that built up the skill-set of the learners while also expanding and strengthening their understanding of the theoretical concepts taught to them by giving them the opportunity to apply their new skills in a practical context. This led to the design of a totally new course added to the curriculum of one of our Masters degrees which was entirely dedicated to the application of the theoretical knowledge acquired in the lectures to a practical problem, constructed by us on the basis of our experience of commercial software development projects.

Research Objective and Approach

As part of this research, we attempted to create and refine a model (see Figure 1) that can inform educators in the development and application of teaching programmes, with an IT component, aimed at bridging the divide between theoretical and practical elements of the IT curriculum. Additionally a secondary goal was to identify the factors that lead to the successful delivery of IT-based education programmes to students from varied backgrounds with little or no previous knowledge of IT. This research project reports on our efforts at creating and implementing an education programme matching these goals of integration of theory and practice, and conversion of graduates from non-IT backgrounds. The data and analysis presented in this paper emerges from our experience with the last five years of administering the business game and assessing students' performance, motivation and opinions about the game. The data collected come from our notes taken in progress meetings and final presentations of the prototype applications developed by the students, the students' feed back and personal reports (sent at the end of the year by each participant) and close examination of the documentation submitted by the different groups at various stages during the game.

Background to the Case Study – The MIMAS Programme

This study focuses on the implementation and the utilization of an education model in a programme to provide the participants with the qualifications necessary to follow their chosen career paths. The MBS in Management Information and Managerial Accounting Systems (MIMAS) is a two-year full-time degree programme, which includes six months industrial internship in the second year. Students attend lec-

tures, seminars and tutorials in a variety of subjects relevant to both management accounting and management information systems. The IS courses give students an appreciation of how technology can be used to support the operations, transactions and decision making of modern organizations. The managerial accounting courses provide students with a thorough understanding of accounting concepts and techniques, especially as they relate to decision making and to the design of management control systems. The second year of the programme is structured to go beyond this "classroom" learning through a six-month industrial internship with multinationals based in Ireland, the United Kingdom and the United States.

Integrated Systems Design / Management Accounting / Programming Project

As previously explained, one of the core pedagogical features of the programme is a year-long group project. Students are expected to form software companies and develop a system to solve the IT requirements of a fictitious company (HANS Limited). In the traditional side of the degree, students are taught the concepts they require to perform in the business game. They are specifically taught systems analysis and design, programming (with Visual Basic, ASP and MS Access), project management (using MS Project), data modelling, database design and a variety of other relevant topics (such as SQL and an introduction to Oracle). During the year, the teaching of these topics is scheduled to fit with the project's timeline so that students can apply skills that are freshest in their minds. This ensures that the linkage between the theoretical and practical elements of the degree is strong and that knowledge is positively re-enforced within a short time frame.

Industrial speakers with relevant expertise and experience are also brought in to share their ideas and stories with the class and help students realise that the scenario developed for them is very close to what happens in reality, which further boosts their interest in the game and their self-motivation in both the practical and theoretical sessions. At times, the introduction of key techniques is somewhat delayed so that students experience the problems brought on by the absence of these techniques and can more readily see how and why they must be used in real life projects (e.g. data modelling techniques and process/data flow representation techniques).

Project Context

HANS Limited is a newly emerging player involved in the manufacture of computer equipment. Three products are made in the Irish facility: Basic, Corporate and Executive. The successful application by Hans for funding in the context of European and other grant aid from the Irish government requires the development of more adequate budgeting, control and audit trails within the Cork plant and across the organization as a whole. To maximize its investment in the development of same, the Board of the Company decided to commission a complete budgeting and responsibility system for HANS, to be developed and piloted in the Cork plant. Specifically, HANS requires the development of some means of tracking the movement of goods from their point of entry into any form of finished goods stock, through to the point at which the sales transaction is closed, the goods have left the premises and all monies have been collected. The proposed system must also feature a high-level reporting tool which should enable the users to look for problem areas, exceptions and measure the levels of individual and group performance. An introduction to the dashboard approach to developing executive information systems is provided to them (Adam and Pomerol, 2002).

Project Procedure

Students are divided into teams and are asked to apply the knowledge they have gained in the classroom to the 'problem' presented in the ITT (Invitation to Tender) document distributed to the class at the start

of the academic year. Each project team is required to complete the following in accordance with the accounting, technical and individual requirements listed in the project context section:

- Create fictitious software companies, build up a group identity and mission statement, and organise the project team to complete the overall assignment.
- Construct and submit a preliminary tender for the above problem situation (students are provided with detailed briefing documents providing ample background on Hans). As part of this, they often form a strong identity as a group and adopt the development methodologies they prefer sometimes in a customised form (e.g. SDLC and RAD)
- Prepare the necessary database structures and entity relationship diagrams.
- Develop test data for the databases, toward the ultimate aim of an overall working prototype of the system available for demonstration and capable of meeting the transaction processing and management accounting requirements of HANS Limited.
- Document the design phase. Produce subsequent support documentation for users, explaining the system, and giving some general trouble-shooting advice and tips.
- MS Project must be used to co-ordinate and document the group effort. In recent years, some groups have also used it as a basis to cost their projects (labour cost).
- Groups are then required to submit a final tender document and demonstrate the working prototype to the Management of HANS Limited.
- After the game has ended (but before results are returned by staff), students are asked to submit personal reports highlighting their own contribution to the group effort and commenting on whether they think their group has worked well. Over the last years, we were impressed with the serious nature of the reports submitted and the quality of the self-criticism applied by students. Mistakes were often made, but students were aware of them and were unlikely to repeat these in future team work.

Implementing the Education Programme

Every year we run the Hans case study, the game follows a two stage process as documented below. The two stages involve teaching the students about IT (Phase 1) and applying their new knowledge to the case (Phase 2). This two-prong approach works well in most situations, but in practice, the short duration of the academic year means that the two phases run in parallel in a coupled manner whereby the IT knowledge are delivered in relevant instalments.

Phase 1: Learning about IT

As stated earlier, the participants in our degree programme have little or no background in IT and must, therefore, be taught many basic IT concepts in a short space of time. This requires an intensive series of lectures in key areas supported by many hours of hands-on, development oriented practical sessions. The following provides detailed explanations of how this is operationalised in the first year of the programme:

- The initial generic education/training phase was intended to ensure that all participants in the MIMAS degree achieved a reasonable level of proficiency in IT or knowledge in managerial accounting, due to the learners' diverse backgrounds. As part of this, students must undertake an induction training session in computers and accounting to ease them in at the start of the year.
- A complete programme of practical hand-on computer sessions was organised within each subject taught in the programme, covering the most important skills required by the case study. MS Project, Visual Basic, MS Access, Visio, ASP and Oracle are demonstrated to a high level of detail.

- Students formed teams for assignments to collaborate and fundamentally understand the dynamics of individual and group behaviour. Each student was expected to keep a diary of events such as meetings. Every year students reported incidents (e.g. arguments concerning project deadlines) in the weekly meetings of their groups, which demonstrated how well the group dynamics worked. This emphasis on analysing strengths and weaknesses also discouraged students from not pulling their weight in the business game. Penalties applied to such behaviour when identified.
- State-of-the-art equipment was provided to aid both instructors and students. Technical support was the primary concern of the participants. If a problem arose with the network or the speed of the CPUs was affected for some reason or a database connection failed, the students always identified the problem and requested technical assistance if their own security privileges prevented them from fixing the problem themselves.
- The maximum duration of education sessions was restricted to two hours, thus ensuring that the students did not become overwhelmed with complex material
- The number of participants to gain entry into the course was kept low—a maximum of twenty students. This was intended to ensure that all students' performance and progress could be monitored to ensure they understood the concepts and promote the student-oriented model of teaching (Cuban, 1993).
- Two instructors were in attendance at each practical session, thus achieving a trainee-instructor ratio of 10:1. One generally led the instruction, while the other had a roving role, visiting each workstation to ensure that all of the students understood the material. When difficulties were encountered, the instructor would provide one-on-one instruction in a discreet manner until the difficulty was fully resolved. Outside these formally led sessions students worked at their own tasks in their own time.
- The education material was designed to be user-friendly. Different booklets or case studies were prepared or provided for each element of the education/training. However, not all of the information was provided in order to stimulate 'problem-solution' behaviour.
- Exercises, such as case studies, were also chosen from 'real life' examples to demonstrate the application of skills or knowledge and also to boost and maintain students' interest.

Applying New Knowledge in the Business Game

Given the limited time available to get students started in the game, a carefully prepared sequence of steps must be followed involving both the teaching side and the unfolding of the business scenario in complete coordination. Thus, as explained above, students must be introduced to concepts as they become necessary for the proper execution of the key stages of the business game. This is operationalised in the programme of study in the following way:

- At a high level, the separation of the initial generic education phase from the subsequent applied education phase (Phase two) ensured that the usefulness of the technology or managerial accounting could be demonstrated in the second phase. Students had achieved a base level of capability, and the instructors had several group sessions with them to see how technology could be used in a variety of situations similar to the case study, but without providing them with ready-made solutions that would have restricted their creativity. Examples include the creation of database models and the development of an executive information system using Forrest and Trees™.
- A Web-based educational system (See the next section.) has been constructed specially to support the programme for both the students and the educators.
- Competition between groups to win the tender agreement also forced the groups to strive to use both their individual and combined knowledge to succeed. In some cases, this competition also pushed in-

dividuals into dictatorial strategies within their groups. In particular, inputs from members were discarded without discussions if it was deemed "not good enough" and this was detrimental to overall group learning. When this happened, the group was penalised and the low rating given to their performance helped the group put pressure on the individuals to change their work practices.

- Progress report sessions provided the students with deadlines for the development process as well as the opportunity to determine the progress of other groups, sometimes resulting in both espionage and sabotage. However, pressure from circumstances also fostered collaborative behaviours at times, when groups realised that they could trade rare expertise they possessed against knowledge they did not have.
- The skills and knowledge gained as a result of the Hans Project are the principal attributes in attracting and strengthening the link between the programme and industry. In interviews between students and potential placement organisations during the job interviews, which students attended after their graduation, the tasks performed by the students during the business game and the stories they had about their competition against other groups became very important talking points.

Web-based Education (WBES) System

The customized Web-based education (WBE) system (Figure 1) is used to support the education/training in phases 1 and 2. The education material is available on-line, but in addition, a discussion forum was implemented. This enables participants to provide feedback (anonymously, if desired) to the instructors/lecturers. It also allows them to pose queries, which other participants or the instructors can answer to encourage collaboration. All of the participants can see the initial queries and the discussion stream of answers from other students, the lecturers and industrial consultants (other staff members nominated to act as advisors on special issues). They remain helpful to a point and then start playing "hard to catch" if students require too much help. This further extended the reach of the education as the students could log on to the system at home or on campus and pose questions for which answers would be available when they next logged on. The facility also allowed the students to voice their satisfaction regarding the different elements of the education programme. This provided the students with the opportunity to take

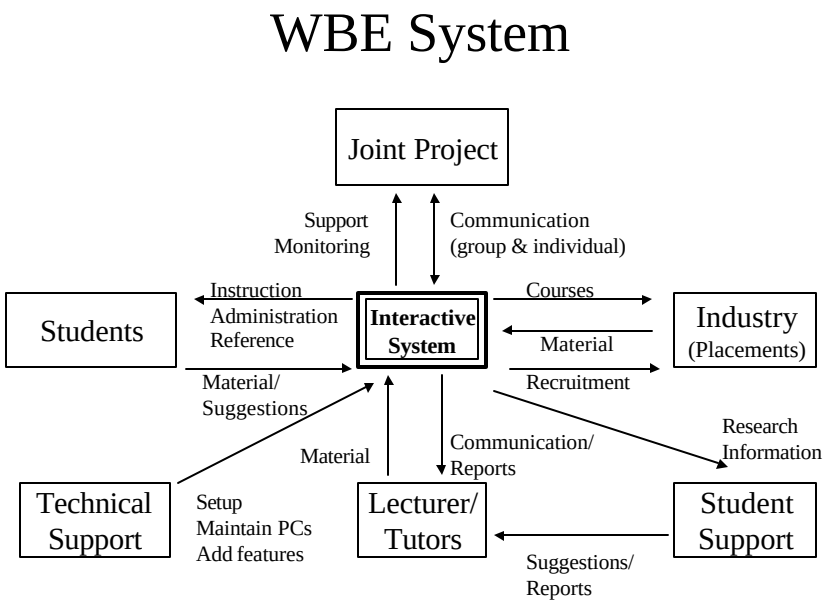


Figure 1: The Web-based Education (WBE) System

part in the ongoing customization of the system, and therefore increase the likelihood of user acceptance (Whitten et al., 1994; Avison and Fitzgerald, 1995; Bocij et al., 1999).

To be effective, education or training should follow a framework that can stimulate the mind (Kyllonen and Shute, 1989; McCormack et al, 1997). Each student has a unique level of skills and knowledge pertaining to any of the modules studied. They are motivated differently, may or may not be interested in the module in question; they may have their own style of tackling the assignment and expectation of the outcome of the lesson (Driscoll, 1998). Therefore the task or demonstration is perceived differently as a result of the student's background and the very assignment itself.

Phase two focuses on the factors necessary to enable students to apply the skills learned during phase one and therefore increase their problem-solving skills. The student's experience determines the approach applied to the given problem; therefore the authors incorporated real world examples into the education model (to provide practical experience). Completion of the exercise or project provides feedback (see Figure 1) to both the student and the instructor. The instructor can, as a result of the feedback from the success of the assignment, decide on the effectiveness of the course. The model is a representation of the experiences of the authors of the study. Therefore, learners and educators alike are influenced by a number of factors. The characteristics of the participants affect their individual learning processes. Previous knowledge, expectations and perceptions influence learning. The authors took these issues into consideration when designing the course to ensure a high level of success.

Discussion

We are now in the fifth year of running the Hans case study and this gives us the opportunity to reflect on what we have achieved in our attempt to boost students' learning and retention of concepts with this business game. Overall, there is no doubt that students have been very committed and very happy about the *Hans project* as they call it. Although the project required of them a very significant volume of work, probably greater than the volume of work corresponding to the formal course that it replaced, students never complain about the Hans case study. At times, they complain about the lack of clarity in the ITT (which we then claim is only a reflection of the lack of clarity in our understanding of what we, as managers for the Hans company, require in order to manage the firm), but the time spent on the project always seems to them to be well spent. This is likely to be a consequence of the *self-assigned* nature of the work, whereby teams organise themselves and assign work to their members without any intervention from staff members. Also, the teams are self-motivated and, since we implemented Hans, no group has ever submitted bad work through lack of time spent. This level of satisfaction is achieved despite certain aspects of the case study being obviously too difficult for most students at the start of the game where their understanding is still limited. It is quite obvious that students derived great personal satisfaction from ultimately being able to deliver a full software solution for a problem they originally could not understand.

Some groups do perform badly, but always because they fail to organise themselves as groups and either do not share the work properly or else, fail to bring together the work of different team members. This is an important lesson both for them and for us. It teaches them that group dynamics are not straight forward and that harnessing the power of group work requires much experience and intelligence. On the other hand, it reminds us that software development more often fails due to poor project management than to a lack of technical skills. This message is often relayed to our students by our industry speakers, but students sometimes fail to realise that their own groups are about to fall pray to the seemingly well-identified problems revealed by their industry speakers.

As far as the core technical skills are concerned, we are increasingly impressed with the amount that students seem to be able to learn outside the class room. Every year, interfaces become more integrated and the well documented features of the software developed (e.g. Sales Order Processing) look easier to

use than most ERP packages available on the market. When asked about the origin of some of their ideas, students will often admit to having used the web as a source of inspiration and technical expertise as they progressed through the project. This may be construed as some kind of software plagiarism, but we have taken the view that the re-use of material, when clearly relevant and technically controlled, is actually a positive point, because it means students understand they do not have to re-invent the wheel and can therefore go much further towards delivering complete systems than if they spend undue time solving basic problems.

One of the strongest point in the MIMAS degree is the hybrid orientation towards IT and management accounting subjects. This dual focus helps students develop a broader range of competence, which increases their understanding of two key dimensions of software development: the technical dimension concerned with *how to develop systems*, and the business relevance dimension concerned with *what features to develop / what information content to provide*. In the business simulation, management accounting teaching staff are also involved and play the role of users whose specific needs must be met by specific features of the software. The communication that must develop between the developers and their users is quite realistic and reveals the gap in understanding that can arise between people with different background. This aspect of the project gives students a practical experience of the difficulties in discussing with users how best to meet unfamiliar requirements and emphasises the usefulness of the hybrid competence taught in the degree programme.

As regards the web learning system used for the project, the way it is being used by students provides another very realistic dimension to the business game as it simulates physical distance between the participants and introduces the need for other means of communication than face-to-face commuication. However, we have to conclude that the value of the Hans case study is not determined by the implementation of the software in a major way. The web interface is a useful complement, but the quality of the teaching experience is more deeply rooted in the case study itself and the experience the particpants gain than in the software we developed. This is reminiscent of the strategic information system literature of the 90s (e.g. Clemons and Row, 1991 or Lee and Adams, 1990) which emphasises that real benefits from IT deployment will only come to those who perform a rigorous analysis of their needs and attempt to build upon the specificities of their companies rather than merely apply a cookbook approach. Certainly, a cookbook approach to Web Based Learning will not work.

Conclusions

Practical projects, such as the Hans case study, must be included in the curriculum of IT programmes, at least at postgraduate level. Our experiences indicate that a multiplier effect can be obtained from these, which results in students demonstrating a much greater level of familiarity and expertise with the development platforms they use than the content of formal lectures and tutorial sessions would otherwise give them. The Hans case study also gives students the occasion to understand the need for hybrid IT-Business expertise. Thus, the introduction of a self-motivating case study which forces students to go beyond the material presented in the lectures and to stretch their basic understanding by applying the concepts presented to them makes them far more competent than a traditional training programme. The area of systems development methods is a good example of the difference between theoretical knowledge and practical understanding as students re-label existing methods and mix them together to suit their needs. Some groups are attracted to RAD type methods and claim to deliver quicker, cheaper software, while others swear allegiance to traditional SDLC and play the *purity* game. This leads to greater confidence and greater likelihood of attracting potential employers in interview situations.

The use of the Hans case study also speeds up learning and enabled us to create a viable two year conversion course, with the second year spent in industry and writing a business report, rather than sitting through another 12 months of class room teaching. This is a major selling point with students who, after several years spent obtaining their primary degrees, want to feel closer to the job market. On the other

hand, the relevance of the MIMAS programme to industry is highlighted in both the demand for its graduates, and in the questions posed and the interest shown by interviewers in the method employed to integrate the theoretical and practical aspects of IT as practitioner-oriented discipline.

More fundamentally, the objective of this research was to formulate a map of the factors necessary to achieve a successful educational programme that provides the learners with a more practical understanding as opposed to merely a theoretical one. The model presented in Figure 1 can help to inform educators in the development and application of programmes, with an IT component, aimed at bridging the theoretical and practical divide in education. A number of important conclusions can be drawn from this research. The development of the model presents enormous challenges and opportunities to both academics and management in developing IT and problem-solving skills to satisfy the needs of all of the stakeholders. It provides the learners with Masters level qualifications geared towards industry and, therefore. provides industry with the type of graduates they require. After running the case with and without our WBES, it is apparent that the case lacked an efficient Web-based support system, which would complement and reinforce the link between the participants of the case as well as strengthen the learning process in the acceptance and use of IT. However, web based learning systems are not enough in themselves and we are convinced that the relevance and attractiveness of the Hans case study play a major role in obtaining the high degree of commitment and participation we get from our students. Our WBES plays an important role, but only as a support for the business simulation. This indicates that the development of such systems should probably only be undertaken when a clear need for them is identified.

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