Bridging the gap between academia and industry through user-centred training

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ABSTRACT. Bridging the Gap is a project-based online track within TU-Towson University's undergraduate curriculum that will provide industry and theoretical background through a module-based e-learning environment. Bridging the Gap will develop and enhance TU's existing IT courses with the addition of self-paced e-learning modules and hands-on industry projects. The project will assist faculty members with developing and administering class assignments by utilizing modulated project repository and providing them with continuous real-time technology updates, required skill sets and knowledge of industry trends. The business community will also benefit from the User Centred Software Engineering and Web Technology Lab; the lab will serve as a test bed for industry applications. Active collaboration with industry will result in the development of new research initiatives for undergraduate and graduate students while, at the same time, helping them develop real-world skill sets to compliment what they will learn through self-paced e-learning modules. Bridging the Gap's approach will lead to the development of a project-based course curriculum, which will benefit the students, TU and other universities, and ultimately the IT industry.

KEYWORDS: *Academia and industry, Self-paced e-learning, User-centred training*

Introduction

In IT industry, the demand for new skill sets needed to accomplish their work is higher than ever before and the trend will continue as the modern society demands for more and more from their IT personnel. At any point within such demands, some skill sets become outdated or no longer needed by the industry and some are newly added. To cope with such dynamic environment, academia has been working hard to produce their students armed with such skill sets that are needed by the industry. However, the pace in such direction from academia often is hopelessly slow, which creates an inevitable gap between academia and industry.

The proposed approach is designed to “fill the gap” between academia and industry by utilizing a module-based self-paced e-learning system developed for this purpose. The learning modules designed for this system are based on the skill set requirements extracted from the industry-supplied projects.
The theme of the project is to develop user-centred learning environment through module-based self-paced e-learning system and industry-grade projects. Through this environment, students will be able to develop competitive industry-grade technical knowledge in Information Technology (IT).

Educational needs

Real-world project

Over decades researchers have presented research results that support the need for not simply teaching theory in computer science course, but rather adding “hands-on”, applied projects. Active learning exercises have been cited as significant contributors to successful education. The latest computing curricula published by the ACM-Association for Computing Machinery, the leading academic organization in the field, argued that programming fundamentals, DB theory and practice, analysis and technical requirements and software design are still the key knowledge areas for students in computer science. Students graduate by computer science program are highly expected to have the capability of doing small and large-scale programming, developing new software systems (such as Web development, interface design, security issues, mobile computing, etc.), designing spreadsheet program (for example Excel), designing a database system, and communication software. To obtain the desired skill sets, the report recommends giving students “exposure to an appropriate range of applications and case studies that connect theory and skills learned in academia to real-world occurrences to explicate their relevance and utility”. Meanwhile, it also specifically recommends adding student projects to capstone courses, in order to adequately prepare students for their careers.
Coll and Zgwaard conducted a survey to total of 458 undergraduate students (n=71), recent graduates (n=143), faculty members (n=72), and employers of graduates (n=172) investigating the perceptions of 24 desirable graduate competencies for new science and technology graduates entering the workforce both today and in ten years’ time.

They reported that not only cognitive and technical skills are highly valued, but some behavioural skills as well. The behavioural skill, “ability and willingness to learn”, was ranked the highest by all the survey participant groups. They concluded that it is unlikely to help graduates build the most desired skills by classroom-based instruction, and that work-integrated learning environment may help in the development of graduate competencies. Integrate real-world; industry specific project into the curriculum will give students the opportunity to develop not only technical skills, but the desired soft skills as well. Hence, it will improve students’ competency upon their graduation (Coll, Zgwaard, 2006).

Currently, most educational materials introduce simulated projects hoping to give students some exposure of project development process. However, comparing to regular simulated course project, the real-world or “more realistic” projects allow students “to learn what is relevant to the environment in which they will be working” (Ellen, West, 2003). As a result, it reduces the problems of students having a “hard time adjusting to real work jobs after graduation” (Tan, Phillips, 2003).

Vliet and Pietron also demonstrated the benefits of using real-world project in Information Systems development course by conducting a survey of their former students. Over the period of three years, they sent out survey to students one year after the students completed the system development course. The survey included questions on students’ perception on the impact of the real-world project the students did in the course on their current job (Vliet, Pietron, 2006). The result of the survey shows majority of the students think that real client project has been “a useful preparation for my job” (88%), “useful for my activities in my current position” (74%), “made the system development effort more predictable” (52%), “provided more learning opportunities than a book project would have provided” (94%), “a good preparation for the demands of my current job” (76%). Even for students not in IT jobs, 92% of the students agreed that real client project provided more learning opportunities - indicates that the real world project approach was perceived as valuable even by those not in IT jobs.

Past literature has shown some evidence that the project organization will have some influence on the type of knowledge developed (Lynn, Akgun, 2000). Takeishi argued that the type of knowledge gained by the firm varied according to the type of technology involved and the organizational mechanisms used to transfer knowledge (Takeishi, 2002). To compare the project organization's impact on learning process and types of knowledge developed within a firm, Chen studied three different company's product development project and found internal development projects encourage synthetic learning and development of architectural and tacit knowledge (Chen, 2005). Working on industry level projects while communicating with fellow students and faculty members on related projects will therefore encourage synthetic learning among project participants. This project is trying to fill the gap between materials taught in classrooms and industry requirements by giving the students opportunities to work on real industry projects. To work on those projects, students must first obtain the necessary skills that are not normally being taught in regular classrooms by taking some self-paced e-learning modules developed by this project. Through those projects, students will be exposed to various technologies. This kind of active learning exercise will supplement the passive learning activities such as lectures to achieve more positive education results. Moreover, this kind of project will provide students opportunities to obtain highly valued workplace soft skills that are hard to be obtained otherwise.

Learner control and e-learning

Learner control refers to "instructional designs where learners make their own decisions concerning the aspects of the path, flow, or events of instruction" (Williams, 1996). Constructivism suggests that learning can take place best when learners can control the pace of learning (Piccoli et al., 2001). Through a field experiment, Chou and Liu also concluded students in learner controlled environment, Technology-mediated Virtual Learning Environment (TVLE), achieved higher-level satisfaction than their counterparts in the traditional environment (Chou, Liu, 2005). Based on constructivism, knowledge is actively constructed by the learner and learning takes place when the outside world is organized and adapted to the learner's experiences (Gadanidis, 1994).

E-learning, as a popular trend in instruction, provides learners the capability to access materials anywhere, anytime. Hence, it makes self-paced learning (a form of learner-controlled learning) a reality. In addition, by fusing learning experience and the assessment together, e-learning will increase the efficiency of the educational process (Reeves, 2002).

As a form of learner-controlled, learner-centred educational approach, multiple assessment strategies need to be available to meet the needs of each student. To make sure that students reach a high level of learning (rather than simply memorizing), the design of e-learning modules will adopt outcome-based performance assessment. The assessment of this kind of e-learning modules will focus on what students can do after they are taught (Towers, 1996). Students with different abilities will follow different paths to reach their goals and may finish at different times. Students pass a module/course by demonstrating that they can finish a certain task. Bloom introduced the concept of mastery of learning. This concept combines the conduct of instruction and its assessment. In conventional instruction, the student's test scores are plotted in normal curve. According to the normal curve, only few students will receive A in the course. The rest of the students will receive C for fairly well in the course or they will fail (Bloom, 1968).

According to Bloom, Hastings, and Madaus's observation, instructors and students set the academic goal too low, because of the influence of the instructional normal curve Part of the problem of the conventional instruction is that every student is expected to learn at the same rate and by the same mode of instruction. If the given time and the instruction mode are fixed then the achievement of each student becomes the function of his aptitude (Bloom et al., 1971). However, if both learning rate and mode vary among learners, more students can become successful in their learning (Block, Anderson, 1975).

Modularized, individualized instruction can largely solve the rate problem and the problem of learning style. In mastery learning, if the proper condition can be provided, perhaps 90-95 percent of the students can actually master most objectives to the degree that can be reached by "good students". An effort is made to find out why students fail to reach mastery, and to improve the situation for such students. To improve the learning problem, following measures are required: (1) more time for learning, (2) different media or materials, or (3) diagnosis to determine what missing prerequisite knowledge or skills they must acquire to master the objective.

Based on Bloom's mastery learning model and new computer-based e-learning, each module should be designed to contain multiple level materials, in which the lower level supports the higher level in content (Bloom, 1968).

In this proposed project, students start the learning from the standard starting level of the learning module of their choice. If one passes the level - took the corresponding quiz and made sufficient points, they move one level up, until they finishes the whole module (pass all levels in the module). However, if students unfortunately fails the quiz at one level, they need to repeat the same level and, when they are ready, they can take the quiz again. In case a student fails the same level repeatedly, an assistant (graduate student or an instructor) may get involved in the learning process by face-to-face tutoring or online discussion.

Industry needs

Recent studies by the U.S. government indicate a growing demand for Computer Science and Information Technology professionals. Although offshore outsourcing has raised a lot of concern over potential job market decrease, U.S. IT employment has been growing steadily since 2002. The occupation projection for year 2004 to 2014 published by U.S. Bureau of Labor Statistics has identified computer science related occupations as one of the occupations that have the highest growth.
From the past experience, many companies find it difficult to retain people with right skill set, which motivates them to look for partnership with the universities. However, due to the lack of trust between university and industry, collaboration between two parties was not done frequently. The Bridging the gap project aims at making universities and industry work together and build mutual trust through long term relationship such as project-based collaboration. The project allows the universities to provide opportunity to their students to get some hands-on experience on industry's much needed skill sets. It also helps industry to save money by not giving long-term commitment to the students and get the job done while getting access to a talented students' pool for their future employment needs.
Anwalt elaborates on the fact that most universities teach either the business or technical approach. But what is in greatest demand in industry is a well-rounded individual that has a good knowledge of both disciplines, and can work collaboratively in a team environment (Anwalt, 2003).

Project description

The Bridging the Gap project facilitates the relationship between industry and academia through the implementation of User Centred Software Engineering and Web Technology Lab (UCSEWTL). It is one of our efforts to meet the industry's changing demands. It will get both undergraduate students and faculty members involved. In this project, Bridging the Gap model will focus on creating industry-favoured training materials and attracts students to take part in the training at their own schedule. This model may be replicated at other undergraduate institutions to serve the needs of students in the rapidly changing world of Information Technology (IT). Changes in the industry are so rapid that academia's efforts to prepare students are often outdated. Consequently, many college graduates with IT degrees lack skill sets that industry needs and are ill-prepared for the job market. Bridging the Gap's model directly addresses this problem by combining a module-based self-paced e-learning training system with components from industry-grade projects, thereby "filling the gap" between academia and industry and also creates a new teaching strategy in IT related courses. The project will have the following components:

- User-centred e-learning system.
- Training modules based on industry demand and associated exams.
- Industry projects.
- Decomposed industry projects that are tuned to some IT-related course project.

The project is designed to offer students of minimum eligibility for participating real-world projects once they have finished 60% of the available modules.

Broader impacts

The Bridging the Gap project aims at preparing computer-science major students and computer information system major students for the real world with industry's much needed skill sets. It will have industry-grade project store and self-paced learning module store within undergraduate curricula that will provide industry-grade projects, and theoretical background through its module-based e-learning system. Bridging the Gap will develop and enhance the existing IT courses with the addition of self-paced e-learning modules and "hands-on" industry projects tuned to IT classes. The project will assist faculty members with class assignments by utilizing modulated project repository and providing them with continuous technology updates, required skill sets, and knowledge of industry trends. The business community will also benefit from the User Centred Software Engineering and Web Technology Lab. The lab will serve as a test bed for industry applications, and also get their projects done. Active collaboration with industry will result in the development of new research initiatives for undergraduate and graduate students while helping them develop real-world skill sets to compliment what they will learn through the self-paced e-learning modules. The Bridging the Gap's approach will lead to the development of a project-based course curriculum, which will benefit the students, TU and other universities, the IT industry and ultimately the consumer.

Motivation and illustration of the project

In today's rapidly changing IT industry, having the right skill set at the right time is the most important thing for anyone who is considering IT as their career. However, building such knowledge is not an easy task since it takes constant industry input for the skill they need. In response to such needs, academia is trying very hard to incorporate practicality to their curriculum so that their graduates may have industry favoured skill sets when they graduate. Often times, the changes in industry are so rapid that academia's effort in preparing students is not enough or could be considered poor. To make matters worse, academia has its own constraints, adequate blending of theory and practicality. With the given time and credit hour constraints, it is almost impossible for academia to achieve both goals (theory and practice). As a result, the lack of practicality and insufficient skill sets college graduates are not properly prepared for IT jobs.

The project will be initiated at the User Centered Software Engineering and Web Technology Lab (UCSEWTL) where industry and university instructors meet and collaborate to develop and maintain training modules and industry-grade projects. The modules can be updated and added as the latest technologies trend. The project will enable the university to offer state of the art technology education to its undergraduate students who are interested in real world IT fields mainly focused on software engineering and web technology areas both theoretically and in practice. It will guide the students in developing their knowledge, skills and abilities in these two very important areas through industry projects and module-based training offered by an e-learning system from the UCSEWTL. Industry projects provided by industry collaborators or by instructors who may design the projects after rigorous research on industry trends will play an important role in this proposal.

Once an industry grade project is available, it will be analyzed, decomposed and the required knowledge or skill set for the project will be extracted. The instructors for IT related courses will look up the decomposed and modulated project repository for the suitable project. The students in the course may need to consult the e-learning system for the necessary self-paced modules that are necessary to complete the project. Each self-paced e-learning module will be designed for the students to finish within a week or so. The outcome of each module will be either pass or fail. The students who successfully finish the training modules may be able to participate in the real industry project, for example work with supervisor to solve industry problems.

Figure 1.
UCSEWTL-User-centred Software Engineering and Web Technology Lab workflow

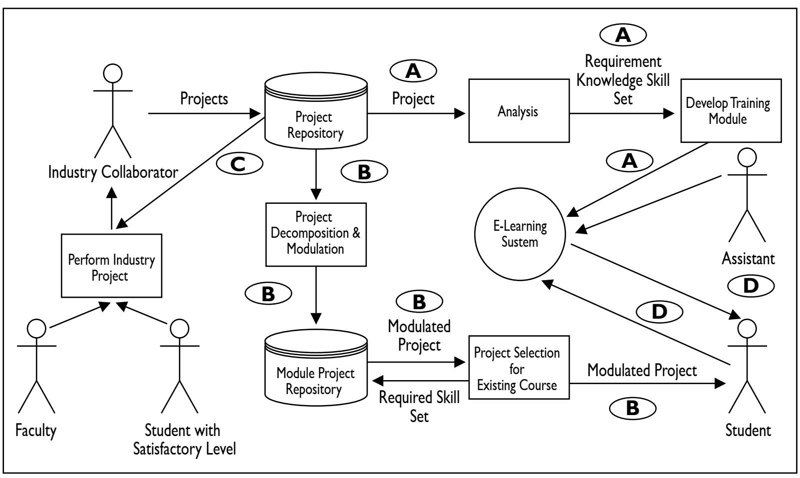

Figure 1 shows how a project provided by industry collaborator can be processed in 4 different paths (letters a-d):

a) project analysis path: used to identify necessary skill sets in order to complete it; training modules will be prepared to support each identified skill or knowledge
b) project decomposition path: project is decomposed and modulated into pieces to make it suitable for existing course projects with specified skill set
c) problem solving path: project execution to produce a solution for the given project
d) self-paced learning path: identify required skill set and take corresponding self-paced training to be prepared for project. Students will get help from the assistant who have completed current materials in the e-learning system and have achieved satisfactory level

In path A, the project will be analyzed and identified by involved technology and the necessary skill set that is required to work on the project. The result of this analysis will be used to create modules for the e-learning system as in Figure 2.
In path B, the project will be decomposed into required skill set and modulated so that it can be used for the course project with required skill set. The instructor in each course will look into the module project repository for the suitable project that has reasonable concentration of skill set for the course. She-he may request course project with a certain technology requirements. Students who are assigned to the modulated/decomposed project will check the necessary skill set for the project and determines which self-paced training module they need to take from the e-learning system. Each module in the e-learning system is designed to be finished within one or two weeks.
In path C, faculty and students will work together to come up with the solution for the industry projects. In this path, the participating students must have satisfactory level of understanding in the topics of required skill set for the project. This path can be used to generate revenue for the operation of the UCSEWTL.
In path D, students take e-learning module(s) that are necessary to complete the project they are assigned. As they pass more modules, their level may be upgraded. When they reach satisfactory level for

the topics required by the given industry project, he/she may be assigned to solve the real world problems. The assistant is a student who have completed most of the modules and received satisfactory level. The lab hires such students for the help of other students who may have difficulty in following the materials.

The e-learning tool - virtual collaboration and distance learning

The e-learning tool that lies in the core of this project has various useful features for this project. It provides Web-based administration feature that enables students to take any relevant modules any time. When they log on to the system, it knows the level of the student on each topic. On completion of each chapter, quiz will be given to the student to check the level of understanding. If students fail, they must retake the quiz after studying for that topic. The quiz screen shot is shown in the Figure 3.

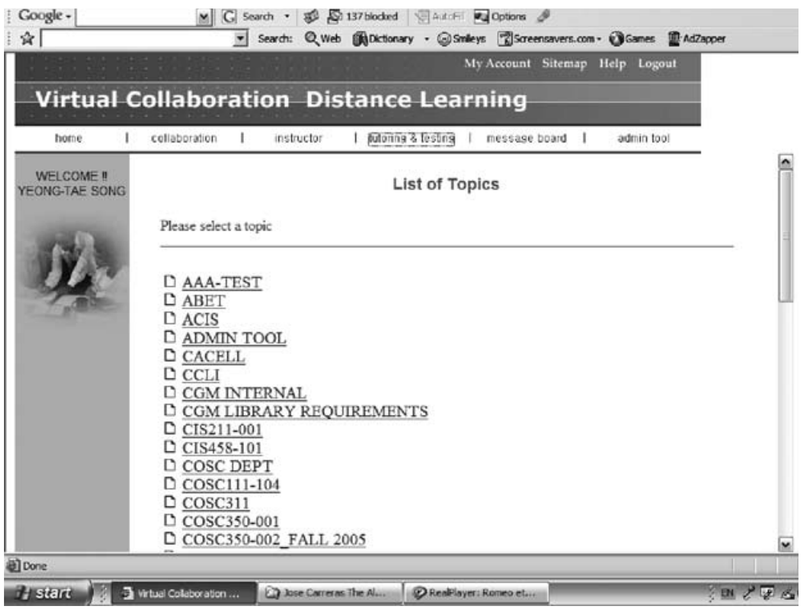

Figure 2.
The topic listing screen shot of e-learning system

E-learning system will be playing a major role in our module-based approach. It has been developed and used to provide module-based approach to the students. It has proven record of successfully delivering regular course materials to the selected courses. Our quiz based progress ensures the level of understanding for the students on some topic. Without satisfactory grade, students are not allowed to move on to next chapters. Figure 3 is a screen shot of quiz delivery in the e-learning system. The list of topics will be based on each student's selection. It will maintain students' progress level so that they can check their level of understanding of each topic. Those levels will also be used to determine how many topics did a student completed and where they stand in the current topics.

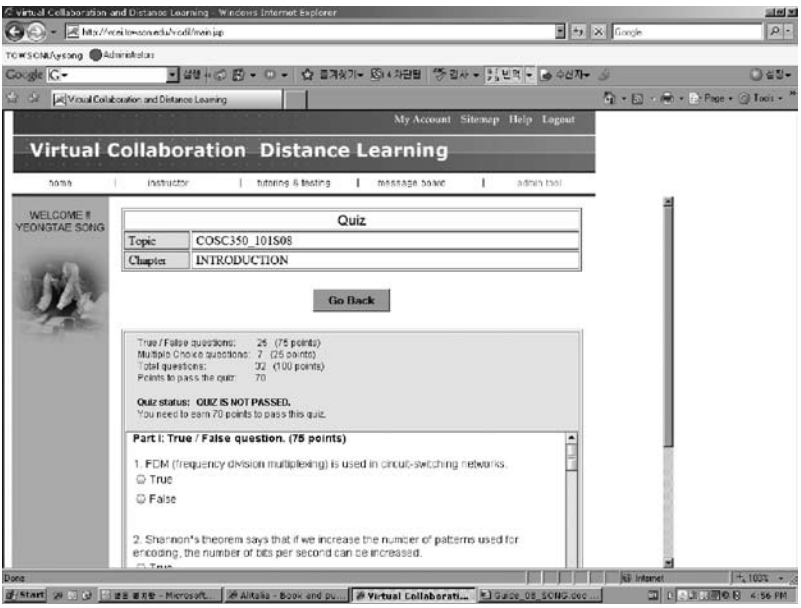

Figure 3.
The quiz screen shot of e-learning system

Student focus

The UCSEWTL lab will provide industry-applicable practical knowledge for students who already have or in a process of having theoretical background on the subject. In addition to that, the latest technologies will be introduced and applied to their lab project through a module-based e-learning system. Students will study each module separately and need to achieve satisfactory level for given self-paced modules. The lab projects will be provided by the carefully chosen industry collaborators and tailored and modulated by faculty members. Each project will have specific practical meaning such as requirement analysis and software architecture. Benefits from this project are:

- Filling the gap of knowledge students may have forward industry expectation by studying modules in the e-learning system. Students can also test out the topics they are familiar with without going through all the contents. If they want to be considered in participating real-world projects, they must achieve satisfactory levels for the required skill set.
- Gaining industry-applicable practical knowledge by combining theoretical knowledge and practical skills through real-world projects.
- Exposure to the latest technology and learn how it is applied to real-world projects.
- Easy to cover a specific set of knowledge by combining existing modules and new module, if necessary.
- Projects can be customized to specific industry so that students can be ready for the real world right after graduation by getting involved in the company-specific project.
- Industry collaborators can play a role as mentors for students who are working on the projects and will often be invited for talks and presentations.

For this purpose, we'd like to construct an industry consortium that can provide projects that incorporate current trends in industry, updates on new technologies, discussion on new industry requirements, mentoring students and evaluation of new technology. In return for their contribution, the members in the consortium are eligible to receive the following services from the proposed lab:

- Services: provide solutions for industry problems.
- Evaluating new software packages or technologies.
- Simulation and/or testing of their product in the lab.
- Easy access to qualified students for the future recruitment
- Access to the e-learning training materials on the theoretical background may be available upon request.

Module-based topic management in this project can help solve the problem of the gap between industry and academia. Industry's continuously changing requirements and demands can be analyzed and broken down into sub-modules in such a way that it can be applied to our training modules as quickly as possible.

UCSEWTL modules

The UCSEWTL's self-paced training modules are designed to fill the gap between industry and academia and can be created and adjusted dynamically. They are interrelated to achieve targeted educational goals efficiently. Each module may be associated with real world commercial software to increase students' adaptability to real world industry problems. There can be many different kinds of industrial software in the modules but due to time and resource limits the number of software may be limited. Using the proposed UCSEWTL modules, students will learn software engineering and web technology concepts and practical knowledge. Most of all, students can choose modules (as specified and recommended in the project) selectively and practice in self-paced. All the modules will have a series of chapters so students can advance to the next chapter at their own pace.
The basic modules that we have identified are categorized in Table 1 below. The topics and contents of the modules can be modified, replaced and enhanced as the requirements of each project change and industry demands change. However, we would like to keep the number of modules to be under 20 so students are not overwhelmed.

Table 1.
Potential modules to be developed

Module name	Description
Module 1 (Software Requirement Specification)	Software requirement specification writing tutorial and examples.
Module 2 (Software testing)	Case studies on software test plans and testing software.
Module 3 (Popular DBMS)	Various sample DBMS projects: Oracle, MS SQL server, MySQL, ACCESS.
Module 4 (Web-based programming and projects)	Self paced interactive tutorial for various web based projects: ASP, JSP, Servlet.
Module 5 (UML)	Self paced interactive UML design tutorial and case studies.
Module 6 (XML)	Self paced tutorial for XML, case studies and code samples that using XSLT, SOAP, SAX and DOM.
Module 7 (Security)	Self paced interactive tutorial for e-commerce related security topics.
Module 8 (Spread sheet based DSS)	Self paced interactive tutorial and sample projects for spreadsheet based decision support system.

As the number of undergraduate students taking courses in IT related courses continues to grow and new technologies emerge, there is a significant need for a laboratory to support students' learning, research and hands-on experience. In addition to that, students need industry-grade software and environments where students can manipulate servers, security configuration, and network programming in a real environment, under a supervisor's guidance.
A modern laboratory coupled with a growing set of academic programs and industry grade projects will allow TU to enhance our programs in a number of significant ways:

- Assisting faculty members with developing and administering realistic and gap-filling class assignments by utilizing modulated project repository.
- Continuous updates on industry trends, technology changes, required skill set.
- Developing new research initiatives for undergraduate and graduate students as well as faculty members through industry collaboration.
- Motivate students to do the industry grade projects, and help students develop real world skill set by studying self-paced e-learning modules and working on industry projects.

The User Centred Software Engineering and Web Technology Lab will also involve:

- Partnering and guiding industry through active project collaboration.
- Development of project-based course curriculum.
- Discussions on new industry trend and preparation of corresponding training modules.
- Test bed for industry applications.
- Providing project based online industry track within undergraduate curriculum.
- Providing industry theoretical background through module based e-learning environment.

Impact on academic programs

Table 2 shows the example courses that can get benefits from this project and the corresponding training modules students can take to be prepared for working on the module projects.

Table 2.
Some relationships between existing

Course	Course content	Module
COSC 457 Database Management Systems	Data models and sublanguages security and integrity problems functions of the database administrator implementation and use of a database management systems a comparison of widely used DBMS packages.	Module 1 (Software Requirement Specification) Module 3 (Popular DBMS)
COSC436 Objective-Oriented Design and Programming	Introduction to object-oriented design and programming technology Main phases in object-oriented design and techniques in object-oriented programming Programming language design and implementation issues for object-oriented languages.	Module 5 (UML)
COSC 350 Data Communications and Networking	Networks, topologies, architectures and protocols, circuit and packet switching, TCP/IP suite, network management and security, and network programming.	Module 5 (Network Programming)
CIS379 Systems Analysis and Design	Guides students through the stages of the evolution of data processing systems, including analysis of present information flow, system specifications, equipment selection, and implementation of the system to provide an understanding of the skills and knowledge needed for effective use of data processing equipment in meeting information needs.	Module 1 (Software Requirement Specification) Module 2 (Software testing) Module 3 (Popular DBMS) Module 5 (UML)

Students taking courses listed in the above table are expected take the corresponding self-pace e-learning training modules to obtain required skill sets before working on the module project assigned in that course.

Expected measurable outcomes and project evaluation

Expected measurable outcomes

The project can be measured by the following metrics:

1. The number of industry projects received
2. The number of projects customized to course projects
3. The number of self-paced learning modules created
4. The number of students finished the module
5. The number of modules studied by students
6. The comments from industry collaborators regarding relevancy of the modules to the skill set they need or require (how current are the modules to their requirements)
7. The number of industry projects completed

Project evaluation

We will meet with industry collaborators at least four times a year for the evaluation of the quality of modules and relevancy of the modules to their projects. I have attached industry collaborators support letters as a reference. Those collaborators will do the evaluation of our modules and customized projects using our questionnaire stating:

1. relevancy: Is it necessary or required?
2. completeness: does it cover all the required or necessary skill set?
3. quality: do modules have sufficient materials so that student can acquire the target knowledge, specified in the module, after completion?
4. effectiveness: how much of the knowledge can student achieve after completion?
5. suggestions: how to improve the modules, any missing or required modules, etc.?

The program will be assessed in the context of an established program assessment methodology at Towson University and our industry collaborators. The project PIs will make available to NSF an annual document assessing this CCLI program at Towson University and by industry collaborators. Assessments and evaluations will be made in the following categories:

- **Student participation:** document the number of student participations and provide a trend analysis of key statistics (e.g. number of industry grade projects done, number of modules studied to the completion, papers published).
- **Customized course projects adoption by existing courses:** How many courses adopted the customized project from project repository.
- **Effectiveness analysis:** document level of understanding by monitoring the test statistics for the modules in the e-learning tool. (the number of attempts vs. the score made).
- **Industry collaboration assessment:** the number of industry project received; assess the modules against latest industry trends; benchmark advertised job description and duties. trend analysis of key statistics (e.g. number of participating industry in UCSEWTL, papers published, conference presentations, grants received, patents awarded).
- **Lab Facility/equipment, infrastructure, software, industry project review:** assess whether laboratory equipment is relevant to related industry, update-to-date and whether to meet the requirements of the software engineering process and web technology development environment.

The following methods will be used in program assessment: (1) inputs from students, industry counterparts, and evaluation comments from industry collaborators and (2) peer reviewed results.

Student course evaluation surveys will be conducted every semester for all the courses using projects from our modulated project repository. This is one of the ways students can give input about the effectiveness of faculty, modulated projects and laboratory facilities.

Industry evaluator is a group of industry representatives from various companies in the region. The evaluator will meet a few times a year to evaluate the UCSEWTL project, and assess how it meets the requirements of potential employers and how relevant is the approach to industry's needs.

Peer reviews come from the instructors who are teaching the courses using the projects for the effectiveness of the UCSEWTL project. They will provide inputs on the effectiveness and usefulness of the project repository, level of difficulty of course project, and relevancy of the project to their courses.

Conclusions

We have proposed a user-centred e-learning system that is designed to "fill the gap" between academia and industry. In this approach, we utilized industry-supplied projects, decomposed into skill sets for our IT-related courses. Modules are suggested to build necessary skill sets required for each project. We have developed e-learning system that can accommodate self-paced learning modules to meet the individuals' needs. We also proposed how to evaluate the success of this approach.

References

All URLs checked November 2008

Anwalt Karen (2003), *Utilizing interdisciplinary teams in teaching e-commerce,* "Journal of Computing Sciences in Colleges", V. 19, n. 2, pp. 288-296

Bloom Benjamin S. (1968), *Learning for mastery evaluation comment,* V. 1, n. 2, pp. 1-5

Bloom Benjamin S., Hastings John Thomas, Madaus George F. (1971), *Handbook on formative and summative evaluation of student learning,* New York, McGraw-Hill

Chen Stephen (2005), *Task partitioning in new product development teams: a knowledge and learning perspective,* "Journal of Engineering Technology Management", V. 22, n. 4, pp. 291-314

Chou Shih-Wei, Liu Chien-Hung (2005), *Learning effectiveness in a Web-based virtual learning environment: a learner control perspective,* "Journal of Computer Assisted Learning", V. 21, n. 1, pp. 65-76

Coll Richard, Zegwaard Karsten (2006), *Perceptions of desirable graduate competencies for science and technology new graduates,* "Research in science & technological education", V. 24, n. 1, pp. 29-58

Ellen Nicky, West John (2003), *Classroom management of project management: a review of approaches to managing a student's information system project development,* "Journal of American Academy of Business", V. 3, n. 1-2, pp. 93-97

Gadanidis George (1994), *Deconstructing constructivism,* "Mathematics Teacher", V. 87, n. 2, pp. 91-97

Kirkpatrick Donald L. (1994), *Evaluating training programs: the four levels,* San Francisco, Berrett, Koehler Publishers

Lynn Gary S., Akgun Ali E. (2000), *A new product development learning model: antecedents and consequences of declarative and procedural knowledge,* "International Journal of Technology Management", V. 20, n. 5-8, pp. 490-510

Piccoli Gabriele, Ahmad Rami, Ives Blakes (2001), *Web-based virtual learning environments: a research framework and a preliminary assessment of effectiveness in basic IT skills training,* "MIS Quarterly", V. 25, pp. 401-426

Reeves T.C. (2002), *Key to successful e-learning: outcomes, assessment and evaluation,* "Educational Technology", V. 42, n. 6, pp. 23-29

Takeishi Akira (2002), *Knowledge partitioning in the interfirm division of labour: the case of automotive product development,* "Organization Science", V. 13, n. 3, pp. 321-338

Towers J. M. (1996), *An elementary school principal's experience with implementing an outcome-based curriculum,* "Catalyst for Change", V. 25, pp. 19-23

Vliet Paul J. A., Pietron Leah R. (2006), *Information systems development education in the real world - A project methodology and assessment,* "Journal of Information Systems Education", V. 17, n. 3, pp. 285-293

Sintesi

Il settore tecnico-informatico e delle Information Technologies si caratterizza per la rapidità con cui le competenze professionali invecchiano a causa della continua produzione di tecnologie innovative. Questa situazione genera un corto circuito tra università e impresa: a fronte di una pressante richiesta di personale aggiornato da parte delle imprese corrisponde spesso l'inadeguatezza del mondo accademico a fornire adeguati curricula alle necessità del mercato del lavoro. Nonostante la congiuntura economica sfavorevole per gran parte dell'industria, il settore informatico, telematico e digitale rimane uno dei pochi ambiti tutt'ora in crescita e che, quindi, costituisce uno sbocco professionale ambito per molti laureati in discipline tecniche. Per il mondo accademico è cruciale, dunque, elaborare strategie che permettano di ricucire i rapporti con l'impresa e formare laureati pronti ad inserirsi rapidamente in attività lavorative reali.

Accanto a questa esigenza, le università devono garantire anche la formazione teorica e di base, per conciliare il piano teorico e quello pratico.

Il progetto Bringing the Gap della Towson University statunitense intende rispondere alle esigenze del mondo professionale con la creazione di un modulo didattico fruibile a distanza, cui si affianca un laboratorio di pratica per gli studenti che vengono messi a confronto su progetti reali di aziende informatiche.

Il personale universitario addetto alla progettazione del modulo si occupa di scomporre e analizzare il progetto reale per definire le competenze necessarie alla sua realizzazione e mettere a punto i materiali. I moduli così prodotti possono essere accorpati in maniera differenziata a corsi diversi e gli studenti possono parteciparvi in modalità telematica, seguendo il proprio ritmo di studio e lo stile di apprendimento più adatto alle proprie esigenze. I moduli sono personalizzabili e articolati in base al modello del "mastery learning" di Bloom; lo studente può soffermarsi sugli argomenti che conosce meno e scorrere più rapidamente gli altri e decidere quando affrontare il test per il passaggio al livello successivo. L'assistenza didattica, svolta da studenti meritevoli, è offerta a studenti che ripetutamente non superano i test di livello.

Il completamento del modulo teorico è prerequisito di accesso al laboratorio (UCSEWTL - User Centred Software Engineering and Web Technology Lab).

Una collaborazione tra università e impresa così ideata permette di creare valore aggiunto per entrambe: un'offerta didattica sempre aggiornata per le università e operatori rapidamente inseribili in contesti operativi per le aziende.

La valutazione dei moduli e delle attività del laboratorio telematico, in base a standard di rilevanza, completezza, qualità ed efficacia, viene concordata tra gli esperti dell'industria e i docenti del modulo; la partecipazione degli studenti ai moduli, la loro adozione all'interno di corsi già esistenti, i risultati conseguiti dagli studenti e il

numero dei progetti ricevuti da parte delle aziende, costituiscono ulteriori parametri per la valutazione dell'efficacia dell'iniziativa. Per favorire una collaborazione di qualità tra università-aziende, la Towson University mira alla costituzione di un consorzio di aziende che forniscano progetti su cui lavorare per formare gli studenti con le competenze richieste dal mercato.