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Evolving an Information Systems Capstone Course to Align with the Fast Changing Singapore Marketplace

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Every year, around fifty-five undergraduate teams of four to six students are required to complete a capstone course for the School of Information Systems at Singapore Management University. Each team spends approximately five months working with an industry sponsor using the latest tools and techniques. Students actively learn by implementing the system to solve a real world problem. In addition to delivering value to the local sponsor, our students learn specialized skills currently needed in the marketplace, which might not yet be incorporated into electives and core courses. In this paper, we discuss the tradeoffs of providing students and project sponsors flexibility in designing projects while at the same time ensuring that all students are delivering consistent, assessable milestones. We will also discuss how the tools and techniques available to students are continually changing what the students are able to accomplish in a fixed amount of time.

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Introduction

Every student in the School of Information Systems at Singapore Management University must work with a team to build an information system as part of the four-year undergraduate program. This capstone course provides students with an opportunity for active learning[2] by applying what they learn in the classroom to solve a real-world problem. The out of class environment[3] provides a challenging experience where students encounter unexpected obstacles, which usually leads to learning new tools or techniques. Students are encouraged to seek out local companies to identify problems and opportunities that might be addressed by the creation of a new information system. Over the years, our students have created web portals, mobile applications, content management systems and a variety of other systems for clients. As the capabilities of the student teams and the capstone course in general have improved, more companies have begun to partner with the university to make additional projects available to the students. Capstone teams provide an excellent value proposition for small and medium businesses since they provide an opportunity to have a team of students, armed with the latest tools and technologies solving a real-world business problem for free.

Active Learning

The main idea behind active learning[1] is to involve students in doing things and thinking about the things they are doing. This does not have to be done in the classroom[2]. Our capstone course involves only an hour of classroom time where all students are gathered to hear a briefing on the assessment structure and process. Students are expected to meet regularly as a team, with their sponsors and with faculty supervisors. Meetings with sponsors involve gathering requirements, validating prototypes, and testing the quality of the system. The regular interactions with the faculty supervisors involve the team reporting their weekly progress and sometimes reflecting on what they learnt. These meetings allow the faculty to provide feedback and formatively assess the students' progress. In most cases, students are actively learning during teamwork, interacting with real clients and when reporting progress to faculty supervisors.

Capstone Courses

In 2004, a study on capstone design courses and assessment[3] found that assessment is not done well with uncertain assessment practices. More recent research in 2012, by John Ochs and Lisa Getzler-Linn[4] suggests that industry sponsors have direct impact on how students are assessed. They suggested a formative assessment during "gradable moments", similar to our regular supervisor meetings. That research uses sponsor feedback to help improve the assessment, such as the requirement for suitable written communication. In this paper, we discuss the assessment of the student experience, which is largely determined by the types of industry projects and tools they use. As a relatively

young school of just over 10 years, we are able to improve the quality of industry sponsors and project deliverables as the Singapore IT market place changes. This is done by lowering the cost of failure for the industry sponsor and raising the quality of the deliverables by amplifying and simplifying the tools involved.

Lowering the Cost of Failure

Our low cost to project sponsors enable them to propose riskier projects with hard to quantify value. By outsourcing these projects to university students, organizations get to provide opportunities for students while at the same time see research and system development ideas move forward. Lowering the non-monetary costs of failure can often be as or more important than lowering the potential financial costs of failure in many organizations. When student projects are unable to meet objectives, this is often less of a surprise. Because of these lower costs of failure, many organizations choose to have students work with new tools, technology, and platforms in order to uncover unexpected issues prior to beginning internal development projects using potentially risky new components. Each term, we have seen the types of projects change as organizations become interested in new areas. We started with a team building a mobile application for a local client, followed by multiple teams deploying on Apple's iOS App Store and Google's Play Store, and recently, some teams have been doing web responsive web apps to run on multiple platforms. After the first student team deployed an application to Amazon Web Services, other companies began to request similar applications and deployments. More recently, the areas of geospatial mapping and predictive analytics have become more interesting to local companies as both the technology advances and so does the demonstrated ability of students to deliver projects in these areas.

Appification

A trend that has emerged over the past few years has been the creation of "apps" whether they are for iOS, Android, or web applications. As clients have learned to articulate project ideas as "applications", students have reciprocated by delivering bounded application projects that can be developed, tested, and deployed to an application platform or service prior to the end of the capstone term. This final deployment stage is perceived to be a clearer milestone than simply pushing up a new version of a website which can be continually tweaked and modified. The additional planning and rigor imposed by external approval processes by vendors such as Apple with their iOS App Store has helped many teams to better bound the scope for their projects. Students realize that there is less opportunity to catch-up and make last minute changes once their projects are dependent on external organizations such as Apple. This realization seems to raise the quality of deliverables.

Consumerization

In addition to the appification of our capstone projects, there has also been a trend towards the use of more free, open, and consumer platforms. In bigger companies, organizations would provide access to systems, access to software, and sometimes hardware in order to enable students to develop information technology solutions. This was necessary since students were unable to use academically licensed software to deploy solutions for these companies. With the rise of cloud computing, open source software, and the ubiquitous use of smart phones in Singapore, student teams began to have access to a larger diversity of development tools, platforms and software. For many companies and the students they were working with, it became easier and more convenient to rent free server capacity from cloud computing providers such as Redhat OpenShift, Amazon Web Services and Google App Engine than to deal with the information technology departments of the companies. The availability of these resources enabled student teams to move faster and farther but also had the effect of shifting the overall project portfolio more towards public services and consumer-focused solutions. While this mirrors the shifts in the marketplace to some extent, it also has the potential to shift the time that students are spending working with technology further from the needs of the IT organizations in Singapore that may one day employ them. For example, many teams will build applications for Amazon Webservices, Google App Engine, iOS, and Android; but few currently choose to build solutions using enterprise solutions such as Oracle, Peoplesoft, Salesforce, and other software used by larger companies and IT consultants. One potential way to address this shift has been to reach out to larger companies, solution providers, and consulting firms to encourage them to work with capstone teams to develop proof of concept demonstrations on the latest IT solutions designed for larger enterprises.

Startups

Another option that students have is to serve as their own sponsor and develop their own IT solutions. Students can use this option to work towards starting their own company or to move a research idea forward. We have continued to modify the constraints around

self-proposed project ideas as the market has changed. On one hand, the students now have greater opportunities than ever to transform an idea into something that they can make available for the world to use. The falling costs of hardware, software, and cloud computing coupled with the increasing quality and variety of self-paced tutorials have greatly lowered the barriers for students looking to build and deploy something new. From a program perspective, the challenge has been to ensure that the amount of work done and real-world experience seen by teams with self-proposed ideas is similar to that seen and done by the remaining teams in the cohort. For example, teams that are their own clients do not receive the mentorship, surprises, and sometimes-unreasonable demands received by teams with traditional clients. This led many students to see self-proposed ideas as an easier route while others found it a more difficult process. To address this, the program put a process in place to assign a mentor to work with any teams working on self-proposed ideas. These mentors are most often venture capitalists that are interested in what is going on at the university and other individuals around Singapore associated with the awarding of grants and other funding to startups.

The Process

Students are encouraged to use an agile methodology[5] with the focus on iterative development. Many teams elect to follow a modified version of SCRUM[6]. There are three milestones: acceptance, midterm and final presentations: and three deliverables: a poster, a video pitch, and a public wiki page. The students must deliver an acceptance presentation prior to being enrolled in the fifteen-week capstone course. By acceptance presentation, teams are expected to have selected a project, gather requirements from their client, defined the initial scope, consult with their faculty supervisor, and begun initial development and research. Students are aware that approximately ten percent of the teams presenting for acceptance are unsuccessful and must wait to enroll for the capstone project in future term. This helps to ensure that students put in adequate effort prior to acceptance and that all projects are of similar size in scope and complexity. To aid in setting expectations, all students are required to maintain a public wiki page outlining all aspects of their projects. This wiki along with their presentations serves as the documentation for their project. Since most wiki pages are public, teams currently enrolled in the course can see the other teams' projects. The midterm and final presentations assessments comprise the majority of the students' final grades. Before the final presentations, teams are required to create a poster, a video pitch and attend a poster fair. The poster fair is a public event on campus attended by project sponsors, students, faculty, and the general university community. Various prizes are awarded to the top teams. Friends of the school and potential industry sponsors are often in attendance. It provides an opportunity to evaluate the cohort's capability, ask questions about the projects and soak in the school projects and culture.

Conclusions

As the process of creating and deploying IT solutions has gotten easier, our focus has started to shift more toward ensuring that the right solutions are being built and what did the students learn while creating these solutions. It is no longer a question of what can be built in five months but rather what should be built and how students and their clients will know if a good solution was built given the time and resources provided. As the questions about projects have shifted from the technical to the experiential, new tools, processes, and resources have been added. Many students now follow the Lean Startup Methodology[7] and all teams are required to do multiple rounds of user testing during the course. The Lean Startup methodology allows minimum viable products to be developed and tested quickly with actual users thereby improving the quality and focus on what to build. The capstone course will need to continue to evolve as the Singapore market changes. With approximately fifty-five teams creating new applications to solve real-world problems each year, the opportunities to make an impact are significant. At the same time, if students are given opportunities to work on problems at the forefront of technology to solve real problems, they will be actively learning and will be better prepared to make positive impacts when they graduate and enter the workforce. By raising awareness and improving the overall project quality, we hope the capstone course will produce better-trained students for the Singapore IT industry; one of the primary goals of the SMU Information Systems undergraduate program.

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