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The Imagine Cup Software Development Invitational: Implications for Use in the IS Capstone Course

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ABSTRACT

Employers have been critical of the opportunities students have to integrate technical business and soft skills in IS programs. The IS capstone course is one mechanism through which to address this need. Literature indicates IS capstone courses differ in the weight they place on technology, business, and soft skills integrated as a part of the course. This paper argues it is important to address all three skill sets in a roughly equitable manner while it is often a student's technical skills that get them an interview, it is their business and soft skills that get them hired (Litecky, Arnett, & Prabhakar, 2004). The Imagine Cup Software Development Invitational (SDI) is introduced as a way to accomplish this equitable integration. Benefits and challenges in using the Imagine Cup SDI as a part of an IS capstone course are discussed as well as suggested directions for future research.

INTRODUCTION

Employers of information systems (IS) program graduates have been critical of the opportunities students have to integrate the business, technical, and personal ("soft") skills in their coursework (Mitri, 2008). In most cases, individual classes consist of a business core (comprised of general courses in management, accounting, marketing, finance, economics) and an IS core (primarily including courses in programming, database, systems analysis and design, and networking). The capstone course in the information systems curriculum is one way IS programs are addressing this criticism. However, although the IS capstone course is designed to allow students the opportunity to integrate the various skills acquired from prior coursework, *what* skills are integrated and *how* those skills are integrated varies between IS programs.

For example, some IS programs take an approach that emphasizes the business aspects of the student's skillset such as the enterprise resource planning system (ERP) based approaches adopted by Davis and Comeau (2004) and Beachboard and Beard (2005). The Davis and Comeau (2004) approach focuses on developing the student's ability to take advantage of the benefits of ERP systems by facilitating an understanding of the various organizational and individual issues surrounding the systems. They also provide the students some exposure to ERP technology by requiring them to set up their own company in an SAP environment. The approach taken by Beachboard and Beard (2005) is similar in that it operates in the context of ERP systems, however it differs in that it focuses on IS governance, IS management, and on the integration of the two. Both of these programs, while integrating much of the coursework on IS management and possibly the coursework on systems analysis, do not integrate the coursework on database design, programming, or networking.

Other programs take the more traditional route of a software development project with a greater technical emphasis. These capstone courses focus on integrating the knowledge attained in the core IS courses. Examples of this type of capstone course is seen in the work of Mills, Hauser, and Pratt (2008) and Mitri (2008). This type of course focuses on the design and development (and possibly the implementation) of an information system to address a business need. While this type of course is more in line with the description of the capstone course in the IS 2002 model curriculum (Gorgone et al., 2003) and focuses on the integration of knowledge gained in the IS core classes, it only peripherally address the integration of the student's business knowledge.

Soft skills are addressed differently as well. The content of the capstone course can be delivered to individuals, as in the case of Davis and Comeau (2004). However, most capstone courses utilize the team-based learning approach. This approach has been shown in studies to facilitate learning and to improve soft-skill development (Nance, 2000; Sirias, 2005). One way that the group approach is implemented is in conjunction with service learning. Service learning combines classroom learning with community service to allow for students to gain real-world experience without the pressure for success that is demanded

by the workplace and allows students to hone their soft skills in actual business environments (Wei, Siow, & Burley, 2007). The integration of real-life practice into the programs is also looked favorably upon by both students and those in practice (Wei et al., 2007). All of these factors point to the underlying connection between the design of the IS capstone course and the employability of the students that take the course.

The design of the capstone course is important because it can affect the student's chances of gaining employment after graduation. Programming, systems development, and database skills are competencies that students must have to qualify for many job postings (Lee & Han, 2008; Liu, Liu, Koong, & Lu, 2003; Prabhakar, Litecky, & Arnett, 2005). The paradox here is that while students need the skills they obtain in their IS core to qualify for the position, employers often make the hiring decisions based on the business and soft skills possessed by the student (Litecky et al., 2004). Because of this, it would stand to reason that the IS capstone course should address these factors in roughly equal measure. This paper presents a tool for accomplishing this task in the form of the Software Development Invitational (SDI) competition that is a part of the Imagine Cup.

The Imagine Cup is a worldwide competition sponsored by Microsoft that brings students together to create technological innovations centered on a theme that changes annually. The purpose of this paper is to introduce the SDI as a framework that can be leveraged in the design of IS capstone courses that will serve to integrate the knowledge students gain from their business and IS core coursework, in addition to to enhancing the development of their soft-skills. The remainder of this paper will introduce the Imagine Cup and the SDI, present some of the proposed benefits to students and faculty of using the SDI as a framework for IS captone courses as indicated by our experiences with its use, and present our plan for assessing the validity of the proposed benefits.

THE IMAGINE CUP

The Imagine Cup, as stated on its website, "… encourages young people to apply their imagination, their passion and their creativity to technology innovations that can make a difference in the world – today. Now in its sixth year, the Imagine Cup has grown to be a truly global competition focused on finding solutions to real world issues (Microsoft, 2008b)." The theme for the 2009 Imagine Cup is "Solve the World's Toughest Problems," and focuses on providing innovative technological artifacts that address the United Nations eight Millennium Goals, presented in Table 1.

1.	End Poverty and Hunger
2.	Universal Education
3.	Gender Equality
4.	Child Health
5.	Maternal Health
6.	Combat HIV/AIDS
7.	Environmental Sustainability
8.	Global Partnership

Table 1: United Nations Millennium Goals (Information, 2008)

The competition invites participants to submit their work related to the above themes in nine different areas, described in Table 2.

Competition	Description

Software Design (SDI)	Involves the creation of software applications and services that utilize Microsoft technology including mobile software applications.
Embedded Devices	Students use the Windows Embedded client environment to create an embedded device to meet the theme requirements.
Game Development	Games are produced that meet the theme of the competition.
Robotics and Algorithm	Students compete with their creations to solve increasingly difficult puzzles in a virtual environment.
MashUp	Competitors create innovative Web 2.0 applications related to the theme of the competition.
Photography	Students submit photo essays comprised of still images that explore the competition's theme.
Short Film	The competitors must complete a short film related to the theme and demonstrate their competency in all areas of filmmaking.
Design	This competition challenges participants to address the theme by designing an innovation that makes for easier human-machine interactions.

Table 2: The Imagine Cup Competitions (Microsoft, 2008a)

While other areas are applicable to MIS coursework, this paper will focus on the software design invitational competition (SDI) portion of the Imagine Cup. The SDI challenges students to leverage their creativity to create a software application related to the Imagine Cup theme. Students form and compete in groups of up to four members in order to design and implement their applications. The student groups also have the opportunity to choose a mentor that can provide the team with guidance and insight during the competition. The mentor can either be a faculty member, someone from practice, or both.

We focus here because it relates most to the core of the MIS discipline in that it requires students not only create a software artifact, but also a business plan and design requirements. This allows MIS students to draw on the entirety of their diverse coursework in business and technology when crafting their submissions and provides them with advantages over competitors versed only in technology. There are other advantages to MIS students, however, that extend beyond the boundaries of the Imagine Cup competition. These advantages are discussed in the next section.

PROPOSED ADVANTAGES OF USING THE IMAGINE CUP AS A PEDAGOGICAL TOOL

Outside of the obvious advantages MIS students have in the competition, we propose that using the Imagine Cup as a pedagogical tool will have distinct advantages over traditional classroom development projects for both students and instructors. The proposed benefits discussed here are based both in theory and in the experiences of the authors in using the SDI as a framework in the IS capstone course taught at their institution. These benefits are discussed in the sections below.

Higher Levels of Student Interest

The SDI competition focuses on innovation. This is a key point as students are no longer being told "what" to do for a project. Instead, they are given a framework in which to operate within and allowed to use their creativity to create a project that fits within the contest theme. The students are also allowed the latitude to choose their own problem within the confines of the theme. We have observed students tend to choose problems they are passionate about which translates into higher interest in the project. As a result, the projects we have seen our students undertake have been well beyond what we would have assigned as instructors.

The higher level of student interest is also seen in the way students have approached the material. In our experiences, we have traditionally found programming to be the least enjoyable aspect of many MIS programs from the student perspective. However Long (2006, 2007) has found that innovative approaches to the inclusion of programming in MIS programs such as the use of competitive games increase the student's interest and learning. Our experience using the SDI has indicated that students are now view the programming aspect of the project as a means to achieve their solutions, not just a hurdle they have to overcome to complete an assignment.

Promotion of Student Learning

The first principles of instruction are prescriptive principles common to many of the major instructional design theories. In formulating his first principles, Merril (2002) reviewed several theories and found that while their terms differed, they all incorporated at least some of the following principles to promote student learning by: (1) solving real-world problems, (2) applying existing knowledge to the problem, (3) demonstrating new knowledge acquisition , (4) applying new knowledge to the problem, and (5) integrating new knowledge into their world.

To demonstrate how the SDI can promote learning, we will examine how it relates to these principles.

- **Learning is promoted when students solve real-world problems**. The entire premise of the Imagine Cup and the SDI is to provide innovative technological solutions to real-world problems. In the case of the 2009 Imagine Cup SDI, the problems must be related to one of the United Nations millennium goals mentioned earlier in this paper. The fact that students are afforded the opportunity to identify the actual problem they will address could increase the promotion of learning because of the higher level of interest they have in developing a problem solution.
- **Learning is promoted when existing knowledge is applied to the problem.** The design of the Imagine Cup SDI requires that students apply not only the knowledge that they gained in their IS core curriculum to produce the software artifact, but also knowledge gained in their general business classes to construct the business plan that accompanies their artifact.
- **Learning is promoted when acquisition of new knowledge is demonstrated.** In order to create their solutions, students often need to acquire technical or business skills not covered in their prior coursework. For example, students may conceive a solution that requires programming for a mobile device. This topic is not generally covered in IS core programming courses. Another example would be the knowledge required to construct a detailed business plan. While components of this skill are covered prior to the IS capstone course, it is often necessary for students to go out and gain new knowledge to facilitate their completion of this deliverable. With regards to the Imagine Cup SDI, this need for new knowledge is facilitated via online resources provided through the Imagine Cup site or made available by the project team's mentor.
- **Learning is promoted when new knowledge is applied to the problem.** In almost all cases, students apply their newly acquired knowledge toward the creation of their project team's designed solution.
- **Learning is promoted when new knowledge is integrated into the student's world.** At this point, it is difficult to discern if the knowledge gained in the Imagine Cup SDI will actually integrate into the student's world. However, it seems likely that students will be able to carry the lessons learned and the integrative skill set developed into a business environment at least to some degree.

Overcomes Challenges to Service Learning

Service learning projects expose students to the needs of their community (Lester, Tomkovick, Wells, Flunker, & Kickul, 2005). The Imagine Cup SDI exposes students to the needs of the global community by challenging them to provide solutions to the world's biggest problems. Because of this, any entry into the Imagine Cup SDI can be viewed as a service learning project. This is especially the case when students choose mentors from service agencies as project mentors and becomes exponentially more so if their software applications are later implemented to the benefit of those service agencies.

While service learning projects possess the benefits discussed earlier, they also come with challenges. Some of these challenges include: (1) keeping the scope of the project narrow enough to manage, but large enough to be challenging to students, (2) developing a framework to organize the project, (3) establishing criteria for project success, (4) segmenting the project so that it can be accomplished in a specific timeframe, and (5) gaining and keeping commitment from sponsors

(Papamarcos, 2002; Wilcox & Zigurs, 2003). The Imagine Cup SDI can assist in overcoming these challenges in the following ways:

- **Keeping the scope of the project manageable, but challenging.** The fact that the students design the project can make this especially challenging. Students may design a solution that is too simplistic or too complex. The onus is ultimately on the instructor and mentor to assist the students toward a solution that meets this criterion.
- **Developing a framework.** The Imagine Cup SDI provides instructors with a ready-made framework within which to carry out the project complete with due dates and deliverables.
- **Criteria for project success.** To say that the sole criterion for project success is how the students perform in the SDI would not be fair to the students. However, the successful submission of the competition deliverables to the competition can serve as a basic level of success criteria. Additionally, given that the software applications are judged by a panel of industry experts, how successfully the project performs in the competition is a good indicator of its quality.
- **Segmenting the project for a particular timeframe.** The Imagine Cup SDI is segmented into milestones where incremental portions of the final project can be turned in. The timeframe provided allowed our student groups sufficient time to develop the deliverables required. Also, because the design requirements are set by the students under the guidance of a mentor, issues such as scope creep are not as prevalent.
- **Gaining and keeping sponsor commitment.** This could possibly be the area where the Imagine Cup SDI has the largest impact on the challenges of service learning projects. In traditional service learning projects, students may need to meet with the client several times in order to gain adequate information to determine the problem and generate design requirements (Papamarcos, 2002). This can affect the level of commitment the sponsor has to the project as they try to allocate already stretched resources to meet the demands of the student team. Alternatively, the Imagine Cup SDI requires much less resources. This is primarily because the students are using their imagination to derive design requirements as opposed to taking the time to collect them from an organizational project partner.

PERCEIVED CHALLENGES ASSOCIATED WITH USING THE IMAGINE CUP SDI AS A PEDAGOGICAL TOOL

Having discussed some of the benefits of using the Imagine Cup SDI as a tool for IS Capstone courses, it is also prudent to discuss some of the challenges that we have perceived while implementing this in our program. These challenges do not necessarily have to do with the structure of the Imagine Cup SDI, but rather the demands that it places on the student participants and faculty mentors.

- **Students are unaccustomed to the level of autonomy that the Imagine Cup SDI provides.** In this sense, autonomy refers to the freedom that student's have to complete the contest deliverables in the manner that they see fit. Our experiences with students have shown it takes time for students to adjust to this autonomy. This is especially true for those students that prefer coursework with a high level of structure. These students depend on the instructor to give them instructions and are primarily concerned with meeting those criteria. They also depend on the instructor to define the significance and interrelatedness of the topics in the course (Shaw & Bunt, 1979).

  For students that are used to and/or prefer serious structure to their coursework, the relative freedom inherent to an IS capstone course of this type comes as a bit of a shock. The deliverables in the Imagine Cup SDI, while including the necessary components, do not have the same requirements as the deliverables in a more structured course. For example, there is no minimum length for the business plans. It is important to note that the Imagine Cup SDI is not without structure, there are rules and requirements for each deliverable. Rather they are not as stringent. This is what allows the students the autonomy to distinguish their submissions from the submissions of competitors. It has also been noted that as autonomy increases, students are more personally tied to the project and thus feel more responsible and are more willing to accept accountability for the outcomes of the project (Lester et al., 2005).
- **Instructors must be prepared to quickly familiarize themselves with new technologies.** Our student groups did not constrain the design of their applications to the technological skillset they acquired from their prior coursework. In fact, we had groups that created solutions that required skills for developing on mobile devices, skills in developing web services, and other areas not taught in our core IS curriculum. In order to be effective mentors to our students, this required the course instructors to become at least marginally competent with these technologies as well.

  We are not suggesting that instructors learn every new technology students want to include in their applications as doing so is not feasible given the numerous other commitments to other classes, research, and service activities.

However, by gaining at least a cursory knowledge of the technology, we were able to assist students in finding the resources that would provide them with the instruction they needed to further their projects. Doing so also taught the students how to gain knowledge on their own about new technology, which we believe translates into a valuable career skill.

DIRECTIONS FOR FUTURE RESEARCH

The proposed benefits and challenges of using the Imagine Cup SDI as a pedagogical tool addressed in this paper are based on the experiences of the authors and in prior literature and are not conclusive by any means. Research must be conducted before these claims and assumptions can be validated. This paper simply serves as the starting point for such research. Over the next few months, the authors will develop a survey instrument to collect data on the observations reported in this paper. The instrument will be administered to the students in our IS capstone course over the upcoming semesters. However, this will only provide data on the benefits and challenges of using the Imagine Cup SDI as a tool at one institution. It is our hope that other institutions will also integrate the Imagine Cup SDI into their IS capstone courses and administer the survey to their students as well.

CONCLUSION

The Imagine Cup SDI allows students to innovate and utilize their creativity in the context of a software application development project. The experiences the authors of this paper have had using the Imagine Cup SDI as a pedagogical tool indicate that it can assist students in developing their technical, business, and soft skills in an equitable manner. Doing so not only gives students an advantage entering the workplace in that they will be able to demonstrate the technical skills to get an interview, but they will also be able to demonstrate the business and soft skills required to land the position.

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