

Bridging the Gap: Experience with the Qatar Summer College Preview Program

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Abstract - The transition from high school to college is a challenge for many. The academic, social, and pedagogical expectations among high schools and colleges in different cultures can make this transition even more challenging. How does one bridge the gap from being college eligible to college ready? As part of the answer to this question and to familiarize local high school students with its expectations and majors, Carnegie Mellon University initiated a summer college preview program (SCPP) in Doha, Qatar. This paper discusses our experience with this novel K12 outreach program. We discuss its goals, structure, outcomes, student feedback, and lessons learned.

Index Terms – College Preview Program, Education City, Global Education, K12 outreach.

INTRODUCTION

An interesting experiment in higher education is on going in the Middle East. With the establishment of Education City, the country of Qatar is a pioneer in this experiment. Founded in 1996 as the Qatar Foundation's [1] flagship project, Education City [2] is a center of excellence and a landmark in educational development in the Middle East. It houses facilities from pre-school to branch campuses of leading American universities. A novel aspect of the Education City model of higher education is its diverse multi-university based degree programs. At present, six universities from the United States offer a range of undergraduate degree programs. The programs offered by the various participating universities and their year of inauguration are given in Table-1.

Growing an American style higher education system in the Middle East brings with it some unique challenges and opportunities. The transition from high school to college is a challenge for many. The academic, social, and pedagogical expectations among high schools and colleges in different cultures can make this transition even more challenging. High schools spend a significant amount of time preparing students to gain admission to colleges and universities, yet little time and attention is spent teaching students what will be expected of them once they arrive on campus. Student success or failure in their freshman year is often determined by how well they recognize the difference between high school and college. In his book *College Knowledge*, educator David Conley calls

this issue a “disconnect between being college eligible and college ready” [3].

Since 2004 Carnegie Mellon University in Qatar has offered programs in Computer Science and Business. In 2007 a new program in Information Systems was started. To help bridge the afore mentioned high-school/college transition gap and to familiarize local students with its expectations and majors, two years ago Carnegie Mellon initiated a Summer College Preview Program (SCPP) in Doha for rising junior and senior level high school students in Qatar. The SCPP has several broad components: mathematics, English, personal development, and projects in the three majors offered at Carnegie Mellon, Qatar. Judging from faculty and student feedback the program has been very well received and will be offered again for a third time in the summer of 2009. This paper discusses our experience with the SCPP over the past two years. The paper is structured in two broad parts: (i) the background, motivation, and overall structure of the SCPP and (ii) the structure and delivery of the Information Systems project. We motivate our goals, the structure of the program, outcomes, student feedback, and lessons learned.

SUMMER ACADEMY FOR MATH AND SCIENCES (SAMS)

The precursor and model for the SCPP was the Summer Academy for Math and Sciences (SAMS) Program. SAMS has been successfully run since the summer of 2001 with the goal of increasing the number of minorities (African American, Hispanic, Native) in careers in engineering, science, and other math/science based majors by preparing them to be competitive applicants to selective colleges and universities. The goals of the SCPP are similar to that of SAMS. But SAMS is a 6 week residential program. It was

University	Year Started in Qatar	Programs
Virginia Commonwealth	1998	Communication, fashion, interior design
Weill Cornell Medical	2001	Premed + 4 year medicine
Texas A&M	2003	Chemical, electrical, mechanical, petroleum engineering
Carnegie Mellon	2004	Computer Science, Business, Information Systems (2007)
Georgetown	2005	Foreign service
Northwestern	2008	Journalism, communication

Table 1: Education City (Doha, Qatar): A novel model of higher education involving diverse programs offered by multiple universities.

not clear whether such a program would be viable in the Middle East and hence the SCPP was initially conceived as a 3 week non-residential program.

SUMMER COLLEGE PREVIEW PROGRAM

For the past several years we have asked our students (at Carnegie Mellon, Pittsburgh) the following question: compared to your high school, in terms of the amount of work, time commitments, and general academic pressures, do you find college less intense, more intense or about the same? The typical breakup has been about 1/3 of the class feels that college is about at the same level of intensity as their high school, and 2/3 feel that college is more intense than their high school. Very few (on average about 1 or 2 in a class of 35) feel that college work is lighter than their high school. From these stats it is apparent that for a majority of students even from a US style high school education the transition to a US style college system is still a challenge. When social, cultural, and academic differences between high school education and college education are added to the mix the transition becomes even more challenging. Providing an awareness of this challenge and assisting students bridge the gap from high school to college is the overall goal of the SCPP. More specifically our goals are:

- To expand the pool of Qatari students admissible to select American universities.
- To identify motivated students with high academic potential.
- To improve skills in math, SAT, and English.
- To develop a strong academic work ethic in Qatari students.
- To provide hands-on exposure to the majors offered at Carnegie Mellon, Qatar.

The next two sections expand upon our motivation as well as the structure of the SCPP.

Motivation

Student success or failure in their freshman year is often determined by how well they recognize the difference between high school and college. This means understanding the importance of being prompt and consistent with class attendance, of being engaged in lectures by taking notes, of managing time effectively, of setting priorities, and generally accepting greater responsibility for their own learning. Since this is not intuitive for many high school students, it must be taught to them.

The disconnect between being college eligible and college ready can be even greater for high school students in the Middle East region who want to attend American universities. This is because the two educational systems have significant differences in teaching methods, expectations, motivation, and values towards scholarship and learning. Modeling the success of the SAMS program in Pittsburgh, Carnegie Mellon University in Qatar is taking a considerable step in bridging this academic disconnect with

Year	# applicants	# enrolled	Junior		Senior	
			Male	Female	Male	Female
2007	116	33	3	9	10	11
2008	126	52	5	10	12	25

Table 2: Distribution of applicants and enrollees in the SCPP. Applicants from 32 high schools in and around Doha were solicited.

the creation of the Summer College Preview Program for highly motivated, academically-talented high school students. The aim of this program is to prepare students for the difference between the level of study required in high school and what will be expected of them in college. By exposing students to a preview of the college environment, they will be more likely to understand the amount of work required per class, the quicker pace of college courses and how to write college-level papers. Our goal is to increase the likelihood that students will achieve academic and personal success in college.

Program Overview and Structure

The SCPP has been created to help high school students from Qatar and the surrounding region prepare themselves to gain admission and, more importantly, to excel at American universities once they are accepted. The rigorous three-week program is a non-residential, non-credit-earning summer experience targeting high school students who have completed 10th or 11th year, who maintain a grade point average of 3.0 or above, and a have high level of English proficiency.

The SCPP introduces participants to college level teaching, course content, and expectations of students. Classes are coeducational and are taught entirely in English by highly regarded Carnegie Mellon professors and full-time graduate students. These instructors teach college students during the regular school year and also have a special interest in preparing high school students for the college experience. Currently enrolled Carnegie Mellon Qatar students serve as peer counselors, providing participants with role models who can share their experience as college students, the amount of high school preparation and the effort it takes to do well.

Admission to the program is highly competitive. The student distribution is given in Table 2. Students who take part in the program have a unique opportunity to gain first-hand knowledge about life as a college student. While some aspects of the program focus on the math-based business administration, computer science, and information systems majors at Carnegie Mellon Qatar, the experience will be useful for any highly-motivated, academically-

8:00a	Juniors	Seniors
	Algebra	Pre-Calculus/Calculus
	Academic Writing	Personal Statement
	SAT	
	Advising / Tutoring / Personal Development	
	SAT	
5:30p	Business / Computer Science / Information Systems Project	

Table 3: Structure of one day in the SCPP. Classes were held daily from 8a to 5:30p, 5 days a week, for 3 weeks.

talented student who is pursuing a college degree in any field.

Separate tracks of study are created for juniors and seniors. The structure of a typical day in the SCPP is given in Table-3. Students take classes to improve skills in math and English, and become familiar with American approaches to teaching and learning. Since writing has always been at the forefront of an American university's education, courses in English expose students to the basics of academic writing. This includes instructors' expectations of students to produce well-reasoned, mechanically-sound pieces of writing.

Math is considered one of the "gateway" skills necessary for finding success in a vast array of college majors. Students who lack math proficiency often turn toward non-technical majors that close off many possible career pathways. The math courses in the SCPP expose students to college-level mathematic skills they will need to succeed in a variety of courses of study.

The SAT course teaches students the test taking strategies that will assist them with improving their test scores. Rather than teaching specific course content, students learn how hard work and practice can contribute to their success on this important college admission measure.

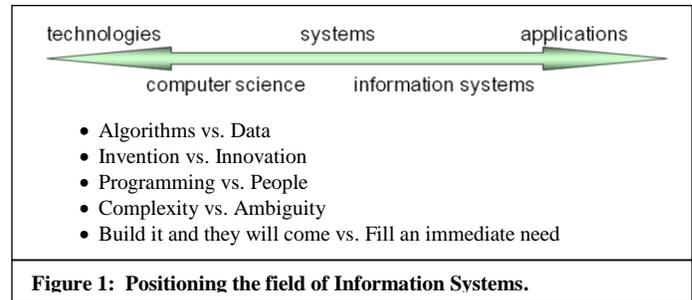
The schedule also includes workshops on how to become a master student by learning to set goals, manage time effectively and how to be more a competitive college applicant. Individual mock admissions interviews familiarized students with a vital component of the college admissions process.

Another important aspect of the program is that students are submerged in a learning community of peers, faculty, and staff who encourage and support their efforts to embrace a new set of educational expectations. This supportive peer group encourages students to go the extra mile and work exceptionally hard to become impressive scholars [4]. Additionally, several extracurricular activities (ice-breakers, team-building, informal get-togethers) provide opportunities for fun and social interaction with new friends.

In addition to traditional classroom instruction, students are also assigned to one hands-on project in Business Administration, or Information Systems or Computer Science based on their preference. The projects are designed to apply concepts and principles introduced in the classroom to real-world problems. In completing these projects, students will gain first-hand knowledge about the majors offered at Carnegie Mellon, Qatar. The next few sections describe in detail the structure and delivery of the Information Systems project.

INFORMATION SYSTEMS

From technology to systems to applications (business, science, engineering etc.), the Information Technology spectrum is very broad (Figure 1). An attractive aspect of the fields of computer science and information systems is



that based on their personal preference a student may position him or herself anywhere on this spectrum. By the very nature of the two fields, traditionally a student of computer science, tends to position herself towards the left side of the spectrum where as a student of information systems tends to position herself towards the right side of the spectrum (especially focusing on applications for businesses and organizations). Hence the training and career goals of an information systems student, while similar, are different from that of a computer science student. Majoring in computer science and not being comfortable with programming and the algorithmic reasoning it entails may be akin to aspiring to be a pilot but having concerns of acrophobia. While information systems students work extensively with technology and software systems and need to know about programming, not all of them view themselves as being software developers. Their training, which includes a blend of technology/systems, management and business acumen, is focused on being a *business technologist* by examining how technology can enhance and add value to a business or organization.

STUDENT BACKGROUND

Where we would like to go depends on where we currently are. To assess the technology background of the participants in the IS project we conducted the survey shown in Table 4. On a five point scale evaluating general computer expertise the average was 3.4 (17 students) indicating moderate expertise. Facility with various web technologies was then examined on a 4 point scale and these indicated a lower level of sophistication. Given the competitive nature of the selection process for the SCPP, the lack of prior technology background was well made up by the enthusiasm and energy of the participants.

INFORMATION SYSTEMS PROJECT

With the above perspective on the field of Information Systems and the background of the participants, the question arises as to what a modern student of information systems needs to know about technology and system development? What would be an effective pedagogical strategy for conveying a glimpse of these skills and knowledge in a summer program?

HTML	CSS	XML	JavaScript	C#	WebApps	Ajax	Mashups
2.5	1.3	1.4	2.4	1.5	2.9	1.1	1.1

General computer expertise: 3.4 (on a 5 point scale)

Four point questionnaire:

1. Have never heard of this
2. Have heard of it but don't know what it means
3. Have some idea what this means, but not too clear
4. Have a clear idea what this means, and can explain it to others.

Table 4. Technology background survey of students enrolled in the Information Systems Project component of the SCPP. 17 students (12 girls and 5 boys).

The focus of the field of IS is solving problems. A common way in which such solutions are now realized are as web applications. Hence in addition to providing an overview of the field of IS, the IS project focused on building web applications and integrating information with mashups.

Total contact (classroom) time with the students in the IS project was 30 hours (2 hours/day, for 5 days, for 3 weeks). A normal semester is typically 40 hours. An objective was to convey the intensity of a typical semester in a period of 3 weeks.

A Birdhouse Metaphor

Given the nature of the program an overarching motif of the IS project was exposure as opposed to mastery. The metaphor used in developing the IS project was that of building a birdhouse at summer camp. In a prototypical summer camp one builds a birdhouse. One is guided through this process of construction and in the end one has a tangible artifact for ones efforts---something that one can take pride in and share with ones families. While one may not be able to reconstruct the birdhouse again, that is not the point. The goal was to expose camp participants to what it takes to build a birdhouse, and to provide a glimpse of the process. A question then is: What is the equivalent of an IS birdhouse?

Gregory Bateson succinctly characterized "information" as *the difference that makes a difference*. So, what does it take to represent, process, present, and share information in the modern e-world? Part of the focus of the IS project was to introduce students to these ideas in the context of developing applications.

How is information represented?

The representation depends on what we want to do with the information—form follows function. Students were

introduced to XML as a way of representing information. Contrary to a more traditional approach, students used XML before they used HTML. The simplicity and power of RSS news feeds as an XML application and the Google reader were introduced. Students had to represent their resume in XML format choosing tags of their own.

How is information presented?

After introducing XML students were introduced to HTML and CSS [5]. With the broader design guideline of separation of concerns, students were introduced to the value of separating content from style. Microsoft Visual Studio and Expression studio were used.

How is information shared?

What does it take to share information? One needs to (i) have a common vocabulary between the sharing parties and (ii) be able to verify the integrity of the information shared. XML was revisited and Jason was also briefly discussed. An important lesson conveyed in this context is the value of standards.

How is information processed?

The client-server architecture of modern web applications was discussed. Both client side and server side technologies were illustrated. Students developed a simple web application which is detailed in the next section.

A SIMPLE WEB APPLICATION: TINYURL

Students were introduced to web applications [6] by the development of a simple application. We first worked through a simple numbering guessing game to explore the features of Visual Studio and asp.net web development with C#. We then developed a miniature version of the application TinyUrl.com.

	<p>Ansaldo STS USA 1000 Technology Dr, Pittsburgh, PA 15219 (Union Switch & Signal Inc)</p> <p>http://tinyurl.com/d7mq3</p>	<p>http://maps.google.com/maps?li=d&hl=en&f=d&iwstate=1=dir:to&daddr=1000+Technology+Dr,+Pittsburgh,+PA+15219+(Union+Switch+%26+Signal+Inc)&geocode=Cf2qPo1pJCZJFZH4aAlducw7-w&iwloc=1&dq=Union+Switch+%26+Signal+1000+Technology+Dr,+Pittsburgh,+PA+15219&cid=40433</p>
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Figure 2: On the left is a snapshot of a Google map, pictorially showing the address in the middle (a company in Pittsburgh) . On the right we have the actual Google map URL and in the middle the URL provided by tinyurl.com.

TinyUrl.com satisfies an interesting need. For certain applications (e.g., MapQuest etc) the generated URLs can be very long and unwieldy (Figure-2, right column). TinyUrl.com maps such long URLs to short codes (middle column). We developed a simple version of TinyUrl without a database component. Along the way students were exposed to the notion of incremental, iterative and interactive [7, 8].

AN IS BIRDHOUSE: MASHUPS

There is an interesting discontinuity between the technologies students use in their daily life and what they are exposed to inside their classroom. Whereas technologies such as Facebook, Flickr, RSS feed readers, Twitter, etc play an integral role in the day of a modern student, these technologies are not often used inside the classroom. An elusive goal for us teachers has been to see how these technologies could be used in the classroom to better engage students. The third component of the IS project was the custom integration of Web 2.0 technologies via mashup creation tools such as Microsoft Popfly, Yahoo Pipes etc.

The modern student lives in a sea of fascinating Web 2.0 applications [9]. At the same time, often there is an interesting desophistication when a student enters a classroom -- there is a technological discontinuity between what students use in and out of the classroom. An elusive goal has been to make classroom material more relevant to the student by tying it to the technologies they often use outside the classroom. The challenge in having an introductory student build an application with these technologies is that such an effort has traditionally required significant programming expertise. But that is slowly changing now with the advent of tools such as Microsoft Popfly and Yahoo Pipes. These technologies allow one to build interesting applications -- mashups which integrate information from multiple sources into a single application [10, 11] -- with little or no programming.

Microsoft Popfly and Yahoo Pipes

Popfly [12, 13] is a web 2.0 application that allows users to visually create games and mashups of sites such as Flickr, Facebook, Google Earth etc. Pipes [14] is a web application that allows the visual aggregation and processing of web feeds (RSS, atom) and other services e.g., combining a Reuters news feed with Google maps, so that news is displayed based on the location where it occurs. Using both of these applications students are able to create visually appealing applications that integrate their personal data (e.g., photos on Flickr or Facebook) with their web site.

THE ESSENCE OF OBJECT ORIENTATION

System design addresses two questions (1) how to build the right system and (2) how to build the system right. The simplest and best way to build the right system that meets the need of clients is to get continuous feedback (iterative, incremental, interactive design). A prevalent way to build the system right (modifiability, resilience to change,

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Instance	Class	Message	Method
Inheritance	Delegation	Polymorphism	Interface
Abstraction	Encapsulation	Overloading	Overriding

Table 4 Concepts of Object Orientation.

scalability, reliability etc) is object orientation. We discussed the various concepts of object orientation (Table 4) using analogies independent of code. For example, in the spirit of separation of concerns, it is useful to separate what we can ask an object to do (its interface) and how the object actually does what is asked of it (its implementation). Reasoning about the interface of an object separate from its implementation fosters resilience to change. An interesting analogy of this type of resilience is contrasting the TV shows Law & Order and Seinfeld.

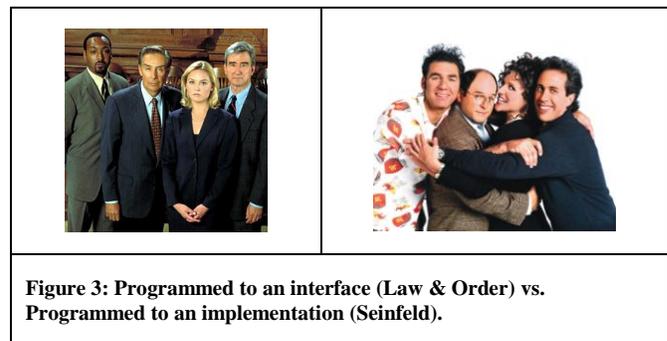


Figure 3: Programmed to an interface (Law & Order) vs. Programmed to an implementation (Seinfeld).

Currently in its 19th season, Law & Order has had an interesting evolution. Over its long and successful run the show has changed: various actors have come and gone, but the popularity of the show has been unaffected. The audience tunes in for the roles played by the different actors (district attorney, police captain, detective, prosecutor etc.) and not necessarily the people who play the roles. Law & Order is a show programmed to its interface and is only loosely coupled to its implementation. As a result of which the show has been flexible and resilient to change. But a show such as Seinfeld is programmed to its implementation. The audience tunes in for the actors and hence the show would probably handle change less gracefully.

In a similar vein all the other concepts of object orientation listed in Table 4 can be intuitively conveyed.

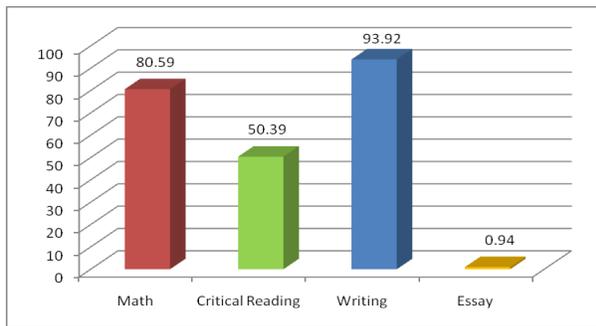
ASSESSMENT & FEEDBACK

Two years of the SCPP are over. Based on feedback from both faculty and students we were pleased that the program has been viewed very favorably. Some quantitative measures on the value of the program:

- 94% rated the overall SCPP as “worthwhile” or “extremely worthwhile”.
- 96% of the students rated the SCPP as “helpful” or “extremely helpful” in preparing them for future math and English coursework.
- 79% improved their SAT scores between first and last practice exams. The improvements in each component of the SAT between the 1st practice test and the final (4th) test are given below (80.59, 50.39, 93.92, 0.94):

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- 97% of students said they feel more confident about taking or retaking the SAT in the future. Only 9 of the 33 students in the program the first year had taken the SAT previously.
- On the math component of the SCPP, student's average performance increased from 5.46 (pre-test) to 10.92 (post-test).

Feedback on the IS project component has also been very favorable:

- In terms of impact on student's interest in the field of Information Systems, the IS project rated 98% favorably.
- In terms of usefulness, the IS project rated 85%.
- In terms of enjoyment, the IS project rated 83%.

It has also been gratifying to hear from the SCPP alumni that they have continued to use concepts from the IS project in their high school and in web design contests.

LESSONS LEARNED

As mentioned at the beginning of this paper, the SCPP was inspired by and modeled on the SAMS program. As was also anticipated due to cultural and academic differences, the SAMS program could not be transplanted mechanically; several adjustments needed to be made:

- SAMS was a residential program where much of the socializing and bonding amongst participants took place outside class times. SCPP needed to be non-residential and hence social events had to be worked into the regular schedule.
- Parents had to be brought into the process and briefed on what was expected of the participants in the three weeks of the SCPP (regular home works, punctuality etc).
- When forming teams, if gender diverse teams were desired they had to be explicitly created and not let to the volition of the participants.
- Students need to be briefed on class room integrity and what constitutes ethical behavior.
- If we value something, we need to explicitly reward it. To encourage 100% attendance in all classes on all days, the 2nd year the SCPP was run students were made aware of a medallion they would receive in recognition of their perfect attendance.
- It is important to have periodic knowledge probes during a class discussion to ensure that students really know what they say they know.

The SCPP is an ongoing experiment adjusted each year based on faculty and participant feedback [15]. It will be offered again for the third time in the summer of 2009 and this time as a 4 week program. Armed with the experience and new knowledge taught in the SCPP, the aim is that students will return to their high schools prepared to focus their efforts, work to their fullest potential and commit to achieving academic excellence.

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