IPRO It takes a team INTERPROFESSIONAL PROJECTS PROGRAM

IPRO 321 Final Report
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Increasing Computer Science Awareness in High Schools and Colleges

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Abstract

IPRO321 project team's goal is to get high school students excited about Computer Science, and to ultimately increase the number of students in the Chicago area taking Computer Science (CS) courses in high school and college. After lots of works of searching, analyzing and discussing, the team decided to use presentation as one of the tools to aware high school students' interesting of CS. The team presented their presentation on April 18, Women's Day and got a great result.

Background:

Recent studies have indicated that there is a lack of appropriate computer science education in these grade levels. In addition, their computer science integration in non-computer science is minimal at best and in most cases non-existent.

The risk of lack of awareness of Computer Science is obvious and serious. In an increasingly globalized society, American students will no longer be competing with other American students but rather with the rest of the world. In order to maintain competiveness, it is necessary to impart the knowledge and skills sets that will prove advantageous in the workplace. Computer science falls in this desired category and even today its widespread reach can be seen across all fields and disciplines. Importing foreign talent to fill the gap will no longer be a viable option as those individuals will have more of an incentive to avoid relocation. Ignoring these issues will have negative economic and social consequences in the future.

Efforts to locate the source of the obstacles and instituting these curricular changes have identified several areas of hindrance. Amongst educational administrators, there is an unwillingness to embrace CS integration due to financial constraints. Maintaining computer networks can become quite costly.

In addition, other problems such as standardized test scores and crime seem to divert attention from CS. Amongst the teachers, some are open to the changes whereas others reject them. Amongst the rejecters, there are varying reasons. Some do not find enough time or resources to incorporate such changes into their accustomed methodologies of teaching. Others have some anxiety with new technologies and lack the proper expertise to make such incorporations.

Objectives:

The target customers/sponsors of this project include students, teachers, educational administrators, and policy makers involved in the K-12 educational experience. The project team's goal is to get high school students excited about Computer Science, and to ultimately increase the number of students in the Chicago area taking Computer Science (CS) courses in high school and college

The project team's short term objective is to research and explore further the various sources of impedance and to identify routes where investing efforts will yield the most returns. The team is trying to accomplish this by debunking myths and increasing the understanding of what CS and computational thinking entails, explaining and providing

evidence for why CS is important and emphasizing importance of attracting women and underrepresented minorities to CS.

Methodology:

The initial idea and breakdown mold for how things were going to proceed in the IPRO changed significantly by the time it came into fruition. The groups were broken down into fewer teams due to the need of brainstorming and bouncing ideas between each other. The deadlines were changed in some regards because the vision of the final product was not in view until half way through the semester. This was mostly because there were a lot of trial and errors when it came to what worked and what didn't. Our goals for the IPRO also were not clearly defined because of how broad the topic was. All these issues were addressed after much debating, but a second semester for the IPRO would be much needed.

One of the most major issues was what kind of work was actually needed to be done. Once we figured out and narrowed down what kind of work was needed, we needed to narrow down what audience would this work target and whose skills would be used best. Because the IPRO was so small, there were skills and subject matter experts missing, so we had to improvise. There was a heavy skill set in terms of technical, but very little on the psychological and philosophical portions of the topic.

Team structure and Assignments:

Team Members:

- Sergio Aguilar

- Saad Ahsan
- Qiaoqiao Chen
- Jason Chin
- Herbert Edwards
- William Foret
- Eddie Martinez
- Christos Mitillos
- Jianqi Xing

Individual Team Member Assignments

IPRO Deliverables Sub-team Individual Task Assignments	
Task	**Assignee**
Compile Information for Final Report	Jianqi
Brainstorm Ideas for Exhibit & Posters	Qiaoqiao, Sergio
Presentation	Chris
Modifications	Wil
References, Resources, Acknowledgment	Jason
Obstacles	Muhammad
Posters and Exhibit	Sergio, Qiaoqiao
Abstract/Brochure	Sergio
Finish Exhibit	Joe, Jennifer
Recommendations	Muhammad, Eddie

Women's Day Presentation Sub-team Individual Task Assignments	
Task	**Assignee**
Algorithm Presentation	Muhammad
Doing Million Things at One Time Presentation	Qiaoqiao
Painting in Numbers Presentation	Jianqi
Parallel Computing	Jason
Investigate Analysis for Problems	All
Survey Preparation	Herbert
Survey statistics	Herbert

Obstacles:

Several obstacles were encountered through the course of the IPRO. Most of these obstacles revolved around approaching the problem and selecting an appropriate solution to implement. The identification of the problem was the first and most time consuming obstacle. It was understood and unanimously agreed upon that computer science enrollment amongst American students is low, but attempting to find the cause or causes behind this phenomenon proved to be difficult as there was a multitude possibilities. There were issues related to the educational systems of many towns and cities, the difficulties in effecting change through bureaucracies, problems with teachers lacking sufficient computer science skills, issues with acquiring monetary funds necessary for purchasing and maintaining computer equipment, discrepancies in race and gender, and also discrepancies arising from the academic talents of different students.

One by one, the aforementioned causes were discussed and whatever remedies were offered would be inhibited by obstacles that reduced their feasibility. After investing substantial time and research to recognize and appreciate the impact collectively carried by each of these individual causes, it was then decided that the only avenue for effectuating any potential change would have to bypass dealing with the causes, the complexity of which was beyond the stated goals of this IPRO.

The second major obstacle arose from deciding on a proper course of action. Curriculum changes were decided as being the most opportune method for achieving our goals. Initially the intention was to implement a top-down change that would increase computer science requirements for high school students. However, the bureaucratic difficulties of

most education systems unveiled the limitations with this particular option. It was then decided to create curricula modules that will be able to serve as versatile teaching aids that teachers could adopt and incorporate at their convenience. These curricula modules were researched and designed to be cross disciplinary in order to high light that the concepts of computer science and computational thinking are not solely limited to the field of computer science, but also have broad and significant ramifications for numerous other fields as well. Progress was made in developing our own modules and adapting existing ones that were uncovered through our research efforts.

The third obstacle major arose in choosing a method for administering the curricula modules and finding a way to gauge the level of benefit that they carried. The team collectively decided that the best way to approach this problem would be to develop pre-test and post-test surveys that will be able to assess the target student audience. The final challenge remained in finding a group of students that would be able to commit the time and energy to aid us in our efforts. Options were explored in terms of visiting schools, arranging for schools to visit us, and so forth. In the end, the best solution was to take advantage of sessions conducted by the office of admissions and Women's Day was chosen due to ease of logistics and also for the fact that it allowed for testing the modules on an exclusively on females, a group that is heavily underrepresented in the computer science field.

Results/Findings

Overview: Over the past decade the United States has shown a significant decline in Computer Science (CS) enrollment. IPRO 321 was assigned the task of studying the problem and trying to improve CS awareness. The group found clearly defining what CS is difficult, because CS consist of variety of skills and knowledge based applications. What the group ultimately found was that the foundation of the basic skills and knowledge of CS are strongly correlated with those of *Computational Thinking* as a whole. Therefore, the group decided to format a presentation that would teach simple computer; hypothesizing that it would lead to an increase in CT.

To test our hypothesis several surveys were conducted to test individual's knowledge and awareness of Computational Thinking. The surveys were given in a Pre/Post survey format whereas, one set of surveys was given before a group presentation and the exact same surveys immediately following. The surveys were conduct on four Computational Thinking based concepts: Algorithms, Scheduling, Parallelism, and Image Processing. Each survey consisted of four questions, rated on a five-point scale. Therefore, it can be shown that the effects of the presentation have a high correlation with improved survey scores. The results are as follows:

Strongly Agree = 5, Agree =4, Don't Know =3, Disagree =2, Strongly Disagree = 1

Algorithms

Algorithms Pre-survey mean score total = 15.36.

Algorithms Post-survey mean score total = 19.53.

Total variation in mean score total = +4.17.

Standard Deviation = 2.75.

Scheduling

Scheduling Pre-survey mean score total = 14.91.

Scheduling Post-survey mean score total = 18.66.

Total variation in mean score total = +3.75.

Standard Deviation = 1.63.

Image Processing

Image Pre-survey mean score total = 12.88.

Image Post-survey mean score total = 17.

Total variation in mean score total = +4.12.

Standard Deviation = 1.72.

Parallelism

Parallelism Pre-survey mean score total = 11.62.

Parallelism Post-survey mean score total = 15.12.

Total variation in mean score total = +3.50.

Standard Deviation = 2.44.

Recommendations

Based on the team's research findings and conclusions, the IPRO team recommends that the sponsor implements the web application designed by the IPRO team. The web application would be implemented through Access' intranet. The web application records what was previously being recorded and additional information. The additional information allows various infectious disease trends to be recorded. Such trends include

location of outbreaks for diseases, age of the infected, and race of the infected. Using Access' intranet allows such trends to be generated instantaneously. This allows Access personnel to spend less time manually completing the abnormal log books. It also allows trends for infectious diseases to be noted faster, so that any preventive measures can be executed as fast as possible. Such speed can save many lives. Also, the use of a web based program further enhances the technological background for Access personnel.

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