Attracting K12 Students with Standardized Outreach Activities

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Abstract

Most academic departments of U.S. institutions implement some type of recruitment strategies to attract new students into their programs. This article focuses in the unique issues that affect enrollment in Computer Science departments, and it proposes a standard Outreach Activity Template: OAT. This template is used to design outreach activities to persuade K12 students into Computer Science majors. Some preliminary results of the implementation of this model indicates that a large number of student participants become interested in computer science.

Key Words: Computer Science Education and Recruitment.

1. Introduction

Higher education institutions are facing the continuous challenge of recruiting fewer students for the computer science programs [1]. In fact, recent reports show a decrement in the number of graduates in computer science in the last decade. While current technological innovations would actually require an increasing number of computer science professionals. Currently, this problem is being addressed by several institutions; however, most efforts are being invested in attracting high school students into a career in computer science. Nevertheless, some research data indicates that recruitment should start as early as in elementary school [2], [3]. This does not signify that high school recruitment for computer science programs is null, but that earlier recruitment would produce better results.

This article reports an outreach experience of the University of Wisconsin-Parkside with local fifth graders. The purpose of the activity is to encourage students to stay in school, study math and increase their critical skills to be ready for a future career in computer science. The type of outreach activity described in this article uses the Outreach Activity Template (OAT) with image processing fundamentals as its *"inspiring"* content area of computer science. OAT is defined in the next section.

2. Outreach Activity Template

Outreach efforts must be consistent, interesting and goal oriented in order to attract as much as possible future computer science students. Therefore, an outreach activity template (OAT) is proposed and defined in this section. The proposed OAT considers the following issues about computer science recruitment: (1) most students do not know about the existence of computer science, and (2) math and critical thinking are skills needed to succeed in computer science programs. Additionally, social constructivism is integrated in some components of the OAT since it promotes active learning and intuitive thinking.

1. *Rapport*
2. *Expectations*
3. *Computer Science Definition*
4. *Mathematical Connections*
5. *Algorithmic Practice*
6. *Enrichment*
7. *Reflections*

Figure 1: OAT components.

The OAT components are listed in figure 1 and defined next.

Rapport: This component consists of the opening statements and remarks. Presenters should relate to particulars of their audience and their daily routines in such a way that there is a connection between them and their spectators. For example, if known that students had lunch before the presentation, the moderator could make comments about it, and welcome everybody to the outreach activity.

Expectations: The purpose of the outreach activity should be indicated during this component. One of the presenters should state directly to the students the type of activities to be performed as well as their outcomes and expectations. For example, a moderator could say: *students today you will work in collaboration with some undergraduate students to process some computer images and manipulate some of its properties*.

Computer Science Definition: The main goal of the outreach activity is to attract students into computer science. This would not be possible if students do not

know about the existence of this field. In fact, it is our experience that for most students attending these activities, computer science is an unknown subject. Therefore, during this component, computer science, some of its subareas and applications should be presented in a clear way. Additionally, we should ask students about their current understanding of computer science.

Mathematical Connections: Mathematics is an important subject needed for the understanding and mastery of most computer science content. This is the opportunity to emphasize the importance of math as a "*helping tool*" in accomplishing complex tasks in computer science. Nevertheless, we have to be careful in not sending the wrong message of being math an impediment for computer science. We have to show that their current knowledge of math would be enough to understand the logic for the solution of some problems, but a deeper mathematical background would help to solve more complex ones. Additionally, we have to review some basic math concepts appropriate for their grade level, and we have to relate them with computer science concepts. For instance, the assignment of variable *a* as *a=4* and how *a=a+7* changes the value of *a* from 4 to 11.This relates basic addition facts, mathematical expressions with memory allocation and variable manipulation.

Algorithmic Practice: During this component, students are introduced to a problem that requires the *"expansion"* of their current math knowledge to solve a problem. For example, an image is represented by a group of numerical values or numbers. Then, we need another type of variable to hold several numbers at the same time such as arrays. Once arrays are introduced, presenters could show how images represented in arrays are manipulated by mathematical expressions.

Enrichment: During this component, students have the opportunity to actually experiment on their own and present interesting results to the rest of the group. This component emphasizes independent practice while the previous component was more of guided practice. Additionally, this is the perfect opportunity to have K12 students interact with undergraduate students while experimenting with the raw data. For example, students could have a set of images stored in some variables. Then, they could use scientific software such Matlab to manipulate them and display their results.

Reflections: During this last component, presenters ask students to make some reflections about their learning experience. Students could state possible future work in their experiments. It is during this component when presenters must ask in the number of students that would consider computer science as a career option. Furthermore, presenters should emphasize the need that we have in computer science of people like them. Finally, presenters should insist in how important is for them and for computer science that they stay in school, study math and reading and consider the field of CS as their major in college.

3. Preliminary Results

Over the span of one academic year, the department of Computer Science at the University of Wisconsin-Parkside has conducted several outreach activities using this model. The K12 population targeted in these activities has consisted of local 5th grade students coming from public school districts of Racine and Kenosha, Wisconsin. In each activity, we had the participation of a computer science faculty, the classroom fifth grade teacher and several undergraduate computer science juniors and seniors. College students have served as role models and they have leaded most of the discussions in the outreach activities. At the end of the activity, during the reflections component, we have surveyed participants about the quality of the workshop and their future interest in computer science. For instance, 63% of 5th graders agreed or strongly agreed that are now more interested in computer science.

5. Conclusions

Our preliminary results indicate that more that 50% of students participating in activities that followed our model became more interested in Computer Science. This is significant after considering that about 90% of them did not know about the existence of computer science as major field of study. Since these activities have started targeting 5th grade students, there should be some follow-up workshops implemented in a later grade to reinforce their learning.

6. References

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