ABSTRACT
Performing summer research is a perfect opportunity to enhance undergraduate education. It provides the student with time to focus on discovering new solutions to real world problems. This paper details a six week summer research experience of a college professor with a student desiring to accomplish a practical project in computer science. The process, challenges, and significant outcomes of guiding an information assurance project are discussed.

Keywords: undergraduate research, information science education, information assurance, security.

1. INTRODUCTION
Summer research is intended to provide supportive research opportunities for discussing challenges, solving problems collaboratively, and gaining skills and knowledge in the relative discipline. The research advisors and the students benefit from the interactions that are less formal and therefore more relaxed than the classroom allows. The student is able to visualize the application of a topic that may have been discussed in the classroom. The summer research experience described below details the process involved in accomplishing a six week project in a popular computer science topic, information assurance. The intent for the student was to explore and demonstrate an understanding of the various information security concepts, learn what risk are of most concern to novice users, explore ways we can arrive at a solution, gain additional experience in writing for a non-technical audience, and improve on presentation skills. In this article the author will describe the planning, necessary background and training, design, implementation, evaluation and results of the research experience.

2. PLANNING STAGE
The first step was to discuss topics that the student found interesting. This allowed evaluation and guidance of the student’s decision-making ability. The student decided to embark upon a topic that was interesting based on national media coverage, while learning something new about the state of the technology being explored. The next step was to define the details of the problem that the student could accomplish in a six week period. This required defining the project and dividing into weekly sub-tasks to allow periodic progress reports. Most of this work depended strongly on the advisor mainly because of the time constraint and the fact that advisor was knowledgeable of the topic while the student was not.

The project was split into the following subtasks:
- Assignment 1: Review of Security Topics
- Assignment 2: Exploring Security Awareness through Survey of Novice Users
- Assignment 3: Simulation Tool

Assignment 1 lead to the literature review of the student’s paper. Assignment 2 resulted in a survey study. Assignment 3 and the results of Assignment 2 specified the requirements for the software interface designed for novice computer users. Without separating the project into subtasks, the student would have been confused about where to start. The planning stage is where the undergraduate student requires the most guidance.

3. METHODS
The student was required to produce a short one page paper describing their understanding of the project. This ensured that the student understood the purpose, requirements, and expected results. In the end, this would be a portion of the project description of the final paper that would be written for the summer project.

The first step of the research involved a review of computer malware literature. This step was very important as it made the research student aware of the different types of intrusive behavior and the importance of using computer security. It was also useful for the next step of designing a computer security survey.

A portion of the project description, literature review, and survey work is given below and was modified to reflect that the project has been completed; hence it is presented in past tense.
3.1. Project Overview

In today's world, the use of stand-alone computing is quickly becoming outdated. As computers are linked together via computer networks, the data and software become vulnerable to attacks. The personal computer has become a major target for intrusive behavior. Many home computer owners are not aware of the need for security nor are they aware of the damage intruders may cause. The purpose of this research is to provide awareness of intrusive behavior for the general home computer user. A survey was created to gauge the current knowledge and to educate the user. The compiled data from the survey was used to create a novice-friendly interface to aid the user to better secure and protect their home computer using security features installed on their computer.

We conducted usability studies to verify the impact of the project. An initial survey was done involving a group of novice students to determine the level of education they have for computer risks and security. We investigated the issues in computer security, and current solutions available to determine how best to address the security risk of a non-expert computer user. Using the input of the users, we determine the items that would be needed to best serve novice users and developed the interface to an intrusion detection system. Our interface is intended to be useful to the general computer user and tailored to protect the system from attacks prevalent in the home personal computer.

3.2. Literature review of malware

Cyber crime is the fastest growing white-collar crime in the United States [2]. The National Conference of State Legislature cannot accurately measure the number of victims because most victims do not know that they have been victimized yet. This issue led to interest in investigating how to make novice computer users more aware of the danger of not securing their home computers and the exploration of techniques to best educate all non-expert users of computers. The Summer Research Experience described here addresses such a concern.

3.3. Design survey

The survey assisted in gathering requirements for the needs of a home computer user that was straightforward, not complicated, and easy to complete. We determined the extent of knowledge that most users have about computer security and malware and identified the subset of security risks that are of most concern to the average personal computer user that is not technologically savvy. This required the design and use of a survey to be given to a pilot group of people. We compiled a list of questions from our learned knowledge of security risks and existing security surveys found on the Web [3] [6]. After the survey was completed, 20 research students and 37 Bridge students were given the survey. This was a pencil and paper version of the survey.

3.4. Search for existing survey software

After the paper version of the survey was created and finalized, it was necessary to create an electronic version to be placed on the Web. This would allow a more diverse group of people to be able to use it. We searched the Internet for commercial software that would allow us to create and launch our survey on the Internet. We wanted software that required little cost, and created tables, charts, and graphs to allow immediate analysis of the submitted survey data. John Bates in “Compare Survey Software” recommended Survey Methods.com as the best survey software to use in the creation of online surveys[1][5][9].

3.5. Implement online survey using Survey Methods software

SurveyMethods.com had great software that we used to create a pilot online version of our Computer Security Survey. We were able to test the survey, input actual survey data responses and create graphs and charts. The software allowed us to make changes and modifications to the survey as well as test different formats for the graphs and charts. We finalized the format for our survey, graphs and charts and prepared to launch the survey.

3.6. Launch Web version of survey

After the survey was created, and tested, a final copy was created and launched using the SurveyMethods.com software. SurveyMethods.com created a web page on its Internet site as part of their service. A sample of the survey is given below in Figure 1.
Figure 1. Partial Security Survey

3.7. Design security tool interface using survey results

After the 57 students completed the survey, the data was compiled. This data along with a copy of a sample security screen was used to design a novice friendly security interface. This interface was created to be a tool to aid the novice user in using the security features installed on their personal computers.

4. RESULTS

4.1. Survey

We designed a survey that was presented to two groups of students as a pilot study. A survey of 37 questions was created and launched on the Internet. We targeted novice users to determine their awareness of computer security, their views on the subject, and to assess their level of practicing secure computing. We wanted to know the risks of not having computer security knowledge by measuring their thoughts on how computer security is important to them, their awareness of the risks of computer malware, and their knowledge of the available tools that assist with the problems.

Two groups of students completed the survey and graphs were created based on their responses. The first group of students was research students and their responses indicated that they understood all of the questions. The second group of students were summer Bridge students who left a lot of the questions unanswered. The second group appeared to have newer personal computers which had security features installed upon purchase. Most of the students were concerned with security especially of their email accounts. It also appeared that many had been a victim of intrusive behavior. Some students were aware of their computer’s security but did not understand the need to accept the security updates when prompted or the need to seek security updates. The purpose of survey was to educate the student and encourage them to be conscience of their own security installed on their personal computer.

Results of the survey analysis were used in designing a security tool interface for novice computer users. The results of one of the questions that reveal the overall knowledge of the participants is given below in Figure 2.

Figure 2. Sample Result of Survey Data

The graph is an example of the results produced by the summer student in the research.

4.2. Security Interface Design

The security interface was created in Java. The design combines the background knowledge gained from the
literature search and collection of survey data. The intent was to develop a prototype of the interface to a security system using Java. It is not a functioning system, but depicts what the user sees when using such a system. The interface is designed for easy use of computer security features by the novice computer user. A portion of the interface is given below.

![Security Interface](image)

### 5. CONCLUSION

The summer experience reinforced the importance of giving practical problems for the student to solve. In the classroom, most of the time professors use prepared labs that have a predefined outcome and requires the student to give text book solutions rather than explore scientific possibilities. This reveals part of the reason why science is not of interest to many students and sparks a renewed effort to find ways to inspire creativity in the classroom.

For the student, summer research provides a great learning experience that allows the student to explore solutions on their own. It allows the student to use skills developed in prior courses. In addition, the student is able to accomplish tasks without the burden of juggling multiple classes while working on the project. Therefore, they are able to focus more on the project details.

A summer student was involved in this research and implementation process. The student had no prior experience in computer security, but was enthusiastic about the topic. The student gave presentations of her work at least three times and therefore became an accomplished speaker on a technical topic. Some comments the student made include “I gained valuable knowledge about computer security that I can pass on to others”, “This research actually helps me understand how my class work actually applies to my life” and “The writing required of research actually helps you organize your thoughts.” All of the skills gained are good preparation for a student preparing to move from undergraduate school into graduate school or industry. This summer research student decided to pursue graduate education as a result of this research effort.

### 6. REFERENCES

6. “Purdue University & Indiana State University Survey of Student Computer Users.” Purdue University Center for Education and Research in Information Assurance and Security (CERIAS). http://www.indstate.edu/cirt/instruct/surveys/student_survey01.htm