Work In Progress – Getting off the High Horse, Student Over Confidence with Computational Tools

Brett H. Hamlin and Amy E. Monte
Michigan Technological University, bhhamlin@mtu.edu, aemonte@mtu.edu.

Abstract - Michigan Technological University is one of the nation’s largest engineering schools (900+ first year students) and houses a large common first year engineering curriculum. The goal of this curriculum is to introduce many of the fundamental components of engineering. One of these goals is the use of modern computational and programming tools to solve engineering problems. This paper focuses on the students’ confidence with the use of computational tools. On the first day of class in the Fall of 2007, students were surveyed on their proficiency with the use of spreadsheets. Students self reported levels of proficiency from expert to no experience. Students were then asked a simple question regarding a spreadsheet cell equation. Only twenty percent of the students selected the correct answer, even though eighty percent ranked themselves as either: familiar, proficient, or expert spreadsheet users. Even more troubling is the fact that only one third of the self reported expert users selected the correct answer. A gender bias was noted, women under estimated their skills, while the opposite occurred for men. This study is significant because it lays the groundwork for creating an assessment plan to identify the preparedness of incoming students and skill at the end of the course.

Index Terms – Assessment, computer skills, first year, gender.

INTRODUCTION

Students today are coming to college with more computer confidence but less computer skills [1]. Faculty in upper level courses complain that students are entering their courses under prepared for intensive use of computers as engineering tools. To determine the preparedness of our students, a simple survey was given to 98 first year first semester students in the Fall of 2007. The survey asked the students to self report their level of expertise. Following the self report, students were asked a simple question to verify their self reported level. A mid-semester computational lab practical was given and student performances were recorded. On the final exam, students were again asked to self report their level of expertise, and again asked a simple question to verify this self reported level.

Our goals for this study were threefold: 1) to determine the students’ incoming level of preparedness in the use of computational tools, 2) to measure gain in student knowledge of computational tool use, and 3) to validate importance of current assessment. All data was collected and analyzed with methods consistent with Michigan Tech’s IRB policies.

PRE EVALUATION REPORT

On the first day of class students were asked to self report their level of expertise (expert, proficient, familiar, or no experience) with the use of modern computation tools, specifically spreadsheets, and were asked a simple spreadsheet question. Table 1 shows student rankings and response tabulation.

Only one of the three experts selected the correct answer. Of the proficient users, fifty eighty percent of the students selected the correct answer. Twelve percent of the students who reported themselves as a familiar user selected the correct answer. Students reporting no experience were unable to select the correct answer.

MID-SEMESTER EVALUATION

During the first semester students utilize and integrate spreadsheets in their coursework and on design project assignments. Since the year 2000, every student who has participated in the first year engineering program has had to prove their level of expertise with the use of a spreadsheet to solve engineering problems. A lab practical was developed to provide instructors a “real-time” evaluation tool. This evaluation tool consists of a twenty minute timed exercise in front of a computer. Students are seated, handed basic instructions and told to solve an engineering problem. When time has elapsed, students leave the computers “as is”. Faculty then check the work for the appropriate methods, and correctness of solution. Data from 2005 to present show the average on the lab practical to be 89% with a standard deviation to be 16%, n=1716 (high standard deviation is due to the distribution following a Poisson model v. a Normal model).
An initial comparison was made between students’ lab practical scores and students’ pre-course self reported levels of expertise. Figure 1 shows that both the proficient and familiar students outperform experts in an applied evaluation.

A similar analysis was performed again using the lab practical data. This time the lab practical data was compared with the students' post-course self reported level of expertise. No student self reported a level of "no experience". Figure 2 shows the comparison of post-course self evaluation and performance on the lab practical. We see a similar trend, the self ranked expert students are not outperforming the self ranked proficient users.

In an attempt to understand discrepancies between performance and self reported abilities the data was analyzed by gender, lab practical score, and post-course reported level of expertise. The results support what is found in other studies [2], [3]. Women self reported a lower level of expertise than men while outperforming men on the lab practical. The proficient women group outperformed the expert men group, by 1%, and outperformed the proficient men by 3%. The familiar user women, outperformed the familiar user men by 16%. Not all students were included in this analysis as some did not participate in both the final survey and the lab practical. Table 2 details this analysis.

### Table 2

<table>
<thead>
<tr>
<th>Self Reported Expertise</th>
<th>Female (n=14)</th>
<th>Male (n=72)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expert</td>
<td>94.6% +/- 7.0%</td>
<td>95.3% +/- 2.9%</td>
</tr>
<tr>
<td>Proficient</td>
<td>95.3% +/- 2.9%</td>
<td>92.7% +/- 3.1%</td>
</tr>
<tr>
<td>Familiar</td>
<td>86.4% +/- 20.9%</td>
<td>63.9% +/- 15.4%</td>
</tr>
</tbody>
</table>

### The Next Step

A large scale pre- and post-course analysis and assessment is planned. A self assessment will be given on day one of the course. Students will self report their level of expertise with different computer tools. To avoid student’s “revising” of self reported expertise, a short multi-question pretest is planned for day two. The mid-semester lab practical will continue to play a major role in measuring student knowledge and assessment of course goals. Additional questions will be added to the final exam which will revisit material from the first and second day evaluations. The large scale analysis will help determine the significance of gender on differences noted in this study.

### Conclusion

Understanding what skills a student brings into the classroom is important. Students too often over estimate their ability, and thus may not be open to learning new material or techniques. The goals of a larger study will be three fold: first, to characterize the true ability of incoming students; second, to continuously inform upper level faculty of student preparedness; third, and most importantly, to develop a plan and/or methods to break the barriers between over-confident students and their ability to learn new material. Once developed for a large scale, this study will run for the foreseeable future and provide feedback on how to enhance the first year learning experience.

### References

