Self-Assessment and Student Improvement in an Introductory Computer Course at the Community College Level 1

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INTRODUCTION

College level computing skills are useful tools that serve students throughout their college career. However, many students enter college lacking necessary computing skills. While many students might be proficient in locating information online through search engines, less is known about the use and application of specific types of software often found in business and industry. As a result of this lack of knowledge, all students entering the participating community college must prove computer competency.

SELF-ASSESSMENT AND STUDENT IMPROVEMENT IN AN INTRODUCTORY COMPUTER COURSE AT THE COMMUNITY COLLEGE LEVEL

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ABSTRACT

The purpose of this study was to determine a student’s computer knowledge upon course entry and if there was a difference in college students’ improvement scores as measured by the difference in pretest and post-test scores of new or novice users, moderate users, and expert users at the end of a college level introductory computing class. This study also determined whether there were differences in improvement scores by gender or age group. The results of this study were used to determine whether there was a difference in improvement scores among the three campus locations participating in this study.

Four hundred sixty-nine students participated in this study at a community college located in Northeast Tennessee. A survey, pretest, and post-test were administered to students in a college level introductory computing class. The survey consisted of demographic data that included gender, age category, location, Internet access, educational experience and the self-rated user category, while the pretest and post-test explored the student’s knowledge of computer terminology, hardware, the current operating system, Microsoft Word, Microsoft Excel, and Microsoft PowerPoint.

The data analysis revealed significant differences in pretest scores between educational experience categories. In each instance, the pretest mean for first semester freshmen students was lower than second semester freshmen and sophomores. The study also reported significant differences between the self-rated user categories and pretest scores as well as differences in improvement scores (post-test scores minus pretest scores). However, the improvement scores (post-test scores minus pretest scores) were higher than the other self-rated user categories. Of the three participating campus locations, students at Location 1 earned higher improvement scores than did students at Location 2. The results also indicated that there was a significant difference between the types of course delivery and course improvement scores (post-test scores minus pretest scores). The improvement scores for on ground delivery was 5 points higher than the hybrid course delivery. Finally, study revealed no significant differences according to the gender and age categories.
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A total of 400 students, out of a potential 426, completed the survey to those students who had chosen to participate. A total of 400 students, out of a potential 426, completed both the pretest and the post-test. The participating community college served ten surrounding counties with three campuses serving diverse populations. Students from three geographically unique campuses participated in this study. The campus locations in the study included: Location 1, centrally located; Location 2, located furthest southeast of the campuses; and Location 3, located furthest west. Because all course sections administered the pretest, post-test, and the survey, there was no skewing of the data by either the selection of a particular introductory computer science course or the time designation that each course was offered.

Research Questions

1. Are there significant differences in students’ pretest scores among the three self-rated user categories (new or novice user, moderate user, expert user) in college level introductory computing classes?

2. Are there significant differences in students’ pretest scores among the three age categories (age 15-19, age 20-28, age 29 and older) as determined by gender in college level introductory computing classes?

3. Are there significant differences in students’ age scores among the three age categories (age 15-19, age 20-28, age 29 and older) in college level introductory computing classes?

4. Are there significant differences in students’ improvement scores (post-test scores minus pretest scores) among the three age categories (age 15-19, age 20-28, age 29 and older) as determined by gender in college level introductory computing classes?

5. Are there significant differences in students’ improvement scores (post-test scores minus pretest scores) among the three campus locations (Cape Fear Community College, Cape Fear Community College, Cape Fear Community College)?

6. Are there significant differences in students’ improvement scores (post-test scores minus pretest scores) among the three campus locations (Cape Fear Community College, Cape Fear Community College, Cape Fear Community College)?

7. Are there significant differences in students’ self-identified skill levels among the three self-rated user categories (new or novice user, moderate user, expert user) and the three age categories (age 15-19, age 20-28, age 29 and older) in college level introductory computing classes?

8. Are there significant differences in students’ self-identified skill levels among the three self-rated user categories (new or novice user, moderate user, expert user) and the three age categories (age 15-19, age 20-28, age 29 and older) in college level introductory computing classes?

RESEARCH METHODOLOGY

Research Questions

The following research questions guided this study:

1. Are there significant differences in students’ pretest scores among the three self-rated user categories (new or novice user, moderate user, expert user) in college level introductory computing classes?

2. Are there significant differences in students’ pretest scores among the three age categories (age 15-19, age 20-28, age 29 and older) in college level introductory computing classes?

3. Are there significant differences in students’ pretest scores among the three campus locations (Cape Fear Community College, Cape Fear Community College, Cape Fear Community College)?

4. Are there significant differences in students’ improvement scores (post-test scores minus pretest scores) among the three self-rated categories (new or novice user, moderate user, expert user) in college level introductory computing classes?

5. Are there significant differences in students’ improvement scores (post-test scores minus pretest scores) among the three campus locations (Cape Fear Community College, Cape Fear Community College, Cape Fear Community College)?

6. Are there significant differences in students’ improvement scores (post-test scores minus pretest scores) among the three age categories (age 15-19, age 20-28, age 29 and older) as determined by gender in college level introductory computing classes?

7. Are there significant differences in students’ improvement scores among the three self-rated user categories (new or novice user, moderate user, expert user) and the three age categories (age 15-19, age 20-28, age 29 and older) in college level introductory computing classes?

8. Are there significant differences in students’ self-identified skill levels among the three self-rated user categories (new or novice user, moderate user, expert user) and the three age categories (age 15-19, age 20-28, age 29 and older) in college level introductory computing classes?
Instrumentation
A group of Computer Science instructors at the partici- pant college aided in the development of the pretest and post-test. The questions represented each unit studied throughout the course. Administration of the pretest and post-test were managed through the course management system. The course management system was comprised of three sections: pretest, post-test, and survey data. The course management system was optional. As with the pretest and post-test delivery, the survey data were collected by a designee of the divi- sion dean to protect the anonymity of students who chose to participate in the study.

RESULTS
Research Question 1
A one-way analysis of variance was used to evaluate the re- lationship between students’ pretest scores and the college experience of students enrolled in college level intro- ductory computing classes. The dependent variable was pre- test scores. The independent variable, college experience, had three levels: first semester freshmen, second semester freshmen, and sophomores – first and second semester. The ANOVA was significant, F(2, 423) = 11.01, p < .001. The effect size as measured by (η²) was small (.05). That is, 5% of the variance in students’ pretest scores was account- ed for by college experience.

Because the overall F test was significant, multiple post hoc comparisons were conducted to evaluate pairwise differences in the pretest means of the three groups. The Tukey post hoc test was used because equal variances were assumed, F(2, 423) = .85, p = .430. The Tukey procedure determined that there was a significant difference between first semester freshmen and second semester freshmen (p < .001) and between first semester freshmen and sophomores – first and second semester (p < .002). In each instance, the mean for first semester freshmen was lower than the mean for second semester freshmen and over 3.5 points lower than the mean for sophomores – first and second semester. There was no significant differ- ence between second semester freshmen and sophomores – first and second semester (p = .322).

Research Question 2
A one-way analysis of variance was used to evaluate the mean differences in students’ pretest scores among the five types of self-reported residential internet access. The de- pendent variable was the pretest scores. The independent variable, type of residential internet access, had five levels: dial-up cable: DSL; wireless and no internet access. The ANOVA was not significant, F(4, 421) = 1.48, p = .209. The effect size as measured by (η²) was small (.01). That is, only 1% of the variance in pretest scores was accounted for by the type of internet access. The results indicated that the type of residential internet access did not significantly affect students’ pretest scores.

Research Question 3
A one-way analysis of variance was completed to evaluate the relationship between students’ pretest scores and the self-rated user category in college level introductory com- puting classes. The dependent variable for this ANOVA model was the pretest scores. The independent variable, self-rated user category, had three levels: new or novice user, moderate user, and expert user. The ANOVA was significant, F(2, 422) = 40.78, p < .001. The effect size as measured by (η²) was large (.16). That is, 16% of the vari- ance in pretest scores was accounted for by self-rated user category.

Because the overall F test was significant, follow up tests to evaluate the differences among the pairs of pretest means were conducted. The Tukey post hoc test was used because equal variances were assumed, F(2, 422) = 78, p = .459. The Tukey procedure determined that all pairs of pretest means were significantly different at p < .001. In each pair of means evaluated, the lower the self-rated user level had the lower pretest mean. That is, the pretest mean for self-rated new or novice users was over 7.8 points lower than self-rated moderate users and almost 15 points lower than self-rated expert users. The pretest mean for self-rated moderate users was 7.4 points lower than self- rated expert users.

Research Question 4
A one-way analysis of variance was completed to evaluate the relationship between students’ improvement scores and the self-rated user category in college level introductory comput- ing classes. The dependent variable was im- provement scores. The independent variable, self-rated user category, had three levels: new or novice user, moderate user, and expert user. The ANOVA was significant, F(2, 371) = 15.54, p < .001. The effect size as measured by (η²) was medium (.10). That is, 8% of the variance in improvement scores was accounted for by self-rated user catego- ries.

Because the overall F test was significant, post hoc multiple comparisons were conducted to evaluate which pair of improvement score means were different. Levene’s Test of Equality of Error Variances showed equal variances could not be assumed, F(2, 372) = 4.33, p = .014. Therefore, the Dunnett’s C post hoc test was used to test pairwise differ- ences. All three pairs of means were significant at the .05 level. Self-rated novel or novice users’ improvement score mean was 5.6 points higher than self-rated moderate users and 10 points higher than self-rated expert users. Moderate users’ improvement mean was 4.5 points higher than self-rated expert users.

Research Question 5
A one-way analysis of variance was completed to evaluate the differences in students’ improvement scores among the three campus location in college level introductory computing classes. The dependent variable was improve- ment scores. The independent variable, campus locations, had three levels labeled: Location 1, Location 2, and Lo- cation 3. The ANOVA was significant, F(2, 369) = 3.57, p = .029. The effect size as measured by (η²) was small (.02) indicating that less than 1% of the variance in improvement scores was accounted for by campus location.

Because the overall F was significant, multiple post hoc comparisons were conducted to determine which pair of means was different. Dunnett’s C was used because equal variances were not assumed, F(2, 369) = 6.03, p = .003. Dunnett’s C showed there was a significant difference in improvement score means between Location 1 and Lo- cation 2. The improvement mean for Location 1 was 3.1 points higher than the mean for Location 2. No other pairs of means were significantly different.

Research Question 6
A two-way ANOVA was used to determine if any signifi- cant differences in improvement scores between any of the three age categories. The ANOVA showed there was a significant age by gender interaction, F(2, 370) = 536, p = .585. The effect size as measured by (η²) was small (.01) in- dicating that less than 1% of the variance in improvement scores was accounted for by age by gender interaction. There was no significant difference in the improvement score means among the age categories, F(2, 370) = 2.966, p = .057. The effect size as measured by (η²) was small (.01) indicating that 2% of the variance in improvement scores was accounted for by age. Finally, there was no significant difference in improvement score means between male and female students, F(1, 370) = .489, p = .485. The effect size as measured by (η²) was small (.01). That is, less than 1% of the variance in improvement scores was accounted for by gender.

Research Question 7
A two-way ANOVA was used to determine if there were differences in students’ improvement score means based on age and self-rated user categories in college level intro- ductory computing classes. The ANOVA showed that there was no significant two-way interaction between age by self-rated user category, F(4, 366) = .61, p = .653. The effect size for the interaction term as measured by (η²) was small (.01). The ANOVA also revealed that age categories were not significant, F(2, 366) = 1.80, p = .167. The ef- fect size as measured by (η²) was small (.01). That is, 2% of

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The variances in improvement scores were accounted for by age. However, the self-rated user category was significant, $F(2, 366) = 12.54, p < .001$. The effect size as measured by $\eta^2$ was medium (.06) indicating that 6% of the variance in improvement scores was accounted for by the self-rated user category.

Regarding the significance of the self-rated user category, as reported in the discussion of Research Question 4, Dunnet’s C showed all three pairs of improvement scores were significant differences. This indicated that there was a significant difference between all three pairs of means was significant. The Tukey test was used because equal variances were assumed, which pair of means was significant. The Tukey test was used because equal variances were assumed, $F(2, 397) = 12.54, p < .001$. The effect size as measured by $\eta^2$ was medium (.06) indicating that 6% of the variance in improvement scores was accounted for by the self-rated user category.

Research Question 8

A one-way analysis of variance was completed to evaluate the relationship between students’ improvement scores among the course delivery types in college level introductory computing classes. The dependent variable was improvement scores. The independent variable, course delivery type had three levels: on ground, online and hybrid. The ANOVA was significant, $F(2, 397) = 3.36, p = .036$. However, the effect size as measured by $\eta^2$ was small (.02) indicating that 2% of the variance in improvement scores was accounted for by course type.

Because the overall $F$ was significant, multiple pair-wise comparisons were conducted to determine which pair of means was significant. The Tukey test was used because equal variances were assumed, $F(2, 397) = 3.36, p = .036$. The Tukey procedure determined that there was a significant difference in the improvement means between on ground and hybrid courses ($p = .048$). The improvement score means for on ground courses was five points higher than the mean for hybrid courses. However, there was no significant difference between on ground and online course ($p = .447$) and no significant difference between online and hybrid courses ($p = .801$).

SUMMARY AND RECOMMENDATIONS

Onsite, online and hybrid courses comprised the methods of course delivery available to students. The findings revealed no significant difference between mean students’ improvement scores (post-test scores minus pretest scores) in the on ground and online courses. However, there was a significant difference between improvement scores in the on ground and hybrid courses. Mean improvement scores for on ground courses were 21% higher than hybrid courses and 13% higher than online courses. One potential reason for this disparity could be that instructors clarify class concepts and assignments for on ground courses with just-in-time teaching, while online courses might require several communications to explain an instruction or assignment.

Advanced, detailed knowledge of course delivery methods would provide additional information for the student before they registered for a course. The institution would benefit from the creation of an online columnar table of delivery types. The table would detail specific components included in each course type, on ground, online, and hybrid. This would provide better understanding when registering for courses, thus improving a student’s success rate in the course. The participating community college should continue to standardize course requirements for all sections of the college level introductory computing class to ensure quality for students. Each college level introductory computing class should continue to administer an exit survey to elicit student feedback.

For new or novice users, the college level introductory computing class should provide a “first steps” video library embedded in D2L. Camtasia (http://www.camtasia.com) or Jing (http://www.jing.com) are two common editing software packages used to create videos. Some introductory video topics would include opening and closing a file, saving a file to different storage locations, and downloading and extracting a file from the course management system. Students could also be directed to free resources that are available online to increase a student’s initial computing skill level. In 2009, Microsoft established the Microsoft Digital Literacy Program. This program is comprised of a series of videos that teach standard literacy skills. The Standard Skills Curriculum includes computer basics, the Internet an introduction to productivity software, security, and leading a digital lifestyle to build computing self-efficacy. As Orr, Allen and Poindeaster (2001) stated, instructors could apply interventions if they had better understanding of the computer attitudes of their students.

Adobe Connect (http://www.adobe.com) is another way to link with students through the use of technology. The purchase and use of Adobe Connect web conferencing software in a college level introductory computing class would facilitate more immediate feedback for online and hybrid students while providing student engagement data for the instructor.

The participating college should develop course learning modules for the college level introductory computing class to tailor student learning. These course learning modules are units of study that students could complete within a specified time period at their own pace and with little instructor interaction. In order for students to move forward to the next module, they would have to attain a predetermined minimum module score. For self-rated expert users, this would provide an alternative to the traditional classroom instruction.

Connected Tennessee’s (http://www.connectedtn.org) organizational mission statement emphasizes design strategies to educate, use, and deliver technology access to Tennesseans. Location 2 would continue to benefit from expanded broadband connectivity for its rural users.

REFERENCES


