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

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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.

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 ei-
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Concepts of literacy were popularized by the United States Army during World War II. Functional literacy included the lowest functioning level of literacy and rarely required an individual to use problem-solving techniques. Functional literacy focused on teaching the basics of reading and writing. The second literacy level was critical literacy, which often referred to a learned individual with the ability to solve problems. This type of literacy comprised teaching the student to interpret and apply information. Many researchers considered computer literacy a type of critical literacy. To integrate computer literacy, the instructor often blended traditional teaching with new technologies. In the classroom, teachers are often required to move beyond simply teaching a skill, such as keyboarding, to integrating computer skills within the core curriculum. This required the teacher to have a combination of a technical skill set and a theory-based skill set. According to Burniske, if we are to achieve literacy across the curriculum, formal teacher training is required.

Computer skills considered necessary for computer literacy varied according to position. For instance, students assumed computer literacy if they could play games or word process a document, activities important to them, thus producing self-efficacy. Self-efficacy included one’s belief in their skill for successful task completion. Individuals who reported high levels of self-efficacy tended to face difficult challenges more easily than others. Additionally, individual beliefs affected how persons felt, behaved, and motivated themselves (Bandura, 1997). Technology skills assessments have taken many forms. For instance, Martin and Dunsworth (2007) proposed formative assessment of computer literacy at the university level to improve curriculum design of a computer literacy course. This formative assessment was conducted to understand the technological advances of the workplace as well as the technological needs of the student. Class observations, student test scores, student and teacher focus groups, and instructor surveys were tools used to collect the data. Four hundred forty-four students received a Likert-type survey through the Blackboard Course Management System in which 329 students responded to the survey. The respondents were five focus groups of 25 students as well as the 11 instructors who delivered the course. Five class observations also aided in data collection. The compiled data formed two categories: 1) what to teach and 2) how to teach it. The findings reported both instructors and students rated Microsoft Office Skills, particularly Word and PowerPoint, as necessary. Additionally, both groups agreed that in class activities and hands-on projects were useful approaches when teaching computer literacy. Instructors and students stated that the Internet and the World Wide Web were considered important tools. However, instructors reported that online quizzes and extended lectures were not helpful, while instructors deemed them valuable teaching tools and a means to measure student learning. Neither students nor instructors considered knowledge of computer hardware (input, processing, storage, and output) as a necessary skill. Instructors submitted that File Management was a needed skill, which instructors assigned a lower rating to this skill. Recommendations from the study included the need for more in class and hands-on activities, and collaboration activities that provided a group learning atmosphere.

Several higher education institutions adopted computer literacy requirements. For example, in 2010 Cape Fear Community College (CFFCC) in North Carolina mandated that students prove computer competency to graduate. The students were presented with two options which satisfied competency requirements. They must have successfully passed the computer competency exam, a one hour examination, or have completed a designated rate for computer course. If students chose the proctored competency exam, it was administered through Blackboard, a course management software application. In preparation for the exam, CFCC provided a computer competency tutorial and a computer competency practice exam for students (Cape Fear Community College, 2010).

RESEARCH METHODOLOGY

Research Questions

The following research questions guided this study:

1. Are there significant differences in students’ pretest scores among the three college experience categories (freshman – 1st semester, freshman – 2nd semester, and sophomore - 1st and 2nd semester) in college level introductory computing classes?

2. Are there significant differences in students’ pretest scores among the five types of self-reported residential Internet access (dial-up, cable, DSL, wireless and no Internet access) in college level introductory computing classes?

3. 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?

4. Are there significant differences in students’ improvement scores (post-test scores minus pretest scores) among the three self-rated user 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 – 1, 2, and 3) in college level introductory computing classes?

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’ improvement scores (post-test scores minus pretest scores) among the course delivery types (on ground courses, online courses, and hybrid courses) in college level introductory computing classes?

Population

Students from 26 sections of the introductory computer science course participated in the study. In each section, the instructor administered the pretest, post-test, and 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 south. 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.

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Instrumentation
A group of Computer Science instructors at the partici- pating 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 as a quiz, and students were required to submit their answers to complete  the survey located in the Surveys section.  The pretest and post-test consisted of 10 multiple choice questions, which in- corporated the chapter units of the course, as follows: (a) Chapters 1-3, operating system; (b) Chapters 1-4, basic word processing; (c) Chapters 1-4, basic spreadsheet chap- ters; (d) Chapters 1 and 2, basic presentation software.

The student survey instrument contained various demo- graphic questions. The independent variables included: gender, age, college experience, campus location, residen- tial Internet access, and the user's self-rated computing skill level. The survey questions were comprised of mul- tiple choice answers. One particular survey question re- garding the user's self-rated computing skill level was of particular importance to this study. The question required the participants to read descriptions of each of three de- fined categories. They then selected the category that best described their computing skill level. The three self-rated categories were new or novice user, moderate user, and ex- pert user. Because the demographic survey was optional, some students chose not to participate in this portion of the study or they completed only portions of the survey.

Data Collection
The online course management system used in the study was Desire to Learn. The online course management sys- tem provided one central location for course materials, quizzes, surveys, calendars, and drop boxes for students to submit their assignments with no installation of additional software required by the participants. The data provided for the study were collected through the course manage- ment system by a designee of the division dean.

In addition, a demographic survey was administered elec- tronically along with the pretest. The demographic survey was developed with the assistance of the instructors in the Computer Science Department. Each instructor of the 28 participating sections was given the purpose of the survey to each class and noted that student participation was optional. As with the pretest and post-test delivery, the demographic survey was administered electronically as part of the class through the course management sys- tem. Students logged in to the course management system and entered into their college level introductory comput- ing class to take the survey located in the Surveys section of the course. The students who chose to participate, students were then instructed to complete and submit the demo- graphic survey questions electronically. Data provided by

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 introduc- tory 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 ω² 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, 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, 423) = 11.01, p < .001. The effect size as measured by ω² was small (.05). That is, 5% of the variance in students' pretest scores was accounted for by college experience.

Research Question 2
A one-way analysis of variance was used to evaluate the mea- sured differences in students' pretest scores and the college experience of students enrolled in college level inter- 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 ω² was small (.05). That is, 5% of the variance in students' pretest scores was accounted for by college experience.

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RESULTS

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Research Question 3
A one-way analysis of variance was used 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) = 40.76, p < .001. The effect size as measured by ω² was large (.16). That is, 16% of the vari- ance in pretest scores was accounted for by self-rated user category.

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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, Dunnnet's C showed all three pairs of improvement score means were significant at the .05 level. 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 Poindester (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.

**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. However, there was a significant difference in the 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.

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**REFERENCES**


