Attitudes Toward Computers, the Introductory Course and Recruiting New Majors: Preliminary Results

Daniel Farkas[1] and Narayan Murthy[2]

[1]IS Dept., Westchester, Pace University, Pleasantville, NY 10570
dfarkas@pace.edu
[2]CS Dept., Westchester, Pace University, Pleasantville, NY 10570
nmurthy@pace.edu

Abstract. In order to investigate reasons contributing to the decline in enrollment in computing programs in colleges and universities, this study examined student attitudes towards computing throughout an introductory computing course for non-majors at a northeastern metropolitan university. In addition to providing computer literacy, the course is used for recruiting students into the CS and IS majors. Six sections of the course, with participation ranging from 106 to 133 subjects at four measurement points, were administered the Loyd Gressard Computer Attitude Scale (Loyd and Gressard, 1984, 1985). This paper is a preliminary analysis of the computer attitude data of all students in all sections across two campuses.

The results indicated that after statistically significant decreases in positive attitudes toward computers through the first 3 measures (2/3 of the course), there was a statistically non-significant rise at the end of the course once the programming part of the course was completed. The conclusion is that initial enthusiasm for computers, which may come from familiarity with using computers for recreational activities, drops rapidly as the work of learning computing concepts and skills begins.

1. Introduction

Many institutions are experiencing declines in enrollment in Information Systems and Computer Science programs ([4],[7],[8]). Yet, according to the Bureau of Labor Statistics ([2]), information technology specialists (software developers, network and communications managers) are still the in the top 10 fastest growing occupations. The authors believe that there are a number of reasons for this beyond the dot.com decline and offshore outsourcing. For one, the narrow focus of both Information Systems and Computer Science and the growing diversity of employment opportunities in the information technology field, operate at conflicting purposes. We may need to diversify our offerings and concentrations which better match the workplace.

A second reason may be the perception by many undergraduate students that computing, programming in particular, is too hard, uninteresting, and unsocial – maybe even anti-social. Thus, this study was initiated to take a pulse on the attitudes of our students during the introductory class. The intent was to study the effect of learning spreadsheets, web-development and programming on attitudes toward computers, investigating whether this might be a contributing factor to declining enrollments.

2. Prior Research

Dalton and Goodrum ([5]) looked at attitudes in a study on the affect of structured programming on problem-solving skills. There were 272 students in elementary school and junior high school in 22 classes with 15 teachers. In this study, they found that those who studied programming had improved problem-skills and attitudes toward computers over a control group with no programming. Woodrow

([13]) also found statistically significant gains in positive attitudes toward computers with programming in the literacy course. The computer literacy course was elective and consisted of 36 pre-service teachers. The study also concluded that it was necessary to include programming in the introductory course because positive attitudes toward computers contributed to further acquisition of computing skills. Koohang ([10]), using the same scale as this study, investigated the affect of prior experience in keyboarding, programming, spreadsheets, databases and word processing on attitudes toward computers. The 81 participants were undergraduate college students in computer education courses at a Midwestern university. All of the skills, except for databases, had statistically significant positive attitudes toward computers correlating with prior knowledge. Contradicting these positive results, Farkas ([6]), investigating the instructional sequence of spreadsheets and programming in the introductory course, found a statistically significant decrease in positive attitude towards computers as a result of learning programming. This study was conducted with 44 participants in 2 classes. The course was a required core course for all undergraduates at a Northeastern university and consisted of liberal arts, education, nursing and business majors. The study described in this paper repeated the Farkas attitude study with a larger sample population.

3. Methodology

In order to investigate the effect of the introductory course and in particular the affect of the programming component on non-majors in the computer literacy class (CIS101, see section 5 below), measures were taken at four points during the class: at the beginning, at the one-third point (week 5), at the two-third point (week 9) and at the end.

Participants in 6 sections of CIS101 were administered the Loyd Gressard Computer Attitude Scale (Loyd and Gressard, 1984, 1985) (CAS) at each time point. The one-third point was after the spreadsheet component had been completed and studying HTML had begun; the two-third point was after the students had studied HTML and were well into programming with Javascript. At the end of the course, the programming component had been completed for two weeks.

For this paper, only the overall scores on the CAS were analyzed, comparing group scores at each point in the course. To measure the overall effect of the course on student attitudes an independent samples t-test was used to compare the CAS scores at the beginning and end of the class. To measure the effect of learning spreadsheets on student attitudes, a t-test was used to compare attitudes at the beginning of the course and at the one-third point. To measure the effect of learning HTML and programming on student attitudes a t-test was used to compare attitudes at the one-third point and at the two-third point. Finally, a t-test was used to measure the CAS scores between the two-third point and the end of the semester. This was the period when the course was over and project presentations occurred.

4. Sample

The CAS was administered to undergraduate students attending a multi-campus private metropolitan northeastern United States university. All of the students were non-computing majors drawn from business, nursing, liberal arts, and education. There were several undecided majors as well. Over 95 percent of the students were 22 or less years old. The CAS was administered to students in 6 sections of the computer literacy course with 5 different instructors. The number of participants in each administration of the CAS varied based on the number of students in class on the days the instrument was administered. Measurements included a low of 106 participants to a high of 133.

5. The Introductory Course

The introductory computer literacy course (CIS101) is required of all students as part of the University core curriculum. It consists of 3 components: computer concepts (hardware, software, and systems), spreadsheets (using Microsoft Excel) and web-development in which the students first learn HTML, publishing pages to a university supplied web-server and then learn Javascript for client-side programming.

When learning Javascript, students are introduced to programming concepts including problem solving, data elements, variables, iteration, conditionals, functions, events and event handling. The reason for using Javascript is that while it can be used to provide a basic introduction to programming concepts, students perceive it as relating to their own experience with the web.

The 3-credit course meets for 14 weeks. Each week it meets with the instructor for 2 hours in a computer classroom. Extensive use of Blackboard, a course management tool for online education [1], is used for the third contact hour and primarily to cover the computer concepts portion of the class. Appendix 1 has a copy of the weekly syllabus.

6. Dependent Measure: Loyd and Gressard Computer Attitude Scale (CAS)

CAS is an instrument measuring different aspects of computer attitude. The total score is a general measure of attitude toward computers and consists of 40 questions with choices measured on a 4 point Likert scale (strongly agree, slightly agree, slightly disagree, strongly disagree). A copy of the instrument is in the appendix. Thus, score values can range from a low of 40 to a high of 160. For this test, higher the scores indicate more positive attitudes toward computers. Four subscores can be used to measure computer anxiety, confidence with computers, liking computers and attitude toward the usefulness of computers. This paper is only reporting on attitudes toward computers based on the total score. Loyd and Gressard ([11].[12]) reported high reliability on the total score (.90). High reliability (.95) and stable factorial validity was reported by Christensen and Knezek ([3]) in constructing an attitude scale from several existing ones. Woodrow ([13]) also reported good factorial stability. A paper copy of the instrument is in Appendix 2.

7. Procedure

For this study there were 6 sections of the course (CIS101). Three of the sections were on the urban campus of the University and 3 were on the suburban campus. There were 5 different instructors and one of the sections was on a late-start schedule meeting for 2 ½ hours instead of 2 hours per week. For this section however, the timing of the administration of the CAS was slightly adjusted. The authors were not teaching any of the sections.

CIS101 is centrally administered with a course coordinator (there are about 60 sections each with 24 students per academic year). All course websites use Blackboard and are loaded with content, quizzes, and assignments by the coordinator. Instructors have freedom to modify their presentation and assignments. The CAS instrument was implemented using an online survey tool, Zoomerang [14], and given to students in the computer classroom with the instructor present at the beginning of the class meeting at the appropriate measurement point.

8. Results

For the most part the news is not that good. Students' attitudes toward computers significantly decreased throughout the course, increasing, but not significantly once the course was effectively completed.

Comparing the attitudes toward computers from the beginning of the course to the end of the course, we see an overall statistically significant decrease ($t(259)=-3.962$, $p=.000$) (Table 1).

Table 1. Significant decrease: t-test comparing attitude from the beginning to end of the course

Course Point	N	Mean	Std. Deviation
Beginning	133	128.0075	19.27414
End	128	118.0313	21.38766

Compares Course Effect	t	df	Sig. (2-tailed)	Mean Difference
Beginning-End	-3.962	259	.000	-9.9763

In fact, there was a significant decrease from the beginning of the course to the first third after the students had learned spreadsheets (($t(250)=-2.6$, $p=.010$) and from the first third to the second third

($t(223)=-2.578$, $p=.011$) when the students were in the middle of learning programming. See Tables 2 and 3.

Table 2. Significant decrease: t-test comparing attitude from beginning to after learning spreadsheets

Course Point	N	Mean	Std. Deviation
Beginning	133	128.0075	19.27414
First Third	119	121.3109	21.61244

Compares Excel Effect	t	df	Sig. (2-tailed)	Mean Difference
Beginning-First Third	2.600	250	.010	6.6966

Table 3. Significant decrease: t-test comparing attitude from the start of HTML into programming with Javascript

Course Point	N	Mean	Std. Deviation
First Third	119	121.3109	21.61244
Second Third	106	113.6792	22.76193

Compares HTML effect	t	df	Sig. (2-tailed)	Mean Difference
First–Second Thirds	2.578	223	.011	-7.6317

Interestingly, there was a rise in students' positive attitudes toward computers from the second third to the end of the course, but the result is not significant ($t(232)=-1.505$, $p=.134$). In the last two weeks of the class, the programming component had been completed and the students were taking exams and giving project demonstrations. See Table 4.

Table 4. Non-significant increase: t-test comparing attitude from programming component to the end of the course

Course Point	N	Mean	Std. Deviation
Second Third	106	113.6792	22.76193
End	128	118.0313	21.38766

Compares Programming Effect	t	df	Sig. (2-tailed)	Mean Difference
Third Quarter-End	-1.505	232	.134	-4.3520

A summary of the means and score ranges can be seen in Table 5. The trend of attitude scores can be seen in the graph in Figure 1.

Table 5. Summary of means throughout the course.

	N	Minimum	Maximum	Mean	Std. Deviation
Begin	133	55.00	160.00	128.0075	19.27414
Onethird	119	57.00	160.00	121.3109	21.61244
Twothird	106	57.00	159.00	113.6792	22.76193
End	128	69.00	159.00	118.0313	21.38766

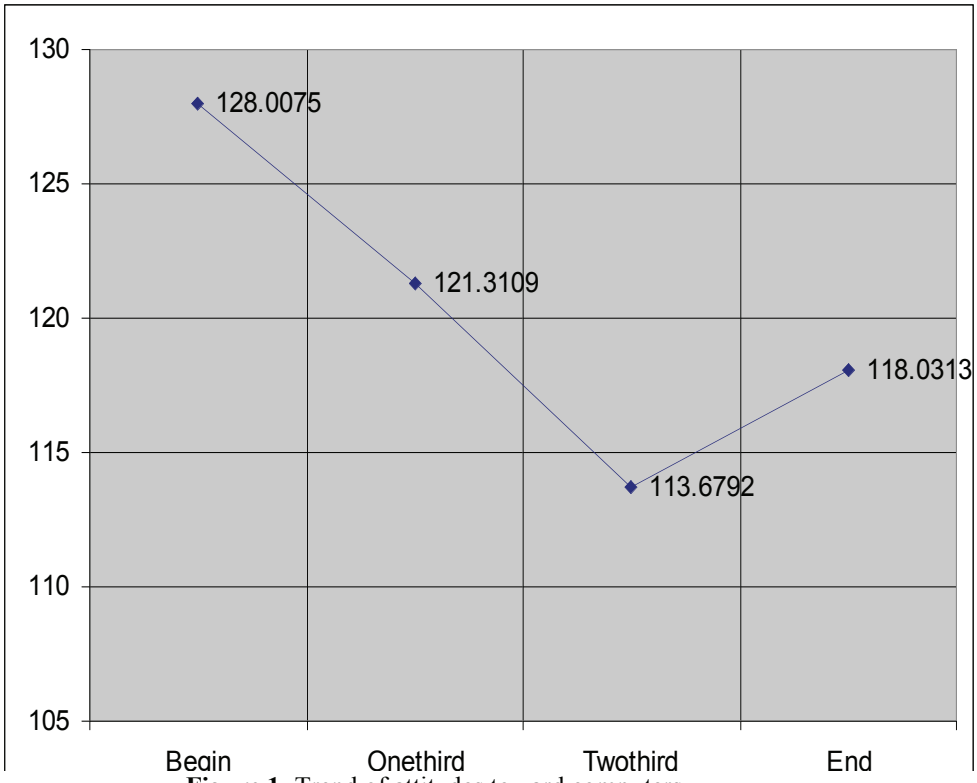

Figure 1. Trend of attitudes toward computers

9. Discussion

The intent of the introductory course is to introduce students to basic computer concepts as well as provide spreadsheet and programming skills so as to provide a basis for further learning. An additional objective, since the students in CIS101 are non-majors, is to introduce them to a new subject of study encouraging them to take more courses to enhance their academic progress as well as, in some cases, to choose computing as a major or minor.

Validating the result of the Farkas ([6]) study, the course does not seem to be successful in creating a positive attitude towards computers. Student positive attitudes decreased through all the learning modules and only appeared to rise again once the course was over. The rise, albeit not significant, could be an expression of relief that the course was over. The results would seem to indicate that students are leaving the course less satisfied than we would have hoped them to be. One reason for this could be the expectation of the course, based on prior experience with the recreational use of computers, is very positive. Once faced with the reality of what computing is about, the students become frustrated and developed a more negative and perhaps realistic (for them) attitude toward computing.

The choice of Javascript as a language was to provide programming instruction in a context students would be familiar with (the Internet). The objective was to raise attitudes toward computers. The results did not seem to support this. While Javascript contains most main programming elements, it can only be explored at elementary levels during this course. This raises the question of whether attitudes toward computers would have continued to decline even further were the material to be covered in greater depth or conversely, would have significantly increased after students began to master programming concepts.

While it is possible to assume that the decline in positive attitude is a function of the programming part of the course, actual measurements were scheduled chronologically at equally spaced points in the course, not at content points. Thus, some overlap of Excel, HTML and Javascript may have confounded the results regarding programming. Lastly, in this phase of the analysis, it is not possible to speculate on how the results may have been affected by different instructors. Several instructors were involved and future analysis will compare individual class participants to the group averages.

10. Conclusion

The study was initiated with the premise of investigating how learning computing skills, specifically programming, affected students' attitudes toward computers and whether or not programming in the introductory course might be a factor for recruitment. Data on gender, major, campus and age were collected and will be reported on in future analysis. Future studies could focus specifically on classes which are all programming. Another possibility is to look at the attitudes of students across different courses in a major to see the impact on retention.

The authors would like to see the introductory course designed to positively change students' attitudes and future studies could investigate strategies for maintaining or increasing them. For example, a future study could include a preparatory unit addressing student expectations. Another possibility is to organize the material around problems which incorporate recreational use (e.g. games [8]).

In general, however, it appears that learning computing skills, concepts and programming in the introductory courses did not contribute significantly to students' positive attitude toward computers and may inhibit them from choosing computing as a major.

11. References

1. Blackboard, Inc., [online] Available: http://www.blackboard.com.

2. Bureau of Labor Statistics (2004), *The 10 fastest growing occupations, 2002-12* [online] Available: http://www.bls.gov/news.release/ecopro.t04.htm

3. Christensen, R. & Knezek, G. (1996). *Constructing the teachers' attitudes toward computers (TAC) Questionnaire.* Paper presented at the annual meeting of the Southwest Educational Research Association, New Orleans, LA.

4. Computer Research Association (2004), *2002-2003 Taulbee Survey* [online] Available: http://www.cra.org/CRN/articles/may04/taulbee.html

5. Dalton, D. W. & Goodrum, D. A. (1991). *The effects of computer programming on problem-solving skills and attitudes*. Journal of Educational Computing Research, 7(4), 483-506.

6. Farkas, D. J. (2004). The effect of the instructional sequence of spreadsheets and programming on performance, computer anxiety, and attitude toward computers, Ann Arbor, MI: UMI

7. Hensel, M., (1998), *The Approaching Crisis in Computing Education: Enrollment, Technology, Curricula, Standards and their Impact on Educational Institutions*. Journal of Information Systems Education, pp. 24-27.

8. Hoekstra, K. (2004), *Getting a job in the game development industry* [online] Available: http://www2.ravensoft.com/getajob.htm.

9. Hoffman, A., *Computer Science Slump*, Monster.com [online]. Available: http://technology.monster.com/print/?article=/articles/collegetech/

10. Koohang, A. A. (1989). *A study of attitudes toward computers: Anxiety, confidence, liking, and perception of usefulness.* Journal of Research on Computing in Education, Winter 1989, 137-150.

11. Loyd, B. H., & Gressard, C. (1984). *Reliability and factoral validity of computer attitude scale.* Educational and Psychological Measurement, 44(2), 501-505.

12. Loyd, B. H, & Gressard, C. (1985). *The Reliability and Validity of an Instrument for the Assessment of Computer Attitudes*. Educational and Psychological Measurement, 45(4), 903-908.

13. Woodrow, J. E. J. (1992). *The influence of programming training on the computer literacy and attitudes of pre-service teachers.* Journal of Research on Computing in Education, 25 (2), 200-219.

14. Zoomerang: MarketTools, Inc., [online] Available: http://info.zoomerang.com.

Appendix 1: CIS101 Course Schedule

CIS101 Schedule

Week #	Text book reading	Online reading
Week 01	Concepts: Chapter 1, pp. 2-17	Introduction to CIS101 Becoming a Successful Online Student Lecture Notes, Concepts, Chapter 1, Part 1
Week 02	Concepts: Chapter 1, pp. 18-44	Lecture Notes, Concepts, Chapter 1, Part 2 Lecture Notes, Excel Project One
Week 03	Concepts: Chapter 3	Lecture Notes, Concepts, Chapter 3 Lecture Notes, Excel Project Two
Week 04	Concepts: Chapter 8 Excel Project Three Network Security	Lecture Notes: Concepts, Chapter 8 Lecture Notes: Excel Project Three

Week 05	HTML: Project One Introduction HTML: Project Two	Introduction to Web Design and HTML HTML Project Two
Week 06	Concepts: Chapter 2 HTML: Project Three	Lecture Notes: Concepts, Chapter 2 HTML Project Three
Week 07	Concepts: Chapter 7 HTML: Project Four	Lecture Notes: Concepts Chapter 7 HTML Project Four
Week 08	Concepts: Chapter 4 HTML: Project Seven	Lecture Notes: Concepts Chapter 4 Lecture Notes, HTML Project Seven
Week 09	JavaScript: Introduction to Programming, Lesson 01, Lesson 02	Lecture notes JavaScript: Introduction, Lesson 01, Lesson 02
Week 10	Concepts: Chapter 5 JavaScript: Lesson 03, Lesson 04, Lesson 05	Lecture Notes: Concepts, Chapter 5 Lecture Notes Javascript: Lesson 03, Lesson 04, Lesson 05
Week 11	Concepts: Chapter 6 JavaScript: Lesson 06, Lesson 07	Lecture Notes: Concepts Chapter 6 "Output" Lecture Notes JavaScript: Lesson 06, Lesson 07
Week 12	JavaScript: Lesson 08	Lecture Notes JavaScript: Lesson 08, "Loops"
Week 13	Exam	Computer Careers
Week 14	Presentations	Presentations

Appendix 2: Loyd & Gressard Computer Attitude Scale (CAS)

Below are a series of statements. There are no correct answers to these statements. They are designed to permit you to indicate the extent to which you agree or disagree with the ideas expressed. Place a checkmark in the space under the label which is closest to your agreement or disagreement with the statements.

		Strongly Agree	**Slightly Agree**	**Slightly Disagree**	**Strongly Disagree**
1.	Computers do not scare me at all.	❑	❑	❑	❑
2.	I'm no good with computers.	❑	❑	❑	❑
3.	I would like working with computers.	❑	❑	❑	❑
4.	I will use computers many ways in my life.	❑	❑	❑	❑
5.	Working with a computer would make me very nervous.	❑	❑	❑	❑
6.	Generally, I would feel OK about trying a new problem on the computer.	❑	❑	❑	❑
7.	The challenge of solving problems with computers does not appeal to me.	❑	❑	❑	❑
8.	Learning about computers is a waste of time.	❑	❑	❑	❑
9.	I do not feel threatened when others talk about computers.	❑	❑	❑	❑

10.	I don't think I would do advanced computer work.	❑	❑	❑	❑
11.	I think working with computers would be enjoyable and stimulating.	❑	❑	❑	❑
12.	Learning about computers is worthwhile.	❑	❑	❑	❑
13.	I feel aggressive and hostile toward computers.	❑	❑	❑	❑
14.	I am sure I could do work with computers.	❑	❑	❑	❑
15.	Figuring out computer problems does not appeal to me.	❑	❑	❑	❑
16.	I'll need a firm mastery of computers for my future work.	❑	❑	❑	❑
17.	It wouldn't bother me at all to take computer courses.	❑	❑	❑	❑
18.	I'm not the type to do well with computers.	❑	❑	❑	❑
19.	When there is a problem with a computer run that I can't immediately solve, I would stick with it until I have the answer.	❑	❑	❑	❑
20.	I expect to have little use for computers in my daily life.	❑	❑	❑	❑
21.	Computers make me feel uncomfortable.	❑	❑	❑	❑
22.	I am sure I could learn a computer language.	❑	❑	❑	❑
23.	I don't understand how some people can spend so much time working with computers and seem to enjoy it.	❑	❑	❑	❑
24.	I can't think of any way that I will use computers in my career.	❑	❑	❑	❑
25.	I would feel at ease in a computer class.	❑	❑	❑	❑
26.	I think using a computer would be very hard for me.	❑	❑	❑	❑
27.	Once I start to work with the computer, I would find it hard to stop.	❑	❑	❑	❑
28.	Knowing how to work with computers will increase my job possibilities.	❑	❑	❑	❑
29.	I get a sinking feeling when I think of trying to use a computer.	❑	❑	❑	❑
30.	I could get good grades in computer courses.	❑	❑	❑	❑
31.	I will do as little work with computers as possible.	❑	❑	❑	❑
32.	Anything that a computer can be used for, I can do just as well some other way.	❑	❑	❑	❑
33.	I would feel comfortable working with a computer.	❑	❑	❑	❑
34.	I do not think I could handle a computer course.	❑	❑	❑	❑

35. If a problem is left unsolved in a computer class,
I would continue to think about it afterward. ❑ ❑ ❑ ❑

36. It is important to me to do well in
computer classes. ❑ ❑ ❑ ❑

37. Computers make me feel uneasy and confused. ❑ ❑ ❑ ❑

38. I have a lot of self-confidence when it comes
to working with computers. ❑ ❑ ❑ ❑

39. I do not enjoy talking with others about computers. ❑ ❑ ❑ ❑

40. Working with computers will not be important
to me in my life's work. ❑ ❑ ❑ ❑