
Student Attitudes and Perceptions Regarding Computing and Its Related Disciplines: A Preliminary Study in the United Kingdom

Charles R. Woratschek
woratschek@rmu.edu
Computer & Information Systems
Robert Morris University
Moon Township, PA 15108 USA

Abstract

Declining enrollments in the computer-related disciplines is not just a United States phenomenon. To study the problem in the United Kingdom and perhaps gain useful ideas to understand and deal with this issue in the United States, a research project was undertaken during a sabbatical semester. Students majoring in a computer-related discipline in the UK were surveyed and faculty teaching in the computer-related disciplines contacted for personal interviews. The survey collected data about: 1) the factors that were used to select a college major, 2) why or why not the student picked a major in a computer-related field, 3) the student's secondary school guidance counseling experience both in general and in regard to computer-related fields, and 4) perceptions regarding the computing field in general. The faculty interviews collected data in four major areas: 1) enrollment, 2) secondary school guidance, 3) students' skills and abilities regarding preparation for collegiate work in the computer-related disciplines, and 4) solutions/suggestions regarding the problem issues.

Keywords: UK computer careers, UK declining enrollment in computer careers, UK student perceptions of computer careers

1.0 INTRODUCTION AND BACKGROUND

Much has been written in the past five years about the declining enrollments in the computer related disciplines in the United States (US). But what about the United Kingdom (UK)? Do they have the same issues as the U. S. in this area, and if so, can their situation help us in the U.S. understand and deal with this issue?

To study the current state of affairs in the UK, the author lived in London, UK for a sabbatical semester and researched the issue first-hand.

1.1 THE UNITED KINGDOM

The Universities UK, with the support of GuildHE and the UK Higher Education Europe Unity have published a series of reports since

2001 examining the trends in UK higher education at both the sector and institutional level. In the ninth report of this series, it is stated that across the UK, undergraduate enrollments in higher education institutions increased by 25 per cent overall in the 10-year period from 1998/99 to 2007/08. This decade saw significant changes in the subjects that students were studying with above average increases in enrollments since 1998/99 occurring in subjects allied to medicine; biological sciences; mathematical sciences; law; mass communication and documentation; historical and philosophical studies; education; social studies; and creative arts and design.

From 1997/98 to 2006/07, there were lower than average levels of increase in enrollments in veterinary science; medicine; architecture, building and planning; engineering and technology; the physical sciences; computer science; agriculture; and business and administrative studies (Patterns, 2009).

Thomson (2008) reported in *Computer Weekly* on a study conducted with nearly 2,000 undergraduates across the UK. Responses indicated that most students thought that the IT sector had a bright future with good prospects for highly paid jobs, but more than 60% of non-computing students did not wish to enter the sector because they 'it will be boring.'

Bruce Webster (2008) cited this study in his article about declining computer science enrollments and added that "talent is a key factor in IT personnel issues, and only a small portion of the general population appears to be talented in IT. People who have little or no aptitude for IT are likely to find it boring at best and confusing at worst."

In a 2009 report published by the IT Job Board.co.uk entitled *The State of the UK IT Recruitment Market*, eSkills predicted that the UK would need more than 140,000 new IT and Telecoms professionals per year over the next five years. This site also reported that The IT and Telecoms Insights stated that due to the lack of supply, half of the needed professionals would be experts from other fields, with only one in five hired directly from education. Why only one in five directly from education? The answer is simply because of the lack of enrollment in key courses. According to Microsoft and The British Computer Society (BCS) there is an insufficient number of students choosing to study the "cpSTEM" (Computer and Physical Science, Technology, Engineering, and Mathematics subjects) in the UK.

eSkills is a new and controversial idea in the UK. It is a not for profit organization led by a group of employers who have formed a sectors skills council for business and technology. Their mission is to ensure that the UK has the skills for a Digital Britain. In April, 2010, eSkills welcomed a UK government report that identified IT services as a source for future job growth. This report, *Ambition 2020: World Class Skills and Jobs for the UK*, published by the UK Commission for Employment and Skills predicted two million new UK jobs will be created in the next 10 years with the most sig-

nificant growth being in the area of IT services (IT skills drive, 2010).

In regard to women, the web cite www.womenintechology.co.uk reported at the end of July, 2010 that "the number of women studying computer science has actually fallen in the past five years, from 24 percent to 19 per cent" (Are female IT graduates, 2010).

1.2 THE UNITED STATES

In the US, the continued decrease in computer-related majors, the continuing retirement of baby-boomers, and the increasing use of computers in all fields is expected to create a substantial number of vacant IT jobs. A number of authors have stated that the shortage of qualified graduates in the computer-related profession is a significant problem that needs immediate attention.

What factors influence students to choose a major in computing? In the US, O'Lander (1996) collected data from 4,127 high school students who were enrolled in a computer course in New York State concerning the factors that influenced their attitude towards computing. He found that these factors included: 1) enthusiasm towards computing; 2) perceptions of computing ability; 3) apprehension about majoring in CS; 4) perceptions of degree of positive instructional influence towards computing received; and 5) perceptions of career and employment opportunities in computing.

McInerney et al. (2006) conducted a qualitative study seeking to determine why US university students chose to major in Information Technology. Focus group interviews with 54 undergraduate university students majoring in computer science, computer engineering or information technology and information were conducted to determine why student choose a specific information technology related major and career. Results of this study suggested that students who chose an IT major and career were influenced by: 1) an interest in the computing, 2) positive experiences in high school, 3) an aptitude for math and physics, 4) perceived job prestige, 5) encouragement of family members, 6) the expectation of a good salary, and 7) the influence of key individual such as a work supervisor or teacher.

Recently, Pollacia & Lomerson (2006) conducted research to determine the factors that influence a US student's decision regarding a

CIS major. They surveyed students enrolled in a first-year introductory computer courses. The results of their survey found: 1) students have limited knowledge of the career opportunities of CIS. Their knowledge seems to be inadequate or inaccurate; 2) many of the respondents indicated they choose their major using only self-developed information and did not rely on family, peers, the media or high school counselors; and 3) there are a wide variety of causes for disinterest in a computer career (Pollacia & Lomerson, 2006).

Woratschek & Lenox (2009) replicated and enhanced the Pollacia & Lomerson study. Their findings confirmed that of Pollacia & Lomerson: students picked their major course of student via self-collected inputs; students seem to have limited knowledge of the fields of computer and/or career opportunities in these fields; students have stereotypes regarding the computer fields; more work needs to be done regarding student's school guidance counselor experience; and that students were not interested in technical careers.

2.0 PURPOSE OF THE RESEARCH

The purpose of the research described here was twofold. First was to study the current UK university student population who choose a computer-related discipline as a major course of study and determine: 1) the factors that influenced a student's decision to major in a computer-related discipline, 2) attitudes towards computers and computer related majors, and 3) the role, if any, that a secondary school computer class and/or guidance counselor had in influencing the student's decision regarding their major. Second, was to gather the faculty perspective regarding the declining enrollment phenomenon.

3.0 METHODOLOGY

A survey was developed and interview questions designed. Initially, an e-mail was sent to the 14 major universities surrounding the London, UK area. This e-mail was sent to the department chairperson of the computer department explaining the research and requesting: 1) a personal interview and 2) a potential meeting with current students majoring in the area. Three positive responses were had. After a second contact, two of the three respondents had to withdrawal their positive responses. The one personal interview was conducted with the department chairperson of one

of these 14 universities, but no students were interviewed.

Because of the poor response, a second e-mail was composed and sent to the department chairperson's of 70 colleges and universities in the UK that offered a major in the computer related disciplines. This e-mail explained the research and asked the department chairperson provide their majors with a link to an on-line survey. Sixty-six positive responses were secured and 384 student responses were gathered.

4.0 RESULTS

4.1 STUDENT SURVEYS

Please refer to Appendix A for all tables.

Table 1 describes the 384 respondents. The vast majority of respondents are male and the majority of respondents both male and female respondents are over 20 years old.

Table 2 describes the size of the graduating secondary school class of the survey participants. A wide variety of class sizes are seen with the majority of respondents graduating from a secondary school class size of 250 or less.

Tables 3 and 4 describe the number of survey respondents that took a computer class in secondary school and what that class was. The vast majority of both females (81.2%) and males (91.4%) took a secondary school computer class. For the 'Other' category in Table 5, there was no one subject area that was reported. Responses included Pascal, CAD, computer history, electronics, Corel Draw, CCNA, MySQL and even Oracle.

Respondents were asked if any professors from nearby colleges/universities visited their secondary school. If there was such a visit, the respondent was asked about the professors' gender, if the professors talked about a major they were interested in, and if the professors talked about majors in computer-related fields. Only 50 (13%) of the respondents indicated that a professor from nearby colleges/universities visited their secondary school. The visiting professor(s) were male (78%) and 50 percent of the respondents indicated that the professor(s) did not talk about majors in computer-related fields. Table 7 details the responses.

Table 8 describes the results of the question that asked the respondents if they had a family

member who works in a computer-related field. The female respondents reported that 26 (30.6%) did have a family member who works in a computer-related field and 91 (30.4%) of the male respondents indicated such. The majority of both the male and female respondents do not have (a) family member(s) who work(s) in a computer-related field.

The respondents were asked as to how they picked their major and were able to pick multiple responses. Table 9 details the results. Eight-eight percent of the male and eight-two percent of the female respondents stated that they choose their major through self-collected inputs. The next option with the highest percentages was "input from family." This option was chosen by 25.9% of the female respondents and 21.1% of the male respondents. For the "Other" the respondents stated some of the following reasons:

- 1) it has always been one of my main interests,
- 2) hobby,
- 3) college teacher recommendation,
- 4) mentor recommendation,
- 5) I just like computers,
- 5) work experience,
- 6) Career Aptitude Test, and
- 7) to join the RAF(Royal Air Force, a science major is required.

Lastly, all respondents were asked to indicate their agreement with a number of statements. These statements concerned the Secondary School guidance counselor, the career counseling the student received, and the computing field in general. Students were asked to state their agreement using a Likert scale of SA (Strongly Agree), (A) Agree, (U) Undecided, (D) Disagree, (SD) Strongly Disagree, (NA) Not Applicable, and (NR) No Response.

The female participant's responses are shown below.

Statement: I visited my secondary school career counselor more than once regarding my college major.

SA	7 (8.24%)
A	16 (18.8%)
U	4 (4.7%)
D	17 (20.0%)
SD	26 (30.6%)
NA	15 (17.6%)
NR	0 (0.0%)

The highest single response was for the option "strongly disagree," but that was only 30.6% of the female respondents. An almost equal percentage either agreed or answered "not applicable." The combined percentage for the options of "disagree" and "strongly disagree" totals 50.6%.

Statement: My secondary school career counselor gave me good ideas concerning my college major.

SA	3 (3.5%)
A	7 (8.2%)
U	8 (9.4%)
D	21 (24.7%)
SD	28 (32.9%)
NA	18 (21.2%)
NR	0 (0.0%)

A mere 11.7% of the female respondents either strongly agreed or agreed with this statement. The combined percentage of the options for "disagree" and "strongly disagree" is 57.6%.

Statement: My secondary school career counselor was knowledgeable about careers in the computing field.

SA	4 (4.7%)
A	7 (8.2%)
U	10 (11.8%)
D	14 (16.5%)
SD	27 (31.8%)
NA	23 (27.1%)
NR	0 (0.0%)

The combined percentage of the options for "disagree" and "strongly disagree" is 48.3%, clearly a majority.

Statement: My secondary school career counselor gave me good counseling concerning computer-related careers.

SA	2 (2.4%)
A	5 (5.9%)
U	9 (10.9%)
D	20 (23.5%)
SD	26 (30.6%)
NA	23 (27.1%)
NR	0 (0.0%)

The combination of percentages of the options for "disagree" and "strongly disagree" total 54.1%.

Statement: Overall, I am satisfied with the college and career counseling I received in high school.

SA	3 (3.5%)
A	13 (15.3%)
U	17 (20.0%)
D	15 (17.6%)
SD	22 (25.9%)
NA	15 (17.6%)
NR	0 (0.0%)

The majority of female respondents indicated that they were unsatisfied with the college and career counseling they received in secondary school. The combined percentage for the options of "strongly disagree" and "disagree" totals 43.5%.

Statement: Computing is mostly for men.

SA	3 (3.5%)
A	20 (23.3%)
U	7 (8.2%)
D	14 (16.5%)
SD	36 (42.4%)
NA	5 (5.9%)
NR	0 (0.0%)

The majority of female respondents strongly disagreed with this statement (42.4%), but 23.3% agreed with it.

Statement: Computing is a field that mostly deals with programming.

SA	5 (5.9%)
A	17 (20.0%)
U	21 (24.8%)
D	33 (38.8%)
SD	8 (9.4%)
NA	1 (1.2%)
NR	0 (0.0%)

The highest number of responses was for the option of "disagree" regarding this statement, but that was only 38.8% of the female respondents. The next highest response is for the option "undecided."

A majority of the female respondents disagreed or strongly disagreed with this statement (87.1%).

Statement: Computing is a field that mostly deals with robotics.

SA	1 (1.2%)
A	4 (4.7%)
U	5 (5.9%)
D	43 (50.6%)
SD	31 (36.5%)
NA	1 (1.2%)
NR	0 (0.0%)

Statement: Computing is a field that mostly deals with video games.

SA	1 (1.2%)
A	2 (2.4%)
U	8 (9.4%)
D	45 (52.9%)
SD	27 (31.8%)
NA	2 (2.4%)
NR	0 (0.07%)

More than half of the female respondents disagreed with this statement (52.9%). The combined percentage for the "disagree" and "strongly disagree" options totals 84.7%.

Statement: Computing is a field that requires a lot of knowledge about mathematics.

SA	3 (3.5%)
A	27 (31.8%)
U	24 (28.2%)
D	23 (27.1%)
SD	6 (7.1%)
NA	1 (1.2%)
NR	1 (1.2%)

For this statement, there is almost an equal split between "agree," "undecided," and "disagree."

Statement: I could build my own working computer if I wanted to.

SA	13 (15.3%)
A	24 (28.2%)
U	12 (14.1%)
D	15 (17.6%)
SD	18 (21.2%)
NA	3 (3.5%)
NR	0 (0.0%)

The majority of female respondents agreed or strongly agreed with this statement (43.5%), but a large percentage also disagreed or strongly disagreed (38.8%).

Statement: I have built my own working computer.

SA	11 (12.9%)
A	10 (11.8%)
U	5 (5.9%)
D	20 (23.5%)
SD	27 (31.8%)
NA	12 (14.1%)
NR	0 (0.0%)

A little more than half of the female respondents (55.3%) strongly disagreed or disagreed with this statement.

Statement: Most computer jobs have been outsourced to other countries.

SA	6 (7.1%)
A	13 (15.3%)
U	38 (44.7%)
D	19 (22.4%)
SD	8 (9.4%)
NA	1 (1.2%)
NR	0 (0.0%)

Almost forty-five percent of the female respondents were undecided about this statement. Some twenty-two percent choose to disagree with this statement.

Statement: I was advised NOT to major in a computer-related field.

SA	3 (3.5%)
A	9 (10.6%)
U	2 (2.4%)
D	14 (16.5%)
SD	44 (51.8%)
NA	13 (15.3%)
NR	0 (0.0%)

The highest single response for this statement was for the option "strongly disagree" followed by "disagree." The combined percentage for these options totals 68.3%.

The male responses are detailed below.

Statement: I visited my secondary school career counselor more than once regarding my college major.

SA	20 (6.7%)
A	63 (21.1%)
U	24 (8.0%)
D	36 (12.0%)

SD	96 (32.1%)
NA	59 (19.7%)
NR	1 (0.3%)

The single highest response for this statement was the option "strongly disagree," representing 32.1% of the male responses. The next highest response is the option of "agree" at 21.12%.

Statement: My secondary school career counselor gave me good ideas concerning my college major.

SA	9 (3.0%)
A	48 (16.1%)
U	39 (13.0%)
D	48 (16.1%)
SD	72 (24.1%)
NA	82 (27.4%)
NR	1 (0.3%)

The combined percentage for the options of "disagree" and "strongly disagree" totals 40.2%. The highest percentage of males chose the option of 'not applicable.'

Statement: My secondary school career counselor was knowledgeable about careers in the computing field.

SA	7 (2.3%)
A	31 (10.4%)
U	49 (16.4%)
D	46 (15.4%)
SD	78 (26.1%)
NA	87 (29.1%)
NR	1 (0.3%)

The single highest response for this statement was "not applicable," 29.1%, followed by "strongly disagree," 26.1%. The combined percentage for the options of "disagree" and "strongly disagree" is 41.5%.

Statement: My secondary school career counselor gave me good counseling concerning computer-related careers.

SA	8 (2.7%)
A	32 (10.7%)
U	35 (11.7%)
D	49 (16.4%)
SD	87 (29.1%)
NA	87 (29.1%)
NR	1 (0.3%)

The highest number of responses from the male participants was a tie between the options of "strongly disagree" and "not applicable." The combined percentage for the 'disagree' and "strongly disagree" options is 45.51%.

Statement: Overall, I am satisfied with the college and career counseling I received in high school.

SA	19 (6.4%)
A	52 (17.4%)
U	57 (19.1%)
D	45 (15.1%)
SD	67 (22.4%)
NA	58 (19.4%)
NR	2 (0.66%)

The single highest response from the male participants for this statement was the option "strongly disagree," 22.4%. The options of 'undecided' and 'not applicable' are very close at 19.1% and 19.4% respectively.

Statement: Computing a field mostly for men.

SA	11 (3.7%)
A	52 (17.4%)
U	38 (12.7%)
D	84 (28.1%)
SD	95 (31.8%)
NA	17 (5.7%)
NR	2 (0.66%)

The combined percentage for the options of "disagree" and "strong disagree" totals 59.9% of the male responses. However, some 52 men (17.4%) agreed with this statement.

Statement: Computing is a field that mostly deals with programming.

SA	11 (3.7%)
A	67 (22.4%)
U	53 (17.7%)
D	107 (35.8%)
SD	53 (17.7%)
NA	5 (1.7%)
NR	3 (1.0%)

The highest single response from the male participants was the option "disagree" at 35.8%. "Agree" was the second highest response at 22.4%.

Statement: Computing is a field that mostly deals with robots.

SA	6 (2.0%)
A	13 (4.3%)
U	27 (9.0%)
D	117 (39.1%)
SD	126 (42.1%)
NA	8 (2.7%)
NR	2 (0.66%)

Forty-two percent of the male respondents choose the "disagree" option for this statement. The combined percentage for the options of "disagree" and "strongly disagree" totals 81.2%.

Statement: Computing is a field that mostly deals with video games.

SA	7 (2.34%)
A	12 (4.0%)
U	23 (7.7%)
D	117 (39.1%)
SD	123 (41.1%)
NA	13 (4.3%)
NR	4 (1.34%)

The single highest response from the male participants was for the option "strongly disagree" with the option "disagree" a very close second. The combined percentage for the options of "disagree" and "strongly disagree" totals 80.22%.

Statement: Computing is a field that requires a lot of knowledge about mathematics.

SA	28 (9.4%)
A	104 (34.8%)
U	67 (22.4%)
D	79 (26.4%)
SD	16 (5.4%)
NA	2 (0.66%)
NR	3 (1.0%)

The single highest response chosen by the male participants for this statement was "agree." The combined percentage of the options of "strongly agree" and "agree" totals 44.2%. Twenty-six percent chose the 'disagree' option and just a slightly less percentage, 22.4% chose "undecided."

Statement: I could build my own working computer if I want to.

SA	166 (55.5%)
A	70 (23.4%)
U	23 (7.7%)
D	21 (7.0%)
SD	12 (4.0%)
NA	4 (1.34%)
NR	3 (1.0%)

The combined percentage for the options of "strongly agree" and "agree" totals 78.9%, with the highest single response for this statement being "strongly disagree."

Statement: I have built my own working computer.

SA	148 (49.5%)
A	39 (13.0%)
U	16 (5.4%)
D	29 (9.7%)
SD	41(13.7%)
NA	23 (7.7%)
NR	3 (1.34%)

The combined percentage for the options of "strongly agree" and "agree" totals 62.5%. Almost an equal number of respondents chose the options 'agree' or 'strongly disagree.' With almost half of the male respondents represented, the highest single response for this statement was the option "strongly agree."

Statement: Most computer jobs have been outsourced to other countries.

SA	13 (4.3%)
A	57 (19.1%)
U	119 (39.8%)
D	77 (25.8%)
SD	24 (8.0%)
NA	6 (2.0%)
NR	3 (1.0%)

The option "undecided" received the highest number of male responses for this statement. The second highest response was for the option "disagree," 25.8%.

The "strongly disagree" option received the highest number of male responses for this statement followed by the "disagree" option. The combined percentage for these two options totals 67.2%.

Statement: I was advised NOT to major in a computer-related field.

SA	7 (2.34%)
A	21 (7.0%)
U	19 (6.4%)
D	58 (19.4%)
SD	143 (47.8%)
NA	48 (16.1%)
NR	3 (1.0%)

4.2 FACULTY INTERVIEW

One faculty member, who wished to remain anonymous, was personally interviewed by the author. He was from one of the top 20 universities in London and the chairman of his department. This university has approximately 11,000 undergraduates, 6,000 post graduates, and a teaching staff of approximately 1700 (McCall et al., 2010). The computer-related disciplines have some 300 undergraduates, 250 post graduates, and 100 doctoral students.

The interview consisted of questions/ observations about four major areas: 1) enrollments, 2) secondary school guidance, 3) students' skills and abilities regarding preparation for collegiate work in the computer-related disciplines, and 4) possible solutions/suggestions for the problems/issues observed. The following sections present this faculty member views.

4.2.1 ENROLLMENTS

In general the UK has lagged behind the US in regard to enrollments in the computer-related disciplines. To date, there has only been marginal recovery. Part of the issue is that the UK has the same problem in regarding to defining/differentiating CS/IS/IT, so students in secondary schools really have no idea what the computer-related disciplines are really about.

4.2.2 SECONDARY SCHOOL GUIDANCE

In general, the secondary schools do a very poor job with CS/IS/IT. Computer-related instruction in the secondary school tends to be skill-based learning, so the student comes away with the impression that CS/IS/IT is all skill-based; i.e., learning software packages.

Counseling in regard to CS/IS/IT is also very poor and this puts off able women and clever students from thinking about a career in the computer-related disciplines.

4.2.3 STUDENTS

There is and has been a steady decline in student's problem solving ability; however, he whether this is a 5, 20, or 20 year trend is hard to say. There has also been a general decline in writing skills and the students of today need much more 'spoon feeding.'

On the other hand, students of the past five years have improved in self-management skills, group work, and project work skills.

4.2.4 POSSIBLE SOLUTIONS/SUGGESTIONS

The university now interviews all incoming students as standard policy. A member or members of each discipline conduct these interviews. It is felt that this way, students get a clearer understanding of what is expected and they can ask questions about specific programs and/or courses.

Complementing this practice, a video series has been developed explaining the computer-related disciplines.

The university is sponsoring a secondary school. Here 'ambassadors,' (undergraduate majors) actually go out to teach a computer class in the secondary schools.

The British Computer Society has developed programs as well for the secondary schools.

It is much too resource intense to send professors out to the secondary schools to help promote the computer-related disciplines. He and his colleagues have instead focused on the secondary school teachers themselves, engaging them in the discipline. For example, he has personally organized a national conference on CS research and invited the secondary school teachers to attend. The conference turned out to be well attended and the secondary school teachers gave very positive feedback.

5.0 DISCUSSION

5.1 DEMOGRAPHICS

The participants in this survey were all students studying a computer-related discipline in a UK university. They ranged in age from under 18 to over 20 years (Table 1). The majority of the respondents were male (77.86%) (Table 2). This finding was in keeping with that of the literature and personal interview, that there are fewer women studying the computer-related disciplines than men.

The size of the respondent's secondary school graduating class but the majority of both men and women respondents graduated with fewer than 299 people (Table 3).

Just as in the US, UK secondary schools have been offering a variety of computer courses to students. The majority of the respondents did have a computer class in secondary school and the Microsoft Office suite of software is by far the most popular application. HTML, Visual BASIC, Front Page, Dream Weaver, Photo Shop, and Flash were also popular applications. MSPowerpoint, Java, and C++ were not well represented (Table 4).

All respondents were asked what software they learned/used in secondary school. This question was asked to determine what software was being used by all of the respondents regardless of a formal class. Once again, the MSOffice Suite of products is the most popular used/learned application. HTML, Dreamweaver, Frontpage, Visual BASIC, and Flash are also popular applications. One might infer from this list that WEB/Internet applications seem to be well represented (Table 5).

5.2 SECONDARY SCHOOL INFLUENCES

An overwhelming majority (more than 85%) of both the male and female respondents reported that a college/university professor did not visit their secondary school (Table 6). It is important to note that this study did not ask if the respondent went to secondary school in the UK; therefore, no general statement can be made about these findings. Nonetheless, it can be said that for the vast majority of the respondents of this study, there was no input at the secondary school level from a college/university professor regarding their higher education decisions.

Of the 50 respondents who remember a college/university professor visiting their secondary, the majority, 39 (78%) reported that the visitor(s) were male, and 25 (50%) said that the visitor did not talk about majors in the computer-related fields (Table 7).

5.3 MAJOR SELECTION

The current study also collected data about whether or not the respondent had a family member who works in a computer-related field and how they selected their collegiate major. Approximately 70% of both the male and fe-

male respondents indicated that they did not have a family member currently working in a computer-related field (Table 8). Interestingly, more than 80% of both the male female respondents indicated that they selected their collegiate course of study through self-collected inputs (Table 9). Clearly, the fact that the majority of respondents did not have a family member working a computer-related field did not effect their decision to major in such.

For both male and female respondents, the vast majority, more than 80%, selected their collegiate course of study via self-collected inputs. The second most popular choice was 'input from family' for both male and female. This result seems to indicate that there is no prejudice in regard to choosing the computer-related disciplines as a course of collegiate study.

5.4 HIGH SCHOOL GUIDANCE COUNSELING EXPERIENCE

The Pollacia and Lomerson study asked respondents about the effectiveness of their high school counseling experience regarding college majors, specifically those majors related to computers. Using a Likert scale of SD (Strongly Disagree), D (Disagree), N(Neutral), A (Agree), or SA (Strongly Agree), they asked participants to describe their level of agreement with the following statements:

- 1) S(he) gave me good ideas concerning my college major,
- 2) S(he) as knowledgeable about careers in the computing field,
- 3) S(he) gave me good counseling concerning computer-related careers, and
- 4) Overall I am satisfied with the college and career counseling I received in high school (Pollacia and Lomerson, 2006, p. 224).

Woratschek & Lenox's study asked these questions adding a few more in depth questions regarding the participant's general high school guidance counseling experience. The current study replicated the questions asked by Woratschek & Lenox (2009).

Statement: I visited my secondary school career counselor more than once regarding my college major.

More than half of both the female and male participants in the current study answered un-

favorably (disagree or strongly disagree) regarding this statement.

Statement: My secondary school career counselor gave me good ideas concerning my college major.

Approximately 58%, a more than half of the females and 40%, less than half of the males either disagreed or strongly disagreed with this statement.

Statement: My secondary school career counselor was knowledgeable about careers in the computing field.

Just slightly less than half of the female (48.3%) and male (47.5%) respondents either disagreed or strongly disagreed with this statement.

Statement: My secondary school career counselor gave me good counseling concerning computer-related careers.

More than half of the female respondents (54.1%) responded either 'disagree' or 'strongly disagree' for this statement. Slightly less than half of the males (45.5%) responded the same.

Statement: Overall, I am satisfied with the college and career counseling I received in secondary school school.

The majority of the female respondents (43.5%) chose either the "disagree" or "strongly disagree" option for this statement. The combined percentage for the male respondents of "disagree" or "strongly disagree" totals 37.5%.

Statement: I was advised NOT to major in a computer-related field.

The vast majority of both the male and female respondents either disagreed or strongly disagreed with this statement.

The data regarding the participants' secondary school guidance counseling experience in this study indicate overall unfavorable experiences.

5.5 GENERAL BELIEFS ABOUT COMPUTING

Eight general statements concerning the computing field were asked of the survey participants. The majority of the both the male and female participants disagreed or strongly disagreed with the statements that computing was mostly for men, computing was mostly about robotics, and computing was mostly about vid-eo games.

The female respondents had mixed reactions about the statement that computing is a field that deals mostly with programming. The majority, 38.8% responded "undecided." The next highest percentage was for the option "undecided" at 24.8% and the option "agree" was a close third at 20.%. For the men, a small majority chose "disagree," (35.8%). The next highest response was "agree" at 22.4% and "undecided" was third at 17.7%.

There is a very close margin between the options chosen for the statement computing is a field that requires a lot of knowledge about mathematics by the female respondents. In order from highest to lowest, the females chose "agree" 31.8%, "undecided" 28.2%, and "disagree" 27.1%. The male respondents chose "agree" 34.8%, "disagree" 26.4%, and "undecided" 22.4%.

A little more than half of the male respondents strongly agreed with the statements that they could build their own working computer if they wanted to and that they have built their own working computer. Combining the options of "strongly agree" and "agree" totals almost 79% for the statement I could build my own working computer if I wanted to. Combining these options for the other statement totals 62%. The female respondents differ from this result. Combining the options of "strongly agree" and "agree" for the statement I could build my own working computer if I wanted to totals 43.5%. Combining the options of "disagree" and "strongly disagree" totals 38.8%, a close margin. For the statement I have built my own working computer, unlike the men, the female respondents disagreed with this statement. Combining the options of "disagree" and "strongly disagree" totals a little more than half of the female respondents (55.3%).

The last general statement asked of the participants concerned whether or not they felt that most computer jobs had been outsourced to other countries. "Undecided" was the option chosen by the majority of both the female participants (44.7%), but "strongly disagree" received the highest number of responses from the men (47.8). For the men, the combined percentages of the "disagree" and "strongly disagree" options totals 67.2%

6.0 CONCLUSIONS

The findings of this study confirm that students currently studying a computer-related discip-

line in the UK seem to have limited knowledge of the fields of computing and/or the career opportunities in these fields. Also needed is some work in breaking down the stereotypes students have regarding the computing fields especially in regard to the areas of programming and mathematics and how they relate to the discipline.

It is clear from the data that the secondary school counseling area has major issues and much work needs to be done. Needing attention here is the idea that the computer-related disciplines are mostly about software applications. Rather than just emphasis skills, secondary school classes should include material on how and why computers are used in specific disciplines. This knowledge would help counter possible inaccurate data the student might gather in their "self-collected" inputs regarding a possible career in the computer-related disciplines. In retrospect, since this study's respondents were all majoring in a computer-related discipline and the vast majority of them responded that they had chosen their major through self-collected inputs, it would have been beneficial to know just what those self-collected inputs were.

The interviewed faculty chairman was clearly aware of some of the major issues facing the computer-related disciplines. He and the university were actively involved in making efforts to maintain and help in the secondary schools. The ideas of using 'ambassadors,' creating videos about the computer-related disciplines, and involving the secondary school teachers in symposia and conferences are all excellent and worthy of further investigation.

7.0 BIBLIOGRAPHY

Are female IT graduates still underrepresented? (2010). Retrieved July 17, 2010 from <http://www.womenintechnology.co.uk/news/are-female-it-graduates-still-underrepresented-news-800006423>.

IT skills drive 'innovation, productivity and employment.' (2010). Retrieved August 1, 2010 from <http://www.womenintechnology.co.uk/news/it-skills-drive-innovation-productivity-and-employment-news-8000012235>.

- McCall, A., Z. Thomas, N. Rodrigues, and M. Clayton. (2010). The Sunday Times University Guide 2010.
- McInerney, C.R., N.C. DiDonato, R. Giagnacova and A.M. O'Donnell. (2006). Students' Choice of Information Technology Majors and Careers: A Qualitative Study. *Information Technology, Learning, and Performance Journal*, 24(2).
- Patterns of higher education institutions in the UK, Ninth Report. (2009). Retrieved July 1, 2010 from <http://www.Universitiesuk.ac.uk/Publications/Documents/Patterns9.pdf>.
- Pollacia, L. and W.L. Lomerson. (2006) Analysis of Factors Affecting Declining Enrollment. *Issues in Information Systems*. Vol. VII, No. 1, 2006, pp. 220-225.
- The State of the UK IT Recruitment Market. (2009). Retrieved July 18, 2010 from http://assets.theitjobboard.co.uk/The_IT_Job_Board_State_of_The_UK_Recruitment_Market.pdf.
- Thompson, R. (2008). IT is boring says graduates. Retrieved July 14, 2010 from <http://www.computerweekly.com/Articles/2009/01/23/231173/IT-is-boring-say-graduates.htm>.
- Webster, B.F. (2008). The decline in computer science students (part 2). Retrieved July 2, 2010 from <http://brucefwebster.com/2008/06/24/the-decline-in-computer-science-students-part-2>.
- Woratschek, C.R. and T.L. Lenox. (2009). Student Attitudes and Perceptions Regarding Computing and its Related Disciplines. *Information Systems Education Journal*, 7(58). <http://isedj.org/7/58>. ISSN:1545-679X. (A preliminary version appears in *The Proceedings of ISECON 2007*:§3522. ISSN:1542-7382.)

**APPENDIX A
 RESULTS TABLES**

Sex/Age	Female	Male
Under 18	1 (1.2%)	2 (0.067%)
18	19 (22.4%)	47 (15.72%)
19	11 (12.9%)	48 (16.1%)
20	13 (15.3%)	56 (18.73%)
Over 20	41 (48.2%)	146 (48.83%)
Total	85 (22.14%)	299 (77.86%)

N=384

Table 1 Age and Sex of Survey Respondents

Size of Graduate Class	Female	Male
Less than 50	17 (20%)	79 (26.4%)
50-99	11 (13%)	45 (15.1%)
100-149	21 (24.7%)	47 (15.7%)
150-199	15 (17.7%)	38 (12.7%)
200-249	8 (9.4%)	36 (12.0%)
250-299	2 (2.4%)	14 (4.7%)
300-349	3 (3.53%)	12 (4.0%)
350-399	1 (1.2%)	9 (3.0%)
400-449	1 (1.2%)	2 (0.67%)
450-499	0 (0.0%)	2 (0.67%)
500 or greater	5 (5.9%)	15 (5.0%)
No Response	1 (1.2%)	0 (0.0%)
Total	85 (22.14%)	299 (77.86%)

N = 384

Table 2 Size of Secondary School Graduating Class of Respondents

Took a Computer Class in High School	Female	Male
Yes	69 (81.2%)	232 (91.4%)
No	16 (18.8%)	67 (8.6%)
Total	85	299

N=384

Table 3 Respondents Who Took A Secondary School Computer Class

Secondary School Computer Class	Count
MS Word	266 (88.4%)
MS Excel	265 (88%)
MS Access	209 (69.4%)
MS PowerPoint	4 (1.3%)
Visual BASIC	75 (24.9%)
Java	22 (7.3%)
C++	14 (4.7%)
Front Page	74 (24.6%)
Page Maker	5 (1.7%)
Photo Shop	55 (18.3%)
HTML	108 (35.9%)
Dream Weaver	74 (24.6%)
Flash	51 (16.9%)
Other	45 (15.0%)

N=301

**Table 4 Secondary School Computer Class Taken
 By Respondents**

Software Learned/Used While in Secondary School	Count
MS Word	332 (71.3%)
MS Excel	321 (59%)
MS Access	237 (24.6%)
MS PowerPoint	7 (4.5%)
Visual BASIC	88 (16.8%)
Java	24 (13.1%)
C++	14 (9.8%)
Front Page	92 (10.7%)
Page Maker	7 (7.4%)
Photo Shop	73 (23.8%)
HTML	117 (21%)
Dream Weaver	98 (9.4%)
Flash	65 (11.5%)
Other	33 (26.3%)

N=384

Table 5 Software Learned/Used By Respondents While in Secondary School

Did college/university professors visit your High School	Female	Male
Yes	9 (10.6%)	41 (13.7%)
No	75 (88.24%)	258 (86.3%)
No Response	1 (1.2%)	0 (0.0%)
Total	85	299

N=384

Table 6 Respondents Who Remember College/University Professors Visiting Their Secondary School

Secondary School Visitors	Yes	No	Don't Remember
Males	39 (78%)	10 (20.0%)	11 (22.0%)
Females	20 (40.0%)	22 (44.0%)	8 (16.0%)
Some Male & Some Female	18 (36.0%)	19 (38.0%)	13 (26.0%)
Talked about a major I was interested in	19 (38.0%)	23 (46.0%)	9 (18.0%)
Talked about majors in computer-related fields	19 (38.0%)	25 (50.0%)	6 (12.0%)

N=50

Table 7 Responses – Characteristics of the Professor(s) Who Made A Secondary School Visit

Family Member working in a computer-related field	Female	Male
Yes	26 (30.6%)	91 (30.4%)
No	59 (69.4%)	208 (69.6%)
Total	85	299

N=384

Table 8 Respondents Who Have A Family member Working in A Computer-Related Field

How did you select your major?	Female	Male	Female Rank	Male Rank
Input from family	22 (25.9%)	63 (21.1%)	2	2
Input from school counselor	8 (9.4%)	24 (8.1%)	6	6
Input from peers	15 (17.7%)	41 (13.7%)	3	4
Self-collected input	70 (82.4%)	263 (88.0%)	1	1
Heard about the field from books, TV, etc.	10 (11.8%)	51 (17.1%)	5	3
Other	13 (15.3%)	33 (11.0%)	4	5

N=384

Table 9 Respondents' Selection of a College Major