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In this issue:

Reversing the Decline of CIS Enrollment in Colleges and Universities by Creating Viable and Attractive Minors in CIS: A Statistical Study of CIS Minors at US Colleges and Universities

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Abstract: The purpose of this paper is to research college and university curricula for minor fields of study in Computer Information Systems. With declining enrollments in CIS Baccalaureate degree programs of study many computer-related departments are looking for alternate sources of students to maintain a positive, reasonable student-teacher ratio in the classroom. A previous article by two of the authors Pollacia, Russell 2007(Pollacia, Russell 2007) addresses the decline in CIS enrollment and explores the reasons for the decline. In the previous study, an analysis of the perceptions students have regarding the IS profession versus the reality of the profession was discussed. The authors propose that universities must do a better job not only recruiting for CIS majors, but also improve their ability to recruit in place, meaning, to recruit on-campus by providing new and innovative minor fields of study. In architecting a viable minor in a computer-related area the authors are interested in knowing what the minor fields of study are called and whether they are Traditional, Composite or Multi-disciplinary. Furthermore, what courses are universities and colleges offering within each Minor Title (CIS, Information Technology and Information Systems) and Minor Category (Traditional, Composite or Multi-disciplinary)? The goal in this study is to further analyze the sample data to determine the frequency of particular minors in CIS, Information Technology and Information Systems. The authors want to discover if specific minors by Minor Title (CIS, Information Technology or Information Systems) are more predominant than others and if a Minor Category (Traditional, Composite or Multi-disciplinary) is more prevalent than the others.
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Keywords: minors, CIS minors, Information Technology minors, Information Systems minors, Traditional minors, Multi-disciplinary minors, Composite minors, declining enrollments, top careers, CIS recruitment

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Reversing the Decline of CIS Enrollment in Colleges and Universities by Creating Viable and Attractive Minors in CIS: A Statistical Study of CIS Minors at US Colleges and Universities

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ABSTRACT

The purpose of this paper is to research college and university curricula for minor fields of study in Computer Information Systems. With declining enrollments in CIS Baccalaureate degree programs of study many computer-related departments are looking for alternate sources of students to maintain a positive, reasonable student-teacher ratio in the classroom. A previous article by two of the authors (Pollacia, Russell 2007) addresses the decline in CIS enrollment and explores the reasons for the decline. In the previous study, an analysis of the perceptions students have regarding the IS profession versus the reality of the profession was discussed. The authors propose that universities must do a better job not only recruiting for CIS majors, but also improve their ability to recruit in place, meaning, to recruit on-campus by providing new and innovative minor fields of study. In architecting a viable minor in a computer-related area the authors are interested in knowing what the minor fields of study are called and whether they are Traditional, Composite or Multi-disciplinary. Furthermore, what courses are universities and colleges offering within each Minor Title (CIS, Information Technology and Information Systems) and Minor Category (Traditional, Composite or Multi-disciplinary)? The goal in this study is to further analyze the sample data to determine the frequency of particular minors in CIS, Information Technology and Information Systems. The authors want to discover if specific minors by Minor Title (CIS, Information Technology or Information Systems) are more predominant than others and if a Minor Category (Traditional, Composite or Multi-disciplinary) is more prevalent than the others. The authors also want to look at the relationships that might exist when cross-tabulating either the Minor Title or Minor Category with either the courses offered or the average credit hours or elective hours associated with this classification.

Keywords: CIS minors, Information Technology minors, Information Systems minors, Traditional minors, Multi-disciplinary minors, Composite minors, declining enrollments, top careers, CIS recruitment

1. INTRODUCTION

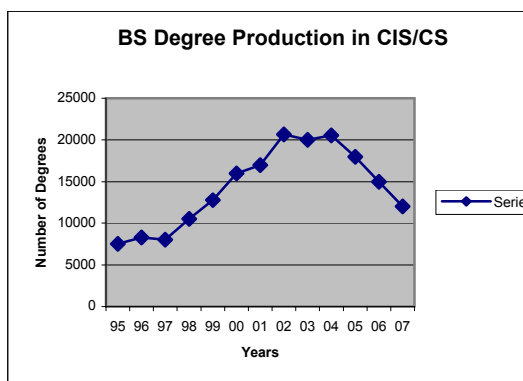
The Problem: Declining CIS Enrollments Not Seen Since the Early 1990s

The students who choose Computer Information Systems, Management Information Systems or Computer Science as a major

has plummeted to levels not seen since the mid 1980s and early 1990s. Since the year 2001 the CIS undergraduate enrollment has continued to decline in the U.S. During the past two years (since 2005) there has been a significant decline in CIS enrollment. (Zweben, 2007). Both small and large computing programs alike are in sharp decline with some programs even closing their doors

(Patterson D. 2005). The decline in CIS enrollment at the author's university has declined sixty-five percent (65%) since 2001 (Pollacia, Lomerson 2006). Carnegie Mellon, one of the leading CIS programs in the country has experienced a significant drop in CIS freshman applications (Chabrow, 2004). Exceptions were seen as enrollments soared during the 1998 and 1999 academic calendars with some enrollments doubling from 1998 and 1999. Most agree that the Y2K era and the growing Internet was largely responsible for this hey day in computing. IS educators seem to agree that a solution is needed to revitalize the growing number of failing programs (Pollacia, Lomerson 2006). This is occurring at a paradoxical time with the IS job market in the best growth period in several years (Bureau 2006). Figure 1 illustrates the research on Baccalaureate degree production from 1995 to 2007 (Swaben, 2007).

Figure 1: BS Degree Production from 1995 to 2007



Perceptions Versus Reality

The U.S. Department of Labor reports that high-level jobs that combine technical and business skills are still abundant in the U.S. The Bureau of Labor Statistics supports this by projecting that the number of IT positions in the industry sector Computer Systems Design And Related Services will increase by 54.6% from 2002 to 2012 (Patterson D. 2005). Most recent IT employment analysis (Paulson, 2006) indicates a continued growth in most IT fields. MONEY Magazine and Salary.Com, leading providers of employee compensation data and software, (Money, 2006) compiles the "Top 10 Best

Jobs in America". The Software Engineer is rated number 1 in this list while the Computer IT Analyst came in at #7. With more and more companies and agencies struggling to find qualified IT professionals they are now becoming more acutely aware of the drop in technology enrollments and are expressing concern (Fleisner 2006).

2. NEW VIABLE MINORS AND MARKETING STRATEGIES NEEDED

Much can be discussed about the reasons for this decline in CIS enrollment including the "dot.com bust", corporate outsourcing, poor advising from high school counselors and teachers, poor teaching techniques, outdated course content, etc. However, concentrating on the reasons for failure does not move CIS educators toward a solution. This article will focus on the question: what can educators do within CIS programs to rapidly move in a positive direction? For many CIS departments, a portion of their budget is tied to the number of student credit hours they produce. The authors believe that there is a way the numbers can be increased: increase service-related courses for the general student body. A department may offer Multi-disciplinary minors that incorporate computer-intensive courses taught by other departments. It is believed that new and innovative minors can offer immediate enrollment increases. Reaching a new audience is critical. The development of "computer-centric" minors can restore enrollment into our CIS programs (Patterson, L. 2005). The results of the authors' previous study (Pollacia, Russell, 2007) on this same subject includes information about: 1) Minor Title, 2) Minor Category, 3) the number of credit hours, 4) the various courses offered in the minor and 5) the number of elective hours associated with the minor. Fifty five (55) universities were initially researched in the previous study. The 2006 Blue Book of Universities was studied for programs with computer-related majors or minors and web site information. In this study the authors extended the survey sample and researched 137 web sites for information about their respective minors especially hoping to find more Composite or Multi-disciplinary minors since these are the types that reach out to other departments.

Better and Diverse Curricula and Better Marketing Strategies Needed

In the past the CIS teaching profession rarely had to be concerned with adequate enrollment. Recruiting was something that "recruiting" did and was not a concern for the CIS educator. Today, with programs closing because of dwindling enrollment, recruitment is now a necessity. Reinventing ourselves within the CIS teaching community is also a necessity as programs will need to align themselves with new technologies and methodologies (Patterson L., 2005). For example, the program that has in the past been successful at only teaching the traditional curriculum will need to consider teaching other highly sought after courses in web design, multi-media, computer graphics design and object-oriented languages and methods. Once the curricula are in place at the university help is needed from industry and government to better market these programs both on and off campus. Universities are not usually equipped the way industry is at marketing themselves and should seek corporate and government assistance in solving the decline in CIS enrollment (Klawe, Schneiderman, 2005).

The authors are planning a future article on this topic of recruitment that will address what companies can specifically do to help universities increase future CIS college enrollments. Corporate involvement in university recruiting may be necessary to solve the CIS enrollment shortage; thus, enabling companies to meet their future hiring quotas.

Doing a Better Job at Recruiting at Our Own University is a Key to Success

What can we do to recruit more students? From the authors' previous articles on this subject, one of the low-cost measures that a CIS department may undertake is to engage in "*recruiting in place*" (Pollacia, Russell, 2007). By definition, this term describes activities that will hopefully increase CIS enrollments by recruiting students who are already enrolled at the institution. Students who are majoring in other disciplines (art, history, math, science, journalism etc.) become excellent candidates for a minor in CIS. The attempt is to not sway these students to change their majors; but rather to

provide additional computing skills that will make the graduate more marketable within their major.

Shifting our thinking away from the traditional major will be necessary to reach new student minors. As a faculty we must be able to see the multi-disciplinary nature of CIS, and learn how to collaborate with other disciplines on our campuses. For example, at the author's institution, a Composite minor in web design and development exists that consists of six courses (18 hours). Four of the courses are from CIS; the other two are graphics art/design courses. The sequence of courses is fixed; however one-third of the curriculum is from the Art department.

3. COMPUTER INFORMATION SYSTEMS (CIS) MINOR

The Computer Information Systems (CIS) minor may be known by other names, such as Information Technology, Management Information Systems, Information Systems, or Information Literacy. The number of credit hours and curriculum of a CIS minor is different for virtually every institution. The vast majority of the CIS minors are what we call **Traditional**. The traditional CIS minor is basically a scaled-down version of the CIS major, with all of the required classes coming from the CIS department. This has been our way of "thinking inside the box" rather than "thinking outside the box."

The authors define two other Minor Categories: **Composite** and **Multi-disciplinary**. The composite minor is one where a majority of the courses are from the IT department. Additionally, however, the student takes courses from ONE other major area to complete the degree. (Pollacia, Russell 2007).

The term, **Multi-disciplinary**, designates minors that focus on the study of information technology through its application in many fields. Departments offering technology-centered courses may include art, computer science, English, journalism, biology, and so forth. Often, students will take a small number of CIS courses from the CIS department prior to pursuing the computer-related courses from the other disciplines. An example of a Multi-disciplinary minor is

the IT minor at the University of North Carolina Wilmington (Patterson, Laurie, 2005). The minor requires 3 computer science courses, i.e. Fluency of Information Technology, one course in programming, and one other computer science course of the student's choosing. There is one other required course offered by their library. This course was created specifically for the minor, and teaches the student how to conduct research using computer technology. The remaining two courses are chosen from those offered by other departments that involve computer technology as a component of the course. These other areas include: Art, Chemistry, Communications, Educational Technology, English, Film Studies, GIS, Music, Logic, and Sociology.

4. METHODOLOGY

The authors gathered data about CIS minors that are offered in U.S. colleges and universities. The data was gathered via Internet search and through a search of the following directories and databases:

Directories:

College Blue Book
American Universities and Colleges
Patterson's American Education

Databases:

ERIC
Professional Development Collection in Education
Business Source Premier
Computer Science Index
Computer Source
Information Science and Technology Abstracts

An interesting finding is that this search revealed that there is no compiled listing of minors in CIS. The keywords used for the Internet search were: "minors", "Computer Information Systems" and "Information Technology". One hundred and thirty-seven (137) universities and colleges were researched. From the 2006 College Blue Book list, it was discovered that one hundred and seventy-three (173) from the list did not list a CIS minor at all. A review was made of each web site, and the following information was listed about each minor: the name of

the institution, the Minor Title (CIS, Information Technology, Information Systems), the Minor Category (Traditional, Composite, or Multi-disciplinary), the number of credit hours (Credit Hours), the number of elective credit hours (Electives), and any special requirements. An examination was made of the courses that constitute the curriculum. A determination was made of what specific courses were included in the minors. The following generic course titles were used that either matched or closely matched the university web site:

1. Introduction to Information Technology (Intro. To IT)
2. Programming I
3. Management Information Systems (MIS)
4. Database Systems (DB or DBMS)
5. Systems Analysis and Design (SAD)
6. Telecommunications
7. Internet and Web Design/Development (Web Design)

The raw data was initially collected into a spreadsheet. Pivot tables were used to cross tabulate most of the results found in the section below. Pearson Chi Square was used in testing the statistical significance related to the hypotheses listed in the section "Testing the Null Hypotheses."

5. STUDY RESULTS

Do minors have commonalities based on the type (CIS, Information Technology, Information Systems, etc.) or by Minor Category (Traditional, Composite or Multi-disciplinary)? An exploration is made to try and answer this question. Nineteen (19) different minor titles were discovered from the computer search. The minors included:

- BCIS
- Business Computer Programming
- CIS
- CIS/CS
- Computer and Information Systems
- Computer Information Science
- Computer Studies
- CS
- Digital Graphic Design
- Multimedia

- Digital Media
- Digital Multimedia Communication
- E-Commerce
- Functional Business Minor
- Information Sciences
- Information Studies
- Information Systems
- Information Technology
- Information Technology Management.

Except for the emerging three (3) minors (CIS, IT and IS) there was only a count of one for each of the others. Only three (3) minor titles emerged with a significant frequency distribution and were chosen as titles for this study. The three titles are CIS, Information Technology (IT) and Information Systems (IS). There were ninety-two (92) programs from the 137 with the title of CIS; fourteen (14) with the title of Information Technology (IT) and nine (9) with the title of Information Systems (IS). The commonalities with which the authors are interested will include information about which courses are being taught in the minor, the number of total credit hours and the total number of electives in the minor. In making reference to this rather large number of minors listed above, to avoid redundancy in the material the term CIS, Information Technology and Information Systems will be used to describe the various minors although there are many similar titles. The term "Minor Title" will be used to reference CIS, IT or IS. The term "Minor Category" will be used to denote Traditional, Composite or Multi-disciplinary.

Research Questions:

From the survey the following research questions are:

1. How similar or different are the average number of credit hours among the Minor Titles (CIS, IS or IT)?
2. How similar or different are the average number of elective hours based on Minor Titles (CIS, IS, or IT)?
3. How similar or different are the average number of credit hours among the Minor Sub-Categories (Traditional, Composite or Multi-disciplinary)?
4. How similar or different are the average number of elective hours

5. based on Minor Categories (Traditional, Composite or Multi-disciplinary)?
5. Of the total count of schools surveyed what percentage of the schools were Traditional, Composite or Multi-disciplinary?
6. What percentage of the surveyed minors include introductory courses that are normally associated with the major discipline (in this case the authors want to know if the minors include an Introduction to IT and/or an Introduction to Programming)?
7. What percentage of the surveyed minors by Minor Title (CIS, Information Systems and Information Technology) required a specific course or courses, and what percentage by Minor Category (Traditional, Composite and Multi-disciplinary) required a specific course or courses such as database, systems analysis, etc.)?
8. Does the Minor Title tend to determine the Minor Category? In other words, is there a preponderance of one Minor Category within the Minor Title?
9. Is the population percentage for each Minor Title the same for each Minor Category?
10. Is the population percentage for each Minor Title the same for three comparison courses (Introduction to IT, Programming I and Web Design)? [These three courses were picked because of their high relevance to any program.]

From the research questions above, the first eight (8) questions are analyzed based on cross-tabulation of the data and pivot tables. Research questions 9 and 10 will be stated as null hypotheses and statistically tested for significance at the .05 level.

Null Hypotheses:

- H₁** There is no significant difference in the population percentage for each Minor Title with the population percentage for each Minor Category.
- H₂** There is no significant difference in the population percentage of each Minor Title with the population per-

centage for the three courses: Introduction to IT, Programming I and Web Design.

Research Questions 1 and 2

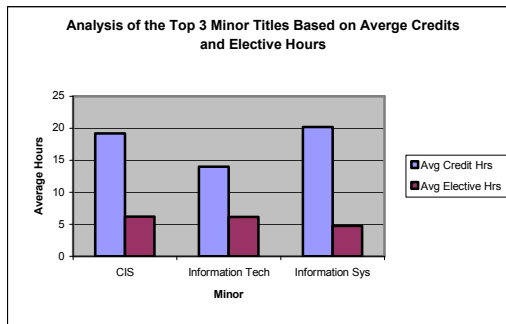
Table 2 shows the similarity and difference in credit hours among the Minor Titles (CIS, IS, or IT)?

Table 2: The Top 3 Minors Based on Average Credits and Elective Hours

Minor Name	Avg # Credit Hrs	Avg # Electives	Count of Minors		Ratio of Minors
			With This Name	To Total Count	
CIS	19.21	6.2	92		67.15%
Information Tech	14	6.14	14		10.20%
Information Sys	20.22	4.75	9		6.60%
Total Pct of All Minors					83.95%

The average number of total credits for a CIS, IT and IS minor are 19.21, 14 and 20.22, respectively. The average number of electives for CIS, IT and IS are 6.2, 6.14 and 4.75, respectively. The CIS minor represents 67.15 percent (67.15%) of the total count of programs within these three minors, and Information Technology represents 10.2 percent of the schools while IS only represents 6.60 percent (6.6%) of the total count. The difference in average credits for CIS and Information Systems is relatively insignificant, but the difference in elective hours seems significant between the Information Systems minor and the Information Technology minor. The difference in the Average Credit Hours between IT and the other two seems relatively significant. More statistics appertaining to this will be presented. Figure 3 below illustrates this difference graphically. The graph fairly evenly depicts the comparison of Average Credit Hours with Average Elective Hours; but the disparity seems to be with the Information Technology minor that shows a higher proportion of elective hours as compared to the average credit hours.

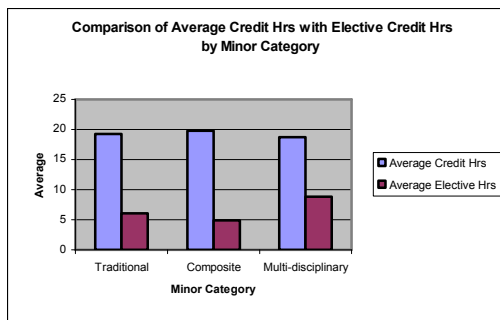
Figure 3: Analysis of the Top 3 Minor Titles



Research Questions 3 and 4

Figure 4 below illustrates a comparison of the average credit hours with elective credit hours by minor category (Traditional, Composite and Multi-disciplinary). The Multi-disciplinary category has a higher proportion of elective hours to the number of total credit hours than the other two categories, as would be expected.

Figure 4: Comparison of Average Credit Hours with Elective Credit Hours by Minor Category



The Composite minor seems to have significantly fewer electives on the average than the other two. A speculation is that with course requirements coming from a composite of departments can likely leave fewer hours remaining as electives.

Research Question 5

Figure 5 below shows a break down of percentages of schools surveyed offering minors that were Traditional, Composite or Multi-disciplinary. The chart reveals that 79.56 percent of the programs are Traditional,

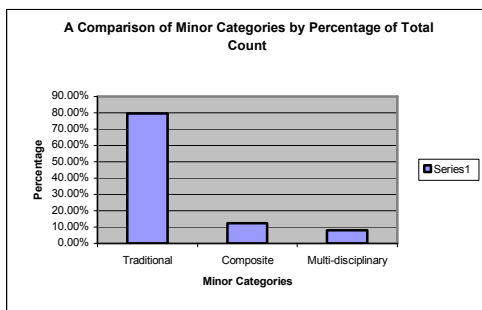
12.41 percent are Composite and 8.03 percent are Multi-disciplinary.

Figure 5: A Comparison of Minor Categories by Count and Percentage of the Total Count

	Ratio of Minor Catg To Total Count	Count of Minors With This Name
Traditional	79.56%	109
Composite	12.41%	17
Multi-disciplinary	8.03%	11

Figure 6 below and Figure 5 above both represent the disproportion between the three minor categories. The percentages seem to indicate that few schools have considered getting involved in either Composite or Multi-disciplinary categories. The authors are interested in determining how many students are pursuing the three minor categories, and if one of the three categories tends to emerge as more popular than the others.

Figure 6: A Comparison of Minor Categories by Percentage of Total Count



Research Question 6

Figure 7 shows a comparison of the count of programs that teach or do not teach either an Introduction to IT or an Introduction to Programming (Programming I) course as a part of the minor. The authors plan to study this unusual finding that such a high percentage of minors that do not require a traditional "Introduction to IT" or a "Programming I" as part of the minor. This may be a very important finding. If this finding only

applied to either the Composite or Multi-disciplinary minor categories one could easily understand since these programs would likely provide their own introductory course within the separate departments involved in the minor, but this finding also applies to the Traditional Minor category as well. Could the lack of an introductory course have an impact on the success or failure of a student who chooses to minor in CIS, IS or IT? Eighty (80) of the 137 programs researched did not have an Introduction to IT course in the minor. Thirty-two (32) of the 137 programs did not have a Programming I course in the minor as a requirement.

Figure 7: Comparison of the Count of All Programs Teaching and Not Teaching Either an Introduction to IT or a Programming I course.

Course	Count	Count Not	% of Programs	% of Programs
	Who Teach	Teaching	Who Teach	Not Teaching
Introductory Course in IT	57	80	41.60%	58.40%
Introduction to Programming	105	32	76.60%	23.40%

Research Question 7

What percentage of the surveyed minors by Minor Title (CIS, Information Systems and Information Technology) required specific courses from the surveyed list (Introduction to IT, Programming I, MIS, Database, SAAD, Networking and Internet/Web Design), and what percentage by Minor Category (Traditional, Composite and Multi-disciplinary) required a specific course or courses from this same list? Figure 8 shows the courses that are included in the three minor titles along with respective percentages of the total count of 92 programs surveyed for this title. Forty-one percent (41%) of all CIS programs require an Introduction to IT course. Eighty-three percent (83%) of the CIS programs require a Programming I course, but only forty-one percent (41%) required an Intro to IT course. Fifty-two percent (52%) of the CIS minor programs include a database course along with 45 percent (45%) requiring a Systems Analysis course. A surprising statistic is that only 25 percent (25%) required a web design course especially with web design and development being one of the most relevant areas in CIS.

The Information Technology minor title shows fifty percent (50%) of the minor pro-

grams requiring a web design course. This is much better than the CIS statistic but still is a surprisingly low percentage. On the other hand, seventy-eight percent (78%) of the Information Systems minors required an Introduction to IT course, but only fifty-six percent (56%) required a Programming I course.

Figure 8: Courses Included in Minor Titles with Average Credit Hours and Average Elective Hours

	Intro.					Net.	Web
	To I.T.	Progr I	MIS	DB	SAAD	Work	Design
	%	%	%	%	%	%	%
CIS	41.30%	82.61%	28.26%	52.17%	44.57%	30.43%	25.00%
Information Tech	57.14%	78.57%	28.57%	42.86%	35.71%	21.43%	50.00%
Information Systems	77.78%	55.56%	11.11%	44.44%	66.67%	22.22%	33.33%

Figure 9 shows this information by percentages of the total count for the courses broken down by Minor Category (Traditional, Composite or Multi-disciplinary). The percentages are ratios based on the count for the course divided by the total count for the said minor category. For example, for the minor category "Traditional" there were forty seven (47) programs teaching an Introduction to IT course with a grand total count 109 programs; thus a ratio of 43.12%. Examining the data by minor category still shows a very low number of programs requiring a web course as a part of the minor (Ex: only 30.28% of Traditional minors required a web course).

Figure 9: Courses Included in Minor Categories with Average Credit Hours and Average Elective Hours

	Intro Course	Progr I	MIS	DB	SAAD	Network	Web Design
	%	%	%	%	%	%	%
Traditional	43.12%	79.82%	25.69%	55.05%	46.79%	34.86%	30.28%
Composite	35.29%	76.47%	23.53%	41.18%	52.94%	23.53%	35.29%
Multi-disciplinary	36.36%	45.45%	18.18%	9.09%	18.18%	0.00%	45.45%

Research Question 8

Does the Minor Title tend to determine the Minor Category? In other words, is there a relationship between the two variables? Is there a preponderance of a particular Minor Category (Traditional, Composite or Multi-disciplinary) within a Minor Title (CIS, Infor-

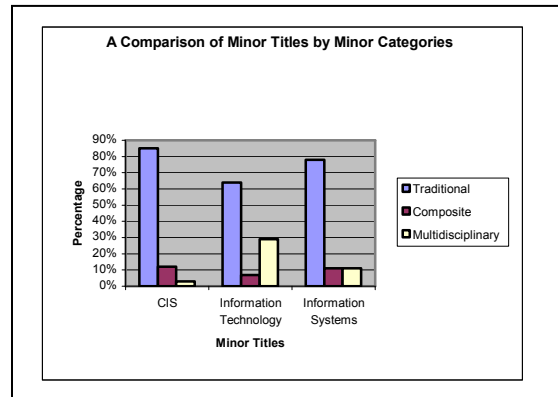
mation Technology or Information Systems)? Figure 10 shows the relationship between Minor Title and Minor Category. A greater percentage (85%) of Traditional minors is titled as CIS while a significantly higher percentage (29%) of Multi-disciplinary minors are associated with Information Technology. It is also worth noting that only three percent (3%) of the Multidisciplinary categories are associated with CIS minor titles.

Figure 10: Minor Title Percentages of Minor Categories

	Traditional	Composite	Multidisciplinary
CIS	85%	12%	3%
Information Technology	64%	7%	29%
Information Systems	78%	11%	11%

Figure 11 especially exposes the preponderance (29%) of Multi-disciplinary minors in the Information Technology minor title with very few (3%) associated with the CIS minor title. These statistics seems to be the most revealing information from this cross tabulation.

Figure 11: A Comparison of Minor Titles by Minor Categories



Testing the H₁ Null Hypothesis

Learning if the population percentage for each Minor Title is the same for each Minor Category is important to this study. The H₁ hypothesis was tested using the Pearson Chi Square for Goodness of Fit. A Chi Square (χ^2) of 12.38 was calculated with 4 degrees of freedom. Since a χ^2 of 12.38 is greater

than the χ^2 of 9.488 required for a .05 level of significance with four (4) degrees of freedom, the authors reject the null hypothesis that the population percentage for each Minor Title is the same for each Minor Category. In other words, the authors believe that chance factors are not the cause that Minor Title population and Minor Category population are not the same. One anomaly is obviously the fact that the Information Technology's Multi-disciplinary cell in Figure 12 is disproportionately large (value of 4) as compared to the other two (3 and 1) considering the percentage of the total. Especially this is true in the case of a comparison in CIS and Information Technology. Figure 13 shows the counts as percentages of the Minor Title total with twenty-nine percent (29%) for Multi-disciplinary. This compares disproportionately larger than the other two.

Figure 12: Count of Minor Categories by Minor Title. Data Used for Cross Tabs and Chi Square Test of Goodness of Fit

	Traditional	Composite	Multidisciplinary
CIS	78	11	3
Information Technology	9	1	4
Information Systems	7	1	1

Figure 13: Percentages of Minor Categories by Minor Title:

	Traditional	Composite	Multidisciplinary
CIS	85.00%	11.96%	
Information Technology	64.30%	7.00%	
Information Systems	78.00%	11.00%	

Testing the H₂ Null Hypothesis

A Chi Square (χ^2) of 5.39 was calculated for the data in Figure 14. The χ^2 of 5.39 is less than the 9.488 value required for 4 degrees of freedom at the .05 level of significance; therefore, the null hypothesis is retained that the population percentage of the three Minor Titles (CIS, Information Technology and Information Systems) by the three courses taught (Introduction to IT, Programming I and Web Design) are the same.

Figure 14: Count of Three Critical Courses Offered by Minor Titles

	Intro. to IT	Programming I	Web Design	Count
CIS	38	76	23	92
Information Technology	8	11	7	14
Information Systems	7	5	3	9

While the results were not significant at the .05 level the authors certainly observe that the percentage in Figure 14 for Web Design courses for Information Technology (27%) as being a statistic to closely monitor in future studies. The authors are very interested in learning why more CIS minors do not include a Web Design course.

Figure 14: Percentage of the Three Critical Courses Offered by the Minor Titles

	Intro. to IT	Programming I	Web Design
CIS	41.30%	82.60%	25.00%
Information Technology	57.10%	78.60%	50.00%
Information Systems	77.70%	55.50%	33.30%

6. CONCLUSION

More attention needs to be directed at developing viable and diverse CIS minors to increase departmental enrollment by "re-recruiting in place." University and college CIS programs must do a better job at marketing themselves to students at their own university to include entering college freshman. Many entering college freshman remain undecided until they have taken a few courses. The Multi-disciplinary minor could be a perfect fit for the student still shopping around. Also, the Multi-disciplinary minor seems to be a new approach as other departments across campus have begun to realize the increased marketability of their graduates who have strong computing skills combined with the competencies and skills from their major course of study. Often, it can be the faculty from other departments across campus that can be encouraging students to consider a Multi-disciplinary CIS minor.

This study shows that there is a disproportion between the Traditional, Composite and Multi-disciplinary minor categories with far too few composite and multi-disciplinary minors. The percentages perhaps indicate that few schools have considered getting involved

in either Composite or Multi-disciplinary minors, and with plummeting enrollments nation-wide in CIS, it would seem that the three minor categories offer head count opportunities in CIS; and, over time, as well have a positive impact on increasing enrollments in the CIS-related majors.

A part of an university's vision could include a statement appertaining to the improvement of the over-all marketability of its graduates by allowing the student to study "across the curriculum" and pursue Multi-disciplinary minors that include CIS. Of course, the bi-product would be to increase CIS enrollments and at the same time create a stronger and more marketable college graduate.

A much better job must be done in educating high school principals, counselors, high school computer education and computer science teachers and the like about the information systems profession and the job availability in this country. Also, CIS educators must do a better job educating their own university and college faculty. Many continue to believe that there are no jobs in the CIS profession available for college graduates in the IT field, and it is believed that this is hurting IS enrollment. Universities must partner with corporations and agencies in marketing the profession to the high school student and to entering college freshman.

Universities Must Take Action

It is recommended that university administrators and faculty take action now to reverse the decline of CIS enrollment in colleges and universities by creating viable and attractive minors in CIS. It is also recommended that a closer network be developed with high schools to insure that high school students have a positive attitude toward the field of computer information systems. This can be accomplished by:

1. The college dean and department head responsible for the CIS program must take action by visiting with other deans and department heads across campus to create viable multidisciplinary minors in CIS, and be able to convey how this minor will increase the success rate of

students across campus whatever their major. Since every administrator is interested in retention this should be an easy "sell."

2. The CIS faculty and department head needs to start somewhere on campus with a pilot curriculum modification. A scenario would be for the CIS department and, say, Library Science to jointly design a CIS minor involving computer-related classes that make Library Science majors better able to utilize the library. Let this pilot CIS minor be the launching pad for other viable minors across campus.
3. CIS faculty must make recruiting visits to various high school campuses and hold short seminars with high school advisors and counselors regarding the viability of CIS as either a potential major or minor. Subsequently, conduct recruiting presentations to high school students especially from the business education classes.
4. The focus of this study was concentrated on CIS, Information Technology and Information Systems for the data analysis since the vast preponderance of programs were titled with these names, it seems also important to explore the lesser prevalent titles such as:

- Digital Graphic Design
- Multimedia
- Digital Media
- Digital Multimedia Communication
- E-Commerce

More research is needed to learn which specific CIS minors are successful based upon enrollment count in the various courses. The cliché "thinking outside the box" may have never been more applicable for the survival of CIS.

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