Factors Affecting First Year Retention of CIT Students

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Abstract

Improving student retention is a major concern for academic programs. To bolster this effort, it would be helpful to identify factors that affect student retention. This study was designed to determine if admission type or status, gender, class standing, introductory math level, course load, course completion, and academic performance are related to retention of first year Computer and Information Technology (CIT) majors. Records of students who declared CIT as a major in the fall 2012 were examined to determine if there is a connection between these factors, and whether CIT students returned in the fall 2013. Results showed that there was a significant relationship between student retention, introductory math level, and completion of required first year CIT courses. In addition, a significant relationship was shown between retention and grade point average (GPA), the number of completed credit hours, and the number of attempted credit hours in the second semester. The results of this study illustrate the need for the faculty to focus their efforts towards providing outstanding instructors for, and maintaining a high quality curriculum in, first year CIT courses.

Introduction

Retaining students is a challenge at any university. Educators are trying to determine which factors may impact a student's decision to remain in his or her program of study. A major initiative is being undertaken at Indiana University Purdue University Indianapolis (IUPUI) to improve student retention in all fields.[1] The Computer and Information Technology (CIT) program is interested in what, if any, curriculum-related factors differ between those information technology students who remain in the CIT program, and those who do not.

This study was designed to determine if there is any relationship between first year information technology student retention and factors such as admission status, introductory math level, course load, required course completion, and academic performance. Using student records of students who declared CIT as a major in the fall of 2012, this study attempts to determine if there is a connection between these factors and whether CIT students returned for their third semester in the fall of 2013.

The results of this study will be helpful to the CIT faculty in creating possible intervention opportunities in the effort to increase retention. The results may also aid other educators in other universities in their efforts to retain information technology students.

Literature Review

A review of existing literature related to this topic revealed that little research has been done on retention of IT students specifically. Prior research that focused on the academic environment included surveys of students who left the major. The primary complaint by students was that classes were boring, and lacked a real-world or workplace focus.[2,3,4] Students also complained about poor teaching,[2] and teaching at too fast a pace. In addition, many students felt that they lacked suitable preparation through prior experience, particularly in programming skills and database concepts. [2,3,5,6]

A few studies found that the students' ability to integrate into the academic and social environment of the university played an important role in retention.[3] The most important factor in this integration was building a peer group support system through peer interaction in the classroom.[5,7,8] In addition, student-faculty relationships were also very important to academic integration. Students had to feel comfortable interacting with faculty members.[2,8] However, Weng et al. found that self-efficacy, or the ability to persist in the face of obstacles, was more important than academic or social integration.[6]

In addition to academic social factors, financial pressures also contribute to many students leaving school.[3] Having to choose between food or rent and classes is a very fundamental process. A student's basic needs take priority over his educational goals. Students with families have even more financial pressure. Many students are financially stressed by college expenses and the demands of family life.[9] In addition, most students work. Often, students must choose between a work schedule and class schedule.[3,9] Since work supplies financial resources and school demands financial resources, the need to make money is often the greater motivator. Access to financial aid is imperative for many students.[7] However, some students do not want to go into debt to pay for their education.[9] For them, adequate work hours and flexible class schedules are of prime importance.

Since women comprise half the population, and therefore potentially half the workforce, retention of women in science, technology, engineering and mathematics (STEM) majors has been the subject of many studies. In recent years, women have made up only 18% of all information technology students.[3] Many factors have been found to contribute to this statistic. First of all, women generally do not spend as much time on computers prior to college. Therefore, they lack confidence in their ability to succeed in computer-related fields.[10,11] In addition, studies have shown that women are more sensitive to grades than their male counterparts,[10] and will often drop the major with grades that are better than males who do not drop.[3,5] Lack of role models, both in faculty and industry, is another factor contributing to the attrition of women in IT.[11] The overabundance of male teachers and students in IT classes often make women feel as if they don't belong in the classes or the major.[2]

As discussed, the academic environment, academic and social integration, financial considerations, and gender have all been the subject of prior study in the field of IT retention. This study will delve in more depth into curriculum-related factors of retention in a particular IT program.

Method

Participants were chosen from among CIT majors at Indiana University Purdue University Indianapolis. The study included all students who first enrolled in the CIT program in the fall semester 2012. There was no direct student involvement in the study.

Data was collected for each participant from existing student records for fall semester 2012, spring semester 2013, and fall semester 2013. The data points collected are shown in Table 1.

Table 1. Data Collected

Variables	Possible Values
Attempted Credit Hours Fall 2012	
Completed Credit Hours Fall 2012	
Attempted Credit Hours Spring 2013	
Completed Credit Hours Spring 2013	
GPA Fall 2012	0 – 4
GPA Spring 2013	0 – 4
Admission Type	New/Transfer
Admission Status	Direct/University College
Class Standing	Freshman/Sophomore/Junior/Senior
Gender	Male/Female
Math Level	Pre-college Algebra/College Algebra /Calculus
CIT 10600 Using a Personal Computer	Completed? Yes/No
CIT 11200 Information Technology Fundamentals	Yes/No
CIT 12000 Quantitative Analysis I	Yes/No
CIT 14000 Programming Constructs Laboratory	Yes/No
CIT 21200 Web Site Design	Yes/No
CIT 21400 Introduction to Data Management	Yes/No

Attempted credit hours were defined as the number of credit hours for which the student enrolled during the semester minus any courses from which the student officially withdrew. Completed credit hours include the number of credit hours completed during the semester. This total included credit for all courses passed with a D- or above. No value was included for semesters in which the student was not enrolled.

GPA was defined as the semester GPA. GPA includes all courses taken in a given semester. It does not include dropped courses. Failed courses were recorded at zero. No value was included for semesters in which the student was not enrolled.

Transfer students were defined as any student who transferred from another university, or transferred from another major at IUPUI. New students include all students who are not transfer students. These definitions were established to differentiate between students with prior post-secondary experience, and those without.

University College is an alternate route into the university for those students who do not meet the admission requirements of a particular major. CIT admission requirements are higher than those of University College. Students admitted directly to the CIT major are considered to have greater preparation prior to admission. Once a University College student meets the CIT entrance requirements, he or she is transferred to the CIT program.[12]

Class standing is determined by the university. In general, the credit hour ranges shown in Table 2 determine class standing. However, some exceptions apply for transfer students with large amounts of transfer credits.[13]

Table 2. Class Standing Credit Hour Ranges

Class Standing	Credit Hour Range
Freshman	0 – 25 hours
Sophomore	26 – 55 hours
Junior	56 – 85 hours
Senior	> 85 hours

For students with prior math credit, math level was defined as the first math class taken in fall 2012. If a math course was not taken in fall 2012, the last math class taken prior to entry into the CIT program was used. For those without prior math credit, math level was determined by the first math course taken.

CIT 10600 is a prerequisite to the program. This variable indicates whether the student obtained credit for this course by the end of fall 2012. Credit can be obtained either through completing the course, demonstrating proficiency by testing out of the course, or through transfer credit. The CIT 11200, CIT 12000, CIT 14000, CIT 21200 and CIT 21400 variables all indicate whether the student had credit for the course by the end of his or her first year. This time period includes summer 2013 courses. These courses were selected because they are taken during the freshman year. Only grades of "C" or better were considered as all CIT courses must be passed with a minimum grade of "C" in order for the course to apply toward a CIT degree. As with CIT 10600, credit can be obtained by completing the course, demonstrating proficiency by testing out of the course, or through transfer credit.

Students were divided into two groups based on whether they were enrolled in the CIT program in the fall 2013 semester. The data points were compared between the two groups to determine

if there was any correlation between any specific data points, and a student's decision not to return to the CIT program for a second year.

Results

The study included 83 participants including 71 men and 12 women (see Table 3). Sixty students were admitted into the CIT program directly, and 23 were admitted through University College. Twenty-six participants were new students, while 57 were transfer students. Nine students were dismissed at the end of the second semester for academic reasons. A summary by admission and class standing is provided in Table 4.

Table 3. Gender Frequencies

Gender	N	Percent	Persisters	Non-Persisters
Male	71	85.5%	43	28 (8 dismissed)
Female	12	14.5%	8	4 (1 dismissed)
Total	83	100.0%	51	32

Table 4. Admission and Class Standing Frequencies

	N	Percent	Persisters	Non-Persisters
Admission Status				
Direct	60	72.3%	40	20 (6 dismissed)
University College	23	27.7%	11	12 (3 dismissed)
Total	83	100.0%	51	32
Admission Type				
New Student	26	31.3%	12	14 (7 dismissed)
Transfer Student	57	68.7%	39	18 (2 dismissed)
Total	83	100.0%	51	32
Class Standing				
Freshman	37	44.6%	20	17 (7 dismissed)
Sophomore	19	22.9%	13	6 (1 dismissed)
Junior	17	20.5%	11	6 (1 dismissed)
Senior	10	12.0%	7	3 (0 dismissed)
Total	83	100.0%	51	32

The data was analyzed using SPSS Version 20. All data was tested at $p < .05$. Independent sample t-tests were calculated comparing the mean values of attempted and completed credit hours, and GPA of participants who persisted to the fall of 2013 to the mean values of those who did not persist. Results are given in Table 5. Significant results are highlighted. A means comparison is provided in Table 6. The means of completed credit hours in fall 2012 and spring

2013, attempted credit hours in spring 2013, and GPA for either semester was significantly higher for persisters than non-persisters. No significant difference was found in the means of attempted credit hours in fall 2012.

Table 5. Independent Samples t Test for Attempted and Completed Credit Hours & GPA

	Independent Samples t Test			
Variable	*t*	df	Sig. (2-tailed)	**Cohen's d**
Completed Credit Hrs. Fall 2012	3.746	81	0.000	0.815/large effect
Attempted Credit Hrs. Spring 2013	6.359	81	0.000	1.367/large effect
Completed Credit Hrs. Spring 2013	7.805	81	0.000	1.716/large effect
GPA Fall 2012	7.705	78	0.000	1.653/large effect
GPA Spring 2013	5.848	64	0.000	1.484/large effect
Attempted Credit Hrs. Fall 2012	0.831	81	0.409	

Table 6. Means Comparison of Attempted and Completed Credit Hours & GPA

Variable	**Enrolled Fall 2013**	**N**	**Mean**	**Std. Deviation**
Completed Credit Hrs. Fall 2012	No	32	7.09	5.50
	Yes	51	11.04	4.07
Attempted Credit Hrs. Spring 2013	No	32	5.06	5.84
	Yes	51	11.84	3.88
Completed Credit Hrs. Spring 2013	No	32	3.22	4.94
	Yes	51	10.92	3.99
GPA Fall 2012	No	31	1.60	1.18
	Yes	49	3.17	0.64
GPA Spring 2013	No	15	1.39	1.26
	Yes	51	2.95	0.78
Attempted Credit Hrs. Fall 2012	No	32	10.56	4.21
	Yes	51	11.33	4.05

Chi-square tests of independence were calculated comparing persistence and non-persistence based on the nominal variables. Results are given in Table 7. Significant interactions are highlighted. Students who completed CIT 10600 by the end of their first semester, or who completed any of the first year CIT courses by the end of their first year were more likely to persist. Those at the college algebra math level were also more likely to persist (see Figure 1). No significant relationship was found between student persistence and admission type, admission status, class standing, or gender.

Table 7. Chi-Square Test of Independence for Nominal Variables

|	Pearson Chi-Square			
	Value	df	Asymp. Sig. (2-sided)	Phi
Math Level (College Algebra)	11.56	2	0.003	0.373/medium effect
CIT 10600	6.54	1	0.011	0.281/small effect
CIT 11200	17.10	1	0.000	0.454/medium effect
CIT 12000	15.05	1	0.000	0.426/medium effect
CIT 14000	13.02	1	0.000	0.396/medium effect
CIT 21200	23.72	1	0.000	0.535/large effect
CIT 21400	13.82	1	0.000	0.408/medium effect
New/Transfer	3.74	1	0.053	
Direct/UCOL	2.49	1	0.114	
Class Standing	1.63	3	0.653	
Gender	0.16	1	0.668	
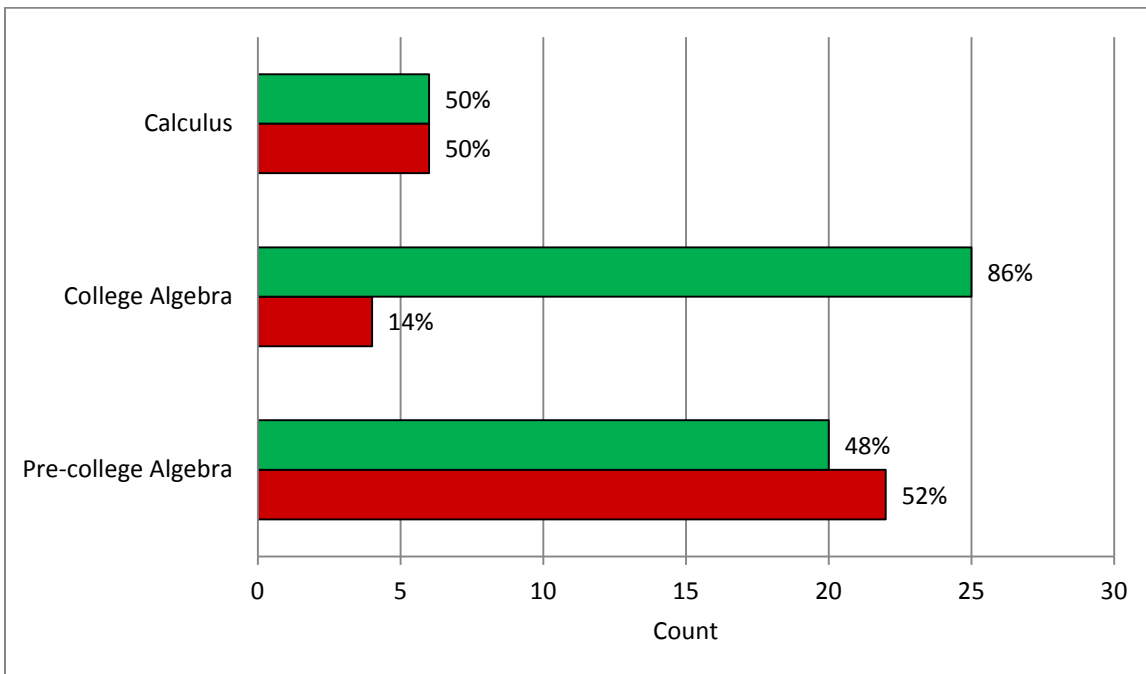
Figure 1. Math Level Comparison of Persisters (green) vs. Non-Persisters (red)

Discussion

This study was conducted in order to determine which admission and curriculum-related factors are connected with persistence of CIT students to their second year. The results show that demographic factors such as admission type, admission status, class standing and gender had no significant connection with retention. The lack of significance with regard to admission status is

in direct contradiction with a similar study of engineering technology (ET) disciplines conducted at this university in 2012.[14] In the ET study, direct admission was found to be a significant predictor of first year student retention. This may be due to the difference in ratios between direct admissions in the two studies. In the ET study only 48% of the students were direct admits while this study had 72% direct admits. Expanding this study to include more participants may lead to results more consistent with the ET study.

Not surprising, students who completed more courses and had higher GPA's were more likely to persist. However, the study also showed that students who attempted more credit hours in their second semester were more likely to return than those attempting less hours. This may be credited with the fact that students who enroll in more classes are more dedicated to their education. Conversely, those attempting fewer hours may have full-time jobs and families, which influence their decision to return for the second year.

Of the three math levels in the study, only the college algebra level was found to be significant. However, the results of the tests on the other math levels may have resulted from a small sample size with only 42 students at the algebra level and 12 students at the calculus level.

One surprising result is that gender was not a significant factor in persistence. This differs from other studies on the topic of IT retention cited in the literature review.[5,11] In addition, the rate of attrition of women in this sample was actually lower than that of their male counterparts even though the results were not significant. One possible explanation for this difference is the small female sample size (12 or 14.5%). Since the numbers of women admitted to CIT programs are much lower than men, and the women are entering what is considered a non-traditional area of study, they may have a deeper commitment to the field than male students. However, the CIT program has an unusually high percentage of female faculty members, with 55% of the faculty being women. This volume of female instructors provides female students with positive role models, and may foster a positive environment where females feel more comfortable in a classroom otherwise dominated by male students.

One weakness of this study is the fact that it was only conducted for one year. The limited sample size and limited time-frame may provide inaccurate results. In addition, there was no student involvement in the study. Consequently, there is no way of knowing whether the reasons for lack of student persistence are truly related to the variables examined here, or due to personal, family, or financial situations. Also undetermined, is whether the students who did not return have any intention of ever doing so. They may return in future semesters.

A longer term study over multiple years could verify the results found in this study, and also determine if non-persisters return over time.   In addition, devising a method to survey students who do not persist would be invaluable in determining their true motivations and intentions.

Conclusion

The study demonstrated that curriculum-related factors had the most significant relationship to first year retention. These results are instructive in that they point to the necessity to maintain high standards in faculty selection and course content within the first year courses. The research indicated that several practices can be implemented to aid students in their academic and social integration to the CIT program:

- While a tutoring program is already in place, individual instructors should be more proactive in advertising and encouraging students who are struggling to take advantage of this resource. Math, programming, and database development should always be included in the tutoring program.

- Class assignments should be developed with a real-world focus so that students understand the relationship between the curriculum they are learning and their opportunities for employment after graduation. Instructors should help students develop a peer group support system through peer-to-peer interaction in the classroom, and implementing peer mentoring opportunities.

- Instructors should give students feedback on major assignments and exams by letting them know how they are doing in relation to the class as a whole. Female faculty members should continue to provide positive role models for female students. Faculty-student interaction should be encouraged through informal class discussions and undergraduate research projects.

Overall, the results of this study illustrate the fact that faculty must continue to focus on the quality of first year courses. Implementing the measures discussed above can have a positive impact on the success of first year students.

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