ABSTRACT
Many institutions of higher education in the US are offering an information technology (IT) education program at an undergraduate level. So far, not many studies about this young academic program have explored students’ perspectives. Students’ perspectives are important input for educators to implement an IT education program that properly addresses students’ needs. This study has investigated college students’ perceptions and expectations for formal IT education in college through in-depth qualitative interviews. Interviewees were college students who were enrolled in courses offered from an IT minor program. This study has revealed that many college students feel that there is a void in college education in dealing with issues emerging from recent developments of IT. The interviewees indicated that the existing computer science program did not satisfy their needs. Students perceived that IT is something that they would have to confront in their future, and sought IT education regardless of their fondness for using and learning IT. By taking the IT minor, students tried to supplement their knowledge in their major and be better prepared for the fields that they would pursue after graduation.

Topics
Nature and scope of Schools and Research

Keywords
IT education, IT learning, IT minor, computer science, programming, informatics, student perceptions

1. INTRODUCTION
Recently, a number of new information technology (IT) education programs have emerged in U.S. colleges and universities, in addition to the traditional computer-related education programs. The new IT programs are being identified with titles such as Information Science, Information Systems, Information Technology, or Informatics. These programs have been developed on the basis that there is a niche between IT and the contexts in which the technologies are situated, in terms of both further research and teaching. Many of these IT programs are providing IT education at an undergraduate level, either as a major or as a minor.

While the IT programs in colleges have been gaining popularity, the identity of the IT programs still remains fuzzy, and the nature and scope of IT education are still being debated intensively. One reason may be that the new area of study is still young, and the existing studies have not had enough time to sufficiently integrate multiple perspectives from various stakeholders of college-level IT education.

One of the most important stakeholder groups in the emerging IT education programs is college students. However, most previous studies have rarely examined what expectations and concerns students have regarding IT education. Instead, they have discussed educators’ and program administrators’ concerns in developing and administering an IT program. Therefore, this study proposes to shift attention from the perspectives of program developers to the perspectives of college students to get a better understanding of college level IT education. The big research question that guides this study is formulated as follows.

What are college students’ perceptions and expectations for an IT education program?

By investigating students’ perspectives, this study eventually aims to help educators answer the questions regarding the identity of the college-level IT education programs.

2. RELATED STUDIES
2.1 College Students: The IT-savvy New Generation
In a large body of literature, younger generation people are typically described as more tech-savvy than older generation people. The digital divide literature has long been discussing the inequality that exists in people’s access to IT. It points out that people’s age and education level are two important factors that make a big difference in their access to IT (e.g., National Telecommunications and Information Administration [4]; Hargittai and Hinnant, [3]). College students are considered to be a group of people who have the most access to information technologies, as they belong to the younger generation that has
grown up with IT and is receiving higher education that often goes together with intensive use of IT.

### 2.2 Spontaneous Learning

A significant improvement brought by the development of user-friendly information technologies is that those technologies have become easier to learn. Nielsen [5], a usability consultant, points out that learnability, the ease of initial learning, is one of the top attributes in any good user-oriented system. One consequence of the enhanced learnability is that users’ spontaneous learning is greatly encouraged. Many people acquire IT skills and knowledge spontaneously, through informal learning embedded in their daily activities, rather than through formal training or written manuals.

In contemplating how people learn to use computers, Twidale [9] pays special attention to users’ informal help giving interactions that are frequently observed in workplaces. His idea of “over-the-shoulder learning” draws on education theories that students learn cognitive skills most effectively through informal, spontaneous learning opportunities embedded in natural classroom settings. According to these theories, interaction within peer relationships is essential when students learn complex cognitive skills (e.g., Vygotsky [10]; Rogoff, [6]). Other researchers, such as Spliter [8], also point out that a critical part of IT learning usually occurs in users’ social interaction with peers rather than through formal training.

### 2.3 The Place for Formal IT Education in College

As discussed above, college students are very active users of IT, and they acquire IT competency spontaneously in their daily lives rather than through any formal training. Previous studies suggest that the immediate value that learners attach to learning computers should be considered in thinking about IT education. Facer, Sutherland, Furlong and Furlong [2] point out that there is a fundamental gap between the reason that educators and parents place emphasis on computer education and the reason that children value computer expertise. They argue that while policy makers and parents tend to view computer skills in terms of the children’s adaptability to the future world of work, the actual reason that young children value IT expertise is that obtaining the expertise is instrumental in shaping their identity among their peer groups.

College students have different values from those of young children who are the target of Facer et al.’s [2] study. College students are situated in a transitioning period from education to “the real world”. Therefore, college years are the time when career-related decisions are important to students. Developmental psychologist Smolak [7] argues that occupation-related values are a significant part of college students' identity formation. It implies that the reason that college students seek formal IT education may be closely related to their career-related issues. Also, many related studies have focused on computer skills, rather than on broad IT education which includes many conceptual parts of IT knowledge other than just computer skills.

If college students are generally savvy with information technologies, and they acquire IT competency more through informal paths, then what would be the place for formal IT education for them? What do they think they are not good at, and what causes them to consider formal IT education?

### 3. METHODOLOGY

As the development of the college-level IT programs is a new phenomenon and students’ perceptions on these programs have rarely been studied, there is no strong theoretical framework that can guide this study to answer the research question. This lack of a strong research framework requires some exploratory research that identifies the major issues first. In this study, this exploratory research was performed through qualitative in-depth interviewing with college students.

Interview participants were college students who were enrolled in one or more courses in the IT minor program in a large Midwestern university. The purposive sampling method has been adopted to obtain participants from various majors. Enrollment in an IT class was taken as an indication of students’ interest in IT education. A total of 26 students from the following majors were interviewed: English, History, Advertising, Sociology, Business Administration, Computer Science, Computer Engineering, Chemical Engineering, etc. Interviewees included 15 male students and 11 female students. 3 sophomores, 8 juniors, and 15 senior students were interviewed. There were no freshman students, as the IT classes require sophomore standing. For confidentiality, pseudonyms were used to identify the interview participants throughout the study.

Interviews were performed during the Spring 2007 and Fall 2007 semesters. Students in the IT classes were given a brief introduction to the study and asked to sign up for an interview session. Each interview session lasted about an hour. The interviews were conducted in a semi-structured format. The semi-structured format allowed the interviewer to adjust interview questions flexibly to get in-depth understanding of each interviewee’s experiences with IT and meanings that they attach to IT education.

### 4. FINDINGS

#### 4.1 Major Interests in IT Education

From the interview data, three major areas of interest that college students have about IT education were identified.

**Learning practical hands-on IT skills**

The interview data revealed that one big interest that college students have regarding IT education is learning practical hands-on IT skills. IT broadly means any type of digital technology that processes information. But to students, IT in the context of college education primarily means computers, rather than other popular consumer IT devices such as cell phones and music players. It seems that their interest in personal computers is related to creating practical digital artifacts on their own. These digital artifacts include personal web pages, portfolios for jobs, and tools to support the groups that they belong to. Emily, a psychology student, expressed how excited she was when she learned some practical hands-on IT skills from an IT class.

Emily: The things that we created in the class, it was something that actually worked and could actually be used. We created things that I feel that we accomplished something, which is kind of cool.

Creating something on computers usually involves programming. However, students clearly indicated that what they are interested in is not the programming per se, which CS people would do.
Learning about social implications of IT

Students also showed interest in learning about implications of IT use on people and society. They are interested in learning how people use IT, and what implications IT use has for society, but not necessarily interested in using IT products proficiently or learning hands-on IT skills. Two students, from English and Business respectively, described their interest in learning the social implications of IT implementation.

Jenna: My expectations were not so much relating IT classes to technical stuff... but more relating it to culture... and current events more like, how the computers have evolved.... All I really thought about it was, I didn’t really think it would be too technical.

Rachel: I’ve always liked learning about technologies and liked how people use it and how it affects people. I don’t necessarily like using technology itself. I took a class last semester.... It was a communications class, and it was a lot about TV, Internet, and different types of media and how they affect society and different groups and different stereotypes.. I thought it was interesting. So I thought that the IT minor is fairly similar to that.

These comments indicate that even students who are not very active in using IT products feel the need for some kind of IT education. Their focus on the impact of IT is clearly different from the focus of the established approaches of CS or other engineering fields.

Interest in Human-Computer Interaction

Human-computer interaction (HCI) is another area that many students showed interest in regarding IT education. Chris, a philosophy major, focuses on computers less as technologies, but more as people’s tools for communicating.

Chris: I am more interested in computing as interaction, less than computing as a goal and end itself. If people are interested in studying how people interact with computers, how computers shape their lives, the IT program is an ideal place to investigate some of that knowledge.

Students perceive HCI as an important issue to pursue in higher education, because it is related to many current changes in society.

Some students also view HCI as a gateway through which non-technical students can get into the study of IT.

Jenna: Because I am not really very experienced with computers, I asked the IT advisor what classes would be less technical, and more underlines of computers and culture, human interaction with computers...

It seems that HCI is a major area of IT education. By HCI, students mean not a narrowly defined sub-area of IT, but rather people’s interaction with computers in a broad sense.

Patterns found among the major interests

Interesting patterns were found among the major interests. The first two interests, interest in learning hands-on IT skills and interest in learning social implications, tended to be negatively correlated. Those who were more interested in acquiring practical hands-on computing stuff tended to be less interested in discussing social implications of IT. Those who showed more interest in learning about social implications of IT tended to be less interested in learning technical stuff. Also, some common underlying interests were found in all three interests. First, most of the students showed interest in the practical aspects of IT education. Second, all the three interests were focused around user-level issues; students take IT classes to learn to make their websites, to make their own portfolio, to conduct their group project, or to learn how IT implementation affects end-users like themselves.

4.2 “I am not good at computers”:
Conflicting Attitude towards their IT competency

Many students had conflicting attitudes regarding their IT competency. While they said they use IT all the time for their school work and socializing purposes, many of them rated their overall competency in using IT not very high, with a comment like “I am not good at computers”. It seems that their intensive use of computers for school work and social purposes does not count as IT competency for them. A lot of times the feeling of incompetence came from their inability to do programming.

Jack: Technology, I do utilize it a lot. I think I’m pretty familiar with a lot of the IT technology in terms of the social use… utilizing different technologies…. The one thing that I don’t feel comfortable with is the coding itself.

It is noteworthy that students did not describe their IT competency as a standalone technical skill without a context. Most times, students described their IT competency in relation to some area expertise. For example, a journalism student Abby indicated that she is not competent to sit down and write a program by herself, but that her IT skills would be good enough to perform her work in the journalism area.

Abby: For the future, I’ll need to know more about online journalism. But could I sit down and make a web page, no, I
think I would need more interaction. I think I have enough base knowledge to accomplish anything that I would want to accomplish... if I want to learn more, I could figure it out on my own without struggling too much.

It seems that students feel that their IT competency is good enough if their IT skills and knowledge are functional in performing what they need to do.

4.3 Perceptions about the Existing CS Program

The interview data revealed that many of the interviewees have some sort of interest in learning issues in computing. As a result, many students have taken or considered taking a CS class. Most students reported that the CS classes they tried did not satisfy their needs.

First, students generally perceived that computer science is very hard. CS classes are usually considered to be hard, because they require a lot of math background. Some students pointed out that CS classes are daunting even for people who already have some level of technical competency outside of class.

Chris: I joined the university with very sporadic knowledge of computing. I had fairly good knowledge of coding and software systems.... However, computer programming courses in computer science department are notorious, being exceedingly difficult even for people who already know the basics of the programming.

Students also commented that the class atmosphere of CS classes is not very friendly to novices and less-experienced people.

Second, the negative stereotype of CS work influences students' perceptions of CS education. Many students believed that CS work typically requires long hours of working alone with tedious tasks, and pointed to this as a very unattractive aspect of learning programming.

Dave: Programming is a good skill to have. It’s not something like for sure going for career, no way. I thought it’s too dull for me personally, because it’s solitary. I feel like I have more social skills, I would rather talk and interact with people on group work, than have just me in a closet with a computer.

Nathan: I do like a lot of practical things, and am not real big into studying theories. I don’t mind studying a theory to get an understanding of how software program works, like the course I had last semester, we used a computer design tool to help us lay-out a processor. So we actually made our own little processors, and one of things you had to connect a bunch of different wires between all these different little pins. If you do it manually, you will have a really big problem, you can use a choice of different algorithms to automatically do it for you. So I learned about different algorithms in class and used them in a practical way. That’s about the technology that I’d like... where I can say “All right, I can use this.” “Here’s an algorithm, you will use it maybe!” I am like, “okay...” Because I am not really big into theory, and just kind of good at research on that algorithm, it’s not all that useful...

Third, they feel that what is being taught in CS is very theoretical rather than practical. They pointed out that CS classes typically require designing everything from scratch and producing outcomes that are not immediately usable. This is not practical for most students who are not CS majors, because the CS way of programming is not only hard for them, but also takes a lot longer time than necessary to get what they want.

Kelly: My friends have had taken them, they come home talking about their really arbitrary assignments, things that are not gonna help them. I didn’t want to deal with those assignments. I want to learn how to really get end up and do something that I can actually physically use, create a product. I know that you need to learn that in order to get to that. But that’s not what I need....

Lastly, some students expressed their concern that CS does not consider the impacts of computing on human life.

4.4 Perceived Gap in College Education

Students reported that they feel some gap in current college education in terms of education for IT. First, students pointed out that most existing academic programs are very theory-based and not practical. Nathan is a computer engineering major. He described his experience that all the theoretical knowledge that he had obtained from his study was not very useful in performing his work assignment.

Nathan: I do like a lot of practical things, and am not real big into studying theories. I don’t mind studying a theory to get an understanding of how software program works, like the course I had last semester, we used a computer design tool to help us lay-out a processor. So we actually made our own little processors, and one of things you had to connect a bunch of different wires between all these different little pins. If you do it manually, you will have a really big problem, you can use a choice of different algorithms to automatically do it for you. So I learned about different algorithms in class and used them in a practical way. That’s about the technology that I’d like... where I can say “All right, I can use this.” “Here’s an algorithm, you will use it maybe!” I am like, “okay...” Because I am not really big into theory, and just kind of good at research on that algorithm, it’s not all that useful...

Second, students commented that most academic programs focus on “history”, and are slow at embracing issues of current affairs and recent developments. This complaint appears over a wide range of academic disciplines.

Dave, a political science major, mentions that political science deals more with historical stuff than the changes that he is experiencing right now.

Dave: Courses in my major deal a whole lot of government stuff, seem more of just history, looking back at the history of government. While in this [IT] course, I feel like what we are studying is going right now. I enjoy that, because it’s something that I feel I am in actually a part of, because I am participating on the Internet which mostly these classes talk about, and how information is shared through different chat. I feel like it’s not just studying the past... it’s studying now.
Another criticism was that there are rigid boundaries among existing disciplinary programs across campus. Many classes are open only to the students enrolled in a specific program. Many social science classes deal with IT issues at an upper-undergraduate level. These upper-level courses usually require several prerequisite courses within a specific discipline. There is no social science class that is entirely devoted to discussions about IT.

Zachary, a CS major, is taking an IT course that fulfills his general education requirements for social sciences. He is very much into his study in CS, and is also interested in different kinds of discussion about computers and other technologies. As he did not want to go too far away from technical issues when choosing social science courses for his general education requirements, he decided to pick two IT courses that satisfy the general education requirements. He found that it is difficult to find such courses from other social science disciplines, because other disciplines usually offer technology-related courses only at a higher level for junior and senior students in their fields.

Zachary: [If I am looking for a social science course that deals with IT,] that’ll be five courses to get to anything that really about computers instead of two [introductory IT] courses.

As IT is increasingly being adopted in many settings in everyday life, students do have some sort of sense that there might be some education program on IT on campus, even without explicit knowledge. This is expressed in the conversation with Brad, an economics major who is not very fond of working with IT.

Heekyung: Did you know that there is an IT minor on campus?

Brad: I guess I would’ve…. I don’t know explicitly, but I figured that there would be…IT isn’t something that I’m extremely interested in, so I wouldn’t have considered it, I wouldn’t look into finding whether there was, but yeah, I guess I didn’t. Not explicitly, but I would have if it was something I was interested in, I would have figured that you can get an IT minor. I had this feeling that there is something like an IT minor on campus…. I figured it would be there, but I didn’t actually know.

It seems that their perceived needs for IT education have to do with their perceived gap in current college education.

4.5 Reasons for Choosing the IT minor

While students choose their major based on what they like and what they are good at, the interview data showed that students choose the IT minor because of its practical value that IT education bears to them.

A few students reported that they chose IT courses because they generally like to work with IT. However, for many other students, IT is something that they will have to acquire knowledge about for their future, whether they like it or not, or whether they are good at dealing with it or not. Many students from various majors, from English to Computer Science, commonly perceive that IT is not very exciting, but something that they will need to learn eventually for their future life beyond education.

Kate, a humanities student, has been hesitant to embrace new technical things since she was young. However, she feels that it is something that she would need to confront in developing her future career anyway. Kate repeated that learning IT is very hard for her, indicating that she is taking the IT minor for its instrumental value, not because of her fondness of what is being taught in IT education.

Kate: Technical things are hard, but worth learning. Especially I am coming into the graduate school of library and information science next year, so I know that I am gonna need to know things about Internet and technology. It’s just hard. It’s hard for me.

Zachary, a CS major, also talks about the need to learn about IT regardless of his willingness to stick to a CS job. In his mind, a CS job is a job that focuses on programming, as opposed to an IT job, which is more about providing technical support to other people.

Zachary: I know I am most likely ending up with being a coder somewhere. I will have to use code repositories, knowledge bases… a lot of tech support things. They put that in a repository.

Students said that they chose the IT minor because they believed the study of IT supplements their major field well. Abby, a journalism major, explained her need to learn IT to be up front in her area of study.

Abby: I feel like it [the IT minor] complements my major, journalism, as where the technology of journalism is going, and what new mediums we will be using to portray the news. I do think they are hard, and I haven’t understood everything they said, but I think overall I have a much better grasp of technology than I did.

Larry: I am going to law school, and I am planning on doing something very related to IT, or technology in general, maybe something like cyber law….

Another important reason is to differentiate themselves from others with similar qualifications. Kelly is a humanities student who is planning to continue her study in library and information science after college. She thinks that there are so many librarians-to-be who have similar qualifications. She considers IT competency as something that would make her unique by showing her well-roundedness.

Kelly: I feel like it’ll at least give me a little bit more a well-rounded aspect just than just doing humanities. Having any sort of IT competency is gonna put you so much higher in the rankings as far as finding positions than anyone else.

Most students’ comments indicated that some practical value of receiving IT education, rather than an inherent interest in IT, is a critical factor in their decision to take the IT minor.
4.6 Factors that Influence Students’ Choice of IT minor

Students’ comments about the IT education program indicate that there would be numerous challenges in building and administering a successful undergraduate IT education program.

First of all, the IT minor is optional to students, unlike a major. Students mentioned that they have to weigh carefully the value of doing the IT minor with other valuable opportunities that they could possibly take, such as internships, study abroad opportunities, part-time jobs, campus honors’ programs, and participating in student organizations.

Another important factor in doing the IT minor is how flexible the course requirements within their major are. While some social science majors do encourage students to have a minor with an additional requirement like “20 hours of supporting coursework”, other majors leave no room for students to seek another interest. Nathan, who is a senior in computer engineering, cautioned that a student in his major has to be very careful in choosing to do something outside of his major.

Nathan: In engineering, if you’re going to take courses that aren’t technical, a lot of times you need to make sure if those are counting for something.

For him, if he takes something outside his major without confirming that the outside course counts towards something for his degree, it would cause trouble in finishing his degree on time. Some students expressed their worries that other important people like hiring managers would not know what the IT minor is. Rachel, a business student, made an interesting comment, based on her interviewing experience for an internship.

Rachel: [In my interviews.] I asked some of the recruiters, what would they think of the IT minor. I think a lot of recruiters would misunderstand, they think IT as computer science, so they think oh, you’re an accounting major, we need you to do accounting, we don’t need you to fix computers. That’s their idea. I don’t think they would understand what it is.

“Fixing a computer” may be a popular stereotype about IT work. Rachel’s comment signals that raising other stakeholders’ awareness about an IT education program would be an important factor for students to have a positive impression about an IT program. If other people who have significant influence on students’ future do not understand what an IT program is, it would make students hesitant about choosing an IT program.

Students’ comments also implied that IT education is facing many challenges. It seems that many of the challenges for an IT program come from its interdisciplinary nature. IT programs are usually built as an interdisciplinary endeavor, as they usually start with the recognition that there is a niche between technologies and their social contexts. To fill the niche, the IT programs emphasize gathering multiple perspectives for viewing computing, from sociology, from communications, and from computer science, etc. To sustain an interdisciplinary program, gathering and organizing supports from many disciplines is crucial. Berghel and Sallach [1] have already observed that many IT programs are being organized at a university level rather than at a departmental level.

The scope of this study is limited to an IT minor program in a specific university. Therefore, the findings may not hold for students in other universities or in other IT programs that are offered as a major program. This case study was conducted with the intention of getting an in-depth understanding of students’ perspectives. There are not many previous studies about students’ perceptions about IT education. At this stage, the benefits of identifying students’ various issues involved in receiving IT education outweigh the value of getting generalizable findings across a large number of college students.

The findings strongly suggest that students expect an IT education program that has a different focus than that of the other existing computing programs. “Just me in a closet with a computer” may be a common portrait of programming/computer science that students have. Wanting something different from that is a major reason that students seek IT education. Students from various majors want some computing education that is more interesting, more practical, and more meaningful than CS. This study is valuable in that it delivers this anticipation to the IT educators’ community.

5. CONCLUSION

In this study, students from different majors showed diverse interests in IT education. However, the existing computer science program does not seem to respond to those interests. Students also pointed out that higher education in general has a gap in addressing the issues emerging from increasing implementation of IT. In addition, most students indicated that they are anticipating some practical advantages by enrolling in an IT education program. The findings also signal that marketing of an IT program should be directed not only to students, but to various stakeholder groups whose perspectives have significant influence on college students.

REFERENCES


