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Parental Perceptions and Recommendations of Computing Majors: A Technology Acceptance Model Approach

Loreen Powell
lpowell@bloomu.edu
Bloomsburg University
Department of Innovation, Technology, and Supply Chain Management
Bloomsburg, PA

Hayden Wimmer
hwimmer@georgiasouthern.edu
Georgia Southern University
Department of Information Technology
Statesboro, SC

Abstract

Currently, there are more technology related jobs then there are graduates in supply. The need to understand user acceptance of computing degrees is the first step in increasing enrollment in computing fields. Additionally, valid measurement scales for predicting user acceptance of Information Technology degree programs are required. The majority of existing research regarding methods for increasing enrollment focus on subjective measures that are often invalid or invalidated. This research study adapts a well-known, validated and established user acceptance of information technology model (TAM) developed by Davis in 1989. The TAM model was adapted to understand factors for the acceptance of information technology and was based on the long standing Theory of Reasoned Action from behavioral psychology. This work adapts TAM to explore factors that influence parents' decision to recommend Information Technology as a Major to their children. Since parents have a high degree of influence over the major selection of their children, determining factors for recommending IT as a major can assist IT programs in improved marketing to increase enrollment. In this work, we hypothesize that perceived usefulness (PU) and perceived ease of use (PEoU) will impact a parent's likelihood of recommending IT as a major to their children. Results revealed parent's perception of the perceived usefulness of IT (PU) affected their willingness to recommend IT as a major to their children; conversely, parents were not concerned with the ease of use of IT (PEoU). Implications include improved marketing of IT programs to parents by focusing on the usefulness of IT as a discipline.

Keywords: Technology Acceptance Model, Computer Science, Information Technology, Enrollment

1. INTRODUCTION

Within the last decade there has been improbable technology development and advancement; specifically in the fields of mobile computing (Chung, Chen, & Kuo, 2015; Iqbal & Bhatti, 2015; Shaikh & Karjaluoto, 2015; Turban, King, Lee, Liang, & Turban, 2015). Today, technology is part of almost every organization. As such, worldwide there is surging demand for computing professionals in both the private and the public employment sectors. However, there is not

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enough supply of computing professionals to meet the current demands. Additionally, there is a deficiency in student enrollment into computing degrees which is also compounding the need for computing professionals (Bullen, 2007; Wong, 2015a). Researchers Granger, Dick, Luftman, Slyke and Watson (2007) believe that there is a negative image about the computing fields that is often portrayed by students, parents, and advisors. Finally, Wong (2015a) suggests that students' perceptions of the computing fields are ill-informed and future research is needed.

Considering that parents are one of the main influences on a student's career path and college major, it is important to understand parents' perceptions and acceptance of computing in order for researchers, educators, and organizations try to augment the supply of computing professionals. As such, it is important to find out what parents believe about computing fields such as information technology. It is also important to understand parents' acceptance of computing fields as their beliefs and acceptance may have a major impact on students' decision regarding majoring in a computing discipline. Understanding parent's beliefs and acceptance of computing disciplines would further aid in recruiting students into computing disciplines.

There are several ways to assess people's beliefs and acceptance of technology. However, the Technology Acceptance Model (TAM) is one of the most valid and accepted ways to assess the acceptance of technology. Despite the widespread use of the TAM in practice, there has not been an adaptation of the model into the context of computing disciplines. This study seeks to further adapt the TAM constructs into understanding parental acceptance towards higher education computing degrees and career opportunities. Specifically, we aim to uncover factors that influence a parent's intention to recommend IT as a major to their children. In this work, we hypothesize that perceived usefulness (PU) and perceived ease of use (PEoU) will impact a parent's likelihood of recommending it as a major to their children. Results revealed parent's perception of the perceived usefulness of it (PU) affected their willingness to recommend it as a major to their children; conversely, parents were not concerned with the ease of use of it (PEoU). Implications include improved marketing of it programs to parents by focusing on the usefulness of it as a discipline.

This work has practical implications for higher education institutions, faculty, and computing degree programs by uncovering factors that can help assist with improving marketing/recruiting efforts to increase enrollment within computing disciplines. The remainder of this paper is structured as follows: background/review of the literature, the methodology, results, and conclusion.

2. BACKGROUND

2.1 Computing Opportunities and Need for Increase Enrollments

Information technology is a broad field that deals with the design, development, analysis, implementation and management of information and technology. The information technology field is one of the most dynamic fields of study that is responding to the upsurge of affordable technology as well as the explosion of free or inexpensive data through the internet. Currently, the building of a new industrial paradigm around the Internet of Things (IoT) calls for information technology managers and professionals to support new growth in new ways, which will form the core of Industry 4.0. As such, information technology worldwide has become a primary driver of economic development and a tool for more effective communication within and across national borders. For example, China's Internet Plus plan will "integrate mobile Internet, cloud computing big data, and the Internet of Things with modern manufacturing, to encourage the healthy development of e-commerce, industrial networks, and Internet banking, and to get Internet-based companies to increase their presence in the international market" (China Daily, 2015).

Almost every business is affected by technology. Technological advances such as the internet have significantly influenced the way businesses function and communicate. Worldwide, information technology has become a primary driver of economic development and a tool for more effective communication within and across national borders. As information technology continues to provide new possibilities and opportunities for businesses globally, the need for information technology related professionals also grows.

Job growth in the information-technology fields is expected to be far stronger than average for the foreseeable future. Specifically, the U.S. News and World Report's Best Jobs Report (2016) lists several information technology related positions within the top 100 best jobs. They expect 50,900 new information technology manager positions

by the year 2022. Additionally, a recent study by the McKinsey Global Institute projects a need for more than 1.5 million more managers and information technology analysts with both analytical and technical skills (Manyika, Chui, Brown, Bughin, Dobbs, Roxburgh, and Byers, 2011).

The American Computing Association's Career News (2016) reports "In just a few years, there will be 1.8 million jobs unfilled in our nation because the U.S. doesn't have enough individuals trained with the necessary technical skills, including the ability to program, to fill them." Furthermore, Moore (2016) states that "The United States faces a global competitiveness crisis that, if not addressed, will put our nation at a strategic disadvantage for decades to come. In just a few years, there will be 1.8 million jobs unfilled in our nation because we don't have enough individuals trained with the necessary technical skills to fill them."

An applied data mining research study conducted by Wimmer, Powell, Kilgus and Powell (2015) using Bureau of Labor Statistics (bls.gov) to determine which skills will be most in demand in the next decade can assist higher education in designing relevant curriculum. Their website, BLS.gov, provides information about occupations, including growth rates, median salaries, and job descriptions. Results reveal that information technology terms are among the top 50 terms used in job descriptions for the top-growing jobs, as defined by number of new positions projected.

Finally, information technology is consistently ranked as a career field in high demand. A CNN Money article titled "5 jobs with the biggest pay hikes" reported that pay raise rates for IT workers outpaced all other professions. It was also reported that "unemployment among IT workers is among the lowest in the nation" (Christies, 2013).

2.2 Why the large amount of projected computing jobs?

There are several reasons as to why there is a large amount of projected computing jobs. Two of the most obvious reasons are the mobile computing market and the Internet of Things (China Daily, 2015; Chung et al., 2015; Iqbal & Bhatti, 2015; Shaikh & Karjaluoto, 2015; Turban, et al., 2015).

In previous years, there was an increase in demand for web developers. However, that has shifted to mobile application developers as mobile phones have seamlessly integrated into everyone's daily lives. Businesses want native iOS apps for the iPhone and iPad, or several other Google Android-based apps for other cell phone manufacturers. Businesses need to connect to their customer to increase or maintain sales. As such, developing a mobile app for businesses to connect to their customers is essential. Hence, the increase in computing jobs.

Additionally, the Internet of Things has manufacturers embedding computers into appliances like refrigerators, ovens, water heaters, and daily products. These embedded computers send data across the Internet, and this data is stored in databases. The data creates a demand for database administrators, data scientists and software developers. Furthermore, when things go wrong with the embedded computers, people will need technical support. As such there is an increase in demand for people with advanced computing skills.

2.3 Technology Acceptance Model

There are several studies have proposed frameworks to identify and investigate the determinants of technology acceptance. Specifically, Fishbein and Ajzen (1975) developed the theory of reasoned action (TRA) model and Ajzen (1985) later developed the theory of planned behavior (TAB) model (Chen, Gillenson & Sherrell, 2002; Prieto, Miguelanez, & Penalvo, 2014). These two models provided the foundation for Davis, Bagozzi, and Warshaw (1989) to develop the Technology Acceptance Model (TAM). The TAM hypothesizes perceived ease of use (PEU) and perceived usefulness (PU) influence a person's acceptance of a new technology (Davis, 1989).

Originally, TAM was developed for determining user acceptance towards a computer system. However, over the years, TAM has been validated and widely utilized, adapted or extended within a variety of different contexts (Osswald, Wurhofer, Trosterer, Beck, & Tscheligi, 2012; Wong, 2015b). For example, TAM was extended for predicting information technology usage in the car (Osswald et. al., 2015), measuring the mobile acceptance among teacher (Prieto et al., 2014), understanding, analyzing and evaluating the acceptance of eLearning systems from the perspective of students in Ireland and Vietnam (Tri Tran & Glowatz, 2014), examining faculty use of learning management systems in higher education institutions (Fathema, Shannon & Ross, 2015) understanding cross cultural context

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for online shopping adoption (Ashraf, Thongpapanl, & Aul; 2014). As such, the TAM has consistently gained theoretical and empirical validity for predicting technology acceptance of users and decision makers (Ajzen 1991). Today, the TAM is one of the most prominent models for information technology acceptance research (Venkatesh et al. 2003; Wirtz & Göttel, 2016).

3. METHODOLOGY

The research method was based on adapting the technology acceptance model to determine parents' perceptions of perceived usefulness and perceived ease of use and whether their perceptions affected their views on recommending IT as a major for their children. While TAM focuses on actual system use as the independent variable, this work focuses on the likelihood of recommending Information Technology as a major Parents have a high degree of influence on a child's major selection; therefore, understanding factors for parents recommending IT as a major can help to market IT programs. The survey had 14 questions, 6 measuring PU, 6 measuring PEoU, and 2 measuring behavioral intention, willingness to recommend IT as a major. Appendix A lists the survey questions which were adapted from (Davis, 1989) changing "Chart Master" to "Information Technology" and adding "For my Child" to measure parent's perceptions of IT as a major toward their children. The survey was collected by paid respondents online and administered using the Qualtrics survey platform. All respondents were required to be parents in order to proceed with the survey.

Several demographic factors were collected on the data sample. Specifically, there were 50 participants with a median age of 35-44 years. A total of 83% were white, 9% black, 4% Asian, 2% American Indian/Native Alaskan, and 2% were other. Additionally, 72% of the participants were male. Education levels varied with 53% having a 4 year degree, 14% a 2 year degree, 11% a professional degree, 11% some college, 9% high school, and 2% less than a high school education.

Most of the participants worked in business and finance (31%), computing and IT (26%), or were listed as other (26%), followed by health and medical (7%), engineering (6%), and homemaker (4%). 64% of respondents had taking a computing course. Most lived in a suburban area (53%), followed by urban (31%), then rural (16%). The median household income was $50,000 to $59,000. Figure 1 shows the distribution of the median household income.

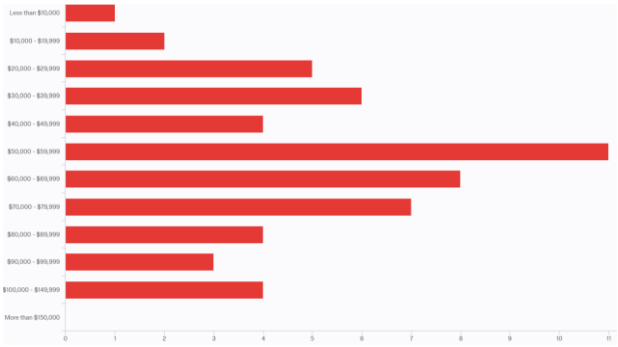

Figure 1 – Median Household Income

The research model is illustrated in Figure 2. From Figure 2, we generate 2 hypotheses:

- H1: Perceived Usefulness positively affects Intent to Recommend IT as a Major
- H2: Perceived Ease of Use positively affects Intent to Recommend IT as a Major.

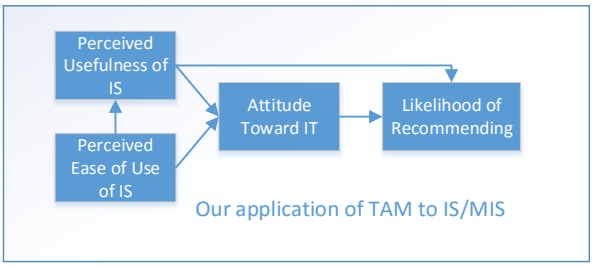

Figure 2 – Research Model Based on TAM

4. RESULTS

The first part of the analysis was performed using Structural Equation Modeling (SEM) using AMOS software. A confirmatory factor analysis revealed that 1 PU variable and 3 PEoU variables did not load at acceptable levels. It is also noted that the second question on behavioral intention was negative, which we expected since it was opposite the first question (not recommend). Advancing to the structural equation model, all remaining questions were significant to their latent construct at $p<.001$. In our tested model, we employed 2 exogenous constructs, perceived usefulness (PU) of IT and perceived ease of use (PEoU) of IT These constructs gauge a parent's perceptions of PU and PEoU as it applies to their children. We apply 1 endogenous construct,

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intent to recommend IT as a major to their child or children. Variables to measure our latent constructs come from the TAM survey in the Appendix. Our SEM is detailed in Figure 3.

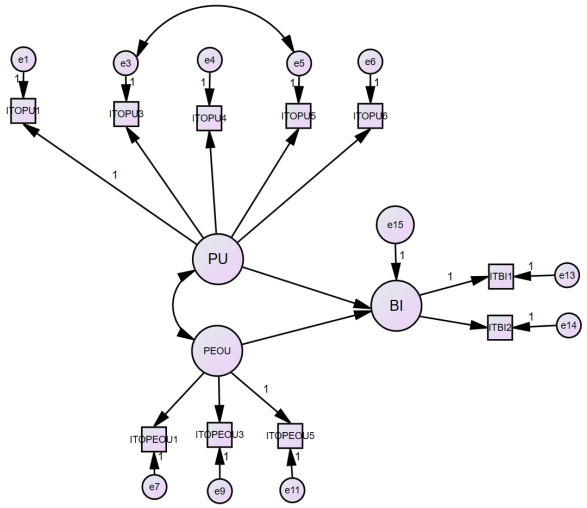

Figure 3 – Structural Equation Model in AMOS

Factorial invariance was tested using a procedure recommended by Byrne, Shavelson, and Muthén (1989). Hence, a non-significant Chi-square is preferable as it indicates that the predicted model is congruent with the observed data. A p value > 0.05 indicates we should accept the model. According to (Thacker, Fields & Tetrick, 1989), the closer Chi-square to the degrees of freedom, the better. Results from our study show Chi-square =29.75, degrees of freedom = 31, and p = 0.53 indicating we accept the model and progress to measuring how our model fits the data.

CMIN/DF was reported as 0.96 which is less that the upper bound of 5. Goodness of fit index (GFI) was 0.879 where 1 is perfect fit and 0 is no fit thus indicating an acceptable model fit with a good model fit being > 0.9. Similarly, root mean squared error of approximation (RMSEA) was 0.000 indicating a good approximate fit (Gefen, Rigdon, & Straub, 2011).

Regarding hypothesis 1 and 2, the results show support of hypothesis 1 that a parent's perception of the perceived usefulness of IT affects their willingness to recommend IT as a major to their children. The model estimates that as PU increases by 1, intent to recommend increases by 1.042 with a standard error of .435 with $p < 0.05$. Hypothesis 2 was not supported with $p = .395$. Based on these results, parents are not concerned with how easy IT is but concerned with the usefulness of IT O'Lander (1996) studied factors that influenced high-school students' attitudes towards computing and found that enthusiasm of computing, perceived abilities, apprehensions in majoring in CS, perceptions of positive instructional influences, and perceptions of career and employment opportunities were all critical factors. In our efforts, we focus not on students but on parents. We note that perceived usefulness, such as career opportunities, are important to both students and parents. Further refining factors measuring perceived usefulness of IT as a major and targeting marketing efforts toward PU are important next steps to increasing IT enrollment.

5. CONCLUSION

In summary, this work hypothesized that perceived usefulness (PU) and perceived ease of use (PEoU) will impact a parent's likelihood of recommending IT as a major to their children. Results revealed parent's perception of the perceived usefulness of IT (PU) affected their willingness to recommend IT as a major to their children; conversely, parents were not concerned with the ease of use of IT (PEoU). Implications include improved marketing of IT programs to parents by focusing on the usefulness of IT as a discipline.

The research method was based on adapting the technology acceptance model constructs to determine parents' perceptions of perceived usefulness and perceived ease of use and whether their perceptions affected their views on recommending IT as a major for their children. The results indicated that parent's perception of the perceived usefulness of IT affected their willingness to recommend IT as a major to their children. Furthermore, parents were not concerned with how easy IT is but, they were concerned with the usefulness of IT.

This research is important because as it provides information that Information Technology programs should consider this in marketing programs to parents by stressing the usefulness and practical nature of IT coupled with the burgeoning demand may influence parents to recommend IT as a major to their children by increasing their perceived usefulness of IT as a major. Future research will be conducted to determine if any demographic information including, but not limited to, as age, gender, and

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occupation will have an effect upon the overall results.

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7. APPENDIX

7.1 Questionnaire

All questions were on a 7 point Likert scale with 1 = Strongly Agree and 7 = Strongly Disagree. Questions were adapted from (Davis, 89).

1. IT-O-PU1 Using Information Technology in his/her job would enable my child to accomplish tasks more quickly.
2. IT-O-PU2 Using Information Technology would improve my child's job performance.
3. IT-O-PU3 Using Information Technology in my job would increase my child's productivity.
4. IT-O-PU4 Using Information Technology would enhance my child's effectiveness on the job.
5. IT-O-PU5 Using Information Technology would make it easier for my child to do his/her job.
6. IT-O-PU6 My child would find Information Technology useful in his/her job.
7. IT-O-PEoU1 Learning to use Information Technology would be easy for my child.
8. IT-O-PEoU2 My child would find it easy to get Information Technology to do what he/she wants it to do.
9. IT-O-PEoU3 My child's interaction with Information Technology would be clear and understandable.
10. IT-O-PEoU4 My child would find Information Technology to be flexible to interact with.
11. IT-O-PEoU5 It would be easy for my child to become skillful at using Information Technology.

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12. IT-O-PEoU6 My child would find Information Technology easy to use.

13. IT-BI1 Assuming Information Technology would be available, I predict that I would recommend it as a major to my child.

14. IT-BI2 Assuming Information Technology would be available, I predict that I would NOT recommend it as a major to my child.

7.2 Figures