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Choosing Information Systems as a Major: Factors that Influence Selection

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Choosing Information Systems as a Major: Factors that Influence Selection

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Education in Higher Education

by

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Abstract

The purpose of this study was to examine student perceptions of factors affecting the decision to select information systems as an undergraduate major. Additionally, information systems students were compared to other business students to see if significant differences existed between groups. The four factors studied included: (a) personal interest in the major, (b) student competence, (c) value and utility, and (d) external influences of other people and academic experiences.

A convenience sample was used at a public university in the Southeastern region of the United States. Two hundred junior/senior students were selected as participants. One hundred of the students were information systems students, and 100 were from other business majors. Both descriptive statistics and inferential statistics, including *t*-tests, were conducted to determine which factors influenced major selection and to see if statistically significant differences were observed between groups of students.

The findings suggested that the profile of an information systems student was male, Caucasian, and 20-24 years of age. Participants generally selected their major in the freshman or sophomore year of college. As suggested by several other studies, student personal interest in the subject appeared to be the most important factor. Interest was generated in large part by being good in high school math and computers and enjoyment in using computers. Those students interested in information systems recognized that the major was more than coding and programming. It was also determined that many information systems students secured information about the major from the Internet, and they did not rely heavily on parents or other people to assist them in deciding on their major. Another factor influencing information systems students to select their major was their perceived competence in the subject matter, including

academic performance and level of confidence. Students opting for other majors suggested that information systems were influenced by the value and utility of an information systems degree. These participants acknowledged that the degree led to immediate jobs, career opportunities, and good salaries.

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Dedication

I dedicate this dissertation to my mother, Nancy Turner Shook, who encouraged me throughout my doctoral program, and led the way as an example of an educator who made a difference. I also dedicate this work to my grandfather John Bradley Turner, Sr. who was the first person in our family to attend college. He attended the University of Arkansas and went on to be an educator after his service in World War I. As part of my independent research inspired by one of my courses, I was able to find numerous references to him in yearbooks and know I was literally walking in his footsteps. Learning who he was as a young man was a very special thing that came from participating in this doctoral program. Also, to Doc, Bella, and Casper...they know why.

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CHAPTER I

INTRODUCTION

Context of the Problem

The number of students enrolled in secondary education at American colleges and universities in the fall of 2018 was 19.9 million. This number has increased from the fall of 2000 when 15.3 million students attended college but was not as high as the peak of college enrollment which was 21.0 million in the fall of 2010 (National Center for Education Statistics, 2018). Approximately 74% of high school graduates attended college in 2018 (Bureau of Labor Statistics, 2018). Each student who attends college selects a major as a part of the college experience. Selecting a major is one of the most important decisions that a student will make in college and can have an impact on career prospects (Porter & Umbach, 2006). The choice of an undergraduate major has a significant impact on job stability and job satisfaction (U.S. Department of Education, 2001).

According to the National Center for Education Statistics (2018), 1.9 million undergraduate degrees were awarded by universities in 2018. The top six fields were: business (19%), health professions (12%), social sciences and history (8%), psychology (6%), biological sciences (6%), and engineering (6%). A few other majors comprised 5% of the degrees awarded: the arts, communication, and education. Other studies found slightly different percentages, but business remained the most popular major with 26.1% of students selecting this field of study (Carnevale, Cheah, & Hanson, 2015). Majors that were typically found in business were accounting, economics, finance, information systems, management (including general business), marketing, and supply chain management (Jimenez, 2018). According to Carnevale et

al., (2015), business majors had one of the highest starting salaries of all college majors which influenced the large number of students selecting to study business.

Within business, there is no definitive ranking of which major is the most popular. Most research lists business majors as a group and does not look at individual majors within business. Caffee (2017) provided a ranking of some of the most popular business majors by providing the number of graduates each year. Majors that fell under the framework of management, which included management, general business, marketing, and supply chain management, graduated 431,898 students, finance/accounting graduated 109,273, economics graduated 46,584, and information systems graduated 44,218.

From the 1970s through the early 1980s, information systems undergraduate degree programs revolved around teaching students about using punch cards and large mainframe computer systems (Weedmark, 2019). While a few students majored in information systems, often the courses were taken by accounting students seeking to gain knowledge about financial analysis that mainframe computers could conduct (Weedmark, 2019). The number of bachelor's degrees in information systems quadrupled from 1980 to 1986 as personal computers began to emerge (U.S. Department of Commerce, 1997; Weedmark, 2019). The number of undergraduate students majoring in information systems decreased by 40% from 1986 to 1990 in large part because small businesses were unable to adapt to the different software programs that ran on the computers produced by multiple companies that existed during this time (U.S. Department of Commerce, 1997; Weedmark, 2019). Because of the computer software problems many small businesses returned to paper records, which lead to a decrease in information systems majors (Weedmark, 2019). By the mid-1990s, the software advancements and widespread advent of the Internet allowed small businesses and others to adopt computers which created a high need for

information systems majors and enrollments in information systems increased until the early 2000s. From the mid-1990s to 2000, the major became so popular that many information systems departments started limiting enrollment (Goff, 2000).

Beginning in 2000 the information systems major started experiencing declining enrollments. The number of students entering these degree programs decreased between 50% to 80% from their highest enrollment peak (Granger, Dick, Luftman, Van Slyke, & Watson, 2007; Seymour & Serumola, 2016). The decrease in students coincided with the dot.com bust which was created when investors sold the stock of overpriced technology companies causing a loss in stock value that resulted in many information systems jobs being outsourced overseas from the United States (U.S. Department of Labor, 2013; Light & Silverman, 2011). This was a trend not only in the United States, but globally (Downey, McGaughey, and Roach, 2011). Students were reluctant to consider information systems because they saw it as a dying field (Wong, 2015), and they were not interested in occupations that worked with technology due to job security concerns (Walstrom, Schambach, Jones, & Crampton, 2008). From 2003-2013, employment in the information technology industry grew by 37%. However, the numbers of students majoring in information systems has not kept pace with the needs of business and industry (Saunders & Lockridge, 2011; Seymour & Serumola, 2016). Part of the low enrollment problem in information systems is that only 19% of graduates are women (National Center for Women in Information Technology, 2018).

Exacerbating the low number of information systems undergraduate majors is the lack of women graduates in the field. According to the National Center for Women in Information Technology (2018), women comprised 57% of the professional workforce while men were 43%. This figure matches graduation rates at colleges and universities, with 57% of those graduating

with an undergraduate degree being women, compared to 43% for men. Women were a much smaller percentage of those that work in information systems with women at 26% of the information technology workforce, while men composed 74% of the information technology workers (Rocheleau, 2016). The numbers were down from 1985, when 37% of graduates in information systems were women (National Center for Women in Information Technology, 2018). Only 17% of Chief Information Systems jobs at Fortune 500 companies are held by women with the majority of these positions being held by men (National Center for Women in Information Technology, 2018). Umoh (2017) stated that only 22% of women named technology as an interesting topic, compared to 46% of men. According to Ball (2012), women are underrepresented in technological and business degrees as jobs do not fit characteristics some or many women prefer to undertake, such as concerns with the lower pay for women compared to men in STEM fields and concerns about work-life balance issues (Ball, 2012; Staniec, 2004). Finding ways to attract women to information systems could assist in having a more robust workforce (Corzo, 2014).

If more women wanted to have an information systems career, this could help alleviate issues with not having enough workers (Corzo, 2014). There are many new opportunities for women with the recent emergence of data analysis and increased need for cybersecurity and blockchain (Corzo, 2014). Additionally, salaries are high compared to non-technology fields (Corzo, 2014). Cohoon and Aspray (2006) found that although there have been 25 years of heavy promotion of the information systems career to women, the low number of women entering careers in information systems has remained consistent over time (Beede, Julian, Langdon, McKittrick, Khan, & Doms, 2011).

Statement of the Problem

There is a high demand for information systems graduates with many jobs and attractive careers available to graduates; however, the low supply of undergraduate information systems students who obtain degrees does not meet the demand for these positions (McLaren, 2018). Demand is projected to continue to increase as more jobs incorporate the use of technology (McLaren, 2018). Technology is becoming more important in all career fields, but many students are unaware of this technological shift (McLaren, 2018). Additionally, there are new and emerging fields based in information systems including business analytics, blockchain, cybersecurity, and cloud computing (Gelber, 2016). Each of these jobs, as well as other information systems positions, create a need for business schools to produce more students who choose to major in information systems (Dalesio, 2017; Gelber, 2016; U.S. Department of Education, 2018). The U.S. Department of Labor (2018) reported information systems has the fastest growing demand for a major in the United States with an increase in positions of 12% as society becomes more dependent upon computers and digitalization (U.S. Department of Labor, 2018). A shortage in the supply of students majoring in information systems has been ongoing, existing for the last 20 years (Dalesio, 2017). According to Gelber (2016), the technology talent shortage is currently the highest since 2008. A large majority of Chief Information Officers, over 65%, say that the challenge of finding people to hire is hurting their business (Gelber, 2016). The primary shortages are in data analysis, cloud computing (including blockchain), and information systems security (cybersecurity) (Gelber, 2016). By 2020, McLaren (2018) predicted that 1.1 million jobs for information systems workers would be vacant with the shortage affecting 54% of all organizations. This shortage is predicted to increase to 4.3 million jobs by 2030 at a cost in unrealized revenue to business of \$447.9 billion dollars. According to

the National Center for Women in Information Technology (2018), 3.5 million jobs are expected to exist in the United States by 2026, and it is predicted that only 17% of these jobs will be able to be filled with United States graduates at that time.

Students struggle with understanding what the information systems career involves and have concerns about the complexity and the emerging nature of several of the concentrations (Walstrom et al., 2008). Students also have fears about their ability to do well in the information systems major and job stability in technology-based jobs (Walstrom et al., 2008). There has been limited research conducted in how students select information systems as their major (Zhang, 2007). As a result of limited research, it is important to gain a better understanding of reasons behind the selection of the information systems major (Kumar & Kumar, 2013). According to Wong (2015), if the issues with students not majoring in information systems are not understood and addressed, the United States could lose its advantage in industries that use technology. As an effect, the U.S. may become dependent upon other countries to provide information systems professionals to U.S. companies. Losing industries could affect the gross domestic product of the U.S. and economic success which would impact most of the citizens of the country if companies cannot maintain revenue or gain value on the stock market (K. Patel, 2017). According to Zhang (2007) “information systems scholars and professionals have been concerned about the decreasing enrollments in information systems programs” (p. 450). Colleges of business must address the shortage of information systems as other majors continue to expand (Downey et al., 2011).

The issues of a lack of supply of information students to meet the demand for such students is also seen at the university in this study. There are 218 students majoring in information systems out of approximately 6,300 business students, making information systems

the smallest major in the Walton College of Business (University of Arkansas Institutional Research, Fall 2018). The average starting salary for information systems majors is the highest of all undergraduate majors in the business college (Sam M. Walton College of Business Career Center, 2018c). The information systems department at the university is training students in the latest trends in blockchain and data analysis. According to Dr. Susan Bristow, assistant department chair of information systems, there are employment opportunities for more than double the number of students currently majoring in information systems. To find enough talent to hire, companies are forming relationships early in a student's academic career to gain an advantage in hiring (S. Bristow, personal communication, June 14, 2018). Over the preceding five years, the Sam M. Walton College of Business has administered a job employment survey in senior-level classes at mid-semester for both fall and spring. The employment level for graduates typically ranged between 82% to 93% for the period of time from Fall 2013 through Spring 2017. Additionally, between 4% and 8% of students continued their education in graduate school instead of seeking employment. The employment level could have increased over reported figures because at the time of each survey approximately two months remained before students graduated. (R. Clay, personal communication, March 13, 2019).

Purpose of the Study

The purpose of this quantitative study was to examine student perceptions of factors affecting the decision to select information systems as an undergraduate major. In addition, information systems students were compared to other business students to see if statistically significant differences existed between groups. The factors to be explored in this study include: (a) impact of personal interest in the major, (b) student competence, (c) value and utility, and (d) external influences of other people and academic experiences (Leon & Uddin, 2016; Ryan,

1982). Persuading more students to major in information systems is critical for the future success of American business, but especially in emerging organizations using technology (McLaren, 2018). This study sought to provide empirical research that could be used as a basis for determining how undergraduate information systems students perceive the demands of the major, compared to non-information systems students who have selected another major. This research might enable more students to be recruited, trained, and developed into the next generation of technology workers.

Research Questions

To accomplish the purpose of this study, the following research questions were posed:

1. What is the profile of a contemporary business undergraduate student majoring in information systems as compared to other undergraduate business students?
2. To what extent do undergraduate business students majoring in information systems perceive themselves to be personally interested in the major?
3. To what extent do undergraduate business students majoring in information systems perceive themselves to be competent in the subject matter?
4. To what extent do undergraduate business students majoring in information systems perceive the value and utility of their major?
5. To what extent do undergraduate business students majoring in information systems perceive themselves to be influenced by other people and academic experiences?

Delimitations and Limitations

Delimitations are self-imposed boundaries the researcher places on the scope of a study (Simon, 2011). The current study examined one public, four-year university in the Southeastern region of the United States and included junior and senior undergraduate business students.

Another delimitation was while almost half of the approximately 200 information systems majors were surveyed, only a small percentage of other majors, composing the majority of the approximately 6,000 undergraduate students in the college, were surveyed in order to maintain a similar sample size for comparison purposes. Students who had not selected a major were excluded as participants.

Several limitations to this study also existed. Limitations are potential weaknesses in the study and are largely outside the researcher's control (Gay, Mills, & Airasian, 2009). First, the study examined factors of major selection at one institution, a public doctoral-granting university with very high research activity (The Carnegie Classification of Institutions of Higher Ed, 2019). The category of Doctoral University: Very High Research is only held by 130 higher education institutions out of 4,424 public and private universities that the Carnegie Foundation classifies, amounting to the top 2.7% of institutions (Shumaker, 2019; The Carnegie Classification of Institutions of Higher Ed, 2019). Therefore, the findings may not be generalized to other institutions of higher education (Gay et al., 2009). Second, the study examined the perceptions of major selection of third and fourth-year undergraduate students, not the actual behaviors involved in the selection of a major (Gay et al., 2009). As a convenience sample the results of the study may only be suggested and cannot be found as reliable as a random sample (Simon, 2011). A convenience sample was used to enable an improved response rate and better encouragement of students to take the survey. Due to the difficulty in obtaining survey participation from a small number of information systems students, it was necessary to use a convenience sample. A convenience sample allows for the use of statistical sampling by selecting people due to their ease of volunteering (Creswell, 2015). A convenience sample is considered to be a weaker sample plan than simple random sampling and the results may not be

as reliable (Simon, 2011). It was possible that some students participating in this study who had selected their major earlier in their college career may not remember all the details involved in major selection. The final limitation involves the survey itself. The design of the study did not involve any follow-up with participants for clarification of their answers. Additionally, the survey was conducted over a time period of two weeks making the survey dependent upon responses received at one specific point of time (Simon, 2011).

Significance of the Study

With a decreasing number of students majoring in information systems and an increasing demand for those students to fill positions, one of the greatest challenges facing employers and universities is finding students who want to undertake study in information systems (Downey et al., 2011). According to Zhang (2007), there is currently limited research available on why students are not selecting information systems as a major. The present study, which examined research from a number of undergraduate majors, builds on research results that currently exist. The current study extends the body of knowledge by looking at more factors that influence undergraduate students than previous studies have undertaken, such as focusing on student interest in information systems.

This study could provide insights to help grow enrollments in information systems departments. It could also aid in understanding what attracts students to the study of information systems and could be used in recruitment by information systems departments, professors, and academic advisors as well as colleges of business (Koch, Van Slyke, Watson, Wells, & Wilson, 2010). Information could be provided to students, advisors, and others on misconceptions that exist about information systems so that clarification can be provided to potential students in the recruitment process (Koch et al., 2010). The evidence from the study could serve as a guide to

both business and academics to close the supply and demand gap that currently exists and increase enrollments for undergraduate information systems programs (Downey et al., 2011; Goff, 2000; Light & Silverman, 2011).

State governments, state departments of education, and state education task forces could have an interest in the findings of the present study if an increased need for information systems classes is discovered for high school students (Hermanson, Hermanson & Ivancevich, 1995; Leon & Uddin, 2016). Based on the finding of the current study, high school curriculums may need to be modernized which could lead to more students being exposed to the most current information systems technologies. In turn, these innovations could advance the numbers of students who have exposure to information systems prior to attending college (Van de Calseyde, Keren, & Zeelenberg, 2014). If students have better exposure to information systems in high schools, students could begin the study of information systems in college at a more advanced level (Leon & Uddin, 2016; Van de Calseyde et al., 2014).

In addition, information from the current study could dispel misunderstandings related to factors that students use when making decisions about major selection. Additional information could improve educational support materials for courses. Also, students could gain a better understanding of careers and opportunities in the information systems field (Downey et al., 2011).

Definition of Terms

Blockchain. The major use of blockchain is a distributed ledger that allows decentralized and dispersed parties to record and process transactions that cannot be altered that enables secure financial dealings. Blockchain impacts accounting, finance, and supply chain management to a high degree (Stewart, 2018).

Business Analytics. Analytics involves necessary skills to perform statistical analysis and provide professional presentations of complex large-scale data sets (Walsh, 2018).

Business Applications. The major use of information systems for competitive advantage in running a business including commerce and decision making (O'Brien, 2004).

Cybersecurity. Involves the protection of computer and Internet based systems (Kauflin, 2017).

Information Systems. "Information technologies interact with and inform various actors' in different organizational or social context" (Boell & Cecez-Kecmanovic, 2015, p. 4959).

Management Information Systems. An information processing system that is computerized to support the actions of management and their functions within a company. MIS systems began in the 1970s to help managers with planning and decision making, not simply reporting transactions (Oz, 2004).

National Center for Women in Information Technology (NCWIT). The only national group with a focus on women's involvement in computer science across a spectrum from kindergarten through higher education to career development (National Center for Women in Information Technology, 2018).

STEM majors. STEM stands for science, technology, engineering, and math. Majors related to STEM in information systems are business/management with quantitative methods, computer and information sciences, computer network/telecommunications, computer science and programming, computer software and media application, computer system administration, data management technology, information science, management information systems, and webpage design (ACT, 2018).

Technology. Practical application of knowledge which can be applied in a given field (Stair & Reynolds, 1998).

Utility. Satisfaction of a particular need (Wisner, Tan, & Leong, 2016).

Theoretical Framework

Although there are studies involving students making decisions about major choice upon entering college, existing research conducted has not had strong conceptual frameworks (Cohen & Hanno, 1993; Leon & Uddin, 2016; Zhang, 2007). The lack of theoretical frameworks has made it difficult to determine the process students used to select majors or make future career decisions. The attitudes, socialization, and aptitudes for majoring in a subject can be examined through the tenets of the theory of reasoned action, the theory of planned behavior, and the rational choice theory (Leon & Uddin, 2016; Seymour & Serumola, 2016; Zhang, 2007). These theories have been selected based on their focus of understanding decision-making through a social science lens (Meece, Parsons, Kaczala, Goff, & Futterman, 1982). The theory of planned behavior was chosen due to its multi-dimensional viewpoint (Connor & Armitage, 1998; Leon & Uddin, 2016). The theory of reasoned action is based on the theory of planned behavior (Leon & Uddin, 2016). The rational choice theory uses economics to understand choices and how decisions are made (Eriksson, 2011). The theories explain human sociological behavior and are widely recognized (Ajzen, 1991).

Theory of Reasoned Action

The theory of reasoned action, a decision theory, is most often used in statistical analysis and is a foundation of behavioral and social sciences (Weiruch, 2013). Each decision is structured in terms of options and possible consequences to choices, and an optimal decision would be one that maximizes utility (Wisner et al., 2016). According to Meece et al., (1982) major and career choice develops over a long period of time. These choices analyze behavior

and cognition both of which often plays a role in decision making (Crano & Prislin, 2008). The theory of reasoned action is used to understand models of human behavior (Weiruch, 2013).

There are different types of decision theories. Normative decision theory, such as the theory of reasoned action, explains how decisions are made in order to include things that people believe are important (Sage, 2014). In the present study, several paradigms were examined such as factors that influence the choice of major including student interest, student competence, academic experiences, and lifestyle influences. Descriptive decision theory, such as the theory of reasoned action, shows how people make decisions (Sage, 2014). Finally, empirical decision theory focuses on how decisions are made and looks at the risks associated with decisions and gains and losses from decisions, both expected and actual (Blackburn, 2016).

Decisions have varying degrees of importance to people (Sage, 2014). The theory of reasoned action focuses on the intention of a person to perform some action as this can serve as a predictor to future behavior (Ajzen & Madden, 1986). The attitude towards the behavior is stressed over a response to external variables which are things like personality and values (Fishbein, 1979). Behaviors are formed through logical thought processes that consider possible alternatives and using reasoned behavior choose the alternative that is the most logical (Fishbein & Ajzen, 1975). The theory of reasoned action was significant for this study because students had to decide to select information systems as a major. This theory assumes students will have considered alternatives and made the most logical choice in selecting their major. To use the theory of reasoned action, beliefs of students are examined (Ajzen, 1991). The survey instrument used with this study posed questions based on student beliefs which provided guidance to determine how similar or dissimilar these beliefs were across majors and within the information systems major. The selected variables that related to personal interests determines

how many alternatives students considered, how competent students believe they are, the perception of value and utility of the information systems major, and which of the major-selection elements were deemed as important for information systems students.

Theory of Planned Behavior

Building on the theory of reasoned action is the theory of planned behavior. The theory of planned behavior differs from the theory of reasoned action in that it is a decision theory that emphasizes beliefs, attitudes, socialization, and behavior (Ajzen, 1991). The primary difference is the focus on behavior, whereas the theory of reasoned action looks more at understanding the thought processes students undertake. Students have free choice in selecting the major.

Behavior is chosen using logical processes, consequences are considered, and the most desirable alternative is chosen, but the person may not be able to make choices without constraints (Ajzen & Madden, 1986). According to Ajzen (1991), the intention to perform a given behavior predicts how much effort a person will put forth. The theory examines situations where a person has behavioral control. Attitudes develop from beliefs that people hold. Ajzen and Madden (1986) suggested that behavior can be predicted based on rational intentions. Ajzen (1991) reported behavioral intentions and actual behavior can be conflicting, and the difficulty of actions and controllability also have an impact on behaviors that people will undertake. Feeling that people have control, leads people to follow through with their intentions.

Bandura (1977) reported that people perform actions based on the feeling that they can successfully execute certain behaviors, and that the behavior will lead to specific outcomes. A weakness of the theory is that it does not consider emotions which can often influence both beliefs and behaviors (Ajzen, 1991). Bandura (1977) acknowledged that people need to feel that they can control behaviors and that their behaviors will lead to desired outcomes. People's

behavior is influenced by their belief that they can control outcomes that result from decisions made. The more favorable the attitude of people, and the more control they feel they have over a situation, the more likely people are to follow through with their decision. This theory advanced the current study by looking at people's beliefs about their behaviors and the feeling that they have control over their behaviors and outcomes. It is important to understand how favorably people view or do not view the information systems major. Also, it is vital to understand if students feel they have control over their ability to perform competently within the major, enjoy the courses, and obtain a good job. The survey in this study collected data concerning student behaviors that occurred in selecting their undergraduate major. Behaviors were compared between those that had selected information systems as a major and those that selected other majors in business. The variables related to personal interest, competency, value and utility, and influences of other people and experiences were examined to determine which student behaviors were impacted by each factor.

Rational Choice Theory

Rational choice theory is a recent development in the decision theory field. It is based on economic rationale and applied to how people make decisions (Eriksson, 2011). People make decisions by ranking options in terms of utility (Eriksson, 2011). The theory has roots in the work of Adam Smith and Karl Marx who studied social interaction (Scholtz, 2015). Rationality looks at how a person uses reasonable thinking when making decisions (Weiruch, 2013). Rational choice theory implies that there is intentional goal-oriented behavior when people make decisions (Darity, 2008). Boudon (2003) reported that rational choice theory consists of individual decisions that can be understood and is caused by reasons known to the individual. It is thought that the decisions are based on understanding the consequences of actions with an

understanding of the costs and benefits of those actions (Boudon, 2003). Rational choice means that students will understand both the reason they choose a major and the effects that decision will have (Scholtz, 2015).

According to Darity (2008), in rational choice theory, people tend to look at their own outcomes in making decisions, as well as the costs of those decisions, including opportunity cost. People tend to take action that will maximize their own benefits. Although social norms and expectations are considered in making decisions, ultimately the benefits and costs of the individual will determine the decision made.

There are five premises that compose rational choice theory (Muntanyola-Saura, 2014). The first is that a person has a limited and known set of preferences. Second, choices are based on comprehensive information, and the assumption that the person making the decision is thinking rationally. Third, people gather information from a variety of sources to enable them to make a decision that will reflect utility maximization. Fourth, rational choice theory means common sense will be used in making decisions. Fifth, people will always try to maximize their utility.

However, Boudon (2003) found that people do not always make choices that will maximize their personal utility when using rational choice theory. Martinas and Reguly (2013) defined costs-versus-benefits as a person acting rationally, meaning they will always choose the action that allows personal profit maximization. Eriksson (2011) stated that decisions should consider human or social behavior and are not always based on rational thought processes. Faulty decisions can be made based on personal beliefs which might not be based on facts, and statements may be made that were not based on correct information, and sometimes people do not act in their own self-interest (Boudon, 2003). Decisions are not always weighed out on a

cost-benefit perspective (Eriksson, 2011). Decisions regarding rationality involve assumptions (Lehtinen & Kuorikoski, 2007). A reason becomes motivating only when a person understands it and focuses on it (Dietrich & List, 2011). Rational choice theory has been successful in predicting behavior involving external decisions (Ostrom, 1998). Ostrom found that people do not have strategies for every situation they face, but that they use broad rules based on experience or practices they have learned over time to try to produce a positive outcome. Understanding the strengths and weaknesses of rational choice theory provides insights into the choices that students make in selecting their major if students are considering the outcomes and benefits of their decision. According to Eriksson (2011), decisions made always consider an economic perspective of examining the costs versus the benefits and operate under the assumption that the decision may not be the most optimal choice. The assumption is made that people will follow social norms in decision-making. In this study, rational choice theory aided with understanding how economic factors influenced selection of the major as it related to personal interest, student competence, value and utility, and external influences of other people and academic experiences. While rational choice theory frequently looks at monetary factors as a reasonable person should consider financial factors, not all influences on major relate to salaries students will earn after graduation.

Major Choice Conceptual Model

According to Zhang (2007) and Leon and Uddin (2016), each theory examines three components: (a) the attitude towards the behavior, (b) subjective norms, and (c) perceived behavioral control. Each of these elements leads to an intention to make a decision and ultimately the selection of a behavior which in this case was choosing a major. In this framework, a positive attitude refers to a favorable opinion of a major. A subjective norm refers

to the opinion that a person should perform the behavior because it is expected by a group standard. A behavioral control means that a person feels that they have the ability to control the behavior that leads to success. Each factor in major choice will relate differently to the attitude of the major, the subjective norms, and the behavioral control (Ajzen & Madden, 1986; Eriksson, 2011). In some cases, only one of the elements, attitude, intention, or behavioral control, or some combination of these characteristics, will occur (Ajzen & Madden, 1986).

In this study, if a student has a positive attitude towards information systems then the major should be selected using the theory of reasoned action. If a student thinks they have behavioral control over the ability to perform highly in the major, then the major should be selected using the theory of planned behavior. If a student has strong positive subjective norms or opinions about a major, then the major should be selected using the rational choice theory. Each factor examined needs to be assessed based on the attitude, behavioral control, and subjective norms to help determine the possible behavior that a student would undertake.

The three theories tie together. The theory of reasoned action implicates behavior that is formed through a logical thought process and that decision-makers consider alternatives. People also tend to perform behaviors that others approve of (Ajzen, 1991). The theory of reasoned action was extended into the theory of planned behavior. The theory of planned behavior extends the perception of control over behaviors which relates to the ease or difficulty in performing the behavior (Ajzen, 1991). The more favorable the attitude, as discussed in the theory of reasoned action, and the more control over the behavior that a person may have, exhibited in the theory of planned behavior, the more likely someone will be to perform the behavior (Bandura, 1977). The rational choice theory expounds upon the theory of planned behavior in that optimal considerations are given priority; therefore, planned behaviors are all

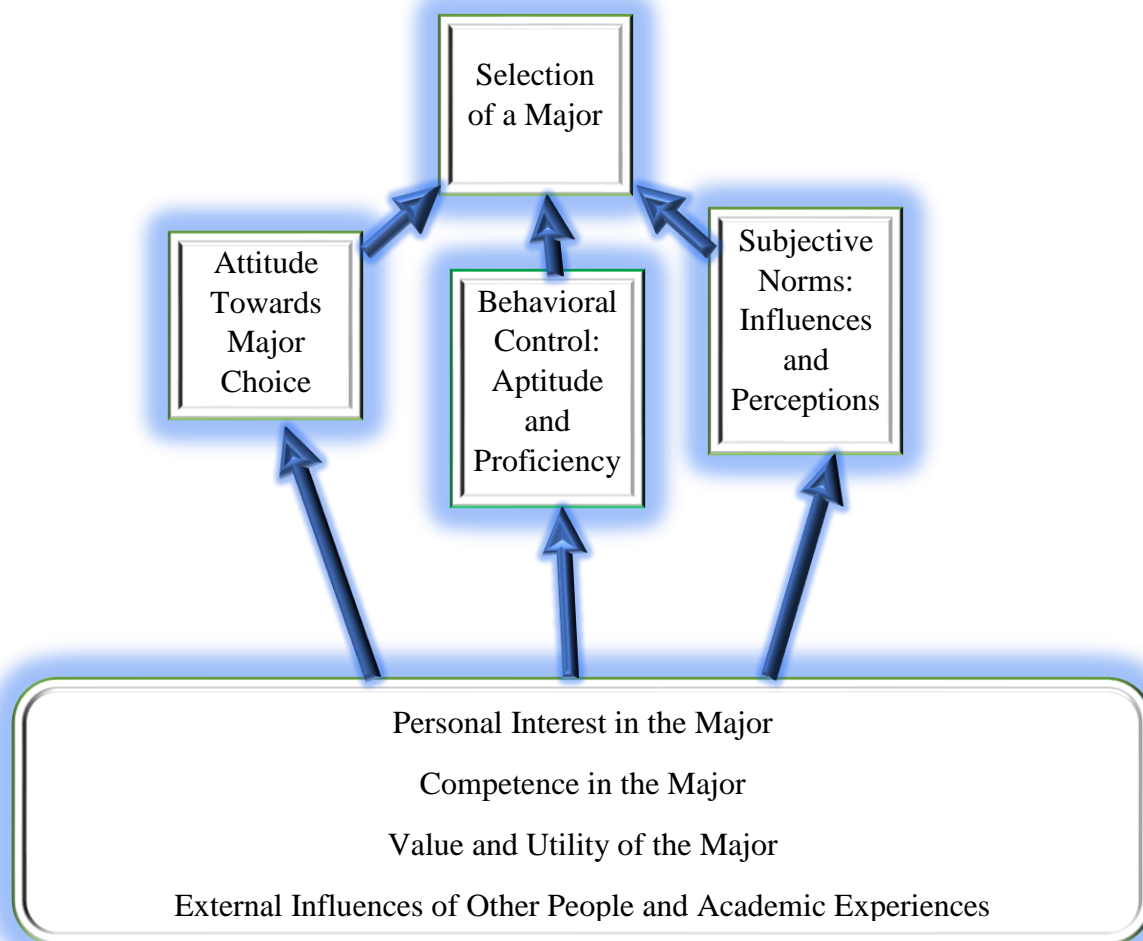


Figure 1: Interrelationship of Theories and Factors Related to Major Choice

considered, yet the behavior selected will produce the most desirable outcome. The theories are combined into Figure 1: Interrelationship of Theories and Factors Related to Major Choice. The three theories examined in this study and the model presented in Figure 1: Interrelationship of Theories and Factors Related to Major Choice were developed from the research of Leon and Uddin (2016). The attitude represents the theory of reasoned action, the behavioral control represents the theory of planned behavior, and the subjective norm represents the rational choice theory. Factors that influence major selection are considered through the lenses of the behavioral theories, and a behavior that maximizes utility should be selected. It must be recognized that

different situations can produce different outcomes (Leon & Uddin, 2016). Sometimes only attitudes will be considered, other times attitudes and behaviors will be combined to make a decision, and in other situations subjective norms will also be considered to reach an optimal conclusion (Ajzen & Madden, 1986).

Summary

Information systems departments are experiencing a low number of undergraduate students choosing to major in the field. Demand for graduates continues to grow, leading to a shortage of professionals to work in information systems. The purpose of this quantitative study was to examine student perceptions of factors affecting the decision to select information systems as an undergraduate major. The research questions posed in this study were examined through a theoretical framework including the theory of reasoned action, the theory of planned behavior, and the rational choice theory. This study evaluated the responses of students in a college of business administration in a public research university to understand why fewer undergraduate students choose information systems as their major despite high job salaries and the increasing demand for graduates.

CHAPTER II

LITERATURE REVIEW

Each year, hundreds of thousands of college students select their major. Choosing a major is one of the most important decisions a student will make in college as it will impact not only the courses a student takes, but also the career a student will follow (Porter & Umbach, 2006). While older studies exist about occupational choice (Hawkins, Bradley, & White, 1977; Phillips & Strohmer, 1983), recent literature on college major choice is less common (Mullen, 2014). According to Leon and Uddin (2016), students explore a variety of factors that influence their decision on college major. Galotti (1999) indicated that while first year students may be exposed to many factors that influence their decision in selecting a major, only a few factors are actually considered.

Scope

A thorough search of the literature was completed using GoogleScholar, ProQuest, Worldcat, EBSCOhost Academic Search Complete, ERIC – Education Resources Information Center, JSTOR, and Sage Online Journals with a focus on research studies from the information systems literature. In searching these databases, the following keywords were used: college career choice, how students choose a major, selection of a college major, selection of a business major, selection of an information systems major, and how students choose a career. To increase the number of articles found more specific search terms were used regarding major selection. Major selection and choosing a major were searched along with additional specific key words. The key words were: agriculture, political science, kinesiology, nursing, STEM, engineering, education, psychology, communication, architecture, health sciences, and social work. These additional majors were searched because they are popular majors. References were also researched from specific papers by Zhang (2007), Leon and Uddin (2016), and Miller (2018) to

further ensure that a maximum number of studies could be located. The review of literature was limited to include the years 2000-2018 with an exception made for landmark studies and for studies in areas with limited research available.

History of Information Systems as a College Major

Information systems are “an integrated set of components for collecting, storing, and processing data and for providing information, knowledge, and digital products” (Oz, 2004, p. 5). An alternative definition by O’Brien (2004) stated that information systems is “any organized combination of people, hardware, software, communication networks, and data resources that collects, transforms, and disseminates information in an organization” (p. 7). According to Oz (2004), the first evidence of an information system was in 1890 when Herman Hollerith created a machine to process the U.S. Census which led to the first computer being built in 1951. The first business computer was created in 1954 for General Electric. This computer was a mainframe, which enabled an operator to send data that were used within the company to analyze problems. Other mainframes were used in large companies. In the 1960s information systems were focused on transaction processing (O’Brien, 2004). Throughout the 1970s decision support systems provided managerial users information that allowed them to make better decisions (O’Brien, 2004). During the late 1970s the first personal computers were available for individual use. In the 1980s workers began to do their own computing, a process known as end-user computing (O’Brien, 2004). The worldwide web was created in 1991 which led to increasing computer usage through the 2000s. Email, social networks, laptops, tablets, and smartphones were common by the late 2010s (Oz, 2004).

According to Boykin (2017) information systems as a college major followed a path similar to the development of information systems as a business practice. There were five eras

that were important in management information systems education. The first era was pre-1965 when large mainframe computers were operated by technicians and companies often used time shares to be able to afford using mainframes. Some universities obtained mainframes and taught students how to process projects. The second era was 1965-1989 when microprocessors, such as the Apple I and IBM's 5150, were being used and enabled data processing at a much cheaper cost. Universities began acquiring these computers in limited numbers and information systems departments expanded. The third era, beginning in 1989 and continuing through the present, allowed the intranet to be developed and for workers to have access to data processed by each other through server networks. Education continued to expand with a focus on computer systems. The fourth era, beginning in 1995 and running to the present, enterprise software networks were developed with large systems processing enabling data to be transmitted back to personal computers. At this time, most universities had information systems departments. Cloud computing marked the fifth era and began in 2001. There was access to information away from personal computers through integrated networks. During this era knowledge workers became more in demand and productivity continued to increase. As with the third and fourth era, the fifth era is ongoing. As noted by Bryant, Black, Land, and Porra (2013) information systems today is known by many names, such as "MIS, IS, IT, Information Science, Design Science, Computer Science, AI, Software Engineering, HCI, Knowledge Management" (p. 11). Information systems departments continue to be on most college campuses, but with declining undergraduate enrollment in the major.

Gasson (2014) reported that instead of being only a technical system as they were viewed in the past, now information systems are viewed as systems of human activity that are supported by technology. According to O'Brien (2004), there is now a blending of information systems

with traditional business activities which impacts all businesses. Information systems has become so pervasive that there is no longer a distinction between a project that involves information systems and a project that undertakes all parts of business. There are three major roles of information systems in organizations today. First, information systems supports business processes by doing things like tracking inventory, recording purchases, buying new merchandise, and paying employees (O'Brien, 2004). Second, information systems facilitates decision-making by providing the data needed to make better decisions (O'Brien, 2004). Finally, information systems helps create a competitive advantage by a ground-breaking use of information technology to permit better tactical decision-making (O'Brien, 2004).

Today, problems exist in developing information systems because software design centers on an individual creating software. A group process, such as using people with expertise in functional areas, would be more useful for system design. Lack of the group process slows the design of software (Gasson, 2014). Current information systems and their design focus on distributing knowledge widely to organization members with collaboration between members being an important key to information systems working well. Blockchain technology, for example, requires that students understand a variety of programming languages (Patel, 2018). Business analysts need expertise not only in computer systems, but also need good communications skills along with problem-solving and analytical skills (Doyle, 2018).

Generation Z

Generation Z (Gen Z) is the generation born between 1995-2010 (D. Patel, 2017). In the current study many of the student participants are members of Generation Z. The oldest members of this generation will be graduating from college in 2019 and is composed of over 61 million potential future job applicants which is 20% of the future workforce (Gassam, 2018).

Generation Z students value academic success and achievement in future careers. They are interested in jobs that are guaranteed to be around for a long time into the future and in job stability (D. Patel, 2017; Stahl, 2018). They do not always think that college is the only way to learn and experience success. They are more interested in positive work environments with the branding of jobs and programs being particularly important (Stahl, 2018). Gen Z students want to engage with leaders one-on-one, and mentorships are extremely important with human interaction being viewed as vital (Gassam, 2018). In viewing information, graphics and interactive designs are particularly important (Gassam, 2018).

Gen Z students like to work on their own and not in teams because they are viewed to be competitive (D. Patel, 2017). Gen Z students can be described as multi-taskers and are technology savvy (D. Patel, 2017). They are most influenced by their peers (Lesonsky, 2018). They are purposeful in decisions made and are concerned with values (Sandehl, 2018). Career advancement and an opportunity to grow are particularly important in occupations (Half, 2018). Opportunities to advance quickly are important for future careers (Half, 2018). Competitive starting salaries are particularly vital (Half, 2018). The top thing Gen Z students look for is a fun place to work, with a flexible schedule and paid time off also considered to be very important (Morris, 2018). They seek to be friends with their managers, which is very different from what other generations have expected (Morris, 2018). It is viewed that Gen Z will be difficult to train, as they are very different from prior generations (Morris, 2018).

Timing of Selection of Major

A dimension of choosing a major is related to when the selection occurs. Some students will choose a major before coming to college and some at varying times during their college

career. While there is some literature that indicates when a major is selected, the number of studies are limited as to when students in business choose their major (Leon & Uddin, 2016).

Wang's (2013) study had a purpose of understanding the underrepresentation of minorities, women, and students of low socio-economic status in science, technology, engineering, and math (STEM) fields and why students chose STEM. The study also contained information on when STEM students selected their major. Wang (2013) used the Education Longitudinal Study (ELS) of 2002 and examined the transition of students to college. Out of the 12,500 students that took the survey, 6,300 were enrolled in college and were selected as the sample. For the study, structural equation modeling was used to analyze the data. Wang found that choosing a major during the first year in college for STEM majors allowed STEM students to stick with the major early on and become more connected and involved in the major.

Zafar (2013) examined students majoring in engineering and reported most students did not declare a major in engineering until they had completed two years of college. The purpose of the study was to examine undecided engineering students to understand factors involved in major selection with timing of the major mentioned in the findings. A survey was given to a group of 161 Northwestern University sophomores all of whom were included in the study. The sample had a demographic composition of 92 females. An econometric model was used to analyze the survey data. It was reported that students did not select a major until after the sophomore year was completed (Zafar, 2013).

In business only a few studies exist examining when students select their major. Most of these studies are in the accounting field. A study by Felton, Buhr, & Northey (1994) had a purpose to look at long term earnings and the timing of the selection of the major examined. Felton et al. (1994) surveyed 897 graduating business students from seven Ontario, Canada

universities. Accounting was the largest major with 431 of the students majoring in that discipline and 396 in a different business major. Univariate tests were used to test the data. The main finding regarding timing of the major was that if students had exposure to accounting in high school, the student was more likely to select accounting as a major in college (Felton et al., 1994).

The purpose of the Hermanson et al. (1995) study was to understand perceptions students had of accounting that influenced selection of this field of study as a major. Timing of the selection of the major was reported. A survey was administered to national honor society members at three major universities. Two universities served traditional students and the other served commuter students that were mostly nontraditional. There were 174 surveys returned from all universities out of 315 provided to students. Most respondents were seniors or graduate students and over 60% of the respondents were majoring in accounting. Descriptive statistics along with measuring the means of each question were used in analyzing the survey results. According to Hermanson et al. (1995), 25% of students decided on accounting while still in high school with 62% choosing the accounting major during their freshmen or sophomore years of college. Only 13% chose accounting in the junior or senior year. Non-accounting majors in the study reported similar findings related to timing of choice of a major (Hermanson et al., 1995).

In a multi-year survey administered in both 2000 and 2006 to 20 schools that participated in the Federated Schools of Accountancy graduate programs, Nelson, Vandrzyk, Qurin, and Kovar (2008), created a study with the intent of understanding how students select the accounting major. Surveys were provided to senior accounting majors and accounting master's degree program students. In 2000, 1,384 students responded, while in 2006 1,612 students responded. Using descriptive statistics, it was found that while 31% of students knew that they

wanted to major in accounting in high school in the second survey, this number dropped 9% from the first survey. More students were making the decision to major in accounting during college. The number of students who made the decision to major in accounting during the sophomore year increased by 4% above reported figures from the first survey with the new number at 40% in 2006 (Nelson et al., 2008).

Other studies support students selecting their major in the first two years of college. In another study with accounting students, Mauldin, Crain, and Mounce (2000) examined the accounting principles instructor's influence on students. A survey was developed and given at three universities in the Southeastern region of the U.S. to 166 students enrolled in accounting principles and intermediate accounting classes. The mean of each survey question was utilized to analyze the data. As a part of the analysis, it was found that students selected their major as a freshman or sophomore in college (Mauldin et al., 2000).

Leon and Uddin (2016) reported different findings regarding timing of selection of the major. The purpose of their study was to understand factors that influenced supply chain management majors to select their major. A survey was conducted at a large college in the Southeastern part of the United States with 1,067 (85%) students returning surveys out of 1,250 enrolled in a supply chain management course. Multinomial logistic regression was selected to analyze survey results. Accounting and management students tended to choose their major in high school, as these were the main classes that students were exposed to in secondary education, while other business majors selected their major in the first and second year of college. According to Leon and Uddin (2016), there were no supply chain management classes taught in high schools, which caused fewer students to have an interest in majoring in this subject even with a plethora of job positions available.

Factors

Factors that students consider when selecting their major can be divided into two broad categories of either intrinsic or extrinsic (Jackling & Calero, 2006). According to Ryan (1982), intrinsic motivation is important in why people make decisions. With intrinsic motivation, “people’s self-esteem is dependent on their ability to do well, causing them to feel they should do well” (Ryan, 1982, p. 9). Intrinsic factors are identified as interest, intellectual competence in an area, and personal value and utility (Savolainen, 2018; Soria & Stebleton, 2013). Interest can be described as wanting to learn about a subject and can be referred to as an appreciation for a topic (Soria & Stebleton, 2013). If intrinsic interest is present, students enjoy taking classes in the topic and feel that they could potentially seek a career in the area of study that would occupy most of their adult years. Competence in a subject area recognizes students have an ability to perform well academically (Soria & Stebleton, 2013). With competence, students earn high grades or have a feeling of mastery of a major. Value and utility relate to the job market and salary (Savolainen, 2018). Other characteristics connected to value and utility relate to choosing a major and obtaining a job are job availability, job flexibility, and salary including starting salary and long-term earnings potential (Akbulut, Looney, & Motwani, 2008; Granitz, Chen, & Kohli, 2014; Kim, Markham, & Cangeliosi, 2002; Kumar & Kumar, 2013).

Extrinsic factors are outside influences that may affect a student’s major selection decision and includes influential people and exposure to subject matter coursework (Soria & Stebleton, 2013). Leon and Uddin (2016) studied the factors that influence major choice including external factors such as the people who influenced students, the impact of exposure to subject-related coursework in high school, the impressions of college classes including introductory courses, and additional sources of information.

The literature revealed that the primary intrinsic and extrinsic influences on college major choice can be organized into four thematic factor categories. These categories include: (a) personal interest of the major, (b) competence in the major, (c) value and utility of the major, and (d) external influences of people and academic experiences (Leon & Uddin, 2016; Zhang, 2007). While these factors influence how each student selects their major, the present study focused on what factors influence information systems students to select their major.

There are many factors that influence a student's selection of major, and while studies contain some of the factors only a few studies are comprehensive and include all the factors mentioned in the literature (Leon & Uddin, 2016). Each study in the literature review organized the factors related to major selection in different ways and by different categories making it difficult to find similarities in content. The literature review of Leon and Uddin (2016) developed categories of: (a) students' choice of major, (b) timing of college major choice, and (c) career and vocational interests. The authors described each category. Students choice of major encompassed interest, salary, job characteristics, the role of parents and others, and ability of the student to perform well in the major. Timing described when students selected their college major. Career and vocational interests included interest in the major and ability to perform well in tasks related to the future position. To create clarity, the current study examined personal interest in the major, competence in the major, value and utility, and external influences of people and academic influences. These categories aid in simplicity and understanding but follow the same framework of Leon and Uddin (2016).

This section of the literature review is organized by each of the four factors. Within each of the factors there are various items that specifically relate to the enumerated factor and that differ slightly from previous studies. Few studies exist on factors influencing students to select

information systems as their undergraduate major. As a result, much of the literature reviewed examines studies involving STEM/engineering students with the primary focus on other business majors.

The present study will include sections for each of the four factors as outlined above. As previously mentioned, no single study discussed all of the factors; however, some did include more than one factor. As a result, the first time a study is presented in this current literature review a brief description of the research context will be provided. When the study is subsequently discussed some detail about the study will be provided but not the entire description.

Personal Interest in the Major

According to Matusovich, Streveler, and Miller (2010), personal interest in a major recognizes some students have an affinity for certain topics. Downey et al., (2011) described personal interest as a curiosity about the subject area studied in the major and an enjoyment of studying the subject area. According to Walsh (2001), students seek out environments that match their personal interests and feelings of belongingness in selecting a major. Interests, abilities, and personalities develop around the same time of being exposed to a major as some students who major in a subject may be more sensitive to personal interest (Kuechler, McLeod, & Simkin, 2009; Lee & Lee, 2006).

Matusovich et al., (2010) developed a study with a purpose of understanding how engineers select their major. The study was conducted at a public research university in the Western United States with a focus on engineering students and involved the use of longitudinal data. Sixteen students began the study, but only 11 provided data over the entire four-year study time frame. Qualitative case study research was used as the research method with an expectancy

theory theoretical framework. Semi-structured interviews gathered information in the spring of each of the four years that students were enrolled with the same interview questions used each year. Themes and patterns were coded, and similarities were used to analyze results within the study. The researchers found interest for students can start out low and increase to become an important factor in major choice as interest increases over the four years of college (Matusovich et al., 2010).

In a study with a purpose of understanding how business majors select their major, Malgwi, Howe, and Burnaby (2005) conducted a study with 3,800 undergraduate business students as a population at one institution. The sample size was 788 students with 184 freshmen, 283 sophomores, 225 juniors, and 182 seniors, and the study was conducted at Bentley College's business school in Massachusetts. Women made up the largest portion of the survey respondents at 60%, and 92% of the participants ranged between 18 and 24 years of age, with 16% of the students entering the college as transfer students. The study used a 5-point Likert scale where participants could rank their most recent major or the major they had when they entered college based on the level of influence of each statement. ANOVA was used to analyze the results of the survey. The majors in business were not differentiated into specific majors. Interest in the subject of business was found to be the most influential overall factor in business students' choice of major. The study was notable because it was the only one that considered the initial major and possible major changes in understanding interest (Malgwi et al., 2005).

Walstrom et al., (2008) conducted a study with the purpose of gathering information about the influences that impact how business students selected their major. The researchers gathered 303 responses from a large Midwestern university in a required introductory business course. Of the students who took the survey 44% were female and 98% were traditionally aged

college students majoring in accounting or information systems. A 6-point Likert scale was used and the data were analyzed by using descriptive statistics. The researchers found that interest was listed as the most important factor and ranked ahead of salary, job security, and job opportunities (Walstrom et al., 2008).

The business major, economics, has experienced a decline in the number of student majors in recent years. Economics is generally a small major with only approximately 3% of business majors choosing this field of study. Calkins and Welki (2006) surveyed both economics and non-economics majors with a purpose of determining what led to students majoring in economics. At a mid-size university in Ohio, 199 out of 783 students enrolled in introductory economics classes were surveyed. There was a disproportionate number of students majoring in economics who completed the survey. Possible factors that influence the choice of major were included in the survey, and descriptive statistics were used to analyze the results. A key finding was that the most important determinant of major selection for students was an interest in the subject with 93% responding that they had an interest in the subject they chose to major in. If students did not major in the subject, they did not have an interest in it. Interest was not the only thing students considered in major selection as low monetary rewards influenced participants away from economics even if students had an interest in the subject (Calkins & Welki, 2006).

In a study previously mentioned, Leon and Uddin (2016) examined how supply chain management students select their major. The researchers found early exposure in high school created interest in a subject. However, there were no supply chain management classes taught in high schools attended by the students participating in the study, which may have caused a lower number of students to have an interest in majoring in this subject (Leon & Uddin, 2016).

Lee and Lee (2006) conducted a study with the intended purpose of understanding how business students select their major. In addition, the researchers examined the strengths and weaknesses of the information systems major in comparison to identified factors found to be important by information systems students. The study looked at 246 students, out of a population of 279, at 12 universities across the United States in a quantitative study that was composed of 67% male students with a relatively even division of freshmen, sophomores, juniors, and seniors. The study found that information systems students were high in personal interest in the subject based on a participant's personal preference. Accounting students were also found to value interest in a topic. Other business majors did not indicate personal interest as being an important part of major selection (Lee & Lee, 2006).

Kuechler et al. (2009) administered a survey based on Zhang's (2007) study. The purpose was to understand how students in general select a major and why students were not selecting information systems as their major. The study was conducted at a major university in the Western part of the United States and had a population of 218 students enrolled in information systems courses. One hundred and sixty-three students comprised the sample with slightly more males than females completing the survey. The study utilized partial least squares to analyze the data collected. A finding for both males and females majoring in information systems was that interest was an important factor, but these results were moderated by attitude towards information systems meaning that if students did not have a positive attitude interest was decreased (Kuechler et al., 2009).

An additional study supported the importance of interest for information systems students. Croasdell, McLeod, and Simkin (2011) sought to determine why women do not major in information systems. This study was undertaken in a required information systems class at a

public university in the Western United States, with 392 students completing the survey out of a population of 494 students. The percentage of female students who took the survey was at 42.3% and male responses were eliminated. The average age was 23.4 years old and 86% were non-information systems majors. A questionnaire was developed with categories of factors and partial least squares was used as the method of analysis. Interest was found to be an important determinant for women in selection of information systems as the major (Croasdell et al., 2011).

With a purpose of understanding how information systems students decide on their major, Akbulet and Looney (2007) conducted a study at a large U.S. university in an introductory information systems class. Most students in the class had not selected their major. A survey was completed by all 205 students in the course, with 52.8% male and an average age of 21. Quantitative statistical analysis was conducted. Almost all students had used a computer, but most had not used computers in a course. Demonstration of computer tasks in class allowed students to feel more confident about computer work they would be assigned. The researchers concluded class demonstrations ignited interest which resulted in major selection and career choice. Course content needed to be current and contemporary to attract students to study information systems. Also, having information technology professionals visit the classroom helped with recruitment of students to major in information systems as well (Akbulet & Looney, 2007).

Some research indicated that interest may not be an important factor for information systems students as it is for other majors. Kim et al. (2002) studied how business students select their major. While the study examined multiple business majors, individual majors within business were reported in the results. This research involved students at 15 universities around the U.S. Of the 2,150 surveys that were mailed out 868 were returned with 671 being useable.

The participants were primarily juniors and seniors and were majoring in business. Descriptive statistics were used for each major with numerical percentages provided. Information systems students were more compelled to select a major based on job prospects rather than by interest in the topic. This was found to be different from all other business students, who indicated interest as the top selection factor in choosing a major (Kim et al., 2002).

In a study by Li, Zhang, and Zhang (2014), focused on the purpose of understanding how best to promote an information systems major to undergraduate students, data were collected through use of a survey in a required information systems class at a medium sized public university in the Southeastern United States. The researchers received 249 responses out of 287 students with 53.9% of the respondents identifying as female. The participants were composed primarily of sophomores and juniors, but only 4% of students were majoring in information systems. Statistical means for each survey question were calculated to analyze the survey data. Contradictory to other studies on information systems, the Li et al. (2014) study found that students with the most positive interest in information systems did not necessarily major in the subject.

Zhang (2007) conducted a study of students enrolled in an introductory information systems course at a public urban university in the Northeastern part of the United States. The purpose of the research was to get a better understanding of factors that influence students to select information systems as their major. Students took the course early in their college career and many had yet to select a major. There were 114 participants and demographically responses were composed of 70% freshmen and sophomores with an average age of 22 years old. Sixty percent of the participants were minorities that were primarily Asian and approximately 43% female. Partial least squares was used to analyze the survey data. The researcher found interest

was the most important factor in selecting a major. However, female students were less interested in information systems than males.

Downey (2011) built on the work of Zhang (2007) and conducted a study with the purpose of determining what aspects of interest are most important to information systems students. Participants were students enrolled at a mid-size Southern university in three required non-information systems courses and two information systems courses. There was a total of 452 students who were included in the study. Demographics were 60% male with an average age of 22, and the participants were primarily juniors and seniors. The findings indicated the challenging nature of the work created the most interest for students, lifestyle associated with a job was appealing if there was a good work-life balance, and working with quantitative skills was important. These findings applied to both information systems students and non-information systems students (Downey, 2011).

Student Competence in the Major

Student competence in the major indicates that a student has the aptitude to successfully complete the coursework to earn their degree. For information systems competence is often indicated by skill in technology and computer programming. Student competence also means that students feel they can perform at a high level and earn good grades in courses related to information systems (Dalci, Arash, Turner, & Baradarani, 2013; Kumar & Kumar, 2013; Lee & Lee, 2006). This section of the literature review examined three aspects of student competence in the major: (a) ability, (b) aptitude, and (c) self-efficacy and attitude.

Ability.

Ability was found to be important for students majoring in STEM subjects. Staniec (2004) conducted a study to examine how students selected their major in STEM fields with a

focus on race and gender. The researcher used data from the National Education Longitudinal Study of 1998, which allowed for a population of 9,487 of U.S. students for the study. A multinomial logit model was used to analyze the data. After examining the responses, researchers found that female students were less likely to enroll in science, engineering, math or other technologically based classes. Asian and black students were more likely to choose STEM majors over humanities majors. Students good at science and math were more likely to choose technological majors. The research indicated that ability played a larger role in major choice for males than for females. Math test quantile was found to have an impact on which students chose a technologically based major (Staniec, 2004).

In three studies previously discussed, researchers focused on the impact that a student's perceived competency level has on understanding how engineering students select their major. Matusovich et al., (2010) found that as students competency levels in engineering classes decreased, students no longer wished to major in engineering. Conversely, students who performed at high academic levels elected to stay in engineering. Wang's (2013) study to determine how students in STEM select their major found that students who did well in math and science in high school were more likely to select a STEM related major. Finally, Calkins and Welki (2006) looked at classroom performance of business students enrolled in economics classes to learn how economics students selected a major. Strong academic performance in classes was the determining factor in major selection and for continuing study of economics (Calkins & Welki, 2006).

Student perceptions of technology as they related to electing a major in technology related fields was studied by Bhatnagar and Brake (2010). A sample was taken of 152 out of 2,836 high school students who took the Pupil's Attitude Towards Technology (PATT) survey at

a Midwestern high school. These students had indicated an interest in majoring in a technology related field of study. Correlations were used to analyze the survey data. Females composed 54% of the participants and indicated they had received the message that males were better at technology, and the study suggested that males displayed more confidence in technological tasks confirming the results of Staniec's (2004) study. The researchers concluded that students desiring to major in a technology discipline, needed to have confidence they can complete all technology related tasks, as well as thinking that technology is fun (Bhatnagar & Brake, 2010).

Carter (2006) carried out a study to determine if students must be exposed to a major through coursework to know if they have the ability in computer science. Carter's research was conducted with 786 high school students in Arizona and California. The participants included 363 men and 423 women. Descriptive statistics were used to analyze the data. Findings regarding why students selected computer science to major in related to enjoyment of video games for men and for women an ability to learn skills that will enable them to perform their jobs in another field better. The researcher also found that the top reason for men and women to not choose to major in computer sciences was a desire to not sit in front of a computer every day (Carter, 2006).

Math has been addressed as a point of concern in major choice. Pritchard, Potter, & Saccucci (2004) used the New Jersey College Basic Skills Placement Test to understand if students majoring in business perceive math as a barrier to choosing a quantitatively based major. Ninety-two business majors participated in the study. Accounting and finance students were found to have strong computational and algebra skills. On the other hand, students with weaker quantitative skills tended to major in marketing, management, and information systems (Pritchard et al., 2004).

Aptitude.

Students who chose any major in business generally agree that aptitude is important. Kumar and Kumar (2013) designed a quantitative study to discover why students major in business. Participants were enrolled in multiple sections of an introductory business class at a large public university in the Midwest. Six hundred seventy out of 720 students returned usable surveys and included 510 freshmen, 127 sophomores, 28 juniors, and five seniors. Of these students, 360 had decided their major within the business college, and 310 were undecided but were planning to select a major in business. The survey was adapted from the work of Kuechler et al., (2009) and Zhang (2007). Multiple regression was used to analyze the data. The researchers found that while aptitude was particularly important for males, it was not as important for females. For students who were decided on a major, aptitude was the strongest predictor of the intention of students to major in business. For undecided students, aptitude was one of the most important factors as well (Kumar & Kumar, 2013).

In a study previously discussed regarding how business majors select their major, Malgwi et al. (2005) found that women majoring in business were more likely to be influenced by aptitude than men. This finding was contradictory to Kumar & Kumar's (2013) research findings. In addition, Malgwi et al. (2005) also examined attitude towards a subject and found students more likely to select a major if they had aptitude and ability in that particular area. In a similar study previously mentioned, Lee and Lee (2006), found that information systems and accounting students tended to rate themselves highly in aptitude. Student participants noted that information systems was perceived as the most difficult major. Kim et al. (2002) also studied how business students selected their major in a study discussed earlier. Kim et al. reported aptitude was the most important determinant in major choice for information systems students.

However, in other studies previously reviewed, researchers found that for information systems majors aptitude did not influence major choice (Croasdell et al., 2011; Downey et al., 2011; Li et al., 2014).

Self-efficacy and attitude.

A student's belief in his or her own abilities, known as self-efficacy, influences major choice (Harder, Czyzewski, & Sherwood, 2015). With the intent to test self-efficacy in business students, Harder et al. (2015) administered a survey to 247 students enrolled in business classes at a small university in the United States. The researchers achieved a response rate of 84.6%. Factor analysis was used to analyze the data. Statistically significant findings were that finance and marketing majors were innovative, and accounting majors were found to be more adaptive. Those students found to be more adaptive were more likely to choose their major earlier in their college career. Students with high self-efficacy tended to have better grades and reported being more confident in their choice of a major (Harder et al., 2015).

In a study discussed earlier in this chapter, Akbulet and Looney (2007) found that self-efficacy helped generate interest within the subject area. Other findings indicated that information systems students with perceived self-efficacy expected positive outcomes in academic activities such as choosing a major, but this did not hold true for all business students. In another study of self-efficacy in students enrolled in information systems classes, Akbulet et al. (2008), examined 400 respondents enrolled in an introductory information systems course at a large public university in the United States. The students had not yet selected their major. Partial least squares analysis was used to calculate the quantitative results of the study. It was found that computer self-efficacy was a predictor of interest in information systems confirming findings in an earlier study by Akbulet and Looney (2007). Finally, in a study previously

discussed Downey et al. (2011) found that a student's attitude towards a subject was a determining factor in the major chosen.

Certain inherent characteristics influence a student's interest and ultimately major choice. Noel, Michaels, and Levas (2003) studied 177 (N=187) undergraduate business students in two separate universities from different regions of the United States. Students were randomly selected in capstone business classes. A self-monitoring scale was used, and the data collected were analyzed using ANOVA. Information systems students had a high emotional orientation compared to other business students. These students valued human contact and did not want to work alone, and they reported being more creative and abstract thinkers. Information systems majors scored higher than other business students regarding the need for feelings of accomplishment. Information systems majors had low inhibitions, enjoyed attention, spoke openly about their feelings, and sought out intense work situations. Information systems students were the most comfortable breaking rules of all business majors. Information systems students took risks and enjoyed adventure and exciting activities. They also liked to develop a deep comprehension of one subject by itself which they studied with enthusiasm (Noel et al., 2003).

Value and Utility of the Major

The third category of literature-based factors is value and utility. Value and utility of a major includes salary, job availability, job security, job flexibility, and perceived opportunities in the profession. Most of the studies reviewed in this section focused on a single aspect of value and utility of the major; no study examined all the influences of value and utility as related to selecting information systems as a major.

Salary.

Montmarquette, Cannings, and Mahserejian, (2002) designed a study to examine the impact of salary factors on major selection. A national longitudinal study from the Bureau of Labor Statistics from 1979 was examined that included 562 students. An econometric model was created to look at the data. It was found monetary factors were more important to men than women. Success in a field with higher salaries was more important to men who majored in business and engineering than to females (Malgwi et al., 2005; Matusovich et al., 2010; Montmarquette et al., 2002). Granitz et al. (2014) conducted a study to examine why high school students chose business as a major. A survey was used to collect data from 150 out of 248 (60.5% of response rates) Los Angeles high school students. Descriptive statistics and analysis of the mean of each question were used to analyze the quantitative data. Possible monetary awards associated with a career were found to be a major determinant of why students choose a particular major. Another study focused on engineering students found similarly that monetary factors were important factors to engineering students (Matusovich et al., 2010).

Besides starting salary, students also considered long term salary and benefits. A national study was conducted by Berger (1988) to understand how predicted future earnings impacted the decision to select a college major. The National Longitudinal Survey of Young Men was used where 5,000 male students were surveyed from 1966-1978. Only students that identified a college major were selected, therefore 624 responses comprised the sample. A variety of majors were included in the database and an econometric model was used to analyze the data. Berger (1988) found the probability that an individual would choose one major over another increased as the present value of the predicted future earnings stream of that major increased.

In a previously discussed study, Hermanson et al. (1995) found that economic factors were the primary reason that students chose accounting as their major. Different characteristics were considered such as long-term economic success, short-term economic factors, skills needed for success, non-financial characteristics of work, and societal issues. While the study did not examine job salary as a specific category, it did show that economic factors were the most significant influence on accounting students (Hermanson et al., 1995). In studies previously discussed concerning economics and accounting, researchers found that long term economic and salary growth were determinants in major choice for business students (Calkins & Welki, 2006; Felton et al., 1994).

In several previously discussed studies, information systems students were examined regarding the influence of salary. For information systems, average salary was an important factor in degree major choice, although the finance major was found to have the highest starting salary (Lee & Lee, 2006). Kuechler et al. (2009) found that salary was important to males majoring in information systems, but not females. Outcome expectations, such as those related to obtaining a job with a high salary, were found to be an important predictor of interest for information systems majors (Akbulut et al., 2008; Downey et al., 2011).

Job opportunities.

Career opportunities signify possibilities for advancement and upward mobility along with the potential to help others. Agricultural STEM students and major selection were studied by Hegerfield-Baker, Anand, Droke, and Chang (2015), who used a convenience sample at South Dakota State University. The study surveyed 1,826 agriculture majors, with 458 students used as the sample. The agriculture majors had an emphasis in STEM by focusing on food science or biological science. Non-STEM students in arts and sciences were also surveyed as a

control group. Logistic regression and the odds-ratio was used to examine the results of the survey. All students who completed the survey participated in at least one extra-curricular activity. Students tended to come from rural areas. The respondents reported that career ambition, job satisfaction, and valuing financial stability were the strongest factors influencing the selection of a STEM major. The researchers concluded that jobs that had many opportunities were particularly important (Hegerfield-Baker et al., 2015).

Having job opportunities was important to students and affected the perceived value and utility of a college major. Several studies discussed earlier in the chapter examined the importance of job availability. In one study about accounting students, participants had a strong interest in fields that had availability of jobs (Lee & Lee, 2006). For business students, job security, the prospect of having a long-term and stable career, were found to be an important factor in major selection (Li et al., 2014). In a study mentioned previously, research findings indicated that career opportunities were important for business students in the process of selecting their major (Malgwi et al., 2005). Two studies previously examined provided information about the importance of image as it relates to the way people in society and the students themselves viewed the career field (Li et al., 2014). The image of the profession to others and the reputation of the degree program was found to be important to business students (Li et al., 2014). Granitz et al. (2014) found that business students seek positions that provided meaningful and challenging careers.

Long term career prospects were also an important consideration in major selection (Heinze & Hu, 2009). In a study focused on learning how information systems students selected their major, four large schools in the Southeastern United States were used to look at students who had not chosen their major yet. One thousand two hundred students were surveyed and the

researchers achieved a 31.8% response rate. Structural equation modeling was used to analyze the quantitative data. Having future career ladders to gain access to better jobs in a career was noteworthy to students in choosing a major (Heinze & Hu, 2009). For information systems students, job availability was confirmed as one of the most important factors in major choice (Downey et al., 2011), especially for women (Croasdell et al., 2011; Zhang, 2007). Kuechler et al. (2009), in a study previously discussed, found that job security did not influence information systems students in selecting their major, and personal image about the career was not an influence for males but was important for females.

External Influences of Other People and Academic Experiences

There are many external influences on major choice. External influences are those that come from outside the student's locus of control (Joelson, 2017). The most frequently discussed external influences involve influential people and school experiences.

Other People.

There are a wide array of people who may influence academic decisions made by college students. Multiple studies indicated that students' view parents, advisors, and professors as important external influences. However, some studies indicated that other people carried little sway with students.

Parental influence was shown to be important in a study by Workman (2015). The researcher conducted interviews with 12 undecided students, six of whom were freshmen and six of whom were sophomores at a small Midwestern college to understand how students selected their major. The research used a phenomenological method with a semi-structured interview approach. Data were collected, coded and themes reported. Parental influence proved to be critical to students in selecting a major (Workman, 2015). In a study previously examined about

engineering students and major selection, Matusovich et al. (2010) found that enthusiastic professors were an influence for students majoring in engineering but did not mention the influence of parents.

According to Kumar & Kumar (2013), in a study discussed in a prior section about business students, family, professors, and high-school counselors can all play an influential role. For women, family was important in decision making. For males, friends, advisors, professors, and high school counselors had stronger influences than family. Kumar and Kumar (2013) examined both decided and undecided students regarding college major selection. For students who had already decided on their college major, high school counselors and professors provided information that influenced the decision-making process. For undecided students their focus was on their family for guidance about what major to select.

Studies reviewed earlier in the chapter provided information about how people influenced business students. For students choosing business, high school students turned to family as their most extensive resource in choosing their major (Granitz et al., 2014). Female business students were influenced by college advisors and the difficulty of a major (Malgwi et al., 2005). Mentors and parents/friends were influential in the choice of major for accounting students (Hermanson et al., 1995).

According to Daly (2005), women and minorities viewed the person who influenced them very differently. The purpose of Daly's study was to examine how women and minorities selected a major. Anonymous surveys were given to 306 students majoring in business at a medium sized university in the Northeast. All the responses were used in the study. Correlation analysis was used to analyze data collected in the survey. Students majored in a subject when college advisors were involved in providing information to students. Advice from family and

friends was important as was the student's own personal experience and previous experiences with the subject material. When race and gender were considered, there were a few differences, although Daly (2005) considered them to be relatively insignificant. Women were concerned with their impression of what the major would be like, more than advice from any particular person. Minority students rated advice from a professor or advisor as important. Minorities were more concerned with advice from someone at the college than most predominantly white students (Daly, 2005).

In studies involving information systems students, there were divergent findings. Women majoring in information systems, often sought the opinions of family members on choice of major (Croasdell et al., 2011; Kuechler et al., 2009). Women also valued the opinion of professors (Kuechler et al., 2009). For males, the opinions of advisors and friends was important, but not family (Kuechler et al., 2009), although Bhatnagar and Brake (2010) found just the opposite in that parents were the most important influence. When gender was not considered, college advisors emerged as being an important influence (Croasdell et al., 2011). In findings contrary to Croasdell's study, Downey et al. (2011) found that friends and professors influenced information systems students, advisors were not mentioned. Heinze and Hu (2009) found that family and friends were not important to students choosing a major because students felt family and friends would be supportive of any decision made.

Academic experiences.

Exposure to the field of study in high school was an important element in selecting college major. Bottia, Stearns, Mickelson, Moller, and Parker (2015) in a study that examined how high school learning experiences impact students studying STEM fields, used the NC Roots of Stem dataset that contained longitudinal data from all high school students in North Carolina

and who attended North Carolina colleges and majored in STEM. The dataset included 18,000 students, after deleting responses for incomplete responses, the final sample contained 12,000 students. Multinomial regression analysis was used to analyze the data. As a result of their study, the researchers suggested there needed to be a change in how STEM courses were taught to females in high school. Increased courses that relate to STEM in high school should be added because these classes are taken more often by men than women (Bottia et al., 2015). In another study previously examined, Hegerfield-Baker et al. (2015) agreed that high school courses were a moderate influence in selection of STEM as a major; however, teachers from high school were not an influence.

In a study conducted by Phelps, Camburn, and Min (2018), researchers confirmed the importance of exposure to STEM courses in high school. Phelps et al. used the Education Longitudinal Study of 2002 and followed students from 10th grade until they achieved post-secondary jobs. The sample was composed of 2,889 students who were enrolled in college and took a pre-engineering course, 67% of the students were white and 53% were female. The data analysis technique was binary logistic regression. It was reported that only 10% of students in the database took pre-engineering courses in high school; however, in four-year institutions a higher percentage of students who took pre-engineering courses in high school enrolled in engineering courses compared to students who had not been exposed to engineering in high school (Phelps et al., 2018). In the sciences only slightly more students enrolled if they had taken advanced science courses in high school. In two-year institutions students were significantly more likely to enroll in engineering courses if they had been exposed to them in high school. Students in biology and computer science were less likely to enroll in those courses at the two-year institutions. Race, ethnicity, and sociological background did not impact the

findings of the study. The importance of students being able to take pre-engineering courses in high school was emphasized, but the authors found that less than 50% of high schools offered such courses. Although the sample had a large number of females, the researchers found that women were less likely to choose engineering as a major. Finally, confidence in math and science in high school made students more likely to pursue STEM as a major (Phelps et al., 2018).

Lee (2015) created a study for the purpose of determining whether students exposed to computer science courses in high school were more likely to select a STEM field as a major at both four-year and two-year institutions. The Education Longitudinal Study of 2002/2006 was used in the study. Students enrolled in colleges who took computer science courses in their high school years were selected for inclusion in the study with 4,680 students in four-year institutions and 1,700 in two-year institutions. Logistic regression was used to analyze the dataset. While 56.3% of female students took computer science classes in high school, only 14% enrolled in a STEM major in college as most only took one course. The more courses a student took in high school the more likely they would continue studying computer science in college (Lee, 2015).

In a study previously discussed focusing on understanding why women and minorities do not select STEM fields in college, Wang (2013) found that exposure to math and science in high school had the largest impact on white students and the least impact on minority students. High school preparation was critical in choosing a STEM major. Math and science classes were the largest predictor of student choice of a STEM field as a major, more so than math or science alone. The first year in college was critical in major choice with support of academic advisors, financial aid support, and contact with professors. Working in an area related to the major while in school helped solidify major choice (Wang, 2013).

Stiles-Clarke and MacLeod (2016) conducted a study in the physics department in Atlantic, Canada using an introductory physics class to understand how students select physics, considered a part of STEM, as a major. All 135 students were invited to participate in the study and 14 were selected. A qualitative case study methodology was used. The study involved questions about students' interpretations of the physics major and the decision-making process used, data were collected via survey with open-ended questions. Students said they enjoyed learning about physics, and suggested it was interesting in a practical everyday way. Most students had good experiences with physics in high school where someone, such as a high school teacher, encouraged them to take additional courses. Some students reported that physics was too hard and did not want to major in the subject (Stiles-Clark et al., 2016).

Several other studies previously discussed also contained findings on the importance of courses in high school regarding students selecting business as a major. Women were more likely than men to be influenced by a business-related course taught in high school (Malgwi et al., 2005). Calkins and Welki (2006) found exposure in high school was important for economics majors to help students feel more comfortable with a complex and difficult topic. Additionally, college fairs at high schools when information about various college majors was presented did not influence students to select a major (Downey et al., 2011). Conversely to other findings discussed so far, Downey et al. (2011) reported a related course in business in high school was low in influence on information systems students picking their major.

McGill, Decker, and Settle (2016) looked at extracurricular activities that students participated in during college to determine if past activities influenced the selection of a student major in computing or information systems. Participants were from three small universities in the Northeastern part of the United States with 751 out of a population of 770 students

completing a useable survey. Chi-square and independent *t*-tests were used to analyze the survey results. The researchers found that high schools that did not offer computer classes contributed to students who were less likely to pursue a career in the field (McGill et al., 2016).

In a study designed to understand how mentoring students impacts major selection in STEM fields, Ma (2011) used data from the National Educational Longitudinal Study (NELS) and the Public Use Micro Data to examine students interested in technologically based study. The NELS provided precollege data and major choice when in college based on a test given to high school students between the dates of 1988-1994. The NELS dataset included 14,681 students. Additionally, The Public Use Micro Data information from the U.S. Census long form of 1990 was examined to see if any of these students selected a major. Combining both data sets reduced the sample size to 8,743 students. Multinomial logistic regression was used to analyze the data. The researchers found males were more likely to enter technical fields than females (Ma, 2011).

Morgan, Jackson, Reeves, and Valadez (2017) looked at how students chose their major and how that major selection impacted retention of students for a wide variety of majors in a college class. The researchers taught an 8-week introductory course in ecology at a Midwestern university and asked students “what is the story of how you chose your major?” as a required assignment. They received 75 responses from mostly freshmen and sophomore students. The stories were read and coded. One theme that emerged was how students enjoyed the subject matter and had positive classroom experiences (Morgan et al., 2017). Conversely, in a study previously discussed, Hegerfield-Baker et al. (2015) found that students majoring in STEM fields felt that college classes had no impact on major choice.

Several studies previously reviewed had mentioned the role of the professor in major selection. Mauldin et al. (2000) conducted a study with the purpose of understanding the accounting principles instructor's influence on students in the first class of accounting. The instructor was rated third as an influence by accounting majors but was not in the top five for non-accounting majors. In other studies discussed earlier in this section that focused on professor influence on major selection, interesting content in business classes was found to be important as well (Granitz et al., 2014). Granitz et al. (2014) also found teaching reputation and friendliness of the faculty were important influences in attracting students to select a particular major in business (Calkins & Welki, 2006).

Downey et al. (2011) found it was important for information systems students to have professors address career respect, salary, and workload. Akbulet and Looney (2007) confirmed the importance of a positive college classroom experience with professors for information systems students. Course content needed to be current and contemporary to attract students to study information systems. Information technology professionals visiting the classroom helped with recruitment of students to major in information systems. Some students were influenced to select a major by their experiences in the college classroom (Akbulet & Looney, 2007). Innovative classroom techniques were found to increase the choice of a major for information systems students (Akbulet et al., 2008). A 2014 study by Li et al. suggested that more students are turning to the Internet to do research on possible majors.

Summary

The literature review presented an overview of the research concerning the history of information systems, Generation Z, and major selection. Choosing a college major is an activity that all college students experience. Students make these decisions in a variety of ways, but

research has shown that there are influential factors. The review of the literature revealed four factor categories which included: (a) personal interest in the major, (b) student competence in the major, (c) value and utility of the major, and (d) external influences of other people and academic experiences on major choice. Research on the timing of the selection of the major was also reviewed in the chapter.

Personal interest in the major involves affinity and curiosity about a topic. Student interest in a field of study was found to be one of the most important factors in selection of a major. According to the research interest included prior exposure to the major and college classroom demonstrations and experiences. Student competence included a strong performance in classes and ability to do work well taken within a major. Aptitude and strong performance in the major were important in determining competence. Value and utility of the major provided indications about student perceptions related to job salary, job availability, job security, job flexibility, and career opportunities. External influences of other people and academic experiences on major selection were detailed. School experiences related to other high school and college classroom experiences were explored.

CHAPTER III

METHODOLOGY

The purpose of this quantitative study was to examine student perceptions of factors affecting the decision to select information systems as an undergraduate major. In addition, information systems students were compared to other business students to see if statistically significant differences existed between the groups. The factors explored included: (a) personal interest in the major, (b) student competence in the major, (c) value and utility, and (d) external influences of other people and academic experiences in major selection (Leon & Uddin, 2016; Ryan, 1982). Students who did not select information systems as their major were also examined to determine if they understood the advantages to the information systems major and to gain a perspective on why they did not select the major as compared to those students who did. Undergraduate business students at a large public research university in the Southeastern part of the United States participated in this study. The participants were classified as juniors and seniors including both information systems and other business majors. Other business majors were composed of non-information systems students. This chapter presents the research design, research site and participants, and instrumentation. Additionally, a description of how participants were selected and how data were collected and analyzed is provided in this chapter.

The study addressed five research questions to evaluate the four factors examined in the study. The questions considered were:

1. What is the profile of a contemporary business undergraduate student majoring in information systems as compared to other undergraduate business students?
2. To what extent do undergraduate business students majoring in information systems perceive themselves to be personally interested in the major?

3. To what extent do undergraduate business students majoring in information systems perceive themselves to be competent in the subject matter?
4. To what extent do undergraduate business students majoring in information systems perceive the value and utility of their major?
5. To what extent do undergraduate business students majoring in information systems perceive themselves to be influenced externally by other people and academic experiences?

Research Design

The research design used for this quantitative study was a cross-sectional, non-experimental, and retrospective survey. Cross-sectional surveys allow beliefs and attitudes to be captured at a point in time (Creswell, 2015). A non-experimental study is used in cases where random assignment of participants is not possible, and independent variables are not manipulated (Johnson, 2001). Retrospective designs look backwards in time to understand how differences can be explained in groups (Johnson, 2001). Because the research questions were focused on the perceptions of students and how those perceptions influenced their decision to choose or not choose information systems as a major, this research design was appropriate. The variables considered in the study were grouped into four categories. The categories included: (a) personal interest of the major, (b) a student's feeling of competence in the major, (c) value and utility of the major, and (d) external influences of other people and academic experiences on major selection. This study also investigated the differences between the perceptions of information systems majors and non-information systems majors and provided demographic and characteristic information, including timing of major selection, to aid in analysis.

Research Site

The research site was the Sam M. Walton College of Business at the University of Arkansas (WCOB). The University of Arkansas is a public research university with approximately 27,100 students (University of Arkansas Institutional Research, Spring 2018). The University of Arkansas offers around 200-degree programs (University of Arkansas, Fall 2018). The WCOB has roughly 6,400 students (University of Arkansas Institutional Research, Spring 2018). The WCOB offers two undergraduate degrees, the Bachelor of Science in Business Administration and the Bachelor of Science in International Business. There are eight departments in the WCOB with 17 possible concentrations (Sam M. Walton College of Business, 2018a). When students are admitted to the University of Arkansas, they may select the WCOB as their college without additional admissions criteria. Students are required to select a major no later than their fourth or fifth semester, although they can select in the summer before their first semester or any time thereafter. All students take the same pre-business core and as they traverse through the preliminary business courses, they are exposed to the different majors offered by the college (Sam M. Walton College of Business, 2018b). The WCOB is accredited by the Association to Advance Collegiate Schools of Business (AACSB, 2019). The AACSB is the premiere business education accrediting agency in the world with 820 business schools worldwide receiving accreditation.

The information systems department in the WCOB is composed of 218 undergraduate students out of 6,348 undergraduates (1,268 are undeclared) in the WCOB. Of the 5,080 business students who have declared a major, 4.3% were information systems majors. This is one of the smallest majors in the WCOB (University of Arkansas Institutional Research, Fall 2018).

Table 1 shows the number of students enrolled in each major in the WCOB in Fall, 2018 (University of Arkansas Institutional Research, Fall 2018).

Table 1
Majors and Numbers of Students by Major in WCOB

<u>Major</u>	<u>Number of students</u>	<u>% out of 6348 total students</u>	<u>% out of 5080 declared majors</u>
Accounting	697	11	14
Economics	363	6	7
International Business	353	6	7
Finance	1081	17	21
Information Systems	218	3	4
General Business	172	3	3
Management	597	9	12
Marketing	1140	18	23
Supply Chain	459	7	9
Total declared majors	5080	80	100
Undecided	1268	20	
Total	6348	100	

Note. Information from University of Arkansas Institutional Research (Fall 2018).

Participants

This study included 200 student participants selected from several specific courses in a non-probability convenience sample. Some of the courses were core business classes that have a broad base of student enrollment each semester to gain access to non-information systems students. Some of the courses were core information systems classes to gain better access to students majoring in information systems. The business course selected was MGMT 3013

Strategic Management which provided access to 440 junior/senior students. This is the capstone course in business. All students in the course would have been exposed to all majors in the WCOB by the time they enrolled in this course and all will have selected a major.

In addition, required core information systems classes were surveyed. The information systems courses included: ISYS 3293 Systems Analysis and Design, ISYS 3393 Business Application Development Fundamentals, ISYS 4283 Business Database Systems, and ISYS 4363 Business Project Development. These courses were chosen because they were at the junior/senior level and were the courses most likely to consist of information systems majors. The classes selected were the core courses in the major although other majors do take the courses especially if they are seeking a minor in information systems. ISYS 3293 is the first course in the upper-division sequence of courses. ISYS 3393 can be taken as either a stand-alone course or a co-requisite with ISYS 3293. ISYS 4283 is a pre-requisite or a co-requisite of ISYS 3393. ISYS 4363 is a pre-requisite of ISYS 3393 and ISYS 4283. Students were instructed not to take the survey multiple times. The courses were selected to ensure there was limited course overlap and to obtain as many information systems majors as possible.

In the spring of 2019, there were 268 students enrolled in the upper level ISYS courses and 440 students enrolled in the MGMT course that were sampled. To make sure that there was no overlap in students between ISYS courses and the MGMT course, students provided their names and any duplicate names were removed from the sample. Some of the professors of the courses provided extra credit to complete the surveys, but some did not. Students offered extra credit accounted for 435 out of the 708 (61%) students who had an opportunity to take the survey.

Data were collected from 412 participants. Of these participants 103 were information systems majors and 309 were non-information systems majors (other business majors). In examining the returned surveys received from information systems majors, two were eliminated because the students were sophomores, not juniors or seniors. One student was eliminated due to an incomplete survey. These actions produced 100 useable samples from students majoring in information systems.

Next, the 309 other business majors who returned surveys were carefully examined. Of the surveys, five were removed because they were not enrolled in the Walton College, and 16 were eliminated because they were sophomores. Ninety-one returned surveys were from students seeking a minor in the department of information systems such as blockchain, business analytics, and enterprise resource systems were excluded from the sample because they could be pre-dispositioned to have a positive view of information systems. Additionally, 50 incomplete non-information systems surveys were disregarded because they were not complete. This left 140 useable surveys. There were: 12 accounting, seven economics, 29 finance, 23 management, 37 marketing, 17 supply chain management, and 15 multiple majors. To achieve a sample equal to the number collected for information systems students, a random sample was drawn from each major in the percentage of that major to all declared majors. Using the percentages of total students in each major in the WCOB, the following numbers of surveys were selected to be eliminated in order to achieve a sample of 100: two accounting, two economics, six finance, eight management, nine marketing, eight supply chain management, and five multiple majors. A random number generator at <https://www.random.org/> was used. The total number of students in the category were entered into the generator, then a random number was generated. For example, there were 12 accounting majors and numbers one to 12 were entered into the random

generator. It was determined that 10 accounting students should remain in the sample. The number seven emerged, and that survey was removed from the sample. On the next round, one thru 11 was entered into the generator, and the number nine was generated and removed from the sample. This continued through each major until the sample size of 100 was achieved. The other business students sample was comprised of students majoring in the following subjects: 10 accounting, five economics, 23 finance, 15 management, 28 marketing, nine supply chain management, and 10 multiple majors.

According to Alreck and Settle (1985) and their examination of return variation of responses, 100 participants is an adequate size to achieve valid data analysis. A major goal in the design of this study was to obtain a sample of 100 participants within both groups. As reported by Vittinghoff and McCulloch (2007), a general rule of thumb is to have 10 responses per question. However, after they conducted a large simulation study, it was found that the rule of 10 events per predictor outcome can be relaxed without results being affected. It was determined to select to the same number of participants for each group because unequal variances can affect the homogeneity of variance assumption (Keppel, 1993) and increase Type I errors (Rusticus & Lovato, 2014). Equal sized groups maximize statistical power (Rusticus & Lovato, 2014).

Instrumentation

The survey instrument used in this study was developed by combining items from two surveys (Leon & Uddin, 2016; Zhang, 2007) utilized in prior studies plus adding several new literature-based questions. Zhang (2007) created a survey that analyzed attitudes towards information systems as a major by using a 7-point Likert scale with agree/disagree statements. Zhang's research looked specifically at information systems majors, and his survey was administered to freshmen students. Zhang's survey included questions asking students to

respond to job factors, interest in computers, and academic competence related to information systems. As Zhang's questions were incorporated into the survey instrument developed for this study, the items were changed to a 5-point Likert scale to provide greater ease in understanding student responses. In Zhang's (2007) survey, composite reliability was used to measure the quality of the survey. Zhang utilized the theory of planned behavior and the theory of reasoned action as a conceptual framework the same as the current study. Permission to use Zhang's survey was granted on October 21, 2018.

Leon and Uddin (2016) used Zhang's (2007) survey with some modifications as their study contained questions tailored to the supply chain management discipline. Leon and Uddin's survey gathered demographic data, and contained questions related to influences on major selection such as who influenced students, job information from students and parents, and job-related influences like salary and work life balance all related to supply chain management. Leon and Uddin (2016) utilized the theory of planned behavior, the theory of reasoned action, and the rational choice theory as a conceptual framework the same as the current study, and their theoretical conceptual model was adapted for this study. Permission was granted to use Leon and Uddin's survey on May 7, 2018.

Survey Design

The survey instrument developed for the present study consisted of a consent form (see Appendix A) and seven parts containing questions (see Appendix B). Part 1 collected demographic data including multiple choice questions related to gender, age, ethnicity, international status, first generation status, what year of college a student was classified as, timing of selection of the major, major, and minor. This part consisted of 10 multiple choice

questions. The demographic section was the same as Leon and Uddin's (2016) survey. A first-generation student question was added that was not used by Leon and Uddin.

Part 2 of the current study data collection instrument contained questions directed at student interest about the information systems major. There were 11 questions, and a 5-point Likert scale was used (1=strongly agree, 2=agree, 3=neither agree nor disagree, 4=disagree, 5=strongly disagree). Question 11 came from Leon and Uddin's (2016) survey and related to a student's interest in math in high school. Question 12-13 were from Zhang's (2007) questionnaire and were intended to determine if students liked computers. Questions 14-15 were new questions developed in conjunction with the content specialists after the pilot study was completed. The questions covered how students felt about coding and programming and how the field of information systems was designed to help businesses solve problems in a variety of industries. Questions 16-18 originated from Zhang's (2007) survey and focused on enjoyment of math, creativity, and computer systems. Question 19 was a new item developed based on input from the content specialists after the pilot study. It examined student perceptions in understanding that the information systems major was more than coding and programming. Questions 20-21 were designed to determine students' interest in the emerging technologies of data analytics and blockchain.

Part 3 of the present questionnaire involved questions related to students' perceptions of their academic competence in the major. There were four questions. The questions used a 5-point Likert scale (1=strongly agree, 2=agree, 3=neither agree nor disagree, 4=disagree, 5=strongly disagree). This section posed queries concerning students' feelings about the difficulty of courses and if students felt they had the aptitude to complete the information systems major. The questions were adapted from Zhang's (2007) survey.

Part 4 contained questions about the perceived value and utility of the major. There were six questions. The questions used a 5-point Likert scale (1=strongly agree, 2=agree, 3=neither agree nor disagree, 4=disagree, 5=strongly disagree). The questions looked at careers, job opportunities, job security, and salaries. Zhang's (2007) survey served as the basis for the items.

Part 5 of the current survey instrument was about external influences of other people and academic experiences on major selection and contained 12 questions. The first question was multiple choice and allowed students to select the person who had been the largest influence on their major choice. This question was developed from Leon and Uddin's (2016) survey. Several additional choice options were added based on the literature review. The new options were college advisor, college professor, high school teacher, and high school guidance counselor. Religious figure and coach were removed from the choices as they were not represented in the literature. The next six questions used a 5-point Likert scale (1=very influential, 2=influential, 3=neither influential or not influential, 4=not influential, 5=definitely not influential), and addressed other factors influencing students in selecting a major such as high school classes, prior work experience, college courses, and Internet research. These questions were developed from the literature review. The last five questions were adapted from Zhang's (2007) survey and used a 5-point Likert scale (1=strongly agree, 2=agree, 3=neither agree nor disagree, 4=disagree, 5=strongly disagree). The questions looked at respect and human contact as they related to the information systems major.

Part 6 sought student input about selection of their major. There were three questions in this section, modified from Leon and Uddin's (2016) survey. Leon and Uddin's questions dealt with supply chain management. The questions were revised to relate to information systems and

to elicit reasons as to why a student selected or did not choose information systems as their undergraduate major.

Part 7 collected student information for possible extra credit purposes and was provided to course instructors. It asked for name, email address, course, and class time. Results were downloaded to an excel spreadsheet and separated from the rest of the data after sorting. The names were sorted according to instructor and course section and provided to the instructor. The names and other identifying information were discarded prior to the analysis of the data.

Validity

Two faculty in the WCOB served as information systems content experts and reviewed the data collection instrument to help establish validity. One faculty member was a professor and endowed chair in the information systems department. The professor has published numerous scholarly papers, was active in professional organizations, and was a member of the University of Arkansas Teaching Academy. The other faculty member was a clinical assistant professor, assistant department chair, and was the curriculum specialist in the department. This professor was active in numerous professional organizations and was a member of the University of Arkansas Teaching Academy. After reviewing the survey instrument, each agreed that the questionnaire was facially valid. Face validity is the ability of the instrument to measure what it was designed to measure (Anastasi, 1988; Lynn, 1986). Content validity was also examined. Content validity is where experts identify the validity of the questions (Lynn, 1986). There were changes to two questions. Instead of using generic wording to describe functions of information systems, specific language was used to explain the information systems major, including coding and programming, was incorporated. Also, a question was added to the questionnaire that asked

for responses concerning the purpose of information systems and inquiring into a student's understanding about how information systems aids other jobs in completing tasks.

Pilot Test and Reliability

A pilot test was conducted November 28, 2018 through December 5, 2018 with students from a course that was taught by the researcher, SCMT 3443 Transportation and Distribution Management. Students were asked to provide feedback on the survey with 37 out of 42 students completing the questionnaire and were awarded 2% (10 points) extra credit in the course. Students were asked to answer the questionnaire and provide feedback. Of the students who took the survey, 100% said that the survey contained clearly worded questions and the survey contained questions that aided in the understanding of major selection. Three participants provided suggestions regarding wording about two questions. A question about being a "computer geek" was re-worded to attempt to not sound derogatory, and a question labeling information systems students as "nerds" was removed. At the time of the pilot study, there were several questions that only used agree/disagree. Participant feedback on confusion about how these questions were asked led to the development of a consistent a 5-point Likert scale system throughout the survey.

Zhang's (2007) study provided reliability information. The composite reliability was greater than .85, with .70 considered acceptable (Peterson & Kim, 2013). Composite reliability is a measure of reliability that uses factor loadings and provides a slightly higher alpha as compared to Chronbach's alpha due to calculation differences, although both are considered acceptable in determining reliability of an instrument (Peterson & Kim, 2013). Chronbach's alpha is a measure to assess the internal consistency, or reliability, of test items (Goforth, 2015) and was used in Leon and Uddin's (2016) study. Leon and Uddin's study was also proven to be

reliable with Cronbach's alpha of .73 which was classified as a good reliability measure (Tovakol & Dennic, 2011). In the present study, reliability was calculated from the pilot test. Due to the pilot test survey containing continuous variables with dichotomous results, Kuder-Richardson 20 was used to show reliability (Goforth, 2015). Kuder-Richardson 20 for the pilot test was 0.77551. Anything above .70 is an acceptable alpha range; therefore, the survey results were reliable (Tovakol & Dennic, 2011). As there were changes made to the survey used in the present study, Chronbach's alpha was calculated on the sample data for this study. The survey used a 5-point Likert-scale with continuous responses which made Chronbach's alpha the most appropriate method to calculate reliability (Tovakol & Dennic, 2011). Chronbach's alpha was calculated at 0.787115 with anything above .70 considered acceptable (Tovakol & Dennic, 2011).

Data Collection

After the instrument was approved by the University of Arkansas Institutional Review Board (Appendix C), it was entered into Qualtrics survey software which enabled students to use either their computer or their mobile device to complete the survey for MGMT 3013. Before beginning the survey, students had to give their consent to participate (Appendix A). In the information systems classes 98 students received the Qualtrics link due to professor preference, and the other 170 students received a paper copy of the questionnaire which was given in class (Appendix B). For those that received the survey in class, it was administered by the researcher to ensure higher participation due to the small number of information systems majors. The survey was available to online students for a two-week period of April 9-23, 2019 and during this time period was administered in ISYS face-to-face classes between April 10-17. Instructors using the online survey were provided an initial email written by the dean of the WCOB with a

link to the survey (Appendix D). Instructors emailed the letter and link to their students. In face-to-face classes the letter from the dean was placed on an overhead projector and was read out loud (Appendix D). There were two reminders from the researcher for online classes. The first reminder was sent on April 16 (Appendix E), and the last reminder was sent April 22 (Appendix F) by the instructor of the class.

Variables

Student Major Variable

Categorical and dichotomous variables were used in the data analysis. Categorical variables, also known as nominal variables, have two or more categories but there is no intrinsic ordering to the categories (Camm et al., 2015; UCLA Institute for Digital Research & Education, 2019). Additionally, because the dependent variable was limited to two mutually exclusive groups, information systems students and other business (non-information systems) students, it was categorical (Ary, Jacobs, Sorensen, & Walker, 2014). Dichotomous variables are a type of nominal variable which have only two categories (Ary et al., 2014; Lewis-Beck, Bryman, & Liao, 2019). Student participants, studying in the WCOB who had selected a major, were the dependent variable for the present study. In statistical analysis, this variable was assigned a numerical value where 1=information systems major and 0=other business major. As there were two categories only and these categories were presented without order, the student major variable was classified as categorical and dichotomous.

Demographic Variables

Characteristics of those who participated in the survey including major, minor, when the major was selected, classification, gender, age, race/ethnicity, international student status, and first-generation status were examined to compare demographic differences of information

systems students to other business majors. When a participant selected one or more categories that described their characteristics, the variable was classified as nominal and categorical (Creswell, 2015).

Factor Variables

The variables for this study included the four factor variables: (a) personal interest in the major, (b) student competence in the subject matter, (c) value and utility of the major, and (d) external influences of other people and academic experiences. For the topic of interest, each question used a five-point Likert response scale. There were 11 total questions. The responses were assigned numerical values: 1=strongly agree, 2=agree, 3=neither agree nor disagree, 4=disagree, and 5=strongly disagree. Competence also used a five-point Likert scale response with the following numerical values: 1=strongly agree, 2=agree, 3=neither agree nor disagree, 4=disagree, and 5=strongly disagree. There were four questions related to competence. Value and utility contained 6 questions and the same five-point Likert scale was used. The external influences section contained 12 total questions. The questions encompassed different styles and measurements. One question inquired about who helped in making the decision about the college major and used descriptive statistics to provide a frequency distribution. Six questions utilized a five-point Likert scale with: 1=very influential, 2=influential, 3=neutral, 4=not influential, and 5=definitely not influential. Five questions employed a five-point Likert scale with 1=strongly agree, 2=agree, 3=neither agree nor disagree, 4=disagree, and 5=strongly disagree.

When analyzing participant responses with Likert scale questions because equal distance between each selection is assumed, the variables were continuous, interval variables (Creswell, 2015). First, mean scores must be calculated. Mean scores, the sum of the scores divided by the

number of scores was used to measure each question that was a Likert scale response (Creswell, 2015).

Three other questions were addressed about selection of the major. The questions were: (a) why are you not currently majoring in information systems, (b) if you are not considering a job or career in information systems, why, and (c) what do you think would have helped persuade you or did persuade you to choose an information systems career. Descriptive statistics were used to analyze these responses with frequencies provided. These variables were nominal as they provide categorical data (Creswell, 2015).

Data Analysis

The survey data were analyzed using the statistical software SAS Enterprise Guide 7.1 developed in 2014 and commonly known as SAS EG. According to the SAS webpage, the program conducts statistical analysis and reporting using descriptive and inferential statistics in an intuitive interface. SAS EG, developed by the SAS Company, is used by academics in an educational setting for the purpose of research analysis and in businesses to support data analytics (SAS, 2018).

Descriptive and inferential statistics were used to evaluate the data from this study. Descriptive statistics were used to summarize the demographic variables. Descriptive statistics were also compiled for the external influences section of the questionnaire. Also, descriptive statistics were tabulated in the external influences section for three questions focused on perceptions that non-information systems students had about the information systems major. Frequencies and percentages were provided for each of these items to help inform in the comparison of information systems majors and non-information systems majors. Descriptive

statistics were used to address the first research question about the profile of an information systems student.

Research questions 2, 3, 4, and 5 were answered with inferential statistics. Inferential statistics enable the use of sample statistics. The sample can then be applied back to the population (Creswell, 2015). Inferential statistics allow researchers to generalize with restricted evidence, although they do not necessarily provide proof (Ary et al., 2014). An independent *t*-test is appropriate when a researcher makes an assessment with one independent variable and one dependent variable for the purposes of group evaluation (Creswell, 2015). This study examined the mean score of each Likert scale question under the categories of personal interest in the major, student competence in the subject, value and utility of the major, and external influences of other people and academic experiences. Because each of these items was a continuous variable, an independent *t*-test was the best method to examine if the means of the groups were statistically different (Creswell, 2015). Independent samples *t*-tests were appropriate because each of the items examined was a continuous variable, and the independent *t*-test determined if the means of the two groups were statistically different (Creswell, 2015). According to Glass and Hopkins (1996) independent samples *t*-tests are appropriate for samples that are not paired or related in any form. Likert scales were used in the survey completed by participants. Likert scales allow ordinal data to be collected which means that the difference between the options is not always measurable even though they appear to be when survey questions are answered by participants (Norman, 2010; Sullivan & Artino, 2013).

With interval data, the differences between responses can be measured. Interval data can be used with independent *t*-tests as they provide largely unbiased results that are considered accurate when using Likert scales. Likert items are generally grouped into a survey scale with a

range of strongly agree to strongly disagree, then means are calculated and compared for each scale question (Norman, 2010; Sullivan & Artino, 2013). This approach is particularly useful when measuring items or concepts related to perceptions or feelings (Norman, 2010; Sullivan & Artino, 2013). Chronbach's alpha can provide enough documentation that items are correlated to a degree that allows for independent *t*-tests to be used to examine Likert scale responses (Norman, 2010; Sullivan & Artino, 2013).

For the present study, the Chronbach's alpha was determined to be of a sufficient level to allow the use of independent *t*-tests. Brown (2011) stated that the classification of Likert scale data as ordinal or interval is irrelevant and should simply be considered as interval. To report Likert scale responses, Brown (2011) suggested that the frequency of responses should be reported as well as the mean and standard deviation. Brown (2011) found Likert scale items to be more reliable as they represent multiple items for analysis versus one response.

The statistical significance of each independent variable was determined by comparing an alpha level of .05 against the *p* statistic. The sample size of the current study was relatively small and *t*-tests are often used in small samples when the variances of two normal distributions are not known and there is an unknown standard deviation in the population (Camm et al., 2015). Other methods considered were multinomial logistic regression and ANOVA. Multinomial logistic regression was not selected due to overfitting. With overfitting, sampling bias can give overconfidence to a sample, such as when there are too many parameters in relation to the number of observations (Ranganathan, Pramesh, & Aggarwal, 2017). For this study, with a small number of responses and a large number of queries in the survey, overfitting made logistic regression not the most useful model. ANOVA, the one-way analysis of variance, was not appropriate as it requires three or more independent groups (Camm et al., 2015).

In conducting *t*-tests, two assumptions must be examined, the assumption of normality of the dependent variable and homogeneity of variances. For normality it must be determined that the dependent variable is normally distributed in each group (Lund Research, 2018). To test normality, skewness and kurtosis can be calculated for each variable. Skewness is a measure of symmetry and measures the size of the two tails of normal distribution (McNeese, 2016). Kurtosis is the measure of the weight of both tails in comparison to the rest of the distribution (McNeese, 2016). To be considered a normal distribution skew should be $<|2.0|$ and kurtosis should be $<|9.0|$ (Schmider, Ziegler, Danay, Beyer, & Buhns, 2010). Skew for the current study ranged from -.12 to 1.55 placing it in an acceptable range. Kurtosis for this study ranged from -.99 to 2.85. In the current study, the distribution for information systems students and non-information systems students were sufficiently normal for the purposes of conducting a *t*-test.

T-tests assume the variances of the two groups being tested are equal in the population (Lund Research, 2018). To test for the homogeneity of variances, Levene's Test for Equality of Variances is used (Lund Research, 2018). As the *t*-test is run in SAS EG, the *F*-statistic (Folded *F*) and a significance value (*p*-value) are generated. If the *p*-value is greater than 0.05, the group variances are equal (Glass & Hopkins, 1996). In this case the pooled method was used to report the degrees of freedom. If the *p*-value is less than 0.05 there are unequal variances, meaning that the homogeneity of variances has been violated (Glass & Hopkins, 1996) and the group variances in the population are unequal (Lund Research, 2018). To correct this violation, the degrees of freedom should be adjusted by using the Welch-Satterthwaite method (Lund Research, 2018). The degrees of freedom are an estimate of the number of independent pieces of information that entered into calculating the means used in the *t*-tests (Geert van den Berg,

2018). In the current research, these rules allowed the assumption of homogeneity of variances to be met and the variances of the two groups being tested were considered to be equal.

Threats to Validity

Threats to external and internal validity must be examined when using surveys.

According to Creswell (2015), external validity reduces the generalizability of the findings to the population. With survey research, the following factors can impact the external validity: selection bias, constructs, and order effects (Creswell, 2015). Selection bias indicates that the sample population may not represent the entire population due to using a convenience sample instead of a random sample. Other researchers may not be able to replicate the sample due to not being able to obtain the same exact sample. Although the survey was developed to provide clear detail for each question, with constructs there may still be confusion over the interpretation of a question by students. Since the questions have high reliability, it seemed likely that students would understand what the questions were purported to be asking. With order effects, the order that the survey questions were presented could cause students to respond in different ways if the survey was replicated. The order of the questions in this study followed in a logical sequence with questions grouped together to aid students in the ability to understand and focus on the topics to better be able to answer the questions (Creswell, 2015).

Threats to internal validity impact the ability to show that there is a relationship between independent and dependent variables (Creswell, 2015). The internal validity threats that could impacted this study were: history, maturation, selection, experimental mortality, and instrumentation. With history, an unanticipated event could occur while the survey was deployed. History was a threat for this study because the survey was only available for one time period, enabling only one group to be exposed to it. It was not possible to test against additional

different groups. While only one group was tested, approximately 50% of the students majoring in information systems participated in the study, which decreased the history threat. Maturation occurs when there are changes in the dependent variable due to the function of time. Again, this was potentially a problem for this study because only one group was used versus comparing two groups who took the survey at different times. The maturation threat was overcome as the students had access to the survey for a period of the same two weeks. The inclusive dates of the administration of the survey were close together, helping mitigate the maturation threat.

Selection could be an issue as different age categories were asked the questions. The groups selected to participate were possibly not equivalent as the participants were not selected randomly but instead were chosen by using a convenience sample. Although a convenience sample was used, it should be noted that the study was offered to different business majors to increase the breadth of student exposure. With experimental mortality some respondents drop out from the study. This could be a concern with a survey such as the one used in this study where respondents become tired of taking the survey and leave it before finishing. The survey was limited to a time span of 10 to 12 minutes to prevent many students from withdrawing, and students were offered extra credit in some classes. With instrumentation, the way a dependent variable is measured can change. This is particularly a threat in a one group study such as this one. Using dependable statistical standards, such as independent *t*-tests, helped keep the independent variables consistent in the analysis (Creswell, 2015).

Summary

This chapter described the research methodology for this study, including the research design, site, participants, data collection, instrument, variables, and data analysis techniques. The participants consisted of business students in the Sam M. Walton College of Business at the

University of Arkansas in Spring 2019. Descriptive statistics were used to provide information on the demographics of the study. Inferential statistics, including *t*-tests, were used to evaluate the perception of responsiveness of students to dependent variables. This analysis helped to determine which factors influenced information systems students. Threats to external and internal validity were examined and found to be surmountable although a convenience sample was used.

CHAPTER IV

RESULTS

The purpose of this quantitative study was to examine student perceptions of factors affecting the decision to select information systems as an undergraduate major. The University of Arkansas, Sam M. Walton College of Business (WCOB) was the research site for this study. A survey was used to solicit responses from juniors and seniors majoring in information systems and compared to a similar sized sample of other business majors to determine if differences existed between the two groups.

This chapter provides an analysis of the data which were collected from the study participants through the administration of a survey. Demographic information related to the participants is also presented. Next, several other related characteristics of the students is presented along with the results from the independent samples *t*-tests analysis. Finally, the chapter concludes with a chapter summary.

Overview of the Study

This inquiry focused on student perceptions of specific factors influencing why they selected or did not select information systems as their undergraduate major. A quantitative survey was used with a convenience sample of students who were juniors and seniors in the WCOB. The survey was administered in two ways, online and face-to-face. The online survey was sent to students who answered the questions between April 9, 2019 and April 23, 2019. The same survey was administered in person in pre-selected information systems classes beginning on April 10, 2019 through April 17, 2019. Data were collected from 412 participants. The sample participants included students who majored in information systems and in other business majors in the WCOB. Information systems students composed 103 members of the sample. Of

these, two students were eliminated because they were sophomores instead of juniors or seniors, and one student was eliminated due to an incomplete survey. There were 100 useable responses from students majoring in information systems. After removing the information systems students there were 309 questionnaires completed by students in other business majors. Of these surveys, five were discarded since they were not enrolled in the Walton College, and 16 sophomores were eliminated since they did not meet the criteria for inclusion in the study. Ninety-one students were discarded from the non-information systems student sample because they were minoring in information systems or in a minor included in departmental offerings such as blockchain, business analytics, and enterprise resource systems. Additionally, there were 50 student surveys that were incomplete and removed from the sample. This left 140 non-information systems majors. To achieve a sample equal to the number collected for information systems students, a random sample was taken from each major in the ratio of the majors of students in the WCOB. The other business students sample was composed of 100 students majoring in the following subjects: 10 accounting, five economics, 23 finance, 15 management, 28 marketing, nine supply chain management, and 10 multiple majors. Descriptive statistics were used to summarize the demographic variables and addressed the first research question about a profile of an information systems student. A *t*-test for independent samples and inferential statistics were used to address the remaining four research questions and observe differences between information systems students and other business students. Statistical Analysis System Enterprise Guide 7.1 (SAS EG) was used to analyze the results.

Demographic Description of Participants

Five student demographic variables were examined to provide a description of the participants included in the study. Table 2 presents the frequencies and percentages for

Table 2
Demographic Variables

Variables	Total N=200	IS n=100	Non-IS n=100
Frequencies (%)			
Gender			
Males	119 (59.5)	70 (70)	49 (49)
Females	79 (39.5)	28 (28)	51 (51)
Other Gender Identity	2 (1)	2 (2)	0 (0)
Age			
35 or older	4 (2)	0 (0)	4 (4)
30 – 34	2 (1)	1 (1)	1 (1)
25 – 29	6 (3)	5 (5)	1 (1)
22 – 24	75 (37.5)	33 (33)	42 (42)
20 – 21	112 (56)	60 (60)	52 (52)
18 – 19	6 (3)	1 (1)	5 (5)
Race			
African-American	9 (4.5)	7 (7)	2 (2)
Asian	13 (6.5)	12 (12)	1 (1)
Caucasian	151 (75.5)	66 (66)	85 (85)
Hispanic/Latino	17 (8.5)	12 (12)	5 (5)
Multiple Races	7 (3.5)	2 (2)	5 (5)
Other	3 (1.5)	1 (1)	2 (2)
International Status			
International	11 (5.5)	10 (10)	1 (1)
Non-International	189 (94.5)	90 (90)	99 (99)
First-Generation Status			
First-Generation	42 (21)	25 (25)	17 (17)
Non-First-Generation	158 (79)	75 (75)	83 (83)

each of the demographic characteristics for all participants, as well as for information systems students and other business majors. The first demographic variable examined was gender.

Males made up 59.5% of all students included in the study, followed by females (39.5%), and other gender identity (1%). However, when the two groups of students were compared, information systems students were 70% male and 28% female, while other business majors were evenly distributed between males and females (49% and 51% respectively).

The next demographic variable was age. As illustrated in Table 2, most of the students in the study were classified as traditional college students. The most common ages of all participants were 20-24 with 93.5% falling within this category. Ninety-three percent of information systems were between the ages of 20-24, while similarly, 94% of other business major students fell in this same age grouping.

Third, race/ethnicity was explored. Overall, 75.5% of all participants were Caucasian. The largest minority group for all students was Hispanic Latino (8.5%) followed by Asian (6.5%). Caucasian students made up the majority of both information systems majors and other business majors samples. However, information systems majors were only 66% Caucasian when compared to other business majors students who were found to be 85% Caucasian. With information systems students, both Asian students and Hispanic/Latino students were the two largest racial minorities, each at 12% for a combined total of 24%. In comparison, the two largest minorities for other business majors were both Hispanic/Latino students (5%) and multiple races (5%).

Only 5.5% of all participants surveyed in this study were international students. Of the information systems majors, 10% were international students. In comparison, only 1% of the other business students were international.

Lastly, first-generation status of students was investigated. Overall, 21% of all students reported being first-generation college students. Similarly, 25% of information systems students

were classified as first-generation, while 17% of other business majors were first-generation college students.

Other Related Characteristics of Participants

The survey posed three questions related to other participant characteristics as illustrated in Table 3. These questions focused on the following characteristics: (a) declared minor, (b) classification in the college, and (c) point-in-time of college major selection. There are 10 possible minors that students can select in the Sam M. Walton College of Business including: (a) accounting, (b) blockchain, (c) data analysis, (d) economics, (e) enterprise resource planning (ERP), (f) finance, (g) management, (h) marketing, (i) supply chain management, and (j) retail. To earn a minor, students must generally complete an additional 15 hours of designated coursework in the discipline (University of Arkansas Catalog of Studies, 2019). Based on student responses, 65% of information systems majors were pursuing a minor. In comparison, 55% of other business students were working on completing a minor. Supply chain management had the largest percentage of minors (25.5% of all students, 28% of information systems students, and 23% of other business majors). Other business students who selected a minor in one of the three concentrations areas in information systems (blockchain, data analysis, or ERP) were not selected to participate in the study.

This study only included students classified as juniors and seniors. In total, 54% of all students were seniors and 46% of students were juniors. The information systems students were composed of 41% seniors and 59% juniors, while other business students were 67% seniors and 33% juniors.

Table 3
Other Related Characteristics of Participants

Variables	Total N=200	IS n=100	Non-IS n=100
Frequencies (%)			
Minor			
Accounting	2 (1)	0 (0)	2 (2)
Blockchain	1 (.05)	1 (1)	0 (0)
Data Analysis	8 (4)	8 (8)	0 (0)
Economics	12 (6)	6 (6)	6 (6)
ERP	1 (.05)	1 (1)	0 (0)
Finance	8 (4)	4 (4)	4 (4)
Management	10 (5)	4 (4)	6 (6)
Marketing	17 (8.5)	8 (8)	9 (9)
Supply Chain	51 (25.5)	28 (28)	23 (23)
Retail	2 (1)	1 (1)	1 (1)
Undecided	4 (2)	3 (3)	1 (1)
Multiple minors	4 (2)	1 (1)	3 (3)
None	80 (40)	35 (35)	45 (45)
Classification in College			
Senior	108 (54)	41 (41)	67 (67)
Junior	92 (46)	59 (59)	33 (33)
Selection of College Major			
Elementary school	1 (.05)	1 (1)	0 (0)
Middle school	3 (1.5)	1 (1)	2 (2)
High school	33 (16.5)	16 (16)	17 (17)
Before college	35 (17.5)	14 (14)	21 (21)
Freshman year	40 (20)	21 (21)	19 (19)
Sophomore year	60 (30)	34 (34)	26 (26)
Junior year	25 (12.5)	11 (11)	14 (14)
Senior year	3 (1.5)	2 (2)	1 (1)

Students made decisions about what their college major would be at different intervals in their life. Categories that students could select from included: (a) elementary school, (b) middle

school, (c) high school, (d) the summer between high school and college, (e) the freshman year, (f) the sophomore year, (g) the junior year, and (h) the senior year of college. The most frequent point in time when all students (50%) selected a major was during their freshman and sophomore year of college. Both groups of students had similar findings (55% for the information systems major and 45% for other business majors). Of all students, only 16.5% indicated they selected their major in high school. Although the freshman and sophomore years in college were shown to be the point-in-time that students generally select their major, the summer between high school and college was also an important time period for non-information systems students (21% compared to 14% for information systems).

Profile of an Information Systems Student

Research question 1 asked, “What is the profile of a contemporary business undergraduate student majoring in information systems as compared to other undergraduate business students?” From the results displayed in Tables 2 and 3, student profiles were constructed. Seventy percent of the students majoring in information systems were male compared to only 49% for other business majors. Over 90% of both groups were 20-24 years of age (93% v. 94%), and Caucasian (66% v. 85% respectively). Almost all of both groups of students were domestic or non-international (90% v. 99%), non-first generation (75% v. 99%), and selected their major in the freshman and sophomore years in college (55% v. 45%). Most of the students, both information systems and other business majors, were seeking a minor degree in business (65% v. 55%).

Based on the descriptive statistics as shown in Tables 2 and 3, several key differences were observed between the two groups in the study. Men composed 70% of students in information systems, whereas less than half (49%) of the non-information majors were men. In

information systems 34% of the students were non-Caucasian while only 15% other business majors were some race other than Caucasian. Finally, it should be noted, that more first-generation college students selected information systems as their major when compared to other business majors (25% v. 1% respectively).

Results from the Independent Samples *t*-tests Analyses

Independent samples *t*-tests were used to analyze the differences in perceptions between information systems students and other business majors on factors that may influence the choice of information systems as a major. Based on the literature review and review of two similar studies (Leon & Uddin, 2016; Zhang, 2007), four factors of influence on major choice were developed. These factor categories included: (a) personal interest in the major, (b) student competence in the major, (c) value and utility in the major, and (d) external influences of other people and academic experiences on major selection.

Personal Interest Related Variables

Research question 2 posed the question, “To what extent do undergraduate business students majoring in information systems perceive themselves to be personally interested in the major?” Independent samples *t*-tests were conducted to examine the differences between information systems students (labeled IS) and other business (non-information systems) students (labeled non-IS). There were 11 questions concerning interest related to the study of information systems with 1=strongly agree and 5=strongly disagree. Ten of the 11 questions revealed that there was a significant difference between responses of information systems students and other business majors regarding having interest in the subject matter as shown in Table 4. Responses by information systems majors and other business majors to two questions related to high school

Table 4
Results from Independent Samples t-Tests - Interest (N=200)

Variable	IS $\frac{n=100}{M (SD)}$	Non-IS $\frac{n=100}{M (SD)}$	<i>t</i>	<i>df</i>	<i>p</i>
Good at high school math	1.61 (.83)	2.03 (1.20)	2.94	178.44	.004*
Good at high school computing	1.92 (.87)	2.41 (.94)	3.81	198	.001*
Likes computers	1.45 (.61)	2.14 (.74)	7.21	198	.001*
Thinks IS is coding and programming	2.80 (.96)	2.50 (.88)	-2.30	198	.023*
Recognizes opportunities in IS	1.80 (.75)	2.57 (.99)	6.16	184.07	.001*
IS is math intensive	3.38 (.93)	2.60 (.98)	-5.79	198	.001*
IS involves creativity	1.96 (.78)	2.31 (.99)	2.78	187.32	.006*
IS involves working with computing systems	1.63 (.63)	1.69 (.72)	0.63	198	.532
IS jobs aren't only coding and programming	1.70 (.80)	2.36 (.85)	5.67	198	.001*
Interest in blockchain and cybersecurity	2.21 (1.03)	3.32 (1.18)	7.09	198	.001*
Interest in data analytics	1.78 (.91)	2.90 (1.24)	7.31	181.57	.001*

*Note: *p < .05*

academics were found to produce significantly different results. The first question focused on being good in math in high school, $t(178.44) = 2.94$; $p < .05$. The mean scores indicated that

information systems students ($M=1.61$, $SD=.83$) did better in high school math classes than other business students ($M=2.03$, $SD=1.20$). Doing well in high school computing classes also generated significantly different results when comparing information systems students to other business students $t(198) = 3.81$; $p < .05$. The results further showed, based on mean values, that information systems students ($M=1.92$, $SD=.87$) were better in computer classes than non-information systems students ($M=2.41$, $SD=.94$).

Interest in information systems was further analyzed by examining whether students liked computers, whether students thought that information systems was only about coding and programming, and whether students recognized the variety of opportunities available to graduates (see Table 4). The results of the independent samples t -tests revealed that information systems students were more likely to like computers ($M=1.45$, $SD=.61$) than non-information systems students ($M=2.14$, $SD=.74$) and the responses of the two groups was significantly different $t(198) = 7.21$; $p < .05$. As further illustrated in Table 4, information systems students ($M=2.80$, $SD=.96$) were more likely to understand that information systems was more than just coding and programming as compared to non-information systems students ($M=2.50$, $SD=.88$). This question produced significantly different results $t(198) = -2.30$; $p < .05$. Finally, information systems students, more so than other business majors ($M=1.80$, $SD=.75$; $M=2.57$, $SD=.99$ respectively), understood the wide variety of career opportunities available to information systems graduates. The response of the two groups were significantly different $t(184.07) = 6.16$; $p < .05$.

There were other significant difference results concerning interest related variables regarding the intensity of math in information systems classes $t(198) = -5.79$; $p < .05$ and that information systems involves student creativity $t(187.32) = 2.78$; $p < .05$. Information systems

students were more likely to recognize that information systems were not ($M=3.38, SD=.93$) math intensive when compared to non-information systems students ($M=2.60, SD=.98$). As shown in Table 4, calculation of mean values demonstrated that information systems students ($M=1.96, SD=.78$) were more likely to recognize that information systems involved creativity than non-information systems students ($M=2.31, SD=.99$) $t(198) = -5.79; p < .05$.

Three final questions related to interest in information systems were found to be statistically different. The data analysis found that information systems students were more likely to recognize that jobs in the field involved more than just coding and programming ($M=1.70, SD=.80$) when compared to non-information systems students ($M=2.36, SD=.85$) $t(198) = 5.67; p < .05$. As noted, in Table 4, information systems students ($M=2.21, SD=1.03$) were more likely to be interested in blockchain and cybersecurity than non-information systems students ($M=3.32, SD=1.18$) $t(198)=7.09; p < .05$. Finally, the study established that information systems students ($M=1.78, SD=.91$) had greater interest in data analytics than did non-information systems students ($M=2.90, SD=1.24$) $t(181.57)=7.31; p < .05$.

Competence Related Variables

Research question 3 asked “To what extent do undergraduate business students majoring in information systems perceive themselves to be competent in the subject matter?” Four questions focused on students’ feelings of competence with the study of information systems. Each of these items used a Likert scale with 1=strongly agree and 5=strongly disagree. Three of the four questions revealed that there was a significant difference between responses of information systems students (labeled IS) and other business majors (labeled non-IS) (see Table 5). With regard to working well with computers the analysis indicated that there was a significant difference between the two groups $t(167.15) = 6.81; p < .05$. Based on mean values,

information systems students ($M=1.52$, $SD=.54$) worked better with computers than other business students ($M=2.21$, $SD=.86$). Feelings of performing at a high level in information systems classes also showed a significant difference between information systems students and other business students $t(198) = 6.80$; $p < .05$. In Table 5, a comparison of mean scores demonstrated that information systems students ($M=1.73$, $SD=.76$) believed they performed at a

Table 5
Results from Independent Samples *t*-Tests - Competence ($N=200$)

Variable	IS $\frac{n=100}{M (SD)}$	Non-IS $\frac{n=100}{M (SD)}$	<i>t</i>	<i>df</i>	<i>p</i>
Works well with computers	1.52 (.54)	2.21 (.86)	6.81	167.15	.001*
Performed at a high level in IS class(es)	1.73 (.76)	2.54 (.91)	6.80	198	.001*
IS classes are challenging	2.17 (.94)	2.19 (.88)	0.15	198	.877
IS classes are difficult	3.11 (.99)	2.59 (.98)	-3.73	198	.001*

Note: * $p < .05$

higher level in information systems classes compared to other business students ($M=2.54$, $SD=.91$) $t(198) = 6.80$; $p < .05$. Finally, a significant difference existed between information systems students and other business majors regarding whether information systems classes were difficult $t(198) = -3.73$; $p < .05$. As shown in Table 5, information systems students ($M=3.11$, $SD=.99$) did not find information systems classes as difficult as other business students did ($M=2.59$, $SD=.98$). Information systems students worked well with computers, performed at a high level in information systems classes, and found information systems classes easier. There

were no significant differences between information systems students and other business students concerning the challenge of information systems classes.

Value and Utility Related Variables

Research question 4 asked the participants “To what extent do undergraduate business students majoring in information systems perceive the value and utility of their major?” There were six questions related to the value and utility of earning a degree in information systems with 1=strongly agree and 5=strongly disagree. Five of the six variables were found to be statistically significant (see Table 6). Information systems students ($M=1.60$, $SD=.84$) were more likely than other business majors ($M=2.32$, $SD=1.10$) to agree that classes in information systems have demonstrated that there are careers in the field between information systems students and other business students in the feeling information systems careers exist, $t(185.26) = 5.20$; $p < .05$. Information systems majors and ($M=1.36$, $SD=.72$) and other business students ($M=1.98$, $SD=.80$) both indicated a belief that if you major in information systems a job would be available in the field upon graduation. However, as Table 6 illustrates, the responses were significantly different $t(198) = 5.75$; $p < .05$. Based on mean values, both information systems majors ($M=1.26$, $SD=.50$) and other business students ($M=1.65$, $SD=.72$), indicated a perception that long-term careers were available in the field of information systems; however, their responses were significantly different $t(177.95) = 4.45$; $p < .05$. Additionally, there was a significant difference $t(187.01) = 3.45$; $p < .05$ in responses between information systems majors and other business majors regarding the likelihood that information systems jobs may disappear in the future. Information systems students ($M=1.41$, $SD=.77$) were more certain about the existence of future information systems jobs than other business majors ($M=1.84$, $SD=.98$). Finally, information systems students ($M=1.61$, $SD=.71$) were more likely to agree that starting salaries

are more satisfying than non-information systems students ($M=2.11$, $SD=.83$). As shown in Table 6, the responses of the two groups were significantly different at $t(198) = 4.59$; $p < .05$.

Table 6
Results from Independent Samples t-Tests – Value and Utility (N=200)

Variable	IS $\frac{n=100}{M (SD)}$	Non-IS $\frac{n=100}{M (SD)}$	t	df	p
Classes have shown there are careers in IS	1.60 (.84)	2.32 (1.10)	5.20	185.26	.001*
Jobs available in IS	1.36 (.72)	1.98 (.80)	5.75	198	.001*
Long-term careers in IS available	1.26 (.50)	1.65 (.72)	4.45	177.95	.001*
Jobs in IS are not likely to disappear	1.41 (.77)	1.84 (.98)	3.45	187.01	.001*
Starting salaries are satisfying	1.61 (.71)	2.11 (.83)	4.59	198	.001*
Flexible schedule is important	1.60 (.68)	1.76 (.88)	1.44	186.58	.152

*Note: * $p < .05$*

External Influences Variables

Research question 5 asked “To what extent do undergraduate business students majoring in information systems perceive themselves to be influenced externally by other people and academic experiences?” External influences was a broad category. For the purposes of this study, external influences generally related to the people and academic experiences that influenced students in making their major selection. The first group of questions in this category examined external influences regardless of the major selected. There were six questions in this grouping (1=very influential; 5=not influential).

Only two of the six items revealed a difference that was statistically significant.

Information systems students reported that they were more likely influenced by the Internet than other business students in their choice of major ($M=1.93$, $SD=.84$) and ($M=2.32$, $SD=1.04$) respectively, $t(169.72) = 2.91$; $p < .05$. Both information systems students and other business students indicated they were influenced in major choice by a professor in the first class they took in the major subject area ($M=2.24$, $SD=1.10$) and ($M=2.56$, $SD=1.18$) correspondingly. There was a statistically significant difference in this variable between the two groups $t(198) = -1.98$; $p < .05$. Four other external influences including classroom demonstrations, exposure in college

Table 7

Results from Independent Samples t-Tests – Major Explorations (N=200)

Variable	IS $n=100$ $M (SD)$	Non-IS $n=100$ $M (SD)$	t	df	p
Exposure in HS	3.28 (1.26)	3.06 (1.19)	-1.27	198	.206
Prior work in field	3.19 (1.26)	2.97 (1.34)	-1.19	198	.234
College classroom demonstrations	2.64 (1.10)	2.70 (1.08)	.39	198	.697
Internet Research	1.93 (.84)	2.32 (1.04)	2.91	169.72	.004*
Exposure in college classes to real world elements	2.10 (1.03)	2.03 (1.10)	-.49	198	.628
A professor in the first class of my major	2.56 (1.18)	2.24 (1.10)	-1.98	198	.049*

*Note: * $p < .05$*

classes to real world elements of the major, prior work in the field, and exposure in high school were not found to be statistically significant in their differences.

Students were asked to consider their perceptions of a career in information systems as in influence in their major selection. There were five questions in this category with 1=strongly

Table 8

Results from Independent Samples t-Tests – Participant Perceptions of IS Careers (N=200)

Variable	IS n=100 M (SD)	Non-IS n=100 M (SD)	t	df	p
IS is a respectable career	1.48 (.59)	1.89 (.74)	4.33	189.47	.001*
IS professionals treated with respect	1.94 (.74)	2.18 (.76)	2.27	198	.024*
IS involves human contact	1.85 (.72)	2.83 (.99)	8.05	180.76	.001*
IS students are computer geeks	2.93 (1.12)	3.12 (.99)	1.27	198	.207
IS requires significant study time	2.12 (.86)	2.21 (.91)	0.72	198	.473

*Note: *p < .05*

agree and 5=strongly disagree. Three of five variables were found to be statistically significant (see Table 8). With regard to information systems being a respected career, the analysis revealed that there was a statistically significant difference in the responses of information systems majors and other business majors $t(189.47) = 6.18; p < .05$. In examining mean values, it was noted that information systems students perceived the career was more respected ($M=1.48, SD=.59$) than non-information systems students ($M=1.89, SD=.74$), although both groups generally agreed that information systems career was a respected career field. Additionally, both groups agreed that information systems professionals are treated with respect, although there was a statistically significant difference in responses $t(198) = 2.27; p < .05$. In Table 8, the analysis demonstrated

information systems students ($M=1.94$, $SD=.74$) believed that there was more respect for their profession than other business students perceived ($M=2.18$, $SD=.76$). Lastly, information systems students ($M=1.85$, $SD=.72$) were more likely than other business students ($M=2.83$, $SD=.99$) to agree that a career in information systems involved human contact $t(180.76) = 8.05$; $p < .05$.

As Table 9 illustrates, study participants were asked “who was the primary person that assisted the student in selecting their college major.” Students could choose from among 11

Table 9
Primary Person Who Assisted Participants in Choosing their College Major

Variables	Total $N=200$	IS $n=100$	Non-IS $n=100$
Frequencies (%)			
Person Who Assisted Most			
College Advisor	17 (8.5)	12 (12)	5(5)
College Professor	12 (6)	6 (6)	6 (6)
Father	39 (19.5)	12 (12)	27 (27)
Mother	22 (11)	10 (10)	12 (12)
Other relative	14 (7)	7(7)	7(7)
Spouse	2(1)	1(1)	1(1)
Friend	13(6.5)	9 (9)	4(4)
Mentor	8 (4)	5 (5)	3 (3)
H.S. Counselor	0(0)	0(0)	0(0)
H.S. Teacher	6(3)	4(4)	2(2)
No Influence	67 (33.5)	34(34)	33(33)

options and could select only one option. This question was asked of all students regardless of their major. The most common response for both information systems students (34%) and non-information systems students (33%) was no one. Not surprisingly, parents provided the most assistance to their student in choosing a major (22% for information systems students and 39% for non-information systems students). Only 18% of information systems students and 11% of other business students sought assistance from college personnel (advisors and faculty). College advisors were the fourth largest influence at 8.5%. College advisors had a larger influence on information systems students (12%) than for non-information systems students (5%).

Section VI of the questionnaire consisted of three questions concerning the selection of students' major. Two questions were posed only to other business majors (non-information systems students). The first question was why other business students were not currently majoring in information systems (see Table 10). Multiple options could be selected as demonstrated by the 203 responses from the sample of 100 non-information systems students. The most common response selected by 33.9% of students was that they were interested in another subject. The second highest response chosen by 16.2% of students was they did not know much about the information systems major. The third ranked reason reported by 12.8% of other business students was they did not like information systems. Finally, 11.3% of non-information systems majors indicated they wanted to work with people, not computers.

The second question inquired into reasons students were not considering a job or career in information systems. Again, students could select as many responses as they felt appropriate. Out of the 100 non-information systems students who took the survey, there were 154 responses. As shown in Table 11, almost one-third of the students (32.5%) indicated two reasons they were not considering a career in information systems. First, students acknowledged they were not

Table 10
Reasons Other Business Students Do Not Major in IS

Variable	Non-IS N=203	
	Frequencies	%
Interested in Another Subject	69	33.9
Did Not Know Much About IS	33	16.2
Did Not Like IS	26	12.8
Want to Work with People	23	11.3
Did not Know the Advantages of IS	19	9.4
Not Good with Computers	14	7
Classes were Hard	12	6
IS Not Helpful in a Career	7	3.4

interested in information systems or computers and second, it was noted that students did not want to code computer programs. In addition, 30.5% other business majors chose the response that they did not feel capable of performing well in information systems.

Table 11
Reasons Other Business Students Do Not Select a Career in IS

Variable	Non-IS N=154	
	Frequencies	%
Not Interested in IS	50	32.5
Do Not Want to Do Computer Coding	50	32.5
Could Not Perform Well in IS	47	30.5
Not Enough Money in IS	3	1.9
Career Outlook is Not Positive	2	1.3
Low Probability of Getting a Job	2	1.3

The final question in this section was asked of all students participating in the study and inquired what would have helped persuade students to select information systems as a career. Participants were allowed to select multiple answers (Table 12). The item mentioned most often by both groups of students was the awareness of jobs. Information systems students indicated the most persuasive reasons for selecting a career in the field was jobs (22%), job opportunities (21%), and job security (21%). On the other hand, non-information systems students mentioned a more interesting first class in information systems (24%), awareness of jobs (21%), and inclusion of real-world elements into the introductory class (18%).

Table 12
Persuasive Elements in IS Major Selection

Variables	Total <i>N</i> =476	IS <i>n</i> =225	Non-IS <i>n</i> =251
Frequencies (%)			
Real world elements			
In Intro class	87 (18)	41(18)	46(18)
Information session	18 (4)	7 (3)	11 (4)
Awareness of job	102 (22)	49 (22)	53 (21)
Job Opportunities	87 (18)	46 (21)	41 (17)
Job Security	83 (17)	48(21)	35 (14)
More Interesting			
First Class	89(19)	29 (13)	60 (24)
Other	10 (2)	5(2)	5 (2)

Summary

This chapter presented an analysis of the data that examined and compared both information systems majors and other business majors. Data were analyzed by descriptive statistics and by independent samples *t*-tests. Five research questions were posed by the study

and provided a framework for the presentation and analysis of the data: (a) the profile of an information systems student, (b) the impact of personal interest in information systems on major selection, (c) how student competence influences selection of information systems as a major, (d) the perception of the value and utility of the information systems major, and (e) how external influences of other people and academic experiences affect students in regards to major selection.

The demographic profile of both information systems majors and other business majors were similar with a couple of exceptions. Both groups of students were primarily male, aged between 20-24, and were majority Caucasian. Most were non-first generation and non-international students. Additionally, most students selected their major in their freshmen and sophomore years.

In regard to personal interest in the major, the principal themes were that students enjoyed math and computers both in high school and in college. Additionally, information systems students recognized that information systems was more than coding and programming and involved creativity in problem-solving. Information systems students were more likely to recognize opportunities in the career and to have an interest in blockchain, cybersecurity, and data analytics.

Major themes related to competence in information systems were that information systems students worked well with computers and performed at high levels in information systems classes in high school and in college, even while recognizing that the courses had a level of difficulty. Additionally, information systems students recognized that there were careers available in information systems and believed there were long-term future

opportunities in the career. Starting salaries in information systems were regarded as being satisfying.

External influences on major selection involved several surprising findings. Results of the analysis indicated that both groups of students used Internet research to locate information and made the decision about their major without assistance from anyone. Students also reported that having a high-quality professor in the first-class of the major was important. The participant perceptions of information systems careers by both groups of students was that information systems was viewed as a respectable career that involved human contact. When other business students did not select information systems as a major or career they were most frequently interested in another subject. Suggestions to improve the likelihood of selecting information systems as a major included more information being provided about what a job in information systems entails and a more interesting first class in the major.

CHAPTER V

DISCUSSION

This study was designed to examine student perceptions of factors affecting their decision to select information systems as an undergraduate major. In addition, information systems students and other business students, composed of juniors and seniors, were compared to see if statistically significant differences existed between the two groups. The study's participants provided demographic data and shared their views on four overarching factors identified in the literature as impacting the selection of a major: (a) personal interest, (b) student competence, (c) value and utility, and (d) external influences of other people and academic experiences. The participants that took part in this research included 200 total students with 100 of the students majoring in information systems and 100 in other business majors from a single campus located in the Southeastern part of the United States. Learning why college students in business choose or do not choose information systems as their undergraduate major was the objective of this study.

Quantitative research methods were utilized to collect data through the use of a questionnaire. The survey instrument was developed based on two similar studies (Leon & Uddin, 2016; Zhang, 2007) and included other literature-based items not found in the key studies. The data were analyzed, and the research questions were answered with descriptive statistics and independent samples *t*-tests. This chapter presents the research findings, discussion and conclusions, and limitations. The final two sections of the chapter include implications for future research and recommendations for practice.

Research Findings

The findings of this study were organized according to the study's five research questions. A summary of the findings that emerged during the data analysis phase are presented in this section.

Research Question 1: What is the profile of a contemporary business undergraduate student majoring in information systems compared to other undergraduate business students?

This question was analyzed by descriptive statistics (frequency responses and percentages). Based on the results of the study, profiles were developed for both groups of students. The typical information systems major was found to be male (70%), 20-24 years of age (93%), Caucasian (66%), domestic or non-international (90%), non-first generation (75%), pursuing a minor in another field in business (65%), and selected the major in their freshman or sophomore year in college (55%). In comparison, 51% of non-information systems students (other business majors) were female, 94% were between the ages of 20-24, 85% Caucasian, 99% domestic or international students, 83% non-first generation, 55% pursuing a minor degree in another field in business, and 45% selected their major in their freshman or sophomore year as an undergraduate.

Research Question 2: To what extent do undergraduate business students majoring in information systems perceive themselves to be personally interested in the major?

Independent samples *t*-tests were used to analyze the differences of responses between information systems majors and non-information systems majors. Statistically significant differences were found in 10 of the 11 items related to interest. In each of the following items, information systems students' level of agreement ranged between agree and strongly agree. The

level of agreement for non-information systems students generally fell between agree and neither agree nor disagree. These items included: (a) good at high school math, (b) good at high school computing, (c) likes computers, (d) recognized that majoring in information systems produces opportunities, (e) involves creativity, and (f) an interest in data analytics.

In addition, mean values were used to rank order the importance of each item of influence under the factor “Interest” for information systems students. Those students most likely to have an interest in majoring in information systems: (a) like computers ($M=1.45$, $SD=.61$), (b) were good in math in high school ($M=1.61$, $SD=.83$), (c) recognize that information systems is not only coding and programming ($M=1.70$, $SD=.80$), (d) have interest in data analytics ($M=1.78$, $SD=.91$), (e) recognize career opportunities are afforded by majoring in information systems ($M=1.80$, $SD=.75$), (f) were good with computers in high school ($M=1.92$, $SD=.87$), (g) recognize that information systems involves creativity ($M=1.96$, $SD=.78$), and (h) have interest in blockchain and cybersecurity ($M=2.21$, $SD=1.03$).

Research Question 3: To what extent do undergraduate business students majoring in information systems perceive themselves to be competent in the subject matter?

The study’s third research question focused attention on how competent students felt with the subject matter related to their academic performance in information systems coursework. Independent samples *t*-test analysis produced statistically significant results in three of the four items related to competence. In each of the following items, information systems students’ level of agreement ranged between agree and strongly agree. The level of agreement for non-information systems students generally fell between agree and neither agree nor disagree on a Likert scale. These items included: works well with computers ($M=1.52$, $SD=.54$) and performed at a high level in information systems classes ($M=1.73$, $SD=.76$). Also, information

systems majors did not believe that information systems classes were difficult, while non-information systems students felt that the coursework in information systems was more difficult.

Research Question 4: To what extent do undergraduate business students majoring in information systems perceive the value and utility of their major?

The fourth research question examined the value and utility of earning a degree in information systems. The items under this factor focus on jobs, careers, and salary. Analysis of this factor by independent samples *t*-tests produced statistically significant different responses between information systems majors and other business majors on four out of five items. Overall, information systems students perceived greater value in the degree than did non-information systems students.

Importance of each item was established by examining the mean values of information systems students. This group of students reported that they agreed or strongly agreed with each of the following: (a) long-term careers exist in the field ($M=1.26, SD=.50$), (b) jobs are available ($M=1.36, SD=.72$), (c) jobs are not likely to disappear ($M=1.41, SD=.77$), (d) information systems classes have shown there are attractive careers in the field ($M=1.60, SD=.84$), and (e) the information systems field offers good salaries ($M=1.61, SD=.71$).

Research Question 5: To what extent do undergraduate business students majoring in information systems perceive themselves to be influenced by other people and academic experiences?

The final research question posed in the study focused principally on how academic experiences and people influenced students' decision to pick a college major. Three different survey questions were used to address research question five. The first group of items were related to which factors most affected students when selecting their college major. Independent

t-tests revealed statistically significant differences between the responses of information systems students and other business majors on two of the six items examined. Interestingly, information systems students reported that Internet research was very influential, whereas other business majors indicated the Internet was not as influential in their selection of a major. There was also a significant difference as indicated by independent *t*-tests between the two groups of students on the influence of the professor in the students' first class in the major. The professor served as a greater influence on non-information systems students.

Through use of mean values, the importance of each item that affected the student to select their major was determined. For information systems students, the most influential items were as follows: (a) Internet research ($M=1.93$, $SD=.84$). (b) exposure in classes to real world elements of information systems ($M=2.10$, $SD=1.03$), and (c) a professor in the first class in the major ($M=2.56$, $SD=1.18$).

To help answer research question 5, one of the survey questions asked all study participants who was the primary person that assisted the student in selecting their major. This question was analyzed by descriptive statistics (frequencies and percentages). For information systems students, the primary responses included: (a) No-one/no influence (34%), father (12%), college advisor (12%), mother (10%), and friend (9%).

Discussion of the Findings and Conclusions

This section contains a discussion of the findings, and presentation of conclusions drawn from an analysis of the data that addressed the five research questions posed in this study as well as the theoretical framework in the major choice conceptual model. In this discussion the findings from the current study are compared and contrasted against previous studies reported in

the literature review. Conclusions regarding student choice of information systems as an undergraduate major are presented.

Research Question 1

There is limited research on students majoring in information systems and few of the studies report detailed demographic data. In this present study although all the students were similar in many respects, some important demographic and characteristic differences existed between information systems majors and non-information systems majors. Some of the key differences involved gender, race, and first-generation status. Perhaps the most pronounced difference was in gender. In this study, only 28% of the students majoring in information systems were female; however, in non-information systems 51% of the students were female. This finding is generally consistent with the literature where previous studies have found more men majoring in information systems than women (Croasdell et al., 2011; Kuechler et al., 2009; Zhang, 2007). In the key studies involving information systems students reported in the literature, Zhang (2007) found that females made up 43% of the participants. Downey et al. (2011) discovered that women comprised 38% of their sample, and Croasdell et al. (2011) reported in their study, which focused on why women do not major in information systems, that only 42% of the participants were women.

It can be concluded that there are clearly gender differences with regard to students that pursue an undergraduate degree in information systems. As noted by Croasdell et al. (2011), “only two in every ten employees in the information technology work force are women, and current academic enrollments suggest that this is unlikely to change any time soon.” It is imperative that information systems departments and professionals understand what women look

for in a major and tailor their recruitment strategies and advising efforts to meet those needs. As previous research suggests, the needs of women and men may vary.

With few exceptions, previous research paints an incomplete picture on racial diversity within information systems degree programs. In this study, greater racial diversity was found among information systems students, where 34% were non-Caucasian and 24% identified as Hispanic/Latino or Asian compared to other business majors. Only 15% of the non-information majors in the present study were non-Caucasian, with the largest minority groups being Hispanic/Latino (5%) and multiple races (5%). In his study on information systems majors, Zhang (2007) found that 60% of his sample was comprised of minority students, with the largest group being Asian. Somewhat related to diversity the present study showed that, 25% of the information systems majors were first-generation college students compared to only 1% of other business majors. Future research should explore what attracts first-generation college students to study information systems. By studying this sub-population information systems professionals may find new ways to generate interest and successfully recruit first-generation college students.

With regard to timing (when students select their major), 55% of information systems students and 45% of other business majors students in the current study selected their major during their freshman or sophomore year in college. This affords information systems faculty and advisors the opportunity to educate students about information systems and the benefits associated with pursuing a degree in the field. The literature produced some data about when information systems students typically select their major. Prior research found that if students are exposed to a subject area in high school, they are more likely to select that major in college (Leon & Uddin, 2016). Other studies varied slightly as to when information systems students select their major. Wang (2013) reported that the largest number of students select a major in the

first year of college. However, two other studies suggested that students select their major during the second year of college (Nelson et al., 2008; Zafar, 2013).

Research Question 2

A student's interest in a field of study is perhaps the most important of the four factors examined in this study. Findings from previous research generally confirm this conclusion (Croasdell et al., 2011; Lee & Lee, 2006; Malgwi et al., 2005; Walstrom et al., 2008; Zhang, 2007). In fact, in the current study, non-information students were asked why they did not choose information systems and over 33% responded they were not interested in information systems in spite of the availability of jobs, positive career outlook, and competitive salaries. Contrary to the majority position of most researchers, Kim et al. (2002) cautioned that while personal interest is important, it is not the most important factor considered by students in selecting information systems as their major. These same researchers concluded that job prospects (value and utility of the major) were more important. Also, Li et al. (2014) posit that even though students have a favorable impression and are interested in information systems they still might not select the field as their major.

Findings from this current study suggest that interest in information systems can be attributed largely to a student being good at math and computers in high school and enjoying working with computers. Li et al. (2014) agreed that being a strong academic student in math and computers was important for interest to exist. This finding was substantiated by information systems students surveyed in the present study reporting that they did not perceive the major as being math intensive, whereas the non-information students tend to agree that the field is math intensive. Finally, Pritchard et al. (2004) concluded that students that perceive math as a barrier likely will not choose information systems as a major. As a result, it can be concluded that

perceived barriers, real or not, will decrease student interest regardless of value and utility of the major.

Research Question 3

Research Question 3 examined if a student's perceived level of competence was a factor in choosing information systems as a major. In this regard, competence refers to both perceived aptitude and confidence. The results of this present study found that competence is an important factor in major selection. For example, when non-information students in this study were asked why they did not major in information systems, 30.5% responded they could not perform well in the major. In addition, research examined in the literature review concluded that students' aptitude and confidence were key factors in developing and sustaining interest in a field of study in college (Bhatnagar & Brake, 2010; Calkins & Welki, 2006). Some of the research indicated that information systems majors were more concerned about their aptitude (skills) than other business majors; however, this finding was not shared by all researchers (Kim et al., 2002).

As noted in the previous discussion on Research Question 1, a student's skill in math and using computers and other technology greatly impact overall perceived competence to do well in information systems course work. Previous research confirms that students infer competence from how well they perform academically (high grade) in their introductory class in a subject (Dalci et al., 2013; Kumar & Kumar, 2013; Lee & Lee, 2006). Information systems students in the present study indicated that they agreed to strongly agreed that they work well with and enjoy computers and performed at a high academic level in the initial information systems class. This confidence contributes to feelings of competence that builds interest in majoring in information systems. According to the literature if students perform well in a subject, students want to stick with that major (Calkins & Welki, 2010; Matusovich et al., 2010; Wang, 2013). If a student does

not feel as though they can be successful in the major's course work, they will turn to another subject area.

The theory of reasoned action posits that students make logical choices after considering alternatives (Ajzen, 1991). If a student performs well in the classes offered in the major, it is logical that the student should consider studying that major. Additionally, with the theory of planned behavior, people perform actions based on feeling they can successfully execute certain behaviors (Ajzen, 1991; Bandura, 1977). Performing well in degree courses provides students with a feeling that they can be successful in the major and can have a future information systems career.

Research Question 4

Most research related to student choice of a college major recognizes that value and utility of a degree upon graduation is an influential factor. From the point of view of the literature, value and utility include outcome expectations such as job availability (Downey et al., 2011; Lee & Lee, 2006), salary (Akbulut et al., 2008; Downey et al., 2011; Kuechler et al., 2009), long term career prospects (Heinze & Hu, 2009), job security (Kane et al., 2017; Li et al., 2014), job flexibility (Danziger & Eden, 2007), and opportunities (Lee & Lee, 2006; Malgwi et al., 2005; Pinxtion et al., 2015). No study reviewed in the literature examined all these variables together in a single study. This current study found that value and utility is a key factor considered by students when making a decision on their college major. Also, this study found that the most important variables regarding value and utility for information systems majors were the (a) availability of long-term careers, (b) availability of jobs, (c) job security, and (d) salary. Each of these variables were more important to information systems students than non-information systems students in the present study.

Researchers agree that job availability right out of graduation is a key concern for almost all students. Two of the studies suggested that job availability was more important for women than men (Croasdell et al., 2011; Zhang, 2007). Along the same line, job security (long-term, stable careers) is an important consideration for students deciding whether to major in information systems. It can be concluded based on the literature and the findings of this current study that students in introductory courses in information systems need to receive timely and accurate information about jobs, careers, and salary from faculty instructors and other professional guest speakers brought into class. This can make the difference in determining if information systems is the right major for a particular student.

Information systems majors want to know that they will earn a competitive salary by going into the field of information systems. At least three previous studies found that salary was a more important consideration to men than women (Kuechler et al., 2009; Malgwi et al., 2005; Matsuovich et al., 2010). The present study did not examine the differences in views between men and women. The study did however confirm that starting salary is a major consideration.

A final aspect of value and utility is students' perception of prestige as it relates to their career choice. In this study students responded that information systems is a respected career and that professionals in the field are treated with respect. Here again, communication by information systems professionals is essential in conveying the status of the field as a career. To emphasize this point, a study by Dalci et al. (2013) advocated that college faculty need to impress upon students through classroom interaction the prestigious nature of careers in information systems.

Research Question 5

The final research question examined the importance of external factors on major choice. In the present study, as with the research presented in the literature, external factors refer to

academic experiences and other people. It was found in this study that overall external factors do exert some influence on students' decision to choose a major. This is consistent with the literature, but the source of the influence varies somewhat among studies.

There is little doubt that academic experiences affect students' perceptions of a field of study. Most schools or colleges of business introduce students to various aspects of all the majors before students must declare a major. As a result, what happens in the students' introductory class to the major may greatly influence students one way or the other. Previous research accentuates the importance of a positive classroom experience. This includes enthusiastic, friendly professors; use of innovative classroom techniques; and current and updated course content (Akbulut & Looney, 2007; Grantiz et al., 2014; Morgan et al., 2017). It was also found that professors in the introductory class need to communicate information about the field of study including availability of jobs, careers outlook, salary, and prestige and respect for the profession (Calkins & Welki, 2006; Dalci et al., 2013; Downey et al., 2011). In the present study, some non-information students did not fully understand information systems as a major or career. For instance, when other business majors were asked for reasons as to why they did not select information systems 16.2% responded they did not know much about the major, 9.4% did not know the advantages of choosing a career in the field, and 11.3% were under the impression they would not work with other people. Additionally, in this study, other business majors were asked what might have persuaded them to consider information systems as a major, 24% suggested a more interesting first class in the subject and 18% thought that more real-world elements should be introduced into the introductory class. Therefore, it is incumbent on information systems professionals to ensure that all their communications in the introductory

class, website, and program literature provide accurate information about the major and potential careers in the profession.

The prior research on which people influence students or assist students in picking a major includes parents, relatives, friends, mentors, high school counselors, professors, and advisors. Parents and other relatives are mentioned most often (Croasdell et al., 2011; Kuechler et al., 2009). In fact, some researchers have described the parents' role as critical in the selection process (Workman, 2015). If either parent is employed in a professional position, their assistance may be considered even more valuable (Croasdell et al., 2011; Granitz et al., 2014; Kuechler et al., 2009; Workman, 2015). However, not all studies agree. For instance, Heinze and Hu (2009) determined that family and friends were not important because they would support the student no matter the decision. In the current study family (father, mother, or other relative) was mentioned by 36% of the information systems students and by 53% of non-information students as the primary person who assisted or provided in help.

The current study found that high school counselors or teachers had virtually little influence in the decision-making process. They were mentioned by only 4% of students. This finding may be a result of the fact that most information systems students do not choose a major until their first or second year in college. Surprisingly, in this study, college personnel (professors and advisors) also had little influence on major choice. They were mentioned by only 18% of the students. Interestingly, the present study found that 34% of information systems students acknowledged ($M=1.93$, $SD=.84$) that no other person helped or influenced them in selecting their major and that they relied on Internet research in doing so. Again, this may be related to the timing of when students elect to decide on a major and their growing reliance on technology to secure needed information. Faculty and administrators in information systems

programs should be aware that Gen Z students have grown up with technology and use it as a valued source for information.

Major Choice Conceptual Model

In the limited research that exists on students' choice of information systems as an undergraduate major, the theory of reasoned action (TRA) has been used in several studies as a conceptual framework (Croasdell et al., 2011; Downey et al., 2011; Kuechler et al., 2009; Zhang et al., 2007). TRA suggests that a rational decision-making thought process will be used that ensures that alternative choices are considered, with the optimal alternative being selected (Ajzen & Madden, 1986; Darity, 2008; Eriksson, 2011, Wisner et al., 2016). This study went beyond TRA and integrated two additional theories into a choice of major conceptual model. The theory of planned behavior (TPB) and the rational choice theory (RCT) were combined with TRA to comprise the model. TPB postulates that choices will be made only if the individual has the ability to control their behavior leading to success (Ajzen, 1991; Bandura, 1977). Finally, RCT specifies that an individual will select the alternative that leads to the expected and most desired outcome. RCT focuses on cost and benefits with the purpose of utility maximization (Eriksson, 2011).

The conceptual framework used in this study is depicted in Figure 1: Interrelationship of Theories and Factors Related to Major Choice. The model reflects the effect that four factors related to major choice, personal interest, student competence, value and utility, and external influences of people and academic experiences, have on the component parts of the model. The model is composed of: (a) attitude towards behavior – perceived positive and negative feelings about alternative behaviors, (b) behavioral control – perceived feelings that an individual has the ability to control the behavior that leads to the positive outcome, and (c) subjective norms –

perceived social influences exerted by family members and other people on an individual's behavior to act in one way or another (Leon & Uddin, 2016; Zhang, 2007).

While the present study did not address information systems students' actual decision-making process, it did examine factors that led to producing a positive perception of the information systems major. First and foremost, student interest in a particular field of study appears to positively and negatively affect attitudes held by a student regarding the major. Additionally, perceived outcomes from the selection of a particular behavior, as in this case choosing a major, influences overall personal interest. In this study, interest stems from being good in math and computers, enjoying using computers, being undeterred by math presented in course work, and understanding the context of the major. The outcomes of selecting a degree is through positive results such as available jobs, career positions, and salaries. Each of these outcomes are afforded by earning a degree in information systems as participants perceive good salaries and a plethora of career choices.

This study suggests that in order for students to choose information systems as their major they must be able to exercise behavioral control in the courses required to earn the degree. This includes being proficient in math and computers both in high school and college. Study findings show that students who select information systems were good in high school math and in using computers. These students further report that they did not consider information systems classes to be difficult, and they performed well in information systems classes taken early in their college career. As a result, this component of the model appears to be important in the major selection process. Students need to perceive that they have confidence and the necessary aptitude to perform at a high academic level in the major if they select to seek a degree in information systems.

Finally, the model acknowledges that subjective norms influence students as they make decisions regarding which major to choose. Many studies have found that parents and other family members exert influence (Bhatnagar & Brake, 2010; Croasdell et al., 2011; Kuechler et al., 2009; Granitz et al., 2014; Kumar & Kumar, 2013; Workman, 2015). Other studies discovered women and men may be influenced, to an extent, by different social norms (Croasdell et al., 2011; Kuechler et al., 2009). In this study, parents and other family members did provide some influence; however, the participants appeared to place more reliance on Internet research and academic experiences connected with classes taken in information systems prior to selecting their major. It also appears important to students that they perceive that information systems is considered to be a field that is well respected and where human contact occurs in the job, and that professionals are treated with respect. This information could be conveyed through Internet research and the first class in information systems.

Additional research is needed to examine the predictive value of the major choice conceptual model. It appears from the perspective of this current study that the model holds value in understanding what influences undergraduate business students to choose information systems as their major.

Limitations

There were several limitations related to this study that affect the generalization of the findings and conclusions to other undergraduate information systems degree programs. As described in Chapter I, three delimitations associated with the design of the study limit the generalization of the results. These include collection of data from only one institution, use of a small sample size of 200 students, and the use of a convenience sample. During the data collection phase of the study, two additional limitations arose. First, most of the information

systems students were administered a paper copy of the survey in their upper-division information systems classes taken in a traditional on-campus, face-to-face setting, while many of the non-information systems students completed the survey online since they were enrolled in an off-campus, web-based course required of all business majors. The researcher was present for the administration of the survey in classes taught on campus; however, that was not possible with the online students. It is conceivable that the presence or lack of presence of the researcher may have inadvertently influenced student responses.

A second limitation is that extra credit points were offered to some but not all the students participating in the study. Going into the data collection phase of the study, the researcher understood that all professors would offer extra credit to students who completed the survey instrument. However, some of the professors, at their option, elected not to extend an offer of extra credit as an enticement for student participation in the study. In these instances, the researcher had no control over the awarding of extra credit, and this may have influenced student participation in the study.

Recommendations for Future Research

With the growth of technology in all sectors of society there is a greater need for graduates who can create, support, and manage information technology in all types of organizations (Dalesio, 2017; Gelber, 2016; U.S. Department of Education, 2018). This will require that colleges and universities find ways to attract more academically qualified students into undergraduate information systems degree programs at a time when program enrollments are stagnant or declining. Exacerbating the problem is a lack of research focusing specifically on what attracts students to major in information systems. This section offers recommendations for future research.

1. A study that replicates this present study using a national sample of students would be useful in providing additional insight into information systems major selection. This replication could use a larger sample size and focus on examining students' perceptions in similar types of postsecondary institutions.

2. A qualitative case study could be undertaken to understand in greater detail students' processes and perceptions regarding each of the four factors identified in the literature: interest, competence, value and utility, and external influences.

3. Introductory courses can vary in size and in possible interaction of students with faculty. A case study of colleges of business could be undertaken to understand if the size of the courses and amount of faculty/student contact influence the number of students who choose to major in information systems.

4. A study focused on women might be helpful to understand why so few choose information systems as their major. Women comprised only 28% of the information systems majors in this study, while 51% of non-information systems majors were female. A study that looks exclusively at what attracts and deters women from electing the information systems major could be beneficial to faculty and administrators in determining content for the introductory course and designing recruitment strategies.

5. Many students in this study acknowledged they decided on their major without assistance and that the Internet served as an important source of information. A study should be designed to examine this phenomena and how it relates to Gen Z students. Gen Z is the primary group currently enrolled in college. with an estimated 61 million students they will compose 20% of the future workforce (Gassam, 2018). Information gleaned from such a study would be useful to program professionals, college recruiters, and advisors.

Recommendations for Improved Practice

The primary purpose of this quantitative study was to examine student perceptions of factors affecting the decision to select information systems as an undergraduate major. This study offers insight and recommendations to practitioners including the following.

1. Information systems practitioners need to recognize that the way students select their major may be changing. The results of this study suggest that Generation Z students choose their major in their first two years of college, and they rely less on guidance and advice from parents and other family members. Today's students are also making use of the Internet to glean information about majors and careers. These changes have implications for not only faculty and administrators but also professionals in the field. Knowing that the primary factor in major choice is student personal interest, practitioners should develop a web and social media presence that provide students' the information they need to make informed decisions about their college major.

2. Faculty should work with professional associations such as the Association of Information Systems (AIS) to develop strategies to educate and attract high school students into undergraduate information systems degree programs.

3. Because the information systems major may not be as well understood such as other business majors such as accounting, finance, management, and marketing, more should be done to educate admissions counselors and business school academic advisors.

4. As results in this study indicated, there is a need to carefully consider what content is presented to students in the introductory course in information systems. Faculty should recognize that many freshman and sophomore college students are unfamiliar with the study and practice of information systems. The introductory course offers an excellent venue to demystify

the major and introduce students to real world information on job availability, careers, salaries, and what professionals in the field do to earn a living. Having this information may help more personal interest in majoring in information systems.

5. As there are fewer women in information systems, faculty and professionals should join with other organizations focused on improving the opportunities of women such as the National Center for Women in Information Technology. Additionally, new student organizations could be created to support women and engage professionals interested in backing women in the major.

Summary

The purpose of this quantitative study was to examine student perceptions of factors identified in the literature that affect the decision to select information systems as an undergraduate major. Information systems students were also compared to other non-information systems business students to see if significant differences existed between the responses of the two groups. Four key factors were identified in the literature as impacting the selection of a major: (a) personal interest in the major, (b) perceived competence in the major, (c) value and utility in earning a degree in the major, and (d) external influences of people and academic experiences. Five research questions were posed to guide the study. In addition to the focus on the four factors influencing major selection, the study provided an in-depth profile of information systems students and non-information systems students. Understanding factors deemed important to students' selection of a major is essential because there are more jobs currently available in information systems than people qualified to work in the field (Downey et al., 2011; McLaren, 2018). Zhang (2007, p. 447) recommended that "Given the significant impacts of declining IS enrollments, it is imperative that efforts be made to address this issue. A

natural first step would be to understand the underlying factors and processes that influence undergraduate students' decision to choose an IS major." This translates into the need for more research on the topic addressed in this dissertation since presently much is still unknown about why students choose the field of study of information systems.

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APPENDICES

Appendix A: Consent Form

PROJECT TITLE: Choosing Information Systems as a Major: Factors that Influence Selection

You are invited to join a research study to look at how students select their major with an emphasis on information systems. In this research study, we are investigating/testing/comparing/evaluating factors involved in making a choice about a college major. Information systems has a particularly small number of students majoring, and this study hopes to understand the differences within major selection for business students.

If you decide to participate you will be asked to complete an online survey. We think this will take you 10–15 minutes. Most of the questions will involve answering multiple choice questions or questions on a scale.

The investigators may stop the study or take you out of the study at any time they judge it is in your best interest. They may also remove you from the study for various other reasons. They can do this without your consent. Removal from the study might occur if the survey is not filled out. You can stop participating at any time. If you stop you will not lose any benefits.

RISKS

This study does not involve risks to the participant beyond providing information about factors involved in major selection. While names will be gathered for possible extra credit and a drawing for gift cards, names and other identifying information will be removed for the analysis of the data.

There may also be other risks that we cannot predict.

BENEFITS TO TAKING PART IN THE STUDY?

It is reasonable to expect the following benefits from this research: Knowledge about factors involved in major selection, possible extra credit in courses, and entry into a gift card drawing. However, we can't guarantee that you will personally experience benefits from participating in this study. Others may benefit in the future from the information we find in this study.

CONFIDENTIALITY

We will take the following steps to keep information about you confidential, and to protect it from unauthorized disclosure, tampering, or damage: Removal of your name and identifying information from the responses before statistical analysis is completed. A password would be required to access data kept on a computer. The data will be included in dissertation research and may possibly be published in research journals. The data will be aggregated and any direct quotes will not be attributed to any individual.

INCENTIVES

Students may receive extra credit in courses that choose to provide it, but not all courses will select to provide extra credit. To receive incentives a student must enter their name and contact information. If students choose to not participate in the survey, but still desire extra credit if offered, an alternative assignment on a similar topic is an option. This option must be exercised while the survey is in process. Contact Carole Shook at shook@uark.edu for additional information.

YOUR RIGHTS AS A RESEARCH PARTICIPANT?

Participation in this study is voluntary. You have the right not to participate at all or to leave the study at any time. Deciding not to participate or choosing to leave the study will not result in any penalty or loss of benefits to which you are entitled, and it will not harm any relationships.

CONTACTS FOR QUESTIONS OR PROBLEMS?

Email Carole Shook at shook@uark.edu or Dr. John Murry at jmurry@uark.edu if you have questions about the study or concerns about your rights as a research participant. Additionally you may contact Ro Windwalker, the University's IRB Coordinator, at 479-575-2208 or irb@uark.edu

Consent of Subject (or Legally Authorized Representative)

By clicking the box in Qualtrics you have agreed to participate in this study.

Information from the Rochester Institute of Technology

https://www.rit.edu/research/hsro/informed_consent_document_sample_tips

Student Signature on the paper copy: _____

Or students select a box on the Qualtrics copy agreeing to enter and take the survey or to exit the survey.

Appendix B: Survey

This survey examines several factors that explain how students view information systems as a major. Information systems has the highest salary in the Walton College and 100% job placement for jobs, but it is the major with one of the smallest number of students. Students not majoring in information systems is a global problem. The researcher is seeking to understand why students did or did not choose to major in information systems. There are 7 sections in this survey.

Part 1: Demographics

1. In what college are you enrolled?
 - a. Sam M. Walton College of Business
 - b. Other

2. If you are in the Walton College of Business, what is/are your major(s) or your concentration? (Select all that apply.)
 - a. Accounting
 - b. Economics
 - c. Finance
 - d. Information Systems
 - e. Management
 - f. Marketing
 - g. Retail
 - h. Supply Chain Management
 - i. Undecided
 - j. None

3. What is your minor(s) in the College of Business? (Select all that apply).
 - a. Accounting
 - b. Blockchain
 - c. Business Analytics
 - d. Economics
 - e. Enterprise Resource Systems
 - f. Finance
 - g. Information Systems
 - h. Management
 - i. Marketing
 - j. Supply Chain Management
 - k. Retail
 - l. Undecided
 - m. None

4. When did you decide your college major? (Choose one only).
 - a. Elementary school
 - b. Middle school
 - c. High school
 - d. Break between high school and entering college
 - e. During freshman year of college
 - f. During sophomore year of college
 - g. During junior year of college
 - h. During senior year of college
 - i. Still undecided

5. What classification in college are you?
 - a. Graduate Student
 - b. Senior
 - c. Junior
 - d. Sophomore
 - e. Freshman
 - f. Non-degree seeking

6. What is your gender?
 - a. Female
 - b. Male
 - c. Trans/non-conforming gender
 - d. Other

7. What is your age?
 - a. 35 or older
 - b. 30 – 34
 - c. 25 – 29
 - d. 22 – 24
 - e. 20 – 21
 - f. 18 – 19

8. Please select one or more of the following choices that best describes your race. (Select all that apply).
 - a. African American
 - b. Asian
 - c. Caucasian
 - d. Hispanic/Latino
 - e. Native American or Alaska Native
 - f. Native Hawaiian or other Pacific Islander
 - g. Other

9. Are you an international student?

- a. Yes
- b. No

10. Are you a first-generation college student (neither of your parents attended college)?

- a. Yes
- b. No

Part II: Questions about interest.

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
11. In high school I was good at math.					
12. In high school I was good at computing.					
13. I like computers.					
14. I think information systems is coding and programming.					
15. The wide variety of opportunities in many industries, including non-business pursuits, makes it more likely for me to study information systems.					
16. Information systems is math intensive.					
17. Information systems involves creativity.					
18. Information systems involves enjoying working with computing systems.					
19. If I get an information systems job I will not be simply programming and coding.					
20. I have an interest in blockchain technology which provides cybersecurity.					
21. I have an interest in data analytics.					

Part III: The following questions deal with feelings of competence:

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree

22. I believe I work well with computers.					
23. I performed at a high level in my information systems class(es).					
24. I think information systems classes are challenging.					
25. The information systems classes are difficult for me.					

Part IV: The following questions look at value and utility associated with an Information Systems degree.

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
26. Classes I have taken have shown me that there are careers available in information systems.					
27. If I choose Information Systems as a career, there will be jobs available for me when I graduate.					
28. I think there are long term career opportunities in information systems.					
29. Jobs for information systems majors are not likely to disappear in the future.					
30. Starting salaries are satisfying with information systems jobs.					
31. Having a job with a flexible schedule is important to me.					

Part V: The following questions relate to external influences:

32. Which person primarily helped you make the decision in choosing your college major?
- College advisor
 - College professor
 - Father
 - Mother
 - Other relative
 - Spouse
 - Friend
 - Mentor
 - High school guidance counselor

- j. High school teacher
- k. Personal accomplishment/No one influenced me

Of the following factors, which affected you to select a major?

	Very influential	Influential	Neutral	Not influential	Definitely not influential
33. Exposure in high school classes					
34. Prior work experience in the field					
35. College classroom demonstrations					
36. Internet research in the major					
37. Exposure in college classes to real world elements of the major					
38. A professor I enjoyed in the first class in my major.					

The following questions look at external influences in relation to information systems majors.

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
39. If I choose information systems I will have a respectable career.					
40. The business world treats information systems professionals with great respect.					
41. Information systems involves human contact.					
42. Choosing information systems makes students appear like "computer geeks".					
43. If I choose information systems as a major, I will spend a lot of time studying it.					

Part VI: Information about selection of the major.

44. Why are you not currently majoring in information systems? (Select all that apply).

- a. Question does not apply as I am majoring in information systems.
 - b. I do not know much about the information systems major.
 - c. Information systems is not helpful to my career.
 - d. I am not good with computers.
 - e. I do not like information systems.
 - f. I am interested in another subject.
 - g. The classes are hard.
 - h. I want to be able to work with people, not computer equipment.
 - i. I didn't know the advantages of the major before I selected my current major.
 - j. Other
45. If you are not considering a job or career in information systems, why? (Select all that apply).
- a. I am majoring in information systems
 - b. There is a low probability in getting a job.
 - c. I am not interested in information systems or computers.
 - d. The career outlook is not positive.
 - e. I do not want to code computer programs.
 - f. I feel I am not capable of performing well in information systems.
 - g. Not enough money in the field.
 - h. Other
46. What do you think would have helped persuade you or did persuade you to choose an information systems career? (Select all that apply).
- a. An introductory class where students are exposed to real world elements of careers.
 - b. An information session conducted by the department.
 - c. Awareness of what an information systems job is.
 - d. Awareness of job opportunities and a high salary.
 - e. Job security and growth.
 - f. A more exciting and interesting first class in information systems.
 - g. Other

Part VII: Participant Info. This question is used only for providing names of students who participated in the survey in providing extra credit for those that qualify for it. It will be removed from the survey information and not tied to survey results in the analysis.

47. Name:
 Email address:
 Class:
 Class time:
 Instructor name:

APPENDIX C: IRB EXEMPTION LETTER

To: Carole Shook
WCOB 475

From: Douglas James Adams, Chair
IRB Committee

Date: 04/09/2019

Action: **Exemption Granted**

Action Date: 04/09/2019

Protocol #: 1902175337

Study Title: Choosing Information Systems as a Major: Factors that Influence Selection

The above-referenced protocol has been determined to be exempt.

If you wish to make any modifications in the approved protocol that may affect the level of risk to your participants, you must seek approval prior to implementing those changes. All modifications must provide sufficient detail to assess the impact of the change.

If you have any questions or need any assistance from the IRB, please contact the IRB Coordinator at 109 MLKG Building, 5-2208, or irb@uark.edu.

cc: John W Murry Jr., Investigator

APPENDIX D: LETTER 1 TO PARTICIPANTS

April 9, 2019

Dear Potential Survey Participant,

At the Walton College a variety of majors are offered. Nationwide, there has been a trend of fewer students choosing to major in Information Systems. This trend has been seen at the Walton College as well. Information Systems offers some of the highest salaries and has close to a 100% hiring rate.

Carole Shook, an instructor in the Walton College, is working on her dissertation for a doctoral program. As part of her research she is trying to understand what perceptions students may have about Information Systems. To do this she will provide a survey to both Information Systems students and students who are majoring in other subjects in business to compare ideas about Information Systems to determine how to advance Information Systems education.

You are being provided a survey or survey link. The survey should take approximately 10 minutes to complete. The survey is only being offered to select students, so your participation is important. The survey should be completed by April 23 at 5 pm.

If there are questions please contact Carole Shook directly at shook@uark.edu.

Best Regards,

Dr. Matt Waller

Dean, Sam M. Walton College of Business

SURVEY LINK: https://waltonuark.az1.qualtrics.com/jfe/form/SV_9BqBPmzGnrXsFJb

APPENDIX E: LETTER 2 TO PARTICIPANTS

April 16, 2019

Dear Survey Participant,

This is a reminder that the survey about Information Systems and why students major in this subject or choose a different major is due by April 23, 2019 at 5 pm. Here is the survey link:

Your participation in this survey is important as it helps the Walton College gain an understanding of why there is a lower number of students majoring in Information Systems than in other majors offered in the Walton College and could assist the Walton College in the continued effort to improve. The survey is being offered to a small number of participants making your participation appreciated. It should take approximately 10 minutes to complete.

If there are questions please contact Carole Shook directly at shook@uark.edu.

SURVEY LINK: https://waltonuark.az1.qualtrics.com/jfe/form/SV_9BqBPmzGnrXsFJb

Thank you,
Carole Shook
Instructor
Sam M. Walton College of Business

APPENDIX F: LETTER 3 TO PARTICIPANTS

April 22, 2019

Dear Survey Participant,

This letter is your final reminder about the survey that is being used to evaluate the Information Systems department by both Information Systems students and students who selected other majors. Your participation in this survey could assist the Walton College to continue to provide improvements to the offerings made to students.

The survey is being provided to only a small number of participants, which makes your participation particularly important. The survey should take approximately 10 minutes to complete.

The survey link is:

https://waltonuark.az1.qualtrics.com/jfe/form/SV_9BqBPmzGnrXsFJb . The last day to complete the survey is April 23, 2019 by 5 pm.

Thank you,

Carole Shook

Instructor

Sam M. Walton College of Business

shook@uark.edu