The Perceptions of Undergraduate Students Associated with a Career in Technology − An Analysis by Academic Year

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Abstract

In both the educational and business environments, two trends may be inarguable. The difference between the demand of technology positions as compared to the number of people majoring or interested in technology-based careers. Secondly, the education environment is radically changing in several aspects including a high number of undecided majors entering undergraduate institutions as well as the ability of skills development by higher education students entering the marketplace. The recent and historic attention in artificial intelligence and machine learning technology may have an impact on both a change in the demand for total positions and interest in technology-based careers. This research study will investigate the attitudes and perceptions of first-year college students over four academic years to determine changes. Six of the factors studied were found to have significant differences between the research period: attitude, job availability, personal image, social image, subjective norm and intent to major. The intent to major has remained consistently low for three of the four years. The implications from this research will provide insight to both business organizations for recruiting as well as all educational institutions.

Keywords: Technology career, Student perceptions, Career exploration, Experiential integration

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1. INTRODUCTION

Demands of Business Organizations

Since the early 1980s, information technology has become a dominant influence for business organization in both strategic, business analysis and operational activities. The rising dependence and integration of technology systems requires a corresponding need for technology personnel. Technology personnel will require skills and conceptual knowledge. The source of these requirements can be gained from either traditional higher education undergraduate colleges (two- and four-year) as well as technical institutions. However, the demand for personnel compared to people completing a technology-based major is widely different.

Technology Career Trend and Supply

The lack of role models is one of the most significant challenges for women in technology careers. Women hold less than 20% of all technology leadership positions (Clay, 2023). A recent survey found that 84% of the respondents believed that the chief information officer (CIO) has a critical influence to lead business and technology transformation (Drinkwater, 2022). This fact asserts that the information technology function and responsibilities have evolved from operation-focused activities (processing and reporting data) to business analysis/strategy (mobile applications, data analytics). Therefore, the integration of technology outcomes requires the availability of skilled talent.

Another critical component of this discussion is associated with the gender gap. Christensen and Knezek (Christensen & Knezek, 2017) found that middle school males generally have higher intent to pursue a career in STEM. Females are underrepresented in technology-based positions. Currently, women hold only 26% of the technology related positions (Hubbert, 2023). The percentage of females in technology firms (> 10K employees) is the same. Additionally, the percentage of work in technology positions has decreased by 2.1% over the last two years. One of the issues that may affect the low employment of young women is the lack of role models associated with CEO and leadership roles as well as imposter syndrome tendencies (Clay, 2023; Hubbert, 2023). Imposter syndrome is a consistent disbelief that one's success is deserved or legitimately achieved as a result of an individual's effort and/or skills.

Research Objective

The objective of this study is to examine the attitudes and perceptions of first-year undergraduate college students specific to technology careers and majors to explore trends, if any, over a five-year period. The response data will be categorized into four groups to examine the data as shown below in Table 1. These groups are comprised of data collected for two semesters (fall and spring).

Group	Academic Year
1	2016-17
2	2017-18
3	2020-21
4	2021-22

Table 1 – Survey Groups

These academic years were chosen because a full academic year which included a survey administration including two semesters (both Fall and Spring), rather than only one semester in an academic year.

The results of this study found that six of the twelve factors resulted in significant differences between the means for the four groups shown above. The results associated with attitude, job availability, personal image, social image, subjective norm and intent to major. Four of the factors (personal image, social image, attitude, and job availability), increased from the base year (2016-17 to 2021-22) with differences between 0.21 – 0.48. The remaining two factors (intent to major and subjective norm) resulted in minimal change (-0.07 – 0.01).

2. LITERATURE REVIEW

Employment Data for Technology Careers

From an anecdotal perspective, it is common knowledge that demand for technology professionals continues to increase over the next decade. The U.S. Bureau of Labor Statistics compiles data associated with occupations are compiled in Table 1.7. A summary of the various occupational codes associated with technology careers, under the Computer and Mathematical Occupations summary (BLS employment matrix code: 15-0000) has been compiled into Table 2 (U.S. Bureau of Labor Statistics, 2023).

The first row depicts the summary statistics for the 15-0000 matrix code. The remaining rows of Table 2 summarize all matrix codes relating to the six computer (technology) occupations summarized within the 15-xxxx matrix code. The last row provides a total of the computer occupation sub-codes (six). The projected growth for all computer operations matrix codes over a ten-year period through 2032 is 14.2%. However, several sub-classifications (analysts, scientists, support specialists) are double-digit growth (14.9%, 22.7% and 21.7%).

Comparing BLS data from two time periods (2022 and 2032), the occupations with the largest estimated increase are Software and Web Developers (51%) and Computer and Information Analysts (19%). Two occupations have negative trends (Computer Support Specialists and Database and Network Administrators).

Table 2 – Trends in Information Technology Careers (BLS Table 1.7)

While government statistics are important, empirical data relating to actual open job positions can provide more clarity. An analysis of the technology position openings was compiled every six months from August 2021 through August 2022 from a large financial services firm. The open job statistics for technology positions have tracked at 389 (August 2021), 549 (February 2022) and 546 (August 2022). The larger number of positions during 2022 may have resulted due to pandemic and early retirement decisions. While the number of open positions is decreasing, the current number of positions at 271 (September 2023) continues to illustrate a high number of open positions. In addition, it is consistent with the BLS annual average openings. For example, BLS projects the need for 179 thousand positions for software and web developers through 2032.

Factors Influencing Student Perceptions

A compilation of foundational research is required to form the basis of the factors to investigate the perceptions of students toward a technology career. These factors would form the definition of a model to support the objective of this research. Various research studies were examined and reviewed to gather the appropriate factors for the research model. A review of literature was compiled to identify research studies which focused on a range of factors to collect data associated with the attitudes toward career choices with a STEM or technology focus.

Moore & Burrus (2019) applied the Theory of Planned Behavior from Ajzen (1991) to include several factors including subjective norms, perceived behavioral control and intention to major. Finlay et al (1999) defined subjective norm as an individual’s opinion or perception about what others believe the individual should do. Ultimately, influence integrates an individual’s peers, family, and friends. Several research studies identified parents (and their professions) as an influence on their child’s career (Cohen & Hanno, 1993; Law & Yuen, 2012; Pearson & Dellman-Jenkins, 1997; Saleem et al., 2014). Kuechler et al. (2009) found that both families and advisors significantly affected the intention to choose an IS major. Subjective norms and attitudes were also found to predict intentions (Hagger et al., 2015).

Information and data can be gathered from many sources including informal (word of mouth) and formal (structured and codified sources). Walstrom et al. (2008) researched the various information sources associated with information systems careers. Based on the average importance (six-point scale) from student responses, the top four sources (average scores > 3.0) were information from college/department websites, brochures about the major, information on the web/internet, and newspaper articles (Walstrom et al., 2008). The most influential information is from the institution’s internal sources.

The research by Wu et al. (2018) investigated various factors in relation to STEM careers to include their attitudes, beliefs, confidence, and enjoyment. Experiential attitude is defined as whether an object or behavior is considered pleasant or enjoyable while instrumental believes that the object or behavior is useful and worthwhile. Moore and Burrus (2019) investigated two dimensions of attitudes; experiential and instrumental. Moore and Burrus believed that experiential attitudes that consider math boring by students may affect their attitudes toward STEM-related activities. Additionally, a student’s instrumental attitude toward math may not be considered important for their future career decisions. Therefore, these attitudes will reduce their engagement toward math courses and careers.

Kuechler (2009) found that a genuine interest in IS as significant factor to intent to major. Walstrom et al. (2008) found that 56% of the respondents said that information systems was not of interest to them. Additionally, Walstrom found the highest factor in the choice of major was personal interest in the subject matter (5.1 / 6). Compeau & Higgins (1995) found that IS majors are collectively motivated by self-efficacy, work value congruency and normative beliefs. Work value and normative beliefs relate the factors of work environment and subjective norm respectively.

Decisions are often completed based on outcome expectations. The declaration of an undergraduate major is a natural and required decision for a college student. Bandura (1986) believed that these outcomes are based on an integration of the results of actions. Bandura's research categorized these outcomes in three categories: physical, social, and self-evaluating. Three factors from Bandura have been integrated into this study including job availability, job salary, and work environment. Additionally, Bandura believed that the reaction of others (family and friends) as well as the social impact of the environment lead to several factors to be explored by this study (social image, personal image). The starting salary and availability of jobs factor were supported as important factors (4.8/6.0) as reported by students (Walstrom et al., 2008).

Heinze & Hu (2009) found that undergraduate students who had a positive attitude toward IT careers and higher perceived behavioral control regarding IT majors had a greater intention to major in IT. Their research measured the control beliefs of students that will affect the pursuit of an IT major using the definition of CSE.

The image, both personal and social, could provide an influence on the selection of an IT Major. The personal image is reflective of the students' self-image of technology professionals while the social image is focused on whether it is a respectable career. Kuechler (2009) found a positive effect on intent to major from social image while no significance on personal image (PI). Walton (2012) researched the power of social connections enhanced achievement motivation.

After reviewing the various research studies, twelve factors were found to be appropriate measures of student perceptions relating to adoption of technology majors and careers. These studies were used to compile a list of questions to form a survey instrument to gather data to support the research objective. Each of these factors is described in Table 3 with a full listing of the survey questions in Table 9.

Table 3 – Citations for Research Model Factors

Research Hypotheses
Based on the research objective and the completion of the literature review, twelve hypotheses have been developed to complete the research model. Table 4 defines a detailed listing of the research hypotheses.

Table 4 – Summary of Research Hypotheses

3. RESEARCH METHODOLOGY

Survey Instrument
To complete the research objective, a survey instrument was designed to include questions to gather data on students' perceptions. The final survey instrument included 36 questions to gather the perceptions and beliefs for the factors outlined in Table 4. Many of the questions were gathered from either research included in Table 4 as well as other articles used in the literature review. In a few cases (e.g., media influence), the questions were structured based on the media categories included from past research studies.

These questions were structured using a Likert scale for the student's response. A seven-point scale was selected in order to show higher reliability than any number of options (Chang, 1994; Wakita et al., 2012). The seven-point scale also includes a benign response in the middle of the scale (neither agree or disagree). Two Likert scale structures were used for each of the questions: 1) strongly disagree vs. strongly agree and 2) not important vs. extremely important. The values associated were designed from 7 (strongly agree, extremely important) to 1 (not important, strongly disagree). Table 5 outlines the details of the survey instrument.

Table 5 – Summary of Survey Composition by Factor

Several questions were included for classification purposes including gender, grade point average, and the completion date (semester) of the survey.

Survey Sample and Administration
The population selected for this study consisted of first year students. Since most courses completed in the first year consist of core/general

education courses, this population was selected to gain perceptions early in their higher education experience. Students entering higher education as undecided are considered high-risk while a significant percent (61%) change their major (Mowreader, 2023). A study completed by Junior Achievement USA found that only 46% of students believed that they should have a concrete career goal after starting college but before graduating (Anonymous, 2019). All responses associated with this research are from one higher-education institution, a four-year university.

An electronic survey software tool (Qualtrix) was used at the portal for the administration of the survey. The individual questions associated with the factors were scattered throughout the survey to increase reliability of responses. All questions were set up with a required response to each survey question except for the gender question. In the initial deployment of the survey, the gender question inadvertently was not set up properly allowing no response to the question. Therefore, the early semesters contained some "empty" responses for the gender question.

4. FINDINGS AND RESULTS

Population Assumptions

All surveys were administered in a business course required of all first year and transfer students. Students cannot complete multiple surveys within the same semester while registered for different courses. Therefore, the independence of observations as well as the homogeneity of variance assumptions associated with the survey population are appropriate and valid.

Survey Response

For this research study, the survey data was confined to four years (eight semesters) as shown in Table 6 below.

Table 6 – Frequency of Survey Results

The composition of males and females (57.3% and 31.9%) are like the distribution of students at the university. As noted previously, the initial version of the survey did not require the entry of a response to the gender question. Since this research does not investigate any differences with gender, all respondents (1,128) were included in the analysis.

ANOVA Results

Twelve summary variables were created for each of the factors. The average of the individual questions associated with each factor (as outlined in Table 5) was calculated for each factor. The SPSS Mean function was used to calculate the mean of the individual question responses to exclude missing values (no response to a question).

An analysis of variance (ANOVA) was completed on the survey response data using the average (mean) of the twelve factors. The statistical results of the ANOVA mean values have been compiled in Table 7. The table includes the four group means (academic years) as well as the grand mean for the twelve factors. It also includes the number of observations (n) for each factor.

Table 7 – Summary of Group and Grand Means by Factor

The results of the ANOVA statistical test of significance values (p-value) associated with each of the twelve factors. The following table (Table 8) summarizes the values of the ANOVA.

Table 8 – Summary of ANOVA Test of Significance Results

Hypotheses Evaluation

Of the twelve factors analyzed, only six factors have resulted in significant differences between the mean values: Attitude, Job Availability, Personal Image, Social Image, Subjective Norm, and Intent to Major. Three of these factors calculated a highly significant p-value ($p<.001$). The remaining six factors (Aptitude, Difficulty of Major, Interest in IT, Job Salary, Media Influence, and Workload Environment) resulted in no significant differences between the mean values of the four academic years.

Each of the twelve hypotheses were evaluated based on the results of the ANOVA tests as shown in the previous table. A summary of the evaluation of the null hypotheses is contained in Table 9.

The ANOVA calculated 48 calculated group means (four years multiplied by 12 factors). Most of the differences between group means and the factor grand means were less than 0.10. As expected, each one of the factors resulting in significant differences included at least two mean differences (group mean − grand mean) greater than 0.09. Two of the factor's grand mean with $p<.05$ were greater than 5; personal image (5.56) and social image (5.30).

Hypothesis	Result
H1	Accept
H2	*Reject*
H3	Accept
H4	Accept
H5	*Reject*
H6	Accept
H7	Accept
H8	*Reject*
H9	*Reject*
H10	*Reject*
H11	Accept
H12	*Reject*

Table 9 – Summary of Research Hypotheses

5. DISCUSSION AND IMPLICATIONS

Discussion

Six of the ANOVA tests (50%) resulted in significant differences between the four academic years. Students' perceptions have not changed in the areas of aptitude, difficulty of the major, interest in technology, job salary, media influence, and workload environment. The lack of change for some factors is not surprising, specifically with aptitude and difficulty of major; with the associated group means (3.17 – 3.53) below the benign response value of four. Anecdotally, many students believe that science- and mathematical-based majors are more difficult and require a higher aptitude for success. Technology-based careers often follow a similar stereotype as mathematics and science careers.

The group mean values associated with the media influence were less than 4.36 (equating just higher than neither agree/disagree response). With the exponential increase in the use of social media, the influence of media on younger age groups has changed significantly since this study began in 2016. The author considered changing the various categories of media at various points over the last few years. However, it would have precluded any multi-year, such as this research study, analysis as the scale would have changed. The workplace environment issue is also not surprising. With the group means between 4.82 and 4.97, their responses are just below a *slightly agree* response. After reviewing the question averages in detail, students believe that the environment for technology professions lacks four traits: 1) no variety in tasks, 2) fails to lead to leadership positions, 3) lack of creativity, and 4) will not benefit people and society.

The two remaining nonsignificant factors (interest in technology and job salary) are more puzzling. The group mean values remained close to the *slightly agree* response (5). The interest in information technology careers investigates five perceptions (learning software, working in a team, using software, and analyzing/presenting business-related problems). Considering the level of technology adoption associated with young people, the results of this survey can only provide one conclusion – students enjoy using technology, but not as a career. Students enjoy using their phone or tablet. However, they do not have any interest in developing mobile or desktop applications. The author believes that technology has become an "appliance" like a refrigerator or a car. They know that the equipment works when the power is turned on, but do not care how it works. It simply functions for the purpose in which students desire.

The group mean scores for the job salary factor resulted between 4.73 and 4.94; again, below the *slightly agree* response. With the current level of information about job postings available online, it is surprising that students are not more knowledgeable about the higher salaries for technology personnel.

Six of the factors resulted in significant differences between the means of the four academic years (attitude, job availability, personal image, social image, subjective norms, and intent to major). The group mean scores for attitude and job availability are like the responses of previous factors reflecting a *slightly agree* response (5) to the questions. The image factors (personal and social image) calculated group means between 5.16 and 5.92. These values are trending closer to the *agree* response (6) suggesting a more positive image toward technology personnel and careers. On a positive note, these factors (attitude, personal image, and social image) have all realized significant increases over the last two academic years (0.42, 0.44, 0.39 respectively).

The subjective norms and intent to major factors ($p<.05$) are concerning and require some discussion. These factors calculated mean values which are the lowest of the twelve factors. The grand means for subjective norms and intent to major are 2.92 and 2.51 respectively; below the *slightly disagree* response for the questions. These results illustrate that students have limited interest in majoring in technology. Additionally, the results of the subjective norm factor indicate that the advice of several groups (family, friends, advisors, peers, and educators) suggest that information technology careers are not a "*good fit*" for them. It is plausible that these subjective norms may influence, possibly negatively, the major decision.

The importance of the results could be interpreted in a variety of ways using the base (2016-2017) and final year (2021-22) of the study as well as the four years of individual means.

Of the six factors identified as statistically significant, the only factor (subjective norm) declined from the base year to the last year; a small decline of 2.4%. The subjective norm for AY2017-18 to AY2020-21 years declined by 12.1%; (3.06 to 2.69); while increasing slightly to 2.84 in AY2021-22. These results can explain that the pandemic shutdown in early-2020 affected education and its students at all levels with the importance of relationships.

These results could be explained by avoidant coping. Madrigal and Blevins (2022) believed that students escaped the challenges and or stressors caused during the pandemic. Self-medicating the lock-down period with social media breaks. Madrigal and Blevins reported that students' sources of support decreased during the pandemic from the pre-pandemic period. Therefore, it is conceivable that this period reduced the consistency, frequency, and depth of relationships with the groups associated with the subjective norms. Furthermore, Madrigal reported that while there was decrease in socialization with many groups, social media/technology use increased during the same period. Other research supports the loss of social support, isolation, development of social relationships and interaction (Alsubaie, 2022; Elmer et al., 2020; Luan et al., 2023). While these discussions are all negative, there should be some hope that the post-pandemic period will rebuild and restore the interaction in an education setting as noted in the small rise in subjective norm for the last study year.

Personal image factor was the only factor to have increased steadily over the four-year study period. It is plausible that the increase of students' personal image of technology may been explained by the increase in the of technology in classes as well as the new teleconferencing software deployed during the lockdown. The increased reliance during these periods may have acclimated students with technology throughout their educational journey. Additional exposure can create knowledge and a level of comfort in any subject.

The remaining factors (attitude, job availability, social image, and intent to major) resulted in various increases and decreases over the four research years. Except for intent to major factor, the last research year (2021-22) all resulted in an increase over the grand mean for each period. Considering all the turbulence and challenges, over the six years of the research period, this may provide some positive influence on the future academic years.

Practical Implications and Conclusions

If the research period is an accurate representation of undergraduate students' perceptions, the intent to major shows challenging "headwinds" toward the future. In three of the four research years, students clearly responded closer to the "disagree" response (2.0) to the question that they intend to major in information technology.

The results of this research clearly indicate that the population does not consider technology a suitable career. Therefore, if these perceptions are believed to be accurate on a broader scale, the gap between the demand and supply of candidates for technology positions in the marketplace will continue to be wider. The consequences for business organizations will consist of delayed project delivery, reduction in completed projects, increased salaries to retain/attract personnel, and/or increased offshoring deployment of technology activities.

The current trend of technology appears to imitate the issues associated with the accounting profession. The accounting industry is experiencing a sharp decline in the number of accounting majors while the 300,000 accountants/auditors have left their positions in the last two years (Ellis, 2022; Somaiya, 2023). A study by Hsiao (2016) researched factors to investigate career choices in accounting including intrinsic characteristics (contribution to society, challenge, workplace environment), extrinsic characteristics (job availability/salary), and influence on decisions (subjective norms).

Students sometimes have incomplete and inaccurate stereotypes of technology-based careers. One of these stereotypes focuses on the advancement to a leadership position. The chief-information officer (CIO), has transitioned from the "back-office manager and order taker" to an organizational leader managing the strategic decisions which require technology integration (Stackpole & Betts, 2011). Stackpole asserts that 84% of CIOs are viewed as a "critical changemaker" accepting the leadership of business and technology.

A recent article highlighted a list of the highest paying technology positions (Anonymous, 2023). Three of those job titles would be considered "steppingstones" positions from entry-level to leadership (CIO-type) positions: project manager, program analyst/manger, and MIS manager. These job titles earn an average salary of $130k with a salary increase of 13.1% over the last two years.

Implementation Strategies

Higher education institutions should create educational outreach programs to be successful (Rajala et al., 2023). Five implementation strategies have been compiled to address the conclusions and implications of this research.

Promotion of Career – Many students major in marketing to be employed in entry-level positions as sales representatives gaining experience and knowledge about their trade (sales techniques, communication, proposals, etc.) to build a collection of skills to transition to leadership positions (sales managers, strategy analysts, sales vice presidents). Promotional and educational materials should include detailed narratives and examples focusing students' attention on the transition from entry-level positions through middle-management and then to leadership positions. Technology positions should be no different. Specific narratives with applied examples (professional profiles of people from industry, job postings, etc.) will engage students with facts to negate speculation or stereotypes.

Exposure to Technology Careers and Personnel – It is important to create a "*vision*" of various technology careers and occupations. A recent study found that participants in outreach programs for IS did not receive any information about IS, ICT or any computing-related field (Rajala et al., 2023). While this study was compiled in Finland, a similar experience may be formed in U.S. secondary schools. Therefore, it would be important to expose students to the actual tasks and responsibilities of some technology occupations. In addition, this exposure is required to refute the "Wargames" (the movie) stereotype in which students believe that technology positions are "chained" to their desk developing code, hacking, and monitoring computer systems.

Many positions, specifically computer and information analysts (15-1210), are responsible for analyzing and documenting processes, integrating corporate strategies, innovative technology requirements and solving business problems through technology. However, these positions do not require or consist of coding and advanced technical skills. Additionally, many information technology personnel are promoted as Project Mangers. These positions require presentations, project management, analysis, and meeting with various stakeholders of a business. Again, all non-technical and business-oriented tasks performed by technology-based occupations.

Research supports that the level of self-efficacy associated with career decisions is a significant predictor of occupational indecision and career exploration (Blustein, 1989). With the exposure of vocational tasks (selecting goals, gathering occupational information, problem solving and self-appraisal), career self-efficacy increases (Hackett & Betz, 1981). Therefore, these strategies can directly enhance toward position outcomes.

Changing Business, "Society" and People – Generally, Generation Z students are expressing an increased interest in changing people and society. However, these aspirations need to be conveyed and connected to technology positions in a defined context. Every position and facet of our society can translate to those ideals by implementing two concepts: 1) reset students' perspective with different metaphors and 2) compiling narratives using direct examples of technology careers can serve a societal purpose. For example, wait staff in restaurants and hotels can provide exceptional and quality customer service to guests daily by enhancing the customer experience on vacation. This interaction would support the instrumental attitude as researched by Moore and Burns (2019).

This outcome can be achieved through training, exposure and role playing to develop awareness as well as operationalize within their careers. Technology is no different. Students can analyze and design platforms (tablets, laptops, etc.) with an interface that can help the wait staff with technology solutions to enhance their job satisfaction and productivity. Students are so immersed in technology use (phones, apps, games, etc.) that they view the strategy of the technology in a similar manner to the ***engine*** behind driving the car to a destination safely and efficiently. For students, it works, and it does not matter how or why it works.

Interactive Job Fairs and Career Exploration Sessions – Develop and plan sessions to promote technology careers that are staffed with industry personnel; providing a "face" to communicate specific ideas using "real world" examples. The compilation of narratives (printed and online) depicting the emphasizing the previous topics may not be accessed or read. However, the strategy of complimenting these materials with interactive sessions with industry personnel can gain their students' attention. As important, it will also increase their interaction skills that are desperately needed at the present time. The previous strategy discussed the exposure to personnel and careers can add significant value to the exploration process.

Business organizations will agree to volunteer to these events to increase their exposure, build community relations, and (most importantly) develop interest in technology careers for their recruiting efforts. Ainslie (2019) found that companies and practitioners that engage with educational institutions will create a pipeline of workers interested in upward mobility. Ainslie further explains that employers miss opportunities by not engaging in these partnerships. This strategy enables the findings of Rajala (Rajala et al., 2023) which found that the value expectations and value propositions can be gained by participation in outreach activities.

Integration into Curriculum – Educators at all education levels need to be engaged to focus on career exploration. To prepare for job fairs and interaction sessions, homework and in-class assignments can organize various thoughts and ideas for the students prior to interacting with business leaders. Career to Education (CTE) strategies integrated into high schools can provide an environment to "deep dive" into exploration by "doing" and learning and learning immersion. This strategy will dramatically increase the students' knowledge for the career exploration and education decision process by replacing inaccurate stereotypes with objective facts and a hands-on, visual experience. Real-world and hands-on learning activities and projects had a positive effect on students, particularly with female students (Christensen & Knezek, 2017).

7. LIMITATIONS AND FURTHER RESEARCH

Limitations

There are a few limitations from this research study including:

- A few semesters were not included in the survey administration due to the Pandemic and other issues. The lack of data from these semesters limited the number of academic years included in this study.
- Using research, the survey was designed in 2016 and remained consistent over the last six years. No updates or modifications to the survey were implemented to complete a multi-year analysis using several factors and variables with a consistent structure (responses, questions, wording, etc.). It would have been interesting to include additional items such as social media for the media influence factor but may complicate future research studies.
- The responses used for the analysis and conclusions were gathered from only one institution. Using only one institution may not provide an accurate representation of the perceptions investigated in this research study. Students' perceptions and opinions can be influenced by factors due to institutional culture (demographics, geography, socio-economic, size of institution and selectivity of recruiting).

Further Research

As this research study was compiled, one additional idea was uncovered. To replicate this research into a regression for the four academic years using all current factors. Additionally, it may be important to extend the survey administration into the AY2023-24 to gain additional responses. The regression analysis could be completed using the academic year value as a dummy variable in the regression analysis. This research study will amplify the results and outcomes associated with the weights of the several factors on the dependent variable (intent to major).

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Appendix

Occupational Description	Employment (thousands) 2022	2032	Change 2022-32 Number	Percent	Openings Annual Avg 2022-32 (thousands)
Computer and mathematical occupations (summary of 15-0000)	5,277	6,081	803	15.2%	411
Computer and information analysts (15-1210)	700	804	104	14.9%	54
Computer and information research scientists (15-1221)	36	44	8	22.7%	3
Computer support specialists (15-1230)	914	963	49	5.4%	66
Database and network administrators and architects (15-1240)	669	696	27	4.0%	40
Software and web developers, programmers, and testers (15-1250)	2,159	2,628	469	21.7%	179
Computer occupations, all other (15-1299)	449	493	43	9.7%	33
Totals – Computer Occupations	*4,929*	*5,630*	*701*	*14.2%*	*377*

Table 2 – Trends in Information Technology Careers (BLS Table 1.7)

Factor	Research Citations	Factor Category
Aptitude to study information technology	(Epsztajn, 2019; Joshi & Kuhn, 2011; Kuechler et al., 2009, 2009)	AP
Interesting to use; complete work with technology	(Heinze & Hu, 2009; Kuechler et al., 2009; Mims-Word, 2012; Walstrom et al., 2008)	AT
Difficulty of major; requiring significant study time	(Kuechler et al., 2009; Prescod et al., 2018); (Zhang, 2007)	DM
Interest in information technology	(Joshi & Kuhn, 2011; Mims-Word, 2012; Walstrom et al., 2008)	IN
Availability of job positions	(Heinze & Hu, 2009; Joshi & Kuhn, 2011; Walstrom et al., 2008)	JA
Gaining a high starting salary	(Beckhusen, 2016; Joshi & Kuhn, 2011)	JS
Influence of media	(Apostol & Näsi, 2013; Walstrom et al., 2008)	MI
Importance of self-image; image of information technology professionals	(Adya & Kaiser, 2005; Walton et al., 2012)	PI
Social image; considered a respectable career	(Eddy & Brownell, 2016; Walton et al., 2012; Wang & Degol, 2013)	SI
Influence of family, friends, professors, advisors, and peers	(Derricks & Sekaquaptewa, 2021; Joshi & Kuhn, 2011; Walton et al., 2012)	SN
Work environment	(Gill et al., 2008; Joshi & Kuhn, 2011)	WE
Intent to major	(Fishbein & Ajzen, 2010)	IM

Table 3 – Citations for Research Model Factors

Hypothesis	Hypothesis Definition
	There are no significant differences between the academic ***years based on the …***
H1	• *aptitude to gain a career in information technology.*
H2	• *attitude toward information technology.*
H3	• *difficulty to major in information technology.*
H4	• *interest in information technology.*
H5	• *availability of information technology positions.*
H6	• *salaries for information technology positions.*
H7	• *influence by various media environments.*
H8	• *personal image of information technology professionals.*
H9	• *social image of information technology professionals.*
H10	• *influence by others relating to information technology careers.*
H11	• *work environment for information technology professionals.*
H12	• *intention to declare information technology as a major.*

Table 4 – Summary of Research Hypotheses

Factor Name	Number of Questions	Question Scale
Aptitude	2	SD/SA
Attitude	2	SD/SA
Difficulty of Major	2	SD/SA
Interest in IT	5	SD/SA
Job Availability	2	SD/SA
Job Salary	2	SD/SA
Media Influence	5	ENI/EI
Personal Image	2	SD/SA
Social Image	2	SD/SA
Subjective Norm	5	SD/SA
Workload Environment	5	SD/SA
Intent to Major	2	SD/SA
Total	36	

Table 5 – Summary of Survey Composition by Factor

Group	Academic Year	Total Responses	Percent of Total	Male	Female	Missing, Not Disclosed
1	2016 – 2017	403	35.7%	241	121	36
2	2017 – 2018	379	33.6%	171	138	68
3	2020 – 2021	169	15.0%	109	50	10
4	2021 – 2022	177	15.7%	125	51	0
	Total	1,128	100.0%	646	360	114

Table 6 – Frequency of Survey Results

		Mean Values				
Factor	N	2016-17	2017-18	2020-21	2021-22	Grand
AP-Aptitude	1,127	3.42	3.46	3.17	3.43	3.40
AT-Attitude	1,127	4.91	4.74	5.00	5.16	4.91
DM-Difficult of Major	1,126	3.53	3.47	3.46	3.43	3.48
IN-Interest IT	1,127	5.02	4.90	4.92	4.99	4.96
JA-Job Availability	1,127	4.60	4.77	4.48	4.81	4.67
JS-Job Salary	1,127	4.73	4.94	4.77	4.76	4.81
MI-Media Influence	1,127	4.36	4.38	4.17	4.15	4.30
PI-Personal Image	1,127	5.44	5.48	5.64	5.92	5.56
SI-Social Image	1,127	5.32	5.16	5.33	5.55	5.30
SN-Subjective Norm	1,127	2.91	3.06	2.69	2.84	2.92
WE-Workload Environment	1,126	4.84	4.82	4.89	4.97	4.86
IM-Intent to Major	1,125	2.38	2.80	2.31	2.39	2.51

Table 7 – Summary of Group and Grand Means by Factor

Factor		Sum of Squares	df	Mean Square	F	Sig.	
Aptitude	Between Groups	10.303	3	3.434	1.776	.150	ns
	Within Groups	2174.207	1124	1.934			
	Total	2184.510	1127				
Attitude	Between Groups	22.615	3	7.538	4.311	.005	**
	Within Groups	1965.454	1124	1.749			
	Total	1988.069	1127				
Difficulty of Major	Between Groups	1.699	3	0.566	0.546	.651	ns
	Within Groups	1164.247	1123	1.037			
	Total	1165.946	1126				
Interest in IT	Between Groups	3.051	3	1.017	1.015	.385	ns
	Within Groups	1126.109	1124	1.002			
	Total	1129.160	1127				
Job Availability	Between Groups	15.570	3	5.190	3.649	.012	*
	Within Groups	1598.525	1124	1.422			
	Total	1614.095	1127				
Job Salary	Between Groups	9.162	3	3.054	2.371	.069	ns
	Within Groups	1447.739	1124	1.288			
	Total	1456.901	1127				
Media Influence	Between Groups	10.432	3	3.477	2.234	.083	ns
	Within Groups	1744.834	1121	1.556			
	Total	1755.266	1124				
Personal Image	Between Groups	32.288	3	10.763	7.597	.000	***
	Within Groups	1592.350	1124	1.417			
	Total	1624.638	1127				
Social Image	Between Groups	18.016	3	6.005	6.075	.000	***
	Within Groups	1111.076	1124	0.989			
	Total	1129.092	1127				
Subjective Norm	Between Groups	17.099	3	5.700	4.301	.005	**
	Within Groups	1489.561	1124	1.325			
	Total	1506.660	1127				
Workload Environment	Between Groups	3.076	3	1.025	1.355	.255	ns
	Within Groups	849.519	1123	0.756			
	Total	852.595	1126				
Intent to Major	Between Groups	47.443	3	15.814	7.995	.000	***
	Within Groups	2219.450	1122	1.978			
	Total	2266.893	1125				

Table 8 – Summary of ANOVA Test of Significance Results

Factor Category	Category Name	Question Text
AP	Aptitude	Majoring in information technology will be a good fit for me.
AP	Aptitude	I believe that I will perform well in an information technology career.
AT	Attitude	I find computers and technology interesting to use.
AT	Attitude	It is interesting when I use information technology to complete my work.
DM	Difficulty in Major	Majoring in information technology will require more study time.
DM	Difficulty in Major	I believe that I will be able to successfully complete a major in information technology.
IN	Interest in Major	I enjoy learning about technology software.
IN	Interest in Major	I believe that I will enjoy … working in a team
IN	Interest in Major	I believe that I will enjoy … using computer software
IN	Interest in Major	I believe that I will enjoy … presenting business related problems
IN	Interest in Major	I believe that I will enjoy … analyzing business related problems
JA	Job Availability	Upon graduation, the number of information technology jobs will be enough so that I can find a position.
JA	Job Availability	The availability of information technology jobs make me comfortable to maintain a successful career.
JS	Job Salary	I believe that I can secure a high paying job, upon graduating with a major in information technology.
JS	Job Salary	My starting salary will be satisfying if I major in information technology.
MI	Media Influence	For each of the following sources, rate the level of influence on the selection of your major. Career fairs, business presentations
MI	Media Influence	For each of the following sources, rate the level of influence on the selection of your major. Newspapers, magazines
MI	Media Influence	For each of the following sources, rate the level of influence on the selection of your major. Job listings
MI	Media Influence	For each of the following sources, rate the level of influence on the selection of your major. Social media
MI	Media Influence	For each of the following sources, rate the level of influence on the selection of your major. Television, movies
PI	Personal Image	Choosing an information technology major would make me appear to be a nerd or not cool while I am in college.
PI	Personal Image	As an information technology major, people would perceive me as anti-social or boring.
SI	Social Image	Information technology jobs are just for nerds or introverts.
SI	Social Image	Majoring in information technology will lead to a respectable career.
SN	Subjective Norm	My family is encouraging me to choose a majoring in information technology.
SN	Subjective Norm	My friends are encouraging me to choose a majoring in information technology.
SN	Subjective Norm	The opinion of my peers is …
SN	Subjective Norm	My professors believe that information technology would be a good fit for me.
SN	Subjective Norm	My advisors believe that information technology would be a good fit for me.
WE	Work Environment	I believe that information technology will be a challenging career.
WE	Work Environment	Majoring in information technology will give me the opportunity to obtain a leadership position in business.
WE	Work Environment	Majoring in information systems will give me the opportunity to work on a variety of positions, tasks and activities in business.

Factor Category	Category Name	Question Text
WE	Work Environment	I believe that working in information technology will allow me to be creative.
WE	Work Environment	When working with information technology, I will be able to benefit people in society by what I work on?
IM	Intent to Major	I intend to major in information technology.
IM	Intent to Major	It is likely that I will choose to major in information technology.

Table 9 – Survey Factors and Questions