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The Longitudinal Impact of IT Self-Efficacy and Interest on Intent to Major

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Abstract

Although enrollment in information technology has increased, it cannot match the growth of the IT labor market with more students needed to enter into the IT field to fulfill demand. This research follows high school students for two years regarding the choice of IT as a college major using the lens of social cognitive career theory (SCCT) to better understand career decision-making over time. Self-efficacy, interest, and intent to major relationships are examined both cross-sectionally and longitudinally. Findings show that IT self-efficacy has a significant positive effect on interest and intent to major respectively and interest in IT has a significant positive effect on intent to major in IT. These are consistent with previous research in SCCT. Contrarily, only IT self-efficacy increases over time, while intent to major decreases during this same two-year time period.

Keywords: social cognitive career theory, longitudinal, career choice

Please note: A previous version of this article received one of the best paper awards at the 2023 Midwest Association for Information Systems (MWAIS) held at Metro State University in May 2023. The article has been expanded and was subject to a second round of reviews. We congratulate the authors.

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1. Introduction

Recently science, technology, engineering, and math (STEM) programs in colleges and universities often have low student enrollment, high attrition rates (Forney, 2020; Sithole et al., 2017), and in turn low retention rates (Lytle & Shin, 2020). With the rapid development of the tech industry, the situation has exacerbated the shortage of qualified labor. Reports show that the United States of America needs to fill the demand for 3.5 million STEM jobs by 2025 (Cullins, 2022; Lazio & Jr, 2019). This high demand has become a national concern to the point that outreach programs have been designed to attract more students into STEM studies (Makransky, Petersen, & Klingenberg, 2020). The purpose of this study is to utilize one such program to investigate the reasons high school students choose IT as their major utilizing a year-long program to increase interest in IT.

Social Cognitive Career Theory (SCCT) explores career development to understand how to influence occupational interests and choices (Lent, Brown, & Hackett, 2000) through reciprocal links among individual attitudes, environment, and behaviors (Lent, Brown, & Hackett, 1994). While a useful model, most previous research uses students who are already in the STEM field (such as college students) with the majority of this research testing the SCCT model cross-sectionally (Burga, Leblanc, & Rezania, 2020; Heinze & Hu, 2017; Navarro, Flores, & Worthington, 2007). Even though some research focuses on longitudinal impacts, the time is a short period, such as one year or less (Rogers & Creed, 2011). This study extends previous research by not only testing SCCT cross-sectionally, but also brings a greater understanding of the longitudinal impacts within intervention programs designed to influence individual career development. Furthermore, our research utilizes a sample of high school students who have yet to make decisions about their study area. Our research questions are:

1) What factors impact major choice in IT prior to career development (cross-sectionally)?
2) How do these factors influence these individuals over time as they gain more IT-related experience?

This research focuses on measuring the impact of IT interest and self-efficacy on individual intent to choose a major in IT by utilizing the SCCT model and examining these core concepts over time with 43 students across 40 different high schools for two years. Results reveal that initial cross-sectional relationships are consistent with previous research (Flores & O'Brien, 2002; Heinze & Hu, 2017; Rottinghaus, Larson, & Borgen, 2003). Longitudinally, we find that self-efficacy increases but interest does not. Interestingly, the intent to major decreases over this same two-year period. This study contributes to the application of SCCT in the IT domain for longitudinal impacts in early career development.

2. Background

Social cognitive career theory (SCCT) is used to understand how people choose their careers and predict career behavior (Lent et al., 1994). This theory is developed from Bandura's general social cognitive theory (Bandura, 1986) which stresses the dynamic and triadic interactions of individual, behavioral, and environmental factors (Heinze & Hu, 2017; Lent et al., 1994; Lent, Lopez Jr, Lopez, & Sheu, 2008; Luse, Rursch, & Jacobson, 2014). Individual factors represent personal cognitive and emotional states, environmental factors indicate the external environment, and behavioral factors indicate overt behavior, with the three factors having reciprocal effects on one another (Bandura, 1986; Lent et al., 1994). In SCCT, the behavior (outcome variable) is regarded as the individual's choice of major or career while the individual and environmental factors can influence the whole process (Rursch & Luse, 2019). Accordingly, we believe that students have the ability to control their own personal behavior and meanwhile external environmental and internal psychological factors are likely to support or undermine this ability in career development (Lent et al., 1994; Luse et al., 2014).

Depending on various outcomes, SCCT contains three interconnected models: 1) interest model, 2) choice model, and 3) performance model (Lent & Brown, 2019; Lent, 2000). The interest model investigates how academic and professional interests emerge, looking at characteristics of the family, educational, recreational, and peer contexts and how they affect interest in a particular career field. Intention is the outcome variable in the interest model. Moreover, the choice model addresses how individuals form their educational and career choices, with choice goals as the outcome. Furthermore, the performance model explains accomplishments connected to chosen or adopted goals, with performance goals as the outcome (Lent et al., 1994). In particular, we focus on the choice model rather than the other two for several reasons. First, the interest model is built upon the choice model and the two models overlap in their core concepts (Lent & Brown, 2019; Lent et al., 2008). Moreover, this research emphasizes that students intend to choose a major for their undergraduate programs in the future. Therefore, we use the choice model of SCCT to scrutinize how individual predictors influence intent to major.

SCCT implies two individual-level predictors of individual interest and self-efficacy beliefs, which might impact individual intention to major in a certain area (Rursch & Luse, 2019). Individual interest represents whether individuals

like or dislike certain activities (Rursch & Luse, 2019). SCCT assumes that individuals are likely to be attracted to distinct activity niches within a wider sector in part due to their personal interests (Lent & Brown, 2006). Students are more likely to succeed in subjects they enjoy studying as well as seek jobs in those areas (Mohd Shahali, Halim, Rasul, Osman, & Mohamad Arsad, 2018). In addition, self-efficacy beliefs encompass judgments of individual capabilities to organize and execute courses of action to attain specific outcomes (Bandura, 1986). Self-efficacy is considered to directly affect individuals' thoughts, activities, and choices (Lent et al., 1994) since individuals can successfully complete their tasks when believing they have enough skills and ability to conduct them (Rursch & Luse, 2019). Moreover, self-efficacy can be measured using both general and task-specific methods. The program in this study provides different kinds of tasks in certain areas, necessitating task-specific self-efficacy measures.

Intention to choose in SCCT is impacted by not only the two personal factors of interest and self-efficacy but also the environment. Environmental factors represent "the temporal and spatial forces beyond an individual's boundaries". A supportive environment for students contains various resources that can allow students to explore a certain area. For example, an environment with enough teachers and abundant educational materials can let students learn very conveniently. Some research introduces intervention programs to enhance the possibility of attracting students into STEM areas for their future careers (Ball, Huang, Cotten, Rikard, & Coleman, 2016; Betz & Schifano, 2000). By providing mentors, such as faculty or program leaders, to students involved in these intervention programs, they are encouraged to pursue advanced training and careers (Byars-Winston & Rogers, 2019). This research utilizes one such intervention program as a supportive environment to train and attract students into pursuing STEM areas.

This research focuses on a specific area - IT, with the tenets of SCCT specific to this context. IT self-efficacy refers to a belief that individuals have the ability to perform a specific IT task successfully (Bandura, 1986; Luse et al., 2014; Scheibe, Mennecke, & Luse, 2007). Interest in IT represents that people enjoy IT activities or subjects (Luse et al., 2014). Intent to major is when students intend to perform some action (Lent et al., 2015), such as choosing IT as their major (Rursch & Luse, 2019).

Based on previous research, SCCT has been used to measure career aspirations using cross-sectional studies (Lent et al., 2015; Rursch & Luse, 2019). Individuals with higher self-efficacy are likely to develop interests in IT (Lent & Brown, 2019). Since they believe they are good at the tasks in an area and have good performance in each activity, they are more likely to have interest in pursuing or choosing to do these same tasks. In empirical studies, self-efficacy is found to have a positive relationship with interest (Flores & O'Brien, 2002; Krieger, 2022; Lent & Brown, 2019; Rottinghaus et al., 2003; Smith, 2002) and intention to choose IT as a major (Heinze & Hu, 2017; Navarro et al., 2007).

In addition, interest is seen as a strong predictor of choice of future career goals (Brown & Brooks, 1990). Interest is found to have a positive impact on the intention to choose IT (Asli Yagmur Akbulut, 2008; Zhang, 2007). When students enjoy doing IT tasks, they are more likely to intend to choose IT for their future career. Given this information, we hypothesize:

Hypothesis 1: Initial IT self-efficacy will positively influence the initial level of interest in IT.
Hypothesis 2: Initial IT self-efficacy will positively influence the initial level of intent to major.
Hypothesis 3: Initial interest in IT will positively influence the initial level of intent to major.

Although most previous research has focused on a one-time impact, SCCT also emphasizes a dynamic process over time – how a focal individual makes a decision (behavior) from the interaction between personal predictors and the supported environment, and how the subsequent behavior impacts these two forces (Clary, Dick, Yagmur Akbulut, & Van Slyke, 2022; Lent et al., 1994; Lent et al., 2000). Specifically, we are interested in the context of intervention programs as an external environmental force. The three core concepts of SCCT, self-efficacy, interest, and intent to major, might change over time during these intervention programs. Self-efficacy is relatively dynamic in particular activity domains (Lent et al., 1994; Lent et al., 2005) with individual beliefs changing dependent on performance (Burga et al., 2020; Lent et al., 1994; Valcour & Ladge, 2008). Particularly, self-efficacy can vary remarkably based on a certain activity or domain (Lent & Brown, 2006; Luse & Rursch, 2021). When students have more experience in IT through an educational program and are good at IT tasks or projects, their IT self-efficacy is likely to increase due to an increase in confidence of performing IT tasks (Lent & Brown, 2006; Luse, Mennecke, & Triplett, 2013).

Interest is dynamic as more positive experience with IT leads to greater interest (Brown & Brooks, 1990; Smith, 2002). When enjoying studying IT during educational programs, individuals are more interested in IT. Additionally, students having more experience in the program might intend to choose to pursue a career in that area (Belchior & Lyons, 2021; Lent et al., 2015). For example, students with strong coding skills might choose information systems as their major in college. Given this information, we hypothesize:

Hypothesis 4: As students gain more experience in IT, they will show an increase in IT self-efficacy.
Hypothesis 5: As students gain more experience in IT, they will show an increase in interest in IT.
Hypothesis 6: As students gain more experience in IT, they will show an increase in intention to major in IT.

Figure 1 shows the research model with the proposed hypotheses.

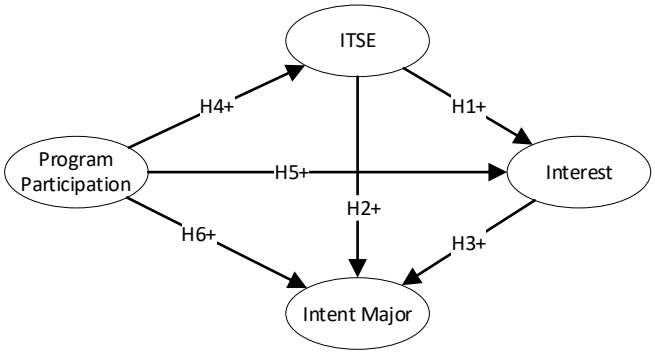


Figure 1. Research model

3. Data collection

The research consisted of a field study of participants in the outreach program. A field study is used to observe and interact with subjects in a natural environment and in real life with less control while an experimental study is conducted in a laboratory environment under controlled conditions (Heppner, Wampold, & Kivlighan, 2008). In our case, we did not consider using a control group which does not allow all students to have equal access to the educational content. The students in the control group could not benefit from the program until finishing this study; therefore, a field study is appropriate for our case and pedagogic purpose.

Subjects in this study signed up for an IT outreach program that allows students to explore IT areas and to increase interest in IT majors. The program contained educational programming, service-learning projects, and competitive events in the areas of cyber defense, game design, and robotics as outlined in previous research (Rursch, Luse, & Jacobson, 2009). Since this program targeted high school students across a Midwestern state, IT clubs in high schools played an important role in letting local students know and engage in this program. The IT clubs provided classes with educational materials and equipment, mentors, and transportation to the final competitive event for students, coined the IT Olympics. Although it was difficult to provide a complete gamut of IT information, the program supplied enough material that allowed students to conduct their own in-depth and inquiry-based approach to overcome a specific IT challenge during learning. Overall, the program provided a supporting environment to enhance understanding and enthusiasm for IT and increase enrollment in IT-related post-secondary education to address future needs in the IT industry.

Most participants had little experience in IT before taking part in the program. The students were encouraged to learn all three areas (cyber defense, game design, and robotics), but some chose one area to explore. During the program, students not only went to their IT clubs to learn about various IT concepts, but also could participate in year-ending IT Olympics competition related to one of the three areas (Rursch et al., 2009). More detailed information about the area design and concepts taught is provided in the Appendix. The program has been running since 2008, and we collected data from 2008 up until the pandemic. We sent emails with online surveys to students both in the fall, after initial enrollment in the program, and spring, after the conclusion of the program. The purpose of this study was to assess the multi-year impact of those who participated in the program multiple years. Over a two-year period, students were surveyed four separate times, at the beginning and end of each academic year, as seen in Figure 2.

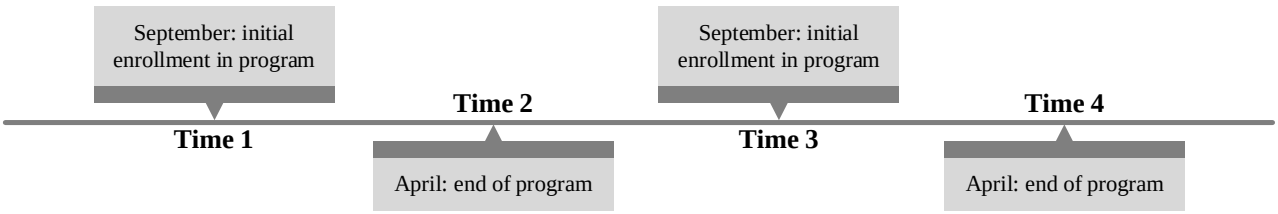


Figure 2. data collecting processing.

4. Results

The sample consisted of 43 students measured at four separate time points, totaling 172 measurements. The sample consisted of six female and 37 male participants. Questions measuring the three constructs of IT self-efficacy, interest in IT, and intent to major in IT were utilized from previous research (Luse et al., 2014) based on best practices of task-based assessment (Davazdahemami, Luse, Scheibe, & Townsend, 2018) (see Appendix for questions). Cronbach alpha values at all four measurement times were found to be high for both ITSE (0.89, 0.85, 0.85, 0.84) and interest (0.86, 0.82, 0.84, 0.88), with intent to major in IT measured using a single item. Gender and year in school were also included as control variables.

Growth curve modeling was used to test the hypotheses, allowing examination of both the cross-sectional impact of the exogenous variables on the endogenous variables (H1-H3), and the longitudinal change of each variable over time (H4-H6) (Luse et al., 2013). Results show that the initial level of ITSE has a significant positive effect on the initial level of interest ($\beta = 0.48$, $p < 0.001$), supporting H1. The initial level of ITSE also has a significant positive effect on intent to major ($\beta = 0.28$, $p = 0.033$), supporting H2. Furthermore, the initial level of interest has a significant positive effect on intent to major ($\beta = 0.64$, $p < 0.001$), supporting H3. Examining the longitudinal relationships, there is a significant increase in ITSE over time (mean = 0.64, $p = 0.031$), supporting H4. Conversely, there is no significant increase in interest over time (mean = -0.47, $p = 0.534$), not supporting H5. While there is a significant change in intent to major over time (mean = -0.63, $p = 0.040$), the change is decreasing, contrary to H6. Figure 2 shows the mean trajectories of each of the three variables over each of the four time points.

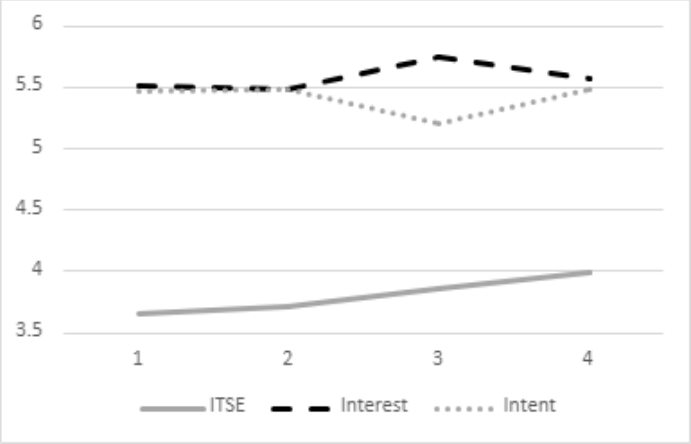


Figure 3. longitudinal impact

5. Discussion

It is important to satisfy the demand of the IT job market by encouraging more students to choose an IT-related field as their major. Interacting with high school students in their early career development can increase the possibility of opportunities to major in IT areas (Babin, Grant, & Sawal, 2010). This study builds on previous research using SCCT in IT (Luse, Rursch, & Jacobson, 2016; Luse et al., 2014; Rursch & Luse, 2019) and extends previous findings investigating why students choose to major in IT and the change in self-efficacy, interest, and intent to major over time by examining cross-sectional and longitudinal impacts in the choice model of SCCT.

Our research reveals that IT self-efficacy has a significant positive effect on interest, and intent to major and interest in IT have a significant positive effect on intent to major in IT before the program starts, which are consistent with previous research of cross-sectional studies in SCCT (Flores & O'Brien, 2002; Heinze & Hu, 2017; Luse et al., 2014). Subsequently, to measure the longitudinal impact of the three concepts, our results show that IT self-efficacy steadily increases over time. By completing more IT tasks successfully, students have more confidence to perform these tasks. Conversely, interest does not change while intention to major significantly decreases over time (Mohd Shahali et al., 2018). It is interesting to see in Figure 3 that this decrease in intent to major takes place in timepoint 3. It is possible that when students gain more understanding of IT, they might know what they really like or dislike and may have more thoughts and plans for their career development. Moreover, the quality of teaching and learning experience in the classroom might be another possible factor to impact interest over time (Xu, 2016). Furthermore, research indicates that

interest highly correlates with steady personality traits that do not change over time (Bonitz, Larson, & Armstrong, 2010), which may explain the lack of change in interest.

A surprising finding of this research involved the decrease in intent to major as the students progressed in the program; however, some previous research has found similar results (Henderson et al., 2022; Schultz et al., 2011). Henderson's study included college women who were interested in a STEM major (intending to major), were in STEM disciplines from various universities, and took part in a longitudinal survey of women's education and success without intervention. The survey contained educational experiences and achievements, psychosocial factors, and career aspirations. Although this study focused on different factors in the outcome of intention, the authors revealed a meaningful result about intention using a growth curve model. Specifically, female students expressed a high level of intention to persist in the science area at the beginning, yet as time went on, their intentions decreased and eventually leveled off. Moreover, Schultz's research conducted a quasi-experimental design for college students who had enrolled in a prototypical minority training program, named the RISE program, for 3 years. In this sample, all participants who were attending a 4-year university majoring in a STEM discipline showed that they wanted to pursue a science-related research career. The authors expected the RISE treatment group and matching control group to be similar on intention at the beginning and then these two groups would differ in their growth trajectories over time. The finding revealed that the trajectory of intention was negative in both the RISE and matching control students. Although students in the study showed interest in pursuing a scientific research career at first, the trend of intention declined steadily over time. These studies revealed that even though students have more training, their intention to major has a negative growth trajectory, which is consistent with our findings.

These results paint a disturbing picture of intent to major. We conducted additional post hoc analyses to further investigate the issues found with both interest and intent. Findings show that changes in interest positively affect changes in intent ($\beta = 0.568$, $p = 0.030$), whereby the greater the *increase* in interest, the greater the *increase* in intent to major. This implies that concentrating on increasing student interest can have a correspondingly greater increase in intent. Moreover, post hoc analysis also shows the initial level of interest has a positive effect on changes in intent to major ($\beta = 0.60$, $p = 0.043$), implying an accelerating effect in this relationship. Students with a high level of interest in IT at the start of the program are more likely to increase their intention of choosing IT as a major over time. Given these facts, for students who are predisposed, the program is more likely to increase their intention to major and it is therefore beneficial to expose students to IT concepts prior to the start of the program in order to see greater gains in intent. For implementation in practice, building supportive environments for these students is important. In our case, schools play an important role in the enhancement of student's interests and, in turn, positively impact intention. Schools as social support can provide adequate mentors, materials, classes, and events to let students explore IT. In addition, our program can help students with low ITSE to foster IT interests. The students who do not have much access to explore IT are likely to not have enough confidence to do IT tasks. Our program can increase their ITSE and in turn, positively impact IT interest.

Although this study reveals important findings, a few limitations cannot be ignored. Due to the low number of females in our sample, analysis by gender is not possible, especially in our imbalanced dataset that has only 6 females. Moreover, the participants are high school students under 18 years old. It is hard to track these students due to privacy concerns. In future work, we expect to look more in-depth to see if these students actually choose their major in IT once entering college. Furthermore, our program is designed to focus on three areas (cyber defense, game design, and robotics). Future research could add more subsections, such as business or database analysis. Future research might also consider conducting a qualitative study for further analysis. This type of qualitative analysis may also help to identify commonalities among those with decreasing intent to better understand the attributes of the specific individuals who are either not gaining interest or decreasing in intent to major over time.

This study contributes to understanding the longitudinal impacts of students prior to career development in information technology. Theoretically, this study extends social cognitive career theory for high school students with a longitudinal context. We found that high school outreach programs are effective at raising IT self-efficacy. Although our longitudinal results revealed an unsettling image in intention and interest where students' intention and interest did not increase during this program, post-hoc analysis shows that students can increase in intention to major in IT in college if interested in IT before engaging in the programs. This implies that a supporting environment could cultivate students' interests and that predisposed students can enhance the possibility of intention after joining the program. Moreover, our

program can encourage students to learn IT and conduct IT tasks successfully, which has a positive influence on their interests. Therefore, building a program for high school students is still valuable.

7. References

Asli Yagmur Akbulut, C. A. L. J. M. (2008). Combating the Decline in Information Systems Majors The Role of Instrumental Assistance. *Journal of Computer Information Systems, 48*(3), 84-93. doi:10.1080/08874417.2008.11646024

Babin, R., Grant, K. A., & Sawal, L. (2010). Identifying Influencers in High School Student ICT Career Choice. *Information Systems Education Journal, 8*(26), n26.

Ball, C., Huang, K.-T., Cotten, S. R., Rikard, R. V., & Coleman, L. O. (2016). Invaluable values: an expectancy-value theory analysis of youths' academic motivations and intentions. *Information, Communication & Society, 19*(5), 618-638. doi:10.1080/1369118x.2016.1139616

Bandura, A. (1986). *Social foundations of thought and action*: Englewood Cliffs, NJ, .

Belchior, R. F., & Lyons, R. (2021). Explaining entrepreneurial intentions, nascent entrepreneurial behavior and new business creation with social cognitive career theory – a 5-year longitudinal analysis. *International Entrepreneurship and Management Journal, 17*(4), 1945-1972. doi:10.1007/s11365-021-00745-7

Betz, N. E., & Schifano, R. S. (2000). Evaluation of an Intervention to Increase Realistic Self-Efficacy and Interests in College Women. *Journal of Vocational Behavior, 56*(1), 35-52. doi:10.1006/jvbe.1999.1690

Bonitz, V. S., Larson, L. M., & Armstrong, P. I. (2010). Interests, self-efficacy, and choice goals: An experimental manipulation. *Journal of Vocational Behavior, 76*(2), 223-233. doi:10.1016/j.jvb.2009.09.003

Brown, D., & Brooks, L. (1990). *Career choice and development : applying contemporary theories to practice* (2nd ed.). San Francisco: Jossey-Bass Publishers.

Burga, R., Leblanc, J., & Rezania, D. (2020). Exploring Student Perceptions of Their Readiness for Project Work: Utilizing Social Cognitive Career Theory. *Project Management Journal, 51*(2), 154-164. doi:10.1177/8756972819896697

Byars-Winston, A., & Rogers, J. G. (2019). Testing intersectionality of race/ethnicity x gender in a social-cognitive career theory model with science identity. *J Couns Psychol, 66*(1), 30-44. doi:10.1037/cou0000309

Clary, G., Dick, G., Yagmur Akbulut, A., & Van Slyke, C. (2022). The After Times: College Students' Desire to Continue with Distance Learning Post Pandemic. *Communications of the Association for Information Systems, 50*(1), 122-142. doi:10.17705/1cais.05003

Cullins, A. (2022). Top 6 Benefits of Earning a STEM Degree. Retrieved from https://www.transizion.com/top-6-benefits-earning-stem-degree/

Davazdahemami, B., Luse, A., Scheibe, K. P., & Townsend, A. M. (2018). Training, self-efficacy, and performance; a replication study. *AIS Transactions on Replication Research, 4*(1), 3.

Flores, L. Y., & O'Brien, K. M. (2002). The career development of Mexican American adolescent women: A test of social cognitive career theory. *Journal of Counseling Psychology, 49*(1), 14-27. doi:10.1037/0022-0167.49.1.14

Forney, A., and Sunai Kim. (2020). Redefining retention in STEM education: New perspectives on a student-centered metric of success. *2020 ASEE Virtual Annual Conference Content Access*.

Heinze, N., & Hu, Q. (2017). Why college undergraduates choose IT: a multi-theoretical perspective. *European Journal of Information Systems, 18*(5), 462-475. doi:10.1057/ejis.2009.30

Henderson, H. L., Bloodhart, B., Adams, A. S., Barnes, R. T., Burt, M., Clinton, S., . . . Hernandez, P. R. (2022). Seeking congruity for communal and agentic goals: a longitudinal examination of U.S. college women's persistence in STEM. *Social Psychology of Education, 25*(2-3), 649-674. doi:10.1007/s11218-021-09679-y

Heppner, P. P., Wampold, B. E., & Kivlighan, D. M. (2008). *Research design in counseling* (3rd ed.). Belmont, CA: Thompson Brooks/Cole.

Krieger, C. a. L., Andy. (2022). Utilizing a Virtual Internet Testbed and Private Cloud to Teach O. *MWAIS 2022 Proceedings*, 26. Retrieved from https://aisel.aisnet.org/mwais2022/26

Lazio, R., & Jr, H. F. (2019). The U.S. Needs to Prepare Workers for STEM Jobs. Retrieved from https://www.shrm.org/hr-today/news/hr-magazine/summer2019/pages/the-u.s.-needs-to-prepare-workers-for-stem-jobs.aspx

Lent, R. W., & Brown, S. D. (2006). On Conceptualizing and Assessing Social Cognitive Constructs in Career Research: A Measurement Guide. *Journal of Career Assessment, 14*(1), 12-35. doi:10.1177/1069072705281364

Lent, R. W., & Brown, S. D. (2019). Social cognitive career theory at 25: Empirical status of the interest, choice, and performance models. *Journal of Vocational Behavior, 115*. doi:10.1016/j.jvb.2019.06.004

Lent, R. W., Brown, S. D., & Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest, choice, and performance. *Journal of vocational behavior, 45*(1), 79-122.

Lent, R. W., Brown, S. D., & Hackett, G. (2000). Contextual supports and barriers to career choice: A social cognitive

analysis. *Journal of counseling psychology*, *47*(1).
Lent, R. W., Brown, S. D., Sheu, H.-B., Schmidt, J., Brenner, B. R., Gloster, C. S., . . . Treistman, D. (2005). Social Cognitive Predictors of Academic Interests and Goals in Engineering: Utility for Women and Students at Historically Black Universities. *Journal of Counseling Psychology, 52*(1), 84-92. doi:10.1037/0022-0167.52.1.84
Lent, R. W., Lopez Jr, A. M., Lopez, F. G., & Sheu, H.-B. (2008). Social cognitive career theory and the prediction of interests and choice goals in the computing disciplines. *Journal of Vocational Behavior, 73*(1), 52-62.
Lent, R. W., Miller, M. J., Smith, P. E., Watford, B. A., Hui, K., & Lim, R. H. (2015). Social cognitive model of adjustment to engineering majors: Longitudinal test across gender and race/ethnicity. *Journal of Vocational Behavior, 86*, 77-85. doi:10.1016/j.jvb.2014.11.004
Luse, A., Mennecke, B., & Triplett, J. (2013). The changing nature of user attitudes toward virtual world technology: A longitudinal study. *Computers in Human Behavior, 29*(3), 1122-1132.
Luse, A., & Rursch, J. (2021). Using a virtual lab network testbed to facilitate real-world hands-on learning in a networking course. *British Journal of Educational Technology, 52*(3), 1244-1261.
Luse, A., Rursch, J., & Jacobson, D. (2016). When Size Does Matter Identifying Multilevel Factors Contributing to IT Major Choice. *Midwest Association of Information Systems*.
Luse, A., Rursch, J. A., & Jacobson, D. (2014). Utilizing structural equation modeling and social cognitive career theory to identify factors in choice of IT as a major. *ACM Transactions on Computing Education (TOCE), 14*(3), 1-19.
Lytle, A., & Shin, J. E. (2020). Incremental Beliefs, STEM Efficacy and STEM Interest Among First-Year Undergraduate Students. *Journal of Science Education and Technology, 29*(2), 272-281. doi:10.1007/s10956-020-09813-z
Makransky, G., Petersen, G. B., & Klingenberg, S. (2020). Can an immersive virtual reality simulation increase students' interest and career aspirations in science? *British Journal of Educational Technology, 51*(6), 2079-2097. doi:10.1111/bjet.12954
Mohd Shahali, E. H., Halim, L., Rasul, M. S., Osman, K., & Mohamad Arsad, N. (2018). Students' interest towards STEM: a longitudinal study. *Research in Science & Technological Education, 37*(1), 71-89. doi:10.1080/02635143.2018.1489789
Navarro, R. L., Flores, L. Y., & Worthington, R. L. (2007). Mexican American middle school students' goal intentions in mathematics and science: A test of social cognitive career theory. *Journal of Counseling Psychology, 54*(3), 320-335. doi:10.1037/0022-0167.54.3.320
Rogers, M. E., & Creed, P. A. (2011). A longitudinal examination of adolescent career planning and exploration using a social cognitive career theory framework. *J Adolesc, 34*(1), 163-172. doi:10.1016/j.adolescence.2009.12.010
Rottinghaus, P. J., Larson, L. M., & Borgen, F. H. (2003). The relation of self-efficacy and interests: a meta-analysis of 60 samples. *Journal of Vocational Behavior, 62*(2), 221-236. doi:10.1016/s0001-8791(02)00039-8
Rursch, J. A., & Luse, A. (2019). The Group Level Contextual Support of IT Self Efficacy on Individuals Choice to Major in IT. *2019 IEEE Frontiers in Education Conference (FIE)*.
Rursch, J. A., Luse, A., & Jacobson, D. (2009). IT-adventures: A program to spark IT interest in high school students using inquiry-based learning with cyber defense, game design, and robotics. *IEEE Transactions on Education, 53*(1), 71-79.
Scheibe, K. P., Mennecke, B. E., & Luse, A. (2007). The Role of Effective Modeling in the Development of Self-Efficacy: The Case of the Transparent Engine. *Decision Sciences Journal of Innovative Education, 5*(1), 21-42.
Schultz, P. W., Hernandez, P. R., Woodcock, A., Estrada, M., Chance, R. C., Aguilar, M., & Serpe, R. T. (2011). Patching the Pipeline: Reducing Educational Disparities in the Sciences Through Minority Training Programs. *Educ Eval Policy Anal, 33*(1). doi:10.3102/0162373710392371
Sithole, A., Chiyaka, E. T., McCarthy, P., Mupinga, D. M., Bucklein, B. K., & Kibirige, J. (2017). Student Attraction, Persistence and Retention in STEM Programs: Successes and Continuing Challenges. *Higher Education Studies, 7*(1). doi:10.5539/hes.v7n1p46
Smith, S. M. (2002). Using the social cognitive model to explain vocational interest in information technology vocational interest in information technology. *Information Technology, Learning, and Performance Journal, 20*(1), 1-9.
Valcour, M., & Ladge, J. J. (2008). Family and career path characteristics as predictors of women's objective and subjective career success: Integrating traditional and protean career explanations. *Journal of Vocational Behavior, 73*(2), 300-309. doi:10.1016/j.jvb.2008.06.002
Xu, Y. J. (2016). The Experience and Persistence of College Students in STEM Majors. *Journal of College Student Retention: Research, Theory & Practice, 19*(4), 413-432. doi:10.1177/1521025116638344
Zhang, W. (2007). Why IS: Understanding undergraduate students' intentions to choose an Information Systems major. *J. Inf. Syst. Educ, 18*(4), 447-458.

8. Appendix

An IT-adventure program:

The content of the IT-adventure program can be found in previous work (Rursch et al., 2009). Here we list the main information of knowledge modules and lectures in three areas.

Lectures in cyber defense:

1. Operating systems, specifically FreeBSD
2. Basic Unix/Linux commands
3. Networking concepts - network addresses, cabling, devices, route tables
4. Networking concepts - ports and protocols, Wireshark, firewalls, netstat
5. Network services - Sendmail, DNS
6. Network services - POP/IMAP, Apache/PHP for web servers
7. Securing services - Focused on remote programming environment for FreeBSD
8. Securing services - Windows XP machines, as well as Frerunning; monitoring log files, examining processes, scanning networks/machines to determine what services are running
9. Securing services - More on Windows XP machines

Content to teach in game design:

This program mainly taught the syntax of a new computer language with the Alice software as well as the textbook of *learning to program with Alice*.

Robotics:

This program provides the Lego Mindstorm NXT base education kit, the educational resource kit and the Mindstorms NXT software v1.1. It also supplied the book *Building Robots with Lego Mindstorms* NXT with two sets of DVDs entitled Robotics Engineering Vol I and Robotics Engineering Vol II.

Measurement items:

IT Self-Efficacy: Measured from 1 (not at all confident) to 7 (totally confident)

I believe I have the ability to effectively set up an enterprise email server.
I believe I have the ability to administer group permissions in an enterprise.
I believe I have the ability to modify the configuration of a Web server.
I believe I have the ability to design an interactive user interface.
I believe I have the ability to program for effective user interaction.
I believe I have the ability to program stimulating game logic.
I believe I have the ability to successfully construct the physical structure of a machine.
I believe I have the ability to fine-tune gear ratios for a mechanical device.
I believe I have the ability to use available parts to accomplish a task.

Interest in IT: Measured from 1 (strongly dislike) to 7 (strongly like)

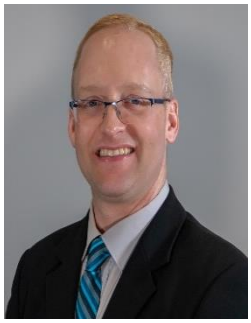
Maintaining hardware and software for my family and/or friends' computer(s)
Keeping up-to-date on the latest software
Researching components and building my own computer
Improving computer performance
Installing a new computer system

Intention to Major in IT: Measured from 1 (strongly disagree) to 7 (strongly agree)

I intend to major in an IT—related discipline upon entering college.

Author Biographies

Qinhui Wang is a Doctoral Student at Oklahoma State University in the department of Management Science and Information Systems. Her research interests include traditional behavioral research in education and misinformation.



Andy Luse is a William S. Spears Chair in Business and Associate Professor of Management Science and Information Systems in the Spears School of Business at Oklahoma State University. He received a B.A. degree in Computer Science from Simpson College, M.S. degrees in Information Assurance, Computer Engineering, Business Administration, and Psychology, and Ph.D. degrees in Human Computer Interaction, Computer Engineering, and Information Systems from Iowa State University. Andy has been published in the *Journal of Management Information Systems*, *Journal of the Association for Information Systems*, *Decision Support Systems*, *Journal of Business Research*, *Communications of the Association for Information Systems*, *Computers in Human Behavior*, and many other outlets.

Julie Rursch received the B.S. degree in applied science from Western Illinois University, Macomb, IL, USA, in 1985, the M.S. degree in journalism and mass communication from Iowa State University, Ames, IA, USA, in 1988, the Ph.D. degree in mass communication from the University of Wisconsin–Madison, Madison, WI, USA, in 1994, and the Ph.D. degree in computer engineering from Iowa State University in 2017. She is currently an Associate Teaching Professor with the Department of Electrical and Computer Engineering, Iowa State University. She has been published in the *ACM Transactions on Computing Education and the IEEE Transactions on Education*, as well as many refereed conferences. Her research has focused on engineering education and cybersecurity.