Abstract

The declining enrollment is a dilemma that many information systems programs are facing. In this study, we design a “Mobile Star” project to promote the information systems major to high school students in Texas. Each “Mobile Star” project consists of a mobile app development workshop and the student’s app showcase. We expect to explore whether the student’s perceived completion, perceived achievement, and perceived enjoyment received from the extracurricular activities can transform into their commitment to formal information systems studies and their actual enrollment into the information systems majors. We introduce our theoretical model, current pilot studies, and future project implementations in this research-in-progress report.

Keywords: IS education, IS curriculum design, STEM intervention, experiential learning

Introduction

The declining enrollment has long been identified as a threatening factor to the information systems (IS) discipline (Firth et al. 2008; Joshi and Kuhn 2011; Looney et al. 2014). Prior studies believe that the dilemma is resulted from several factors. For instance, potential students do not understand what an IS major is, and tend to choose majors (e.g., computer sciences) they are more familiar to (Firth et al. 2008). Mass media frequently use inaccurate data to describe the dimming future of the IS job market, which scare off potential students of the IS major (Panko 2008). In addition, the IS subject name could make some students misunderstand that it is a difficult major similar to other science, technology, engineering, and math (STEM) majors. Subsequently, these students would choose other business majors that they believe would be “easier”. To address these issues, it is critical for IS educators to reach out to future students, especially the high school students, and use intervention extracurricular activities to help them to better understand the IS major at an early stage, get them interested, and establish their commitment to formal studies in the IS major (Choudhury et al. 2010). In fact, a number of intervention programs such as summer camps and career days have been implemented to draw high school students’ interest in the IS major (Choudhury et al. 2010; Warren et al. 2012). These programs have made some progress; however, the enrollment and the number of degrees conferred in the IS major are still much lower than other majors (e.g., business administration) for which fewer motivational efforts have been made in the U.S. (IES, 2014). Educators in many European countries are facing a similar issue. Even though many motivational programs have been implemented, “the proportion of students going into STEM programs is not increasing at the European level” (Caprile et al. 2015, pp. 12). Twenty five of the EU28 countries reported their difficulties in recruiting the IT professionals, making IT the third place in the list of top 20 vocations with most vacancies in Europe (Caprile et al. 2015). These challenges raise a very important question to those who are dedicated to promoting the IS major: What factors can transform the high student’s informal interest to their formal commitment to IS studies?

In this study, we present the “Mobile Star” project designed to answer this question. The “Mobile Star” project is an after-class mobile app development workshop and showcase focusing on high school students in Texas. The objectives of “Mobile Star” are twofold: First, we intend to help high school students to get a preview of an IS major by engaging them in a hands-on app development and real world...
marketing process. Second, we are interested in exploring a new pedagogical model that can transform the high school student’s interest established in the extracurricular activities into their commitment to formal studies in the IS major. We introduce the theoretical model of the project, current pilot studies, future project implementation and data collections in this research-in-progress report.

Literature Review

Prior studies believe that an early intervention can have a positive effect on the high school student’s interest in a collegiate major, especially in those consisting of challenging STEM components (Wang 2013). Furthermore, the prior motivational efforts can be classified into two groups according to their different focuses, including the hedonic learning activities and the career coaching activities. The hedonic learning based view believes that the student’s interest is the most critical factor of the student’s choice of a future academic major, and making a subject fun to learn is the primary step of building the student’s interest (Vansteenkiste et al. 2004). Although this point of view can be applied to almost all learning activities, prior studies suggest that educators should take the following factors into account, when applying the hedonic learning pedagogy into extracurricular programs for high school students: First, educators should place an emphasis on the student’s hands-on learning. “Doing” is better than simply “watching” and “listening” (Gerber et al. 2001). Second, high school students may not have built the knowledge base to comprehend advanced theories. Thus, educators should focus on letting participants “play” rather than “studying” in the activities (Lee and Hoadley 2007; Simpson 2005). The hedonic learning pedagogy has been broadly adopted by the major funding agencies such as the National Science Foundation and the Institute of Education Sciences to sponsor the extracurricular activities for high school students in the U.S. in recent years. Career coaching is another critical pedagogy adopted by a number of extracurricular programs to motivate the student’s interest in a collegiate major (Choudhury et al. 2010; El-Masri and Addas 2014; Warren et al. 2012). This perspective believes that playfulness can only partially influence the student’s commitment to a collegiate major. More important, educators should display a bright career future that the major can create. The student’s expectation of future career success can then have a significant positive effect on the student’s intention to choose a major.

Indeed, the hedonic learning and the career coaching pedagogies have drawn the high school student’s attention to certain majors. However, these two pedagogies are facing several challenges respectively. For the hedonic learning activities, two concerns are frequently raised: First, the motivational effects of the hedonic activities can be ephemeral. By the time when the high school students go to colleges, they could have long forgotten the joy received from an extracurricular program. Second, the motivational purpose of hedonic activities can be blurred by their strategy centered on playfulness. Participants may treat the extracurricular activities as cool “parties” filled with scientific and technological “toys”. After the “parties”, participants still do not fully understand what the major is about. In fact, many high school teachers and counselors have raised their concerns toward the hedonic learning activities: We had so much fun. Now what? A new extracurricular program design is urgently needed to address the weaknesses of the hedonic learning pedagogy. For the career coaching pedagogy, the major concern is placed on how much a high school student, who usually does not have any job experience, cares about his or her career development. Without further investigations, collegiate educators should not intuitively assume that building a career is what high school students focus on at their ages.

Besides the aforementioned concerns, we also find that neither hedonic learning nor career coaching considered the high school student’s desire for social recognition of their personal achievement. Yet, the perceived achievement is a critical motivational factor to an adolescent’s intention and behaviors (Pekrun 2006; Pekrun et al. 2011). This human development key feature creates an opportunity for the IS educators to explore a new path to reach out to high school students: Providing extracurricular activities in which students can feel accomplished, and thereby establish a commitment to the IS major. We propose a theoretical model to further study the influence of the student’s perceived achievement.
Proposed Research Model

Our theoretical model is established on two collections of prior studies, including the experiential learning combination lock model (Beard and Wilson 2013; Wilson and Beard 2003) and the motivational learning research (Pekrun 2006; Pekrun et al. 2011). We consider the experiential learning studies, because engaging students in the mobile app development workshop and showcase are two major tasks of the “Mobile Star” project. Findings from experiential learning studies, especially the holistic combination lock model, can provide helpful guidance to our project design. We consider the motivational learning research, because establishing the student’s commitment to formal IS studies by intriguing their perceived achievement is the primary mission of the “Mobile Star” project. Prior motivational learning research can provide important implications to our pedagogical design as well.

The experiential learning pedagogy believes that individuals can receive better learning outcomes, if they physically experience learning activities by using multiple abilities such as seeing, listening, talking, smelling, and touching (Kolb 2015). This pedagogy has a broad range of applications in early adolescent education, higher education, and enterprise human resource development, and has received a great deal of success (Kolb 2015). Wilson and Beard (2003) established the learning combination local model, in order to provide a systematic process for educators to design the ingredients in an effective experiential learning. According to the model (Wilson and Beard, 2003), an educator should consider six dimensions (i.e., belonging, doing, sensing, feeling, knowing, and being) to achieve the educational objectives. Undoubtedly, “doing” is the most important dimension. It is the factor that differentiates an experiential learning from the traditional lecture based learning. However, “doing” does not mean learners should participate into random physical activities. An educator must establish clear purposes and goals in the doing dimension, so that the learner's physical activities become meaningful from an education perspective (Beard and Wilson 2013). In addition, the educator should design other dimensions to facilitate the process of reaching the established purposes (Beard and Wilson, 2013). For instance, the space where the learning occurs (i.e., the belonging dimension) should be supportive and immersive; the learning contents should enable the learner’s multiple sensing abilities (i.e., the sensing intelligence dimension), etc. With the organic learning content design, the educator can help learners to reach the objectives of understanding (i.e., the knowing dimension) and improving (i.e., the being dimension) (Beard and Wilson 2013). An important observation from Beard and Wilson (2013) is that many educators frequently ignore the feeling dimension in an experiential learning design, because they believe that feeling is personal and has little influence on learning. However, Beard and Wilson (2013) argue that the learner’s enjoyment can not only help the learner to concentrate on the current learning activities, but can also motivate his or her subsequent self-learning. Thus, how to awaken the learner’s enjoyment and enthusiasm should receive the educator’s attention. In fact, prior motivational learning studies (Pekrun 2006; Pekrun et al. 2011) also noticed the importance of an individual’s emotional factors on his or her learning success. An individual’s learning motivation is positively associated with his or her achievement emotions received from prior learning activities (Pekrun 2006; Pekrun et al. 2011). If the individual perceives achievements in prior learning activities, he or she can believe that the new challenges can be under his or her control. Thus, the individual is more willing to engage in a higher level learning (Fredrickson 2001). Extending these findings, we propose a new research model as shown in Figure 1.

Our research model consists of two domains: the informal IS learning domain and the commitment to IS learning domain. The fun factor certainly plays a critical role in getting the student's awareness of an academic subject. This has been a critical theoretical foundation for several hedonic learning initiatives (Gerber et al. 2001; Lee and Hoadley 2007; Simpson 2005). However, the nature of extracurricular activities creates an informal and voluntary learning context for participants. The student’s interest from the informal learning context could be volatile and ephemeral. Educators should not assume that a motivational program is effective by only measuring the student’s informal interest factors. They should also consider the student’s commitment to the formal studies, which require a higher degree of responsibilities from the students. After all, building the long-term commitment to an academic major is the ultimate objective of a motivational learning program.
Commitment to Formal IS Studies

We define a student’s commitment to formal IS studies as the degree to which the student would choose the IS major rather than other majors in colleges. To the IS major, a student’s commitment is particularly important. An IS major consists of knowledge from a variety of supporting disciplines such as computer science, business administration, psychology, etc. A student can believe that it is a great challenge for him or her to comprehend those well-developed knowledge from multiple disciplines. If the student has a strong commitment to formal IS studies, it is more likely for him or her to accept the challenge. Thus,

H1: A student’s commitment can significantly increase the likelihood of the student's actual enrollment into the IS major.

Perceived Enjoyment

We define a student’s perceived enjoyment as the degree to which the student believes that learning IS knowledge and participating in IS related learning activities are pleasant. The perceived enjoyment in our model is different from the “playfulness” focused by prior hedonic learning programs. The playfulness refers to the joy a student receives, when he or she plays an artifact or participates into a game (Lee and Hoadley 2007). The perceived enjoyment we focus on refers to the pleasant mental state a student establishes, when he or she acquires new knowledge and skills. The differences between the two constructs exist in the following aspects: First, the student’s perceived playfulness is strongly dependent on the external environment. Once the playful environment no longer exists, the student’s perceived playfulness can quickly fade away (Cordova and Lepper 1996). The learning enjoyment is established in a learning context; however, a student can still keep enjoyment of receiving new knowledge and skills, even though the context no longer exists (Ainley and Ainley 2011). Second, even though both playfulness and learning enjoyment can lead to the student’s pleasant mental state, learning enjoyment is also positively associated with “broadening-and-building” (Fredrickson 2001). When a student receives enjoyment after understanding and acquiring new knowledge and skills, he or she is more likely to continue the engagement in a higher level learning. Thus, we have the following hypotheses:

H2: A student’s perceived enjoyment (a) has a significant positive effect on the student’s commitment to formal IS studies, and (b) can significantly increase the likelihood of his or her enrollment into the IS major.


**Perceived Achievement & Perceived Completion**

We define a student’s perceived achievement as the degree to which the student believes that his or her activities can lead to outcomes praised by the social group. We define a student’s perceived completion as the degree to which the student believes that he or she has completed a task in a complete manner. We suggest that the student’s perceived achievement is different from self-efficacy (Bandura 1977) in the following ways: Self-efficacy is defined as the degree to which an individual believes that his or her personal capabilities can produce a desired level of performance (Bandura 1977). Even though not clearly stated, the applications of this construct in prior studies imply that it is an individual’s confidence toward his or her existing capabilities (Baumgartner et al. 2014; Calderwood et al. 2014). By contrast, perceived achievement is a student’s belief of capability improvement after the learning activities. Using the student’s perceived achievement, we intend to study how this perceived capability enhancement influences the student’s learning enjoyment. We introduce the following hypotheses:

H3: A student’s perceived achievement received from extracurricular activities has a significant positive effect on (a) the student’s perceived enjoyment and (b) commitment to formal IS studies. In addition, (c) the student’s perceived achievement can significantly increase the likelihood of his or her enrollment into the IS major.

H4: A student’s perceived completion has a significant positive effect on (a) the student’s perceived achievement, and (b) the student’s perceived enjoyment in the extracurricular activities.

**Age**

We predict that the student’s age is a critical influential factor of a learning intervention programs. If a student gets engaged in the intervention activities earlier, he or she can have a deeper recognition about a collegiate major. We introduce the following hypotheses:

H5: Age has a significant negative moderation effect on (a) the relationship between the student’s perceived achievement and his or her commitment to formal IS studies, and (b) the relationship between the student’s perceived enjoyment and his or her commitment to formal IS studies. In other words, the younger a student gets engaged in the intervention learning activities, the stronger the enjoyment and achievement the student would perceive.

**Project Design**

Each “Mobile Star” event consists of a one-day mobile app development workshop and a subsequent student app showcase. The purpose of the workshop is to introduce the technical knowledge of app development to students, and the student app showcase is to enable students to experience the business activities of an app project by using social media and app store. When we planned the “Mobile Star” project, the foremost factor we considered was to differentiate the IS major from other majors (e.g., computer science). Prior endeavor in the definition of the core of the IS discipline (Benbasat and Zmud 2003) provides the theoretical foundation to our content design. As Benbasat and Zmud (2003) suggested, information systems studies should focus on three aspects: (1) how IT artifacts are conceived, constructed, and implemented; (2) how IT artifacts are used, supported, and evolved, and (3) how IT artifacts impact the contexts in which they are embedded. The activities of the “Mobile Star” project are designed according to these three aspects of the IS knowledge. Each “Mobile Star” app development workshop can accommodate thirty students. At the beginning of the workshop, we will introduce the students to that the IS major includes multiple exciting sub-fields such as cloud computing, cyber security management, business analytics, etc. The purpose of the workshop and the showcase is to use mobile app technology as one example to show students what they can learn, what they can achieve, and how their skills will influence others such as their friends and families. By classifying the purpose, we can make sure that the student’s perception of an IS major is not limited to mobile app development. In addition, we choose mobile apps as the IT artifacts shown in the workshop for two additional reasons: First, the development tools (Windows PC and the open source Android Studio) are very accessible to high school students. We can show how an app is constructed, used, and improved to students within a reasonable timeframe. Interested students can also continue their self-learning in app development on the open platforms after the workshop. Second, students can immediately experience how their work influences
other users. In the subsequent app showcase, we encourage students to promote their apps created in this workshop to potential users. The goal is to have students experience how the IT artifacts can impact others. The broad adoption of Android devices makes this exercise possible.

During the workshop, we demonstrate the development process of a Google Android mobile app called “MyNote”. “MyNote” is an app that can record the user’s notes on Android devices. We choose this utility app development for its development simplicity and future adoptions when students promote their apps in the showcase stage. When we teach students the app development, we do not focus on programming. Instead, we focus on the holistic “model-view-controller” (MVC) development process of the app. Different from coding, MVC places an emphasis on the process management and integration of a mobile app. We will give students the needed components such as programming codes and user interface graphics. Students follow our instructions and design the same app in the computer lab. Near the end of the workshop, we will make sure that each participant’s app can run smoothly on the Android emulator, and then we will open the “Q&A” session, in order to answer the student’s specific questions. Because students have a better perception about IS after completing an app, we will discuss the career development in mobile technology and other sub-fields of IS. We will also show students the YouTube videos in which recent graduates share their personal experiences in the IS majors and as IS professionals. We believe that students can make a better connection with these testimonial videos at the end of the workshop. In addition, we will introduce how they can participate into the app showcase, and the rule of thumbs for promoting their apps to friends and families on social media.

The student app showcase will start after the workshop. Students will be separated into groups with two students in each group. The following development task will be given to each group: Using the knowledge they learned from the workshop, each group should add new features (e.g., changing interface graphics) into the preliminary app completed in the workshop, and submit the final apps to us two weeks later. The student’s mobile apps will be uploaded to Google Play store. A social media page on Facebook will also be created for each team and its app. Each team will be given one month to promote their mobile apps through social media and other social connections. Three factors will be considered to determine a winning team: (1) the number of actual downloads of each team’s app (α); (2) the number of positive feedback about each team’s app on the app store (β); (3) the number of “likes” of each team’s app on Facebook (γ). The three numbers will be used to calculate each team’s final score (Π), and Π = α * β * γ. According to the Π scores, one team will win a $200 cash prize. The award plays a role as a motivation for teams to engage in social media marketing activities for their app projects.

Certainly, some teams may receive low α, β, and γ; however, our intention is to motivate students to actively reach out to their potential users or “customers”. During their communications with other users, students actually play roles as “IT project managers”, and can experience what an IS professional would do in practice. This key feature also differentiates our program from computer science based motivational learning programs. The “Mobile Star” project has conducted pilot studies in St. Anthony High School of San Antonio, Texas and Commerce High School of Commerce, Texas. The purposes of the pilot studies include: First, we intend to test if the app development contents can be accepted by students with different background, accessibilities to IT resources, and prior IT skills. Second, we intend to collect feedback from school teachers and counselors regarding whether our survey is designed in an appropriate format that can accurately measure high school students’ perceptions. The two pilot projects received a great deal of positive responses from students, parents, and school administrations.

**Future Project Implementation & Data Collections**

We will adopt an online survey methodology to collect data for the hypothesis testing. Our data collections consist of three steps: First, at the beginning of the app development workshop, we invite the participants to rate “Survey 1: Background Information”. The data we collect in this survey include the participant’s email, age, gender, current grade, expected graduation date, estimated family yearly incomes, self-reported competency in IT, whether the participant is aware of the IS major, and whether the participant knows what an IS major is. In addition, we will ask an open-ended question of “Which major do you plan to choose in college?” By collecting the answers to this question, we will be able to test if the “Mobile Star” project can have an reinforcing effect on the students who have already been interested in the IS major, and if it can have an intervention effect on the students who are not aware of the IS major. Second, the link of “Survey 2: The Participant’s Feedback” will be emailed to the students after the app development
showcase. This survey intends to test the student’s perceived achievement, perceived completion, perceived enjoyment, and commitment to formal IS studies. Perceived achievement will be tested by questions such as “I feel accomplished after I created my mobile app”. The questions are adapted from Pekrun et al. (2011)’s study. We use questions such as “I received a complete training in the mobile app development project” to test the student’s perceived completion. The questions are newly developed to fill the void left by previous studies. We use questions such as “IT development and management knowledge is interesting” to test the student’s perceived enjoyment. The questions are adapted from Ainley and Ainley (2011)’s study. We use questions such as “I am interested in choosing information systems as my major in universities/colleges” to test the student’s commitment to formal IS studies. The questions are also developed proprietarily for the current study. We will also conduct a one-to-one interview with the participants after the app showcase. We will ask students three open-ended questions: (1) What was interesting to you during the workshop and the showcase? (2) What have you learned? (3) What major would you choose for college? Why? The open-ended can help us to further understand the influential factors of the student’s commitment to formal IS studies, and complement the factors that our research model may have ignored. If a student chooses other majors, the third question can help us capture the influential factors of the student’s decision. We can have an insightful understanding of the advantages that other majors have over IS among high students, and correspondingly improve the pedagogy in our project. Third, “Survey 3: Follow Up” will be emailed to K-12 participants right after the showcase, and to other participants one year before their reported graduation dates. The data we collect in this survey include whether the participant receives admissions to colleges, what his or her actual major is, whether he or she receives scholarships and the amount. We choose this time schedule for two important reasons: First, we can investigate the influence of the student’s commitment to the IS studies on their actual enrollment into the IS major. Second, “Survey 3” can also help students memorize the knowledge and achievement they received in the “Mobile Star” project, and remind them considering the IS major before they decide their future majors. We will start the data analyses after we collect the third part of the survey. We plan to adopt structural equation modeling to analyze the student’s commitment to IS studies and the antecedent factors. Because a student would either choose or not choose IS as his or her major, we suggest that logistic regression is appropriate to analyze the relationship between the student’s actual enrollment into IS major and the antecedent factors. A text mining technique such as latent Dirichlet allocation will be adopted to analyze the student’s responses we collect from the interviews.

Conclusion

In this study, we propose a new research model to explore how to transform the student’s informal interest in IS into their commitment to formal IS studies. To our best knowledge, this is the first investigation of its kind in the IS discipline. The findings from this study can contribute to the improvement of IS enrollment. In addition, we proposed a new pedagogy that adopts real-world social media and app store to showcase the student’s projects, in order to build their perceived achievement, and use this achievement to motivate their intention to engage in formal academic studies. This pedagogy can not only be used in the IS motivational learning program, but can also be adopted by other STEM majors that face the enrollment challenges.

References


