Enhancing Retention of Future Information Professionals Using Attitude Inoculation

Isabelle Fagnot
IESEG School of Management, France, ifagnot@audencia.com

Jeffrey Stanton
School of Information Studies, Syracuse University, NY, USA, jmstanto@syr.edu

Follow this and additional works at: http://aisel.aisnet.org/sim

Enhancing Retention of Future Information Professionals Using Attitude Inoculation

Isabelle FAGNOT* & Jeffrey STANTON**

* Management Department, IESEG School of Management, Lille/Paris, France
** School of Information Studies, Syracuse University; Syracuse, NY, USA

ABSTRACT

Employment predictions in the field of Information Systems (IS) vary over time, but employers often report a gap between the available IT workforce and their needs for skilled information professionals. The existence of such gaps raises questions about how college students make decisions about persistence in majors with respect to available information about employment prospects. The main objective of this article is to understand whether and how inoculating messages may help students to maintain pre-existing positive attitudes towards occupational features of the IT profession; to explore why some choose to stay in the information technology disciplines; and to suggest potential solutions to augment the number of those who stay.

This research study used Inoculation Theory to hypothesize that students who heard an inoculative message prior to a persuasive message concerning post-graduate employment would show a greater resistance to attitude change than students in a control group, and that there would be a difference in resistance to change based on gender and on program of study.

The results of our field experiment showed that significant differences arose among the different groups of students. As hypothesized, the participants in the treatment group had more resistance to attitude change; participants in control groups were more affected by the persuasive message than participants who had received an inoculation treatment. The analyses did not detect significant differences in attitudes based on gender and major. These results have implications for effective retention of future information professionals.

Keywords: information systems, information professionals, retention, attitude, Inoculation Theory.

RÉSUMÉ

Les prévisions d'emploi dans le domaine des Systèmes d'Information (SI) varient au fil du temps, mais les employeurs évoquent souvent le fossé entre les besoins de l'entreprise et le manque de personnes qualifiées sur le marché du travail. Ce constat soulève la question de savoir comment les étudiants prennent leur décision de poursuivre ou non un diplôme dans un domaine donné au vu des informations disponibles sur un secteur particulier du marché de l'emploi. L'objectif principal de cet article est de comprendre si et comment des messages d'inoculation pourraient aider les étudiants à maintenir leurs attitudes positives pré-existantes envers les caractéristiques des professions des technologies de l'information; d'explorer les raisons pour lesquelles certains choisissent de poursuivre des études dans le domaine des systèmes d'information et de suggérer des solutions pour accroître le nombre de ceux qui choisissent ce domaine professionnel.

Ce projet de recherche utilise la Théorie de l'Inoculation. Les hypothèses posées ont été testées par une expérimentation de terrain. La première hypothèse teste la résistance au changement pour les participants qui reçoivent un message d'inoculation avant un message persuasif au sujet du domaine professionnel des systèmes d'information. Les deux autres hypothèses testent la résistance au changement sur la base du genre des participants et de leur programme d'études.

Plusieurs résultats significatifs ont été mis en évidence. Les groupes qui ont été inoculés ont présenté une plus grande résistance au changement. Un déclin plus faible de la résistance a été observé pour les participants du groupe de traitement; les participants des groupes de contrôle ont été plus affectés par le message persuasif que les participants qui avaient reçu l'inoculation. Toutefois, l'étude n'a pas montré de différence significative basée sur le genre ou le domaine d'études. Ces résultats permettent de mieux adapter la communication envers les futurs professionnels de l'information.

Mots clés : systèmes d'information, professionnels de l'information, rétention, attitude, théorie de l'inoculation.

1. INTRODUCTION

The ubiquitous presence of information technologies in today's organizations has rendered the role of information professionals increasingly essential in most aspects of a business. Surprisingly the enrollment trend in Information Technology (IT) related majors sagged within the past decade – many schools have faced student retention issues in IT-related programs (Ali, 2009; Erickson, 2005; Fischman, 2007; Panko, 2008). For instance, in 2011, 43,072 bachelor's degrees in Computer and Information Sciences were conferred, well short of the peak of 59,488 in 2003. By contrast in 2011, Business majors were at an all-time high of 365,093 graduates. Health-related majors have almost doubled since 2001. In recent years, the enrollment trend in IT majors has rebounded slightly (Ali & Shubra, 2010), as initiatives to encourage enrollment in Science, Technology, Engineering and Mathematics have increased (Davis, Yeary & Sluss, 2012). Although this enrollment increase may continue, it seems likely that gaps will continue to appear between the available IT workforce and the need for skilled information professionals in organizations, especially given that this need has continued to grow over the years (Wang, 2013).

One explanation for the appearance of such gaps is that students and job seekers seem to have mistaken ideas of the IT field (Wright, 2009). Guzman (2008) showed that young information professionals may undergo "culture shock" upon entering the IT profession, which may in turn lead to their leaving the IT profession at early stages in their career. Both the mistaken ideas and the culture shock suggest that career-relevant information which students obtain during their programs of study may influence career attitudes in powerful ways. Guzman (2008) argues that undergraduate students without pre-existing work experience are the most susceptible to change attitudes when confronted with negative messages.

During their education, students may encounter messages about the profession and may do internships or class projects that put them directly in contact with IT professionals. Although these situations provide a natural setting to learn about the IT profession, they are not specifically designed to provide future information professionals with the tools to succeed in IT – especially when facing negative messages about the profession or having to cope with the challenges of being an IT professional.

The main objective of this research study was to understand whether and how inoculating messages might help students maintain pre-existing positive attitudes towards occupational features of the IT profession, while guarding against undue influence from negative messages that students may hear from peers, parents, or others. Our practical goal was to provide empirically-guided advice to educators on how to improve student retention in IT majors. Three specific research questions were addressed in this study:

a. How do inoculating messages about the IT professions impact participants' standing on relevant

11

attitudes towards occupational features of the IT profession?

b. What differences, if any, exist by gender regarding these attitudes and their resistance to attitude change?

c. What differences, if any, exist by major regarding these attitudes and their resistance to attitude change?

To answer these questions, we designed and carried out a field experiment to examine attitude change in the face of negative information about the IT major. We used a theoretical perspective from the attitude change and persuasion literature called "attitude inoculation," a set of techniques for holding an attitude firm in the face of persuasive messages espousing a contrary position. This paper provides information on the type of inoculation intervention that could be designed and offered to future information professionals – e.g., a workshop using videos as a stimulus.

The rest of the paper is organized as follows. First, we provide an overview of the literature on the retention of information professionals. Next, we introduce Inoculation Theory and outline the concepts that take part in an inoculation process. We then draw hypotheses to guide our work. Following this, we present the method for this study as well as the results. The paper concludes with a discussion of the implications of our study.

2. BACKGROUND

Numerous researchers have examined reasons behind fluctuations in demand, retention, and completion in IT majors. Studies have identified myths about the IT field that have an effect on students' decision to pursue an IT related major (Granger, Dick, Jacobson, & Van Slyke, 2007). Akbulut-Bailey & Looney (2007) investigated the role of students' interests, confidence and outcome expectations in their decision to pursue a degree in the IT field. McInerney, DiDonato, Giagnacova, & O'Donnell (2006) researched why students decide to pursue an IT-related major and career; they found that several factors such as personal interest in technology, perceived positive peer encouragements, and prestige of the profession positively influenced students to enter and remain in the IT field.

Another research approach examined the culture of the IT profession, and assessed its role in influencing students' commitment to the field. The occupational culture of IT professionals has distinctive features, making it easy to examine the effects of those features on IT student retention and the occupational commitment of IT personnel (Ahuja, 2002). Guzman (2008) argued that early exposure to the features of an IT career impacted the retention of students in IT majors who experienced cultural conflict, as well as impacting the commitment of IT professionals to the occupation.

In the late 1990s, studies such as Kaarst-Brown and Robey (1999) identified five varieties of IT culture that play a role in the management of information professionals within organizations: "the revered, controlled, demystified, integrated, and fearful IT cultures". Using a metaphor of magic, with IT

professionals in the role of "wizards," this work characterized the symbolism behind IT artifacts and people, as viewed by various constituencies within the organization. The authors also found that there was no unified meaning for the role of IT within the two organizations that they studied. These results imply that the IT profession was not yet categorized as a professional community in itself. Leidner and Kayworth (2006) wrote a paper that reviewed the literature on IT and culture. The authors found, among other things, that the culture of the IS profession is linked to IT development, adoption and use in organizations. Further, the vision conflict experienced by a user group can create a culture clash that will impact IT at the organizational level.

While previous research has examined the occupational culture of information professionals – group level influences on why some decide to enter and remain committed to the profession and others decide to leave it – the present research examined individual-level attitudes that shed additional light on the occupational culture of information professionals.

Students have attitudes about various features of the IT profession – for instance, the idea that IT professionals must always keep up with emerging innovations in technology. Those attitudes are changeable, by definition (Eagly & Chaiken, 1993). Arguably, if students develop a positive attitude about some aspect or aspects of the profession, helping them to maintain that positive attitude would be beneficial. In addition, maintaining a positive attitude could help with persistence in

their course of study, or their professional career, in the face of the various challenges they may face during the educational process. It seems inevitable that students in professional majors will, at some point in their educational path, encounter persuasive messages about occupational features of their chosen field. These messages could, for example, be from family and friends who have a strong stereotyped image of the field and who oppose it as a career choice. Such messages may influence students in various ways; perhaps depending on such factors as the gender of the student. For example, Guzman (2008) argues that women react differently to occupational features of the information professions.

Gender differences in IT have been subject to investigation in the past decades. Empirical studies such as Trauth (2002); Quesenberry and Trauth (2007); and Tapia and Kvasny (2004) present explanations and perspectives on these gender differences in IT. Trauth (2002) suggests that a theoretical perspective of individual differences provides an interesting framework to explain gender differences in information professions, since the framework takes individual characteristics and environmental influences into account. The author bases this conclusion on thirty-one in-depth interviews with women information workers. Other studies (Guzman, 2008; Fagnot, Guzman & Stanton, 2007) show that occupational features of the information professions influence men and women differently in their decision-making processes to enter, remain in, or leave the information profes-

13

sions. Buche (2008) claims that gender has an impact on the identity of information workers. The researcher based her findings on a survey administrated to 240 IT professionals. The author argued that men and women react differently to job-related factors such as skill variety, task significance, technical role and general business role. Moreover, Buche (2008) states that work identity is an important measure because it influences workers' behaviors and attitudes.

2.1. Inoculation Theory

We identified Inoculation Theory as a particularly suitable perspective to frame the questions identified in this study (McGuire, 1964). This theoretical framework provided the basis to design an experiment with the aim to increase undergraduate students' resistance to attitude change. Inoculation Theory uses the medical analogy of immunization to describe a method for strengthening existing attitudes, beliefs, and behaviors against change (McGuire, 1964, 1970; Miller & Burgoon, 1973). McGuire (1964) argued that a weak attack, which is analogous to a medical inoculation, can protect an individual against subsequent attacks to his or her attitude. The inoculation consists of a weakened form of attack that creates resistance to change by forcing individuals to actively refute it.

Inoculation Theory can be linked to two theories in sociology: the Hypodermic Needle Theory (Katz & Lazarsfeld, 1955) and the Agenda-Setting Theory (McCombs & Shaw, 1972). The Hypodermic Needle Theory posits that

people could be highly influenced by carefully crafted mass media messages. Mass media is portrayed as a "dangerous" means of communication that is directly injecting messages to a passive audience. The Hypodermic Needle Theory suggests that the receivers of the message do not have the means to resist and are strongly impacted by the messages. Agenda-Setting Theory suggests that the media has a strong influence on what the audience thinks of a topic, for instance in the case of political campaigns (McCombs & Shaw, 1972). The authors imply that, even if mass media does not directly impose its opinions on the audience, it nonetheless strongly suggests to the audience what to think about.

These two theories state that the audience is passive and does not have the means to resist. Inoculation Theory posits that inoculating the audience through well-crafted messages would enable the audience to resist when needed.

Inoculation Theory went through two periods of development. The first period was McGuire's initial formulation in the 1960s – a culmination of 15 years of post-war research on the interactions between propaganda and attitude change. The second period comprised efforts in the mid-1990s to understand the cognitive basis of the theory and provide additional empirical support (Compton & Pfau, 2005). In the second period, the theory's core concepts – threat and counterarguing – were examined and reinforced. The concept of counterarguing was studied in the context of change, attitude change and persuasion.

Compton and Pfau (2005) built their theoretical refinements with reference to the Elaboration Likelihood Model (ELM) (Petty & Cacioppo, 1986), which explains the cognitive basis for attitude formation and change. ELM states that there are two routes to persuasion: the central and the peripheral. When an individual receives a persuasive message that urges them to form or change an attitude, there is a tension between wanting to be right and wanting to be efficient. If s/he stops to carefully think through a position, evaluating the merits of an argument in an effort to be right, this is the central route to persuasion. When, on the other hand, s/he relies on environmental cues instead of deep thought about the persuasive message, i.e., taking shortcuts in an effort to be efficient, this is the peripheral route to persuasion.

Petty, Wegener and Fabrigar (1997) discuss how threat and counterarguing fit into the central processing route of the ELM. The concept of threat towards one's beliefs is at the heart of Inoculation Theory (Pfau, Tusing, Koerner, Lee, Godbold, Penaloza, Yang & Hong, 1997a). This theory posits that it is crucial for a subject to experience a threat in order to be inoculated against a subsequent attack. The threat is a motivational trigger that causes people to defend their beliefs in a process called counterarguing. Compton and Pfau (2005) posit that counterarguing strengthens attitudes against influence by elaborating and strengthening the network of beliefs that support the attitude. Pfau (1995) argues that the threat also encourages the subject to acknowledge that their attitudes are vulnerable to change. Thus, the pro-

cess of counterarguing is essential for the subject to develop resistance to subsequent threats.

Two additional concepts are critical to the effectiveness of inoculative messages – "forewarning" and "refutational preemption." In the context of Inoculation Theory, forewarning is simply warning someone before that person receives a message. This step is crucial to build resistance. Quinn and Wood (2004) claim that a person who received a warning prior to receiving a message was less persuaded by the message than someone who was not warned. McGuire and Papageorgis (1962) argue that forewarning is an essential element which, when combined with a threat, enhances the process of inoculation. Compton and Pfau (2005) state that forewarning operates because the mere fact of making a person realize that there exist counterarguments to one's positions positively impacts inoculation.

Refutational preemption is the cognitive part of the inoculation process. When faced with a potential threat, the subject sets in motion his/her own counterargument mechanisms in order to combat the threat by preparing a refutation. Thus, an inoculative message, by prompting this counterarguing (Compton & Pfau, 2005), strengthens the subject's existing attitudes. The inoculative message may be one-sided or two-sided. A one-sided message consists only of the counterargument to the subject's belief. A two-sided message, however, provides both the counterargument and a refutation to that argument – "specific content that receivers can employ to strengthen attitudes against subsequent change"

15

(Pfau et al., 1997a). This refutation helps to prompt further refutational preemption and provides material which the subject can later use if confronted by a stronger threat. A two-sided message is frequently used in inoculation research (Wood, 2007).

Thus, threat is an essential component that leads to resistance to persuasion. Subjects who have not experienced a threat would not be expected to display increased resistance to the attack message. According to McGuire (1964), people's attitudes are threatened by attacks when they do not have the necessary motivation and practice to stand up for their opinions. McGuire drew on this idea to theorize that, if given the chance to practice defending their beliefs, participants become able to counterargue more effectively when actually confronting the threat. Figure 1 presents the chronological order of an inoculation process.

Figure 1 presents the two main stages of the process – an inoculative message and an attack message. Following Wood (2007) and Pfau et al. (1997a), an effective inoculative message has three steps. First, the subjects receive a general introduction of the issue, in the form of a forewarning of the upcoming attack, which initiates the inoculation process and helps to activate defenses, since after hearing the warning, subjects may feel somewhat threatened. This warning is considered a key component of the inoculation process. Then the subjects receive a counterargument to their belief, a weak attack which contains a strong opposed argument and a personal consequence of the threat. Finally, the subjects are offered refutations to the threats. These refutations can later be used by the subjects when they are confronted with a threat and need to defend their positions. After this inoculative message, the subjects will be better prepared to deal with subsequent attack messages.

The original belief, the inoculation process, and the potential threats are all based on the subjects' attitudes. The concept of attitude has received attention principally in the field of social psychology, although it is a concept that has been used, more generally, across the social sciences (Eagly & Chaiken, 1993). Eagly and Chaiken
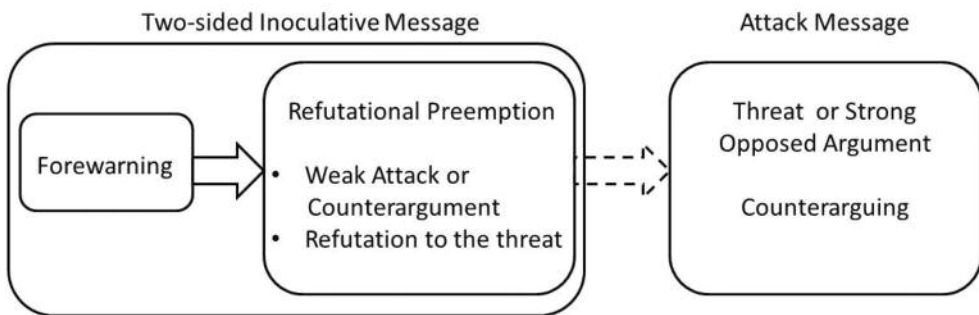
**Figure 1. Inoculation Process (adapted from Wood (2007)
and Pfau et al. (1997a))**

(1993) define the concept of attitude as a "psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor" (p1), which is the definition we use in this research.

The target or focus of each attitude is the attitude object, defined by Eagly and Chaiken (1993) as follows: "Anything that is discriminated or that becomes in some sense an object can serve as an attitude object" (p 5). Each attitude has three components: affective, behavioral and cognitive; however, the attitude may be more strongly based on one component than another. The affective component is one's emotional reaction towards the attitude object. The behavioral component is one's actions toward the attitude object. The cognitive component – the one of greatest interest to the proposed study – is one's thoughts and beliefs about the attitude object (Crites, Fabrigar & Petty, 1994; McGuire, 1985; Zanna & Rempel, 1988 as cited in Aronson, Wilson & Akert, 2005). Thus, an example of an attitude might be the opinion a student or information professional has concerning an occupational feature of the IT profession. In this case, the attitude object would be the particular occupational feature of the IT profession, for example the necessity of working long and unpredictable hours. The affective component of such an attitude might be fear concerning work/life balance, while the behavioral component would consist of attempts to find a subfield with more predictable hours. Finally, the cognitive component might consist of thoughts comparing the proposed career to high-prestige careers with simi-

lar occupational features, such as medicine.

The present study adopts aspects of the method described by Wood (2007) for working with subjects who have differing pre-existing attitudes, but further extends Wood's work by comparing groups that were expected to have differing levels of prior commitment to the attitude in question. Thus, the final construct which we use in the present research is that of attitude strength. This construct captures the idea that the impact of an attitude may vary as well as its durability (Krosnick & Petty, 1995). Studies on resistance to attitude change have put emphasis on strength of attitude as an essential factor in resistance to change (Eagly & Kulesa, 1997). In short, it is more difficult to change a strongly held attitude than a weakly held one.

In order to measure subject attitudes, we turned to Rottinghaus, Day & Borgen (2005), who developed The Career Futures Inventory (CFI), which integrates factors such as Career Adaptability, Career Optimism and Knowledge (p12). The factor Career Optimism has items such as "I get excited when I think about my career" or "I am eager to pursue my career dreams," which are similar to items that can be found in the scales for Career Feelings. For instance, there is a parallel respectively with "I am enthusiastic about the IT profession" and "I have aspirations to choose IT as my career choice". The construct of career feelings was measured using five multi-item scales: About the IT profession; About your choice goals; About career opportunities in the IT profession; About demands in the IT profes-

17

sion; About stereotypes on the IT profession (see Appendix A).

Figure 2 hereafter presents the conceptual framework used in this research. The figure presents two steps showing the impact of an inoculation intervention on participants' resistance to attitude change. The first element illustrates what typically happens when a future information professional enters the IT occupation field. The second element shows that the addition of an attitude inoculation in the form of an intervention prior to a formative work experience may help students maintain their pre-existing positive attitudes towards the information field, and thus their commitment to pursuing a career in the IT field.

Three hypotheses were developed based on the overarching research question and the Inoculation Theory perspective as shown in the research model below (Figure 3) and explained hereafter.

Our experiment, then, is designed to test whether an inoculation, i.e., a weak attack based on Pfau et al.'s (1997a), can protect an individual against subsequent attacks to his or her attitude. The authors argue that well-crafted messages will help their receivers to later use their content to strengthen attitudes against subsequent change. Therefore, we hypothesize that:

H1: Participants that are exposed to inoculation treatment will increase their resistance to attitude change.

H1a. Participants who are exposed to inoculation treatment will have a higher resistance to change for their focal attitude when receiving a negative persuasive message.

H1b. Participants who are exposed to inoculation treatment will have a higher resistance to change for their attitude strength when receiving a negative persuasive message.
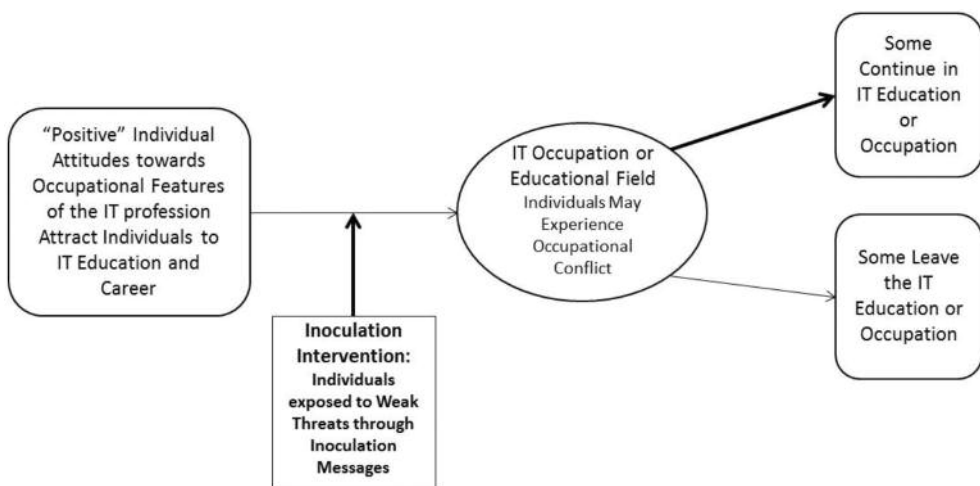
Figure 2. Conceptual Model of Impact of Inoculation to Resistance to Deterioration of Positive Attitudes (Resistance to Attitude Change)
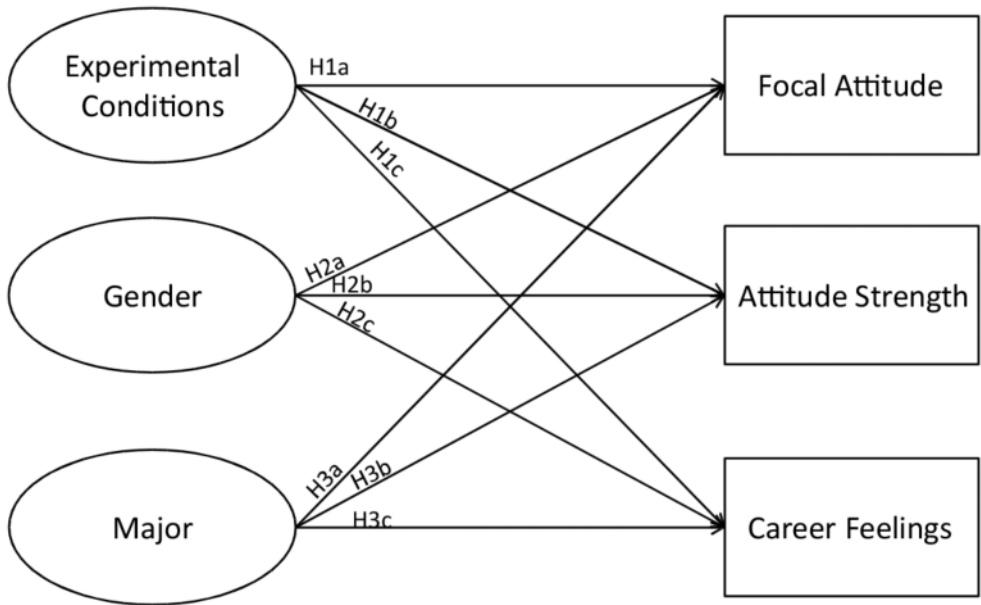
Figure 3. Research Model

H1c. Participants who are exposed to inoculation treatment will have a higher resistance to change for their career feelings when receiving a negative persuasive message.

A few studies on the significance of gender differences in Inoculation Theory, such as Pfau & Burgoon (1988) and Eagly & Carli (1981) in Compton & Pfau (2005), argue that women and men are impacted differently by inoculation experiments. Using gender as a naturally-occurring variable provided an opportunity to explore findings from this previous research. Some studies on gender in the IT field have shown that women and men are typically affected differently in various aspects of the field such as acculturation (Guzman, 2008) or identity of workers (Buche, 2008). Trauth (2002) suggests

that a theoretical perspective taking individual characteristics and environmental influences into account provides an interesting framework to explain gender differences in information professions. Reid, Allen, Armstrong & Reimenschneider (2010) further argue that men and women also have different understanding about the challenges that women face in IS (). We thus hypothesize the following:

H2: Male participants' resistance to attitude change will be more increased than for the female participants.

H2a. Male participants' resistance to attitude change will be more increased than for the female participants for their focal attitude.

H2b. Male participants' resistance to attitude change will be more increased

than for the female participants for their attitude strength.

H2c. Male participants' resistance to attitude change will be more increased than for the female participants for their career feelings.

Previous studies (Guzman, 2008) showed that undergraduate students may have misperceptions about the IT field, whether these students are in IT or non-IT related educational programs. Granger et al. (2007) discuss myths about the IT field that impact students' decision to pursue or not an IT related major. McInerney et al. (2006) state that personal interest in technology, perceived positive peer encouragements, and prestige of the profession encourage students to enter and remain in the IT field. Those students in non-IT related programs may have stronger misperceptions about the IT field (Guzman, 2008). We hypothesize the following:

H3: Resistance to attitude change will be more increased for participants in IT-related majors than those in non-IT related majors.

H3a. Resistance to attitude change will be more increased for participants in IT-related majors than those in non-IT related majors with respect to their focal attitude.

H3b. Resistance to attitude change will be more increased for participants in IT-related majors than those in non-IT related majors with respect to their attitude strength.

H3c. Resistance to attitude change will be more increased for participants in IT-related majors than those in non-

IT related majors with respect to their career feelings.

A field experiment was conducted to explore these hypotheses. Enrolled students from a variety of undergraduate majors participated in an online experiment that included inoculation manipulations. The following section presents the methods used for this research.

3. METHODS

3.1. Experimental Design

A field experiment tested the effects of inoculative and attack messages on participants' attitudes towards an occupational feature of the IT field. This study extended research on Inoculation Theory and demonstrated an application of Inoculation Theory that might benefit retention in educational and occupational settings in the IT field. To this end, it was important to choose a focal "issue" for the inoculation. Given our focus on retention in the IT field, this issue had be something that was relevant to students or workers who might or might not remain in the IT field. In prior research, the specific issue of "Keeping up with Technology" was found to play an essential role in the process by which future information professionals decided whether to remain committed to the IT professions (Fagnot, Guzman & Stanton, 2007).

Three independent variables with two levels each formed a 2x2x2 Factorial Design. This design, because it evaluates the effect of each factor and the interactions between the factors, is

well adapted to answer the research questions. The experimental manipulation comprised an inoculation condition and a control condition with no inoculation as shown in Figure 4 below. The experiment was conducted over a period of three weeks for each participant. A total of eight groups were randomly assigned to treatment or control. The four different groups for treatment and control were: 1) Males in IT-related majors, 2) Males in non-IT-related major, 3) Females in IT-related majors, and 4) Females in non-IT-related major. Gender (male, female) and major (IT, non-IT) were two naturally-occurring independent variables.

The use of academic major as a non-manipulated independent variable was intended to provide a proxy for prior commitment to the attitude – individuals outside of IT-related majors presumably had less weaker attitudes about challenges in the IT field. Note that we also measured this variable. Using gender as a non-manipulated independent variable provided an opportunity to explore findings from previous research on inoculation indicating gender differences in re-

sponses to inoculative messages (Pfau & Burgoon, 1988).

Four web-based surveys (one for phase one; two for phase two – for the control and treatment groups; and one for phase three) were developed to collect data on the attitudes. In phase one of the experiment, participants provided a baseline for their initial attitudes towards the occupational feature of the IT field via a web-based instrument. In phase two, a second web-based instrument exposed participants in the treatment group to an inoculative message, followed by a survey. Following Wood (2007) and Pfau et al. (1997), inoculative and attack messages were developed for the experiment. Based on previous work (Fagnot, Guzman & Stanton, 2007) the specific occupational feature "Keeping up with Technology," considered to play an essential role in future information professionals' commitment to the IT professions, was used as the basis of the inoculative and attack messages. The inoculative message, which comprised four brief paragraphs, included the statement, "IT professionals must continue learning about the newest technologies
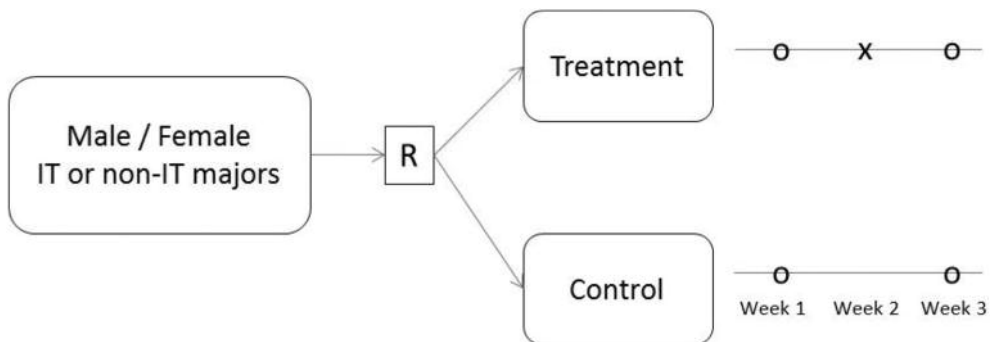
Figure 4. 2x2x2 Factorial Design

throughout their careers. However, there are similar demands in many professions and fields." (See Appendix B for full inoculative and attack messages.) The inoculative message was sent to the treatment group during phase two. Participants in the control group were not exposed to the inoculative message but were asked to fill out a similar survey. In phase three, participants in the eight groups were exposed to the attack message. In this phase, information about participants' attitudes towards the occupational features of the IT was collected again.

The data was collected with an interval of about a week between each of the three phases. Research on Inoculation Theory shows that some delay between inoculation and attack messages is needed for resistance to build (Godbold & Pfau, 2000). A delay of one week between each of the three phases was deemed appropriate because the issue studied was modestly involving (Godbold & Pfau, 2000) and a prior study on a similar topic showed meaningful results with a delay of one week (Pfau & Burgoon, 1988). Using a one week delay gives the participant enough time to process the information presented in the inoculation – i.e., to activate defense mechanisms and to unconsciously rehearse counterarguments. Furthermore, the one-week delay is long enough to ensure that the participant is not relying on short term memory when presented with the threat message.

3.2. Measures

The research instruments for the three phases were designed with vali-

dated constructs from three different studies (Akbulut-Bailey & Looney, 2007; Guzman, 2008; Wood, 2006, 2007). Three scales were used as research instruments for this study: focal attitude level, attitude strength, and career feelings. The three research instruments measured the same constructs to allow for between-groups comparisons (except for minor differences during phase two between the treatment and control groups). Full details of the three scales are given in Appendix A.

For the scale on focal attitude, participants were given a single issue statement on the Information Technology profession: "Information Technology professionals must continue to learn the newest and most up-to-date technologies to stay current." They were asked to rate their attitude on a one to seven scale using six different measures of attitude, such as Negative/Positive and Foolish/Wise.

The attitude strength scale gave participants three different opportunities to rate the strength of their attitude (e.g.: Not very confident/Very confident) toward the issue statement on the Information Technology profession they just rated. There were three items, using a scale from one to seven.

The scale on career feelings measured five related constructs: The Information Technology Profession (seven items); Choice Goals (seven items); Career Opportunities in the Information Technology Profession (eight items); Demands in the Information Technology Profession (seven items); Stereotypes on the Information Technology Profession (seven items).

Participants were asked to read these statements about the Information Technology profession and indicate their agreement on a scale from one to six (1 - strongly disagree to 6 - strongly agree).

3.3. Participants

A statistical power analysis was conducted to identify the minimum number of participants necessary per group at the end of phase three to ensure statistical significance. The calculation for N was made for power of .80 (Cohen, 1992). To uncover a medium difference between eight independent sample means at = .05, each of the eight groups had to try to reach N=30 participants by the end of phase 3. In the end, the recruitment yielded an average of 27 participants per cell.

Participants for the main experiment were undergraduate students pursuing an IT-related or non-IT-related major at a college or university in the United States. Participants were recruited from a convenience sample of classes offered at 17 universities in order to sample widely across institutional settings. Among these participants, those in non-IT related majors at the time of the study were enrolled in programs such Art and Sciences, Education, Communications, Health care, Business and Marketing. Those in IT related majors were in programs such as Information Technology and Management, Soft-

ware Engineering, Computer Science, Computer Engineering, and Information Systems. Statistics from the Department of Education show that the participants in this study are a good representation of the student population in undergraduate studies in the United States. More specifically, archival data from the "Career and Technical Education Report in the United States: 1990-2005," showed that in a typical year there are approximately 30% of students in business and marketing majors and roughly 10% in IT-related majors.

Participants received an email invitation from their professors to participate in phase 1 of the study. The invitation was sent to approximately 2000 students at 17 universities. Once students participated in the first phase of the study, they received an invitation email at about a week's interval to fill out phase 2, and then after another week's interval to fill out phase 3. Table 1 below presents the number of participants for each phase.

Data were exported from the web-based instrument into Excel spreadsheets to be cleaned, organized, and formatted, before being exported to SPSS for statistical analyses. Participants who did not participate in the three phases of the experiment or who did not fill out the survey instrument completely were removed from the final data set.

Phase 1 Only	Phase 1 and Phase 2	All Three Phases
N= 643 participants	N= 275 participants	N= 214 participants

Table 1. Participants in the three-phase survey

23

	Treatment Groups		Control Groups		Totals
IT-related major	N= 26 females	N=30 males	N= 10 females	N=25 males	91
Non-IT related major	N= 43 females	N=15 males	N= 32 females	N=33 males	123
Totals	114			100	Grand Total N=214

Table 2. Final N for treatment and control groups by gender and major

Table 2 describes the size of each group based on retention of those cases where the participant completed all three phases and submitted complete data on their research instruments.

4. RESULTS

Means and standard deviations were computed (Table 3) for all dependent variables for phases 1, 2 and 3. Note that this summary table aggregates across treatment and control, both majors, and both genders. The research questions concerned resistance to attitude change but this was operationalized by looking at changes over time in three kinds of measures (Focal Attitude, Attitude Strength and Career Feelings) with multi-item scales. Career feelings were measured using five multi-item scales (About the IT profes-

	Phase 1		Phase 2		Phase 3	
Variables	**Mean**	**Std. Deviation**	**Mean**	**Std. Deviation**	**Mean**	**Std. Deviation**
Focal Attitude	6.40	.82	6.21	.82	5.78	1.01
Attitude Strength	6.03	1.13	6.07	.98	5.95	1.01
About the IT profession	4.11	.88	4.03	.88	4.06	.84
About your choice goals	3.67	1.58	3.72	1.52	3.70	1.54
About career opportunities in the IT profession	4.71	.76	4.69	.75	4.68	.75
About demands in the IT profession	3.99	1.23	4.03	1.27	4.10	1.29
About stereotypes on the IT profession	3.73	.98	3.80	.99	3.84	.90

Table 3. Means and Standard Deviations for Dependent Variables across Phases

sion; About your choice goals; About career opportunities in the IT profession; About demands in the IT profession; About stereotypes on the IT profession). Note that Focal Attitude and Attitude Strength were on a one to seven scale and that Career Feelings were on a one to six scale.

These results show that overall, participants had positive focal attitudes (4.0 was the midpoint of this seven-point scale), as well as somewhat positive attitudes about career opportunities in the IT profession (3.5 was the midpoint of this six-point scale). The attitude strength for the focal attitude was also above the midpoint. Participant responses were just above the neutral point for attitudes about the IT profession itself and also for choice goals, demands, and stereotypes (3.5 was the midpoint of these six-point scales).

A Mixed Model ANOVA (between and within subjects factors) was con-

ducted to examine the effect of the independent variables (gender, major, and experimental manipulation) on the dependent variables. The within subjects factor was, in all of the analyses below, the comparison between the focal attitude as measured at the different phases. The between subjects factors were gender, major, and experimental condition. As mentioned above, resistance to Attitude Change was operationalized in three ways: by examining changes in Focal Attitude level over time, Attitude Strength over time and Career Feelings over time. Hence three omnibus tests were conducted.

The Mixed Model ANOVA results presented in Table 4 cover one dependent variable at a time (but testing across phases to assess the within subjects factor). The table starts on the left with the focal attitude because it was the most important dependent variable in this study.

	Focal Attitude	Attitude Strength	Career Feelings
Experimental Conditions	H1a Wilks Lambda=.89, $F(2,202)=11.52$, p=0.00, partial eta squared=.102	H1b Wilks Lambda= .96, $F(2,203)=3.93$, p=0.02, partial eta squared =.037	H1c Wilks Lambda= .98, $F(2,204)=1.67$, p=0.19, partial eta squared =.016
Gender	H2a Wilks Lambda=.99, $F(2,202)=.253$, p=0.77, partial eta squared=.003	H2b Wilks Lambda= .99, $F(2,203)=.225$, p=0.79, partial eta squared =.002	H2c Wilks Lambda= .98, $F(2,204)=1.90$, p=0.15, partial eta squared =.018
Major	H3a Wilks Lambda=.98, $F(2,202)=1.69$, p=0.18, partial eta squared=.017	H3b Wilks Lambda= .99, $F(2,203)=.379$, p=0.68, partial eta squared =.004	H3c Wilks Lambda= .98, $F(2,204)=1.63$, p=0.19, partial eta squared =.016

Table 4. ANOVA Results

25

These results suggest that the experimental manipulation (treatment vs. control) affected focal attitude and attitude strength over time but that gender and major did not. Further, the results show that there were no significant differences in the pattern of means for career feelings over time for experimental conditions, major or gender.

4.1. Research Question (a)

The first specific research question was: How do inoculating messages about the IT profession impact participants' standing on relevant attitudes towards occupational features of the IT profession? This question hypothesized that participants exposed to inoculation treatment will increase their resistance to change (Hypotheses H1a, H1b, H1c).

An omnibus ANOVA analysis was conducted in order to assess change over the three phases. This analysis showed that there was no significant difference between phases 1 and 2, as theoretically expected, since the Phase 1 baseline data was collected as a safety precaution to ensure that exposure to the initial study materials did not significantly change attitude levels. Therefore for the purposes of this study, Phase 2 (P2) was used as baseline for comparisons with the post-attack, Phase 3 measures.

Mixed ANOVA results presented above suggested that the pattern of means was different over time for the focal attitude and for attitude strength, when comparing the treatment and control conditions. The focal attitude of participants towards the information

profession was measured on a one to seven scale. Participants had to answer six questions regarding their favorability towards the focal attitude issue. Table 5 hereafter presents the means of the focal attitude between phases 2 and 3 for treatment and control groups.

	Focal Attitude	
	Phase 2	Phase 3
Treatment	6.00	5.64
Control	6.46	5.95

Table 5. Mean of Focal Attitude between Phases 2 and 3

As Table 5 shows, both groups had a decline in their focal attitude, a typical result in inoculation experiments. As a reminder, in phase 3, participants from both treatment and control groups received an attack. It was to be expected that after an attack, participants' attitude would change and in many cases decline for participants of either treatment or control groups. Although we do note that the treatment group both started and ended slightly lower than the control group, this may simply be a result of the limits of randomization (given that participants were randomly assigned to treatment and control, there is no theoretical reason to expect any bias when measured at phase 2). However, the hypothesis concerned the amount of change between phases and there is a larger proportional decline in attitude for the control group than for the treatment group. The ANOVA interaction test showed that this difference was statistically significant. In other words all participants

decreased in their attitude but inoculated participants decreased significantly less (with the exception of participants' attitudes towards a career in the information field). These results support hypothesis H1a in that participants that were exposed to inoculation treatment were less affected by the attack, and thus they had greater resistance to attitude change. Thus hypothesis H1a is partially confirmed by these results.

Participants also had to answer three questions about the certainty of their responses to the focal attitude items. Table 6 below presents the cell means for attitude strength in the treatment and control groups across phases 2 and 3.

	Focal Attitude	
	Phase 2	Phase 3
Treatment	5.97	6.02
Control	6.19	5.88

Table 6. Mean of Attitude Strength between Phases 2 and 3

The mean of the treatment groups slightly increased while the mean of control groups declined. The ANOVA interaction tests suggested that this difference was statistically significant. In parallel to the means of the focal attitude, these results showed that participants in control groups were affected differently by the attack than participants who had received an inoculation treatment. In effect, after the attack, the control group participants were less certain about their position whereas the treatment group participants were more certain about their position. These results fit with the hypothesis that those who do receive inoculation increase their resistance to change, and provided additional confirming evidence for hypotheses H1a, H1b, and H1c.

4.2. Research Question (b)

The second specific research question was: What differences, if any, exist by gender regarding these attitudes and their resistance to attitude change? Based on the literature review, we hypothesized that inoculation treatments would be more effective for male participants than for females. In other words, male participants would be less susceptible than female participants to persuasive attacks following inoculation (Pfau & Burgoon, 1988). The mixed ANOVA results (see Table 7 below) showed that there were no gender differences on participants' resistance to change. Thus hypotheses H2a, H2b, and H2c were not supported.

	Focal Attitude	Attitude Strength	Career Feelings
Gender	H2a Wilks Lambda=.99, $F_{(2,202)}=.253$, p=0.77, partial eta squared=.003	H2b Wilks Lambda= .99, $F_{(2,203)}=.225$, p=0.79, partial eta squared =.002	H2c Wilks Lambda= .98, $F_{(2,204)}=1.90$, p=0.15, partial eta squared =.018

Table 7. ANOVA Results for Gender

27

4.3. Research Question (c)

The third specific research question was: What differences, if any, exist by major regarding these attitudes and their resistance to attitude change? The literature on Inoculation Theory argues that participants who have positive pre-existing attitudes towards an issue will show better resistance to attitude change (Wood, 2006; Wood, 2007). In this study, we hypothesized that participants enrolled in non-IT-related majors would have minimal concern for or stake in the IT field relative to participants enrolled in an IT-related major. As suggested by the mixed ANOVA results (see Table 8) there were no significant differences by major participants' resistance to change. Thus hypotheses H3a, H3b, H3c were not supported.

5. DISCUSSION / CONCLUSIONS

This research study was motivated by poor retention in IT majors which has impacted the IT workforce, as well as the gap between the current available IT workforce and the need for skilled IT professionals. A field experiment was conducted in the form of a three-phase online inoculation experiment on undergraduate students in IT and non-IT related programs. Only un-

dergraduate students were invited to take part in the study. It was assumed that these students could change their career paths more easily than graduate students and therefore would be easier to influence regarding their decision to remain or leave the IT profession (if they were already in IT majors) or to consider entering it (if they were in non-IT majors). At the end of the three phases, there was a total of N=214 usable responses from students who fully completed the three phases of the study.

Answering the three research questions, the results of this study showed that the inoculation experiment was significant. The participants in the treatment group increased their resistance to change compared to their counterparts in the control group; participants who received the inoculation message experienced greater resistance to the position advocated in an attack message compared to the control group. The analyses did not detect any significant differences in attitudes based on gender and major.

The results of this study shed light on some of the factors that influence information professionals to remain committed to their career paths. These results may enhance academics' and practitioners' understanding of retention among undergraduate information

	Focal Attitude	Attitude Strength	Career Feelings
Major	H3a Wilks Lambda=.98, F(2,202)=1.69, p=0.18, partial eta squared=.017	H3b Wilks Lambda= .99, F(2,203)=.379, p=0.68, partial eta squared =.004	H3c Wilks Lambda= .98, F(2,204)=1.63, p=0.19, partial eta squared =.016

Table 8. ANOVA Results for Major

majors and IT professionals. The results may also inform the development of mechanisms to enhance retention in IT majors and avoid high turnover in the field.

The medical analogy of inoculation is commonly used to illustrate Inoculation Theory, as we have done here by applying it to the field of Information Technology. However, there are two significant points where the medical analogy may not apply. In the first place, medical inoculations are only given to those who may come into contact with a disease, e.g., yellow fever vaccination is given to people who plan on traveling to countries such as India, but not to those who plan to travel within France or the US. However, our research suggests that it may prove highly beneficial to inoculate non-IT majors as well. In the second place, Wood (2007) argues that, in the medical field, a doctor typically does not immunize a patient who already has a disease, for fear that the patient's condition will worsen. However, the present research suggests that there may be considerable value in administering an inoculation at the beginning of and during the educational path of IT students.

Training programs which include an inoculation treatment might improve the resistance of those with pre-existing positive attitudes about the IT field, as well as improving resistance to negative persuasive messages among those who may not be well informed about the IT profession – in our study, participants in non-IT majors.

The literature on inoculation and especially on health education research presents examples of successful inoculation based training programs. Most of these experiments have taken place in drug prevention programs (Rones and Hoagwood, 2000) or in stress prevention programs (Meichenbaum, 2007). These interactive programs can be based partly on educational components or videos (Meichenbaum, 2007).

Applied to the field of IT, a training program could take the form of a workshop addressed to all students in an IT/IM/MIS program. This workshop could use videos as a stimulus to focus and generate discussion during the workshop. During the workshop, participants would watch and comment on short videos. The videos would present thoughts of information professionals or future information professionals on some occupational features of the IT field. The videos would also feature challenges that information professionals may have to face at one point in their educational path or career in the field. These short videos could present stories of how people in the IT field managed along the years – both seizing opportunities and overcoming challenges. Participants in the workshop could identify with these success stories of IT professionals. This workshop would aim at giving participants a better idea of the realities of the IT field.

Academics and practitioners who would provide an inoculation-like intervention need to think carefully about the question of whom to target in the intervention. One of the reasons why people in non-IT majors are favorably affected by the inoculation intervention could be that individuals in IT majors have in many cases already

29

received inoculation informally in the form of barriers they have overcome with the help of family members, friends, or the image of IT professionals broadcast in popular media. Thus, in some ways those already in IT majors may already have some "inoculation" by virtue of their socialization experiences in pursuing their majors.

These socialization opportunities are not as available to non-IT majors – they have only experienced attacks and little, if any, inoculation. For example, seeing "geeks" portrayed negatively in popular media is not an inoculation, but merely an attack, which they have no motivation to resist. Mainstream media messages and conventional misperceptions (e.g., "IT people" are socially awkward; their jobs and interests center on fixing broken computers, etc.) would reach this population frequently. The kinds of naturally-occurring inoculation that would normally occur within the major, for example, students and faculty sharing attitudes of knowing current trends, modeling balanced work and home lives, and having women as coworkers, would be nearly absent for the non-IT majors. In short, societal misperceptions would be strongly negative and would come at them from many angles.

In this study, there was no significant result for gender. Although there is not much literature on gender differences in Inoculation Theory, a few studies such as Pfau & Burgoon (1988); Eagly & Carli (1981) in Compton & Pfau, (2005) have argued that women and men are impacted differently by inoculation experiments. Some studies on gender in the IT field have shown that

women and men are typically affected differently in various aspects of the field such as acculturation (Guzman, 2008) and professional identity of workers (Buche, 2008). Other studies have shown that there is a gender gap in how women and men identify and discuss challenges faced by women in IS (Reid et al., 2010). As we suggest above, students who chose an IT major may already be inoculated, and thus in this context, women may be as "naturally" inoculated as men are. This could explain why there is no overall significance of gender.

Studies on resistance to attitude change have put emphasis on strength of attitude as an essential factor in resistance to change (Eagly & Kulesa, 1997). To put it differently, it is more difficult to change a strongly held attitude than a weakly held one. This aspect of resistance to attitude change was tested in the inoculation experiment. In this study there was a significant result which highlights this important feature of resistance to attitude change. It is the fact that the impact of the threat in phase 3 had a lesser impact on those who did not receive inoculation treatment. This finding corroborates the relevance of attitude strength in an inoculation intervention.

The findings of this study offer practical guidance to professors. Based on the results of this study, we can say that conducting an inoculation experiment does increase resistance to attitude change to those who receive inoculation treatment. Future or current information professionals can be presumed, based on their choice of major or career, to have positive pre-existing attitudes towards the field; it is important

to help them retain and reinforce these attitudes. This study argues that it is essential to focus on preemptive strategies in order to prevent information professionals from leaving the field.

REFERENCES

Ahuja, M. K. (2002), "Women in the Information Technology Profession: A Literature Review, Synthesis and Research Agenda", *European Journal of Information Systems*, vol. 1, n°1, p. 20-34.

Akbulut-Bailey, A. Y., & Looney, C. A. (2007), "Inspiring Students to Pursue Computing Degrees: Their Aspirations Are Our Possibilities", *Communications of the ACM*, vol. 50, n°10, p. 67-71.

Ali, A. (2009), "Successful Efforts in Recruiting Women into Technology Courses – A Case Study", *Issues in Information System*, vol. X, n°1, p. 225-231.

Ali, A. & Shubra, C. (2010), "Efforts to Reverse the Trend of Enrollment Decline in Computer Science Programs", *The Journal of Issues in Informing Science and Technology*, vol. 7, p. 209-225.

Aronson, E., Wilson,T.D., &Akert,R.M. (2005). "Social Psychology (5th ed.)". Upper Saddle River, NJ: PrenticeHall.

Buche, M. (2008), "Influence of Gender on IT Professional Work Identity: Outcomes from a PLS Study", *ACM Special Interest Group on Computer Personnel Research Annual Conference*, Charlottesville, VA.

Cohen, J. (1992), "A Power Primer". *Psychological Bulletin*, vol. 112, n°1, p. 155-159.

Compton, J.A. & Pfau, M.W. (2005), "Inoculation Theory of Resistance to Influence at Maturity: Recent Progress in Theory Development and Application and Suggestions for Future Research", *Communication Yearbook*, vol. 29, p. 97-145.

Crites, S.L., Fabrigar, L.R. & Petty, R.E. (1994). "Measuring the Affective and Cognitive Properties of Attitudes: Conceptual and Methodological Issues". *Personality and Social Psychology Bulletin,* vol. 20, n°6, p. 619-634.

Davis, C.E., Yeary, M.B. & Sluss, J.J. (2012), "Reversing the Trend of Engineering Enrollment Declines With Innovative Outreach, Recruiting, and Retention Programs", *IEEE Transactions on Education*, vol. 55, n°2, p. 157-163.

Eagly, A. H., & Carli, L. L. (1981), "Sex of Researchers and Sex-typed Communications as Determinants of Sex Differences in Influenceability: A Meta-analysis of Social Influence Studies", *Psychological Bulletin*, vol. 90, p. 1-20.

Eagly, A. H., & Chaiken, S. (1993), "The Psychology of Attitudes", Harcourt Brace Jovanovich College Publishers: Fort Worth, TX.

Eagly, A. H., & Kulesa, P. (1997), "Attitudes, Attitude Structure and Resistance to Change", in M.H. Bazerman, D.M. Messick, A.E. Tenbrunsel, & K.A. Wade (Eds.), Environmental Ethics and Behavior, p. 122-153. San Francisco: New Lexington.

Erickson, J. (2005), "Scientists, Engineers Call for More Women in Math, Science", Retrieved May 24, 2005, from http://www.now.org/issues/education/05/305science.html

Fagnot, I.J., Guzman, I.R. & Stanton, J.M. (2007), "Toward Recruitment And Retention Strategies Based on the Early Exposure to the IT Occupational Culture", *America Conference on Information Systems (AMCIS)*, Keystone, CO.

Fischman, J. (2007), "Robots to the Rescue: Women are Vanishing from Computer-science Programs. Can the Scribbler Lure them Back?" *The Chronicle of Higher Education*, June, p. A29. Available at: http://chronicle.com/article/Robots-to-the-Rescue/11380

31

Godbold, L. & Pfau, M. (2000), "Conferring Resistance to Peer Pressure Among Adolescents: Using Inoculation Theory to Discourage Alcohol Use", *Communication Research*, vol. 27, n°4, p. 411-437.

Granger, M., Dick, G., Jacobson, C., and Van Slyke, C. (2007), "Information Systems Enrollments: Challenges and Strategies", *Journal of Information Systems Education*, vol. 18, n°3, p. 303-312.

Guzman, I.R. (2008), "As you like I.T.": Occupational Culture and Commitment of New IT People: Using Mixed Methodology to Study the Perceptions of New Information Technologists", VDM Verlag Dr. Muller Publishing, Saarbrucken, Germany.

Kaarst-Brown, M.L. & Robey, D. (1999), "More on Myth, Magic and Metaphor: Cultural Insights into the Management of Information Technology in Organizations", *Information, Technology and People*, vol. 12, n° 2, p. 192-217.

Katz, E., & Lazarsfeld, P. (1955), Personal Influence, New York: The Free Press.

Krosnick, J.A., & Petty, R.E. (1995). "Attitude strength: An overview". In R.E. Petty & J.A. Krosnick (Eds.), Attitude strength: Antecedents and consequences (p. 1-24). Mahwah, NJ: Lawrence Erlbaum Associates.

Leidner, D.E. & Kayworth, T. (2006), "A Review of Culture in Information Systems Research: Toward a Theory of Information Technology Culture Conflict", *MIS Quarterly*, vol. 30, n° 2, p. 357-399.

McCombs, M.E. & Shaw, D. (1972). "The Agenda-Setting Function of Mass Media", *Public Opinion Quarterly*, vol. 36; p.176-187.

McInerney, C.R., DiDonato, N.C., Giagnacova, R, and O'Donnell, A.M. (2006), "Students' choice of Information Technology Majors and Careers: A Qualitative Study", *Information Technology, Learn-ing, and Performance Journal*, vol. 24, n°2, p. 35-53.

McGuire, W. J. (1964), "Inducing Resistance to Persuasion: Some Contemporary Approaches", In L. Berkowitz (Ed.), *Advances in Experimental Social Psychology*, vol. 1, p. 191-229. New York: Academic Press.

McGuire, W. J. (1970), "A Vaccine for Brainwash", *Psychology Today*, vol. 3, p. 36-39 & p. 63-64.

McGuire, W.J. (1985). "Attitudes and Attitude Change". In G. Lindzey & E. Aronson (Eds.), The Handbook of Social Psychology (3rd ed., vol. 2, p. 233-346). New York: Random House.

McGuire, W. J. & Papageorgis, D. (1961), "The Relative Efficacy of Various Types of Prior Belief-defense in Immunity against Persuasion", *Journal of Abnormal and Social Psychology*, vol. 62, p. 327-337.

McGuire, W. J. & Papageorgis, D. (1962), "Effectiveness of Forewarning in Developing Resistance to Persuasion", *The Public Opinion Quarterly*, vol. 26, n°1, p. 24-34.

Meichenbaum, D. (2007), "Stress Inoculation Training: A Preventative and Treatment Approach", in Lehrer, P.M., Woolfolk, R.L. & Sime, W.S. (2007). Principles and Practices of Stress Management (3rd Edition). Guilford Press.

Miller, G. R., & Burgoon, M. (1973), "New Techniques of Persuasion", New York: Harper & Row.

Panko, R.R. (2008), "IT Employment Prospects: Beyond the Dotcom Bubble", *European Journal of Information Systems*, vol. 17, n°3, p. 182-197.

Petty, R.E. & Cacioppo, J.T. (1986), "The Elaboration Likelihood Model of Persuasion", *Advances in Experimental Social Psychology*, vol. 19, p. 123-205.

Petty, R.E., Wegener, D.T. and Fabrigar, L.R. (1997), "Attitude and Attitude Change", *Annual Review of Psychology*, vol. 48, p 609-647.

Pfau, M. & Burgoon, M. (1988), "Inoculation in Political Campaign Communication", *Human Communication Research*, vol. 15, p. 91-111.

Pfau, M., & Kenski, H. C., Nitz, M., & Sorenson, J. (1990), "Efficacy of Inoculation Strategies in Promoting Resistance to Political Attack Messages: Application to Direct Mail", *Communication Monographs*, vol. 57, p. 25-43.

Pfau, M. (1995), "Designing Messages for Behavioral Inoculation", In E. Maibach & R.L. Parrott (Eds.), Designing Health Messages: Approaches from Communication Theory and Public Health pPractice (p 99-113). Thousand Oaks: Sage.

Pfau, M., Tusing, K.J., Koerner, A.F., Lee, W., Godbold, L.C., Penaloza, L.J., Yang, V.S., & Hong, Y. (1997a), "Enriching the Inoculation Construct: The Role of Critical Components in the Process of Resistance", *Human Communication Research*, vol. 24, p.187-215.

Quesenberry, J.L., and Trauth, E.M. (2007), "What Do Women Want?: An Investigation of Career Anchors among Women in the IT Workforce", *ACM SIGMIS Conference on Computer Personnel Research*, St. Louis, MO.

Quinn, J.M. & Wood, W. (2004), "Forewarning of Influence Appeals: Inducing Resistance and Acceptance", In Resistance and Persuasion, edited by Knowles, E.R. & Lynn, J.A., Lawrence Erlbaum Associates, Inc., New Jersey, p. 193-213.

Reid, M.F., Allen, M.W., Armstrong, D.J. & Reimenschneider, C.K. (2010), "Perspectives on Challenges Facing Women in IS: The Cognitive Gender Gap", *European Journal of Information Systems*, vol. 19, p. 526-539.

Rones, M. & Hoagwood, K. (2000), "School-Based Mental Health Services: A Research Review", *Clinical Child and Family Psychology Review*, vol. 3, n°4, p.223-241.

Rottinghaus, P.J., Day, S.X., and Borgen, F.H. (2005), "The Career Futures Inventory: A Measure of Career-Related Adaptability and Optimism", *Journal of Career Assessment*, vol. 13, n°1, p.3-24.

Tapia, A.H., and Kvasny, L. (2004), "Recruitment is Never Enough: Retention of Women and Minorities in the IT Workplace", ACM Press, Tucson, Arizona, USA, p. 84-91.

Trauth E.M. (2002), "Odd Girl Out: An Individual Differences Perspective on Women in the IT Profession", *Information Technology and People,* vol. 15, n°2, p. 98-118.

Wang, X. (2013), "Why Students Choose STEM Majors: Motivation, High School Learning, and Postsecondary Context of Support", *American Educational Research Journal,* vol. 50, n°5, p.1081–1121.

Wood, L.M. (2006), "Expertise and Prior Attitude: Exploring New Moderators in the Context of Inoculation Research". PhD Dissertation, University of Wisconsin, Madison.

Wood, L.M. (2007), "Rethinking the Inoculation Analogy: Effects on Subjects with Differing Preexisting Attitudes", *Human Communication Research*, vol. 33, n°3, p. 357–378.

Wright, B. (2009), "Bureau of Labor Statistics Spring 2009 report: Employment, Trends and Training", *Occupational Outlook Quarterly*, Spring 2009, p. 34-41. Available at: http://www.bls.gov/career-outlook/2009/spring/art04.pdf

Zanna, M. P. & Rempel, J. K. (1988). "Attitudes: A New Look at an Old Concept". In Bar-Tal, D. & Kruglanski, A. W. (Eds). The Social Psychology of Knowledge, p. 315-334, New York, NY.

33

APPENDIXES

APPENDIX A: INOCULATION EXPERIMENT
MULTI-ITEMS SCALES / MEANS AND STANDARD DEVIATIONS

Means and standard deviations for phases 2 and 3 are added after each variable. M standing for Mean and SD standing for Standard Deviation.

Focal Attitude Scale

Phase 2 (M = 6.21, SD = 0.82); Phase 3 (M = 5.78, SD = 1.01)

Participants were asked to rate their attitude toward an issue statement on the Information Technology profession. For instance, in phase 1, the issue statement was as follows: "Information Technology professionals must continue to learn the newest and most up-to-date technologies to stay current." There were six items on a one to seven scale.

1. Negative / Positive
2. Bad / Good
3. Unfavorable / Favorable
4. Unacceptable / Acceptable
5. Foolish / Wise
6. Wrong / Right

Attitude Strength Scale: six items on a one to seven scale

Phase 2 (M = 6.07, SD = 0.98); Phase 3 (M = 55.95, SD = 1.01)

Participants were asked to rate the strength of their attitude toward the issue statement on the Information Technology profession they just rated. There were three items on a one to seven scale.

1. No certainty / Absolute certainty
2. Not very confident / Very confident
3. Not very sure/ Very sure

About the Information Technology Profession

Phase 2 (M = 4.03, SD = 0.88); Phase 3 (M = 4.06, SD = 0.84)

Participants were asked to read statements about the Information Technology profession and indicate their agreement. There were seven items on a one to six scale (1 - strongly disagree to 6 - strongly agree).

1. I would be proud to be in the IT field
2. I would dislike being an IT person
3. I am enthusiastic about the IT profession
4. If I could change my career focus to something other than IT right now, I would
5. I am interested in the technical side of IT
6. I am excited about the business side of IT
7. I can't wait for the newest technologies to come out

About your choice goals

Phase 2 (M = 3.72, SD = 1.52); Phase 3 (M = 3.70, SD = 1.54)

Participants were asked to read statements about the Information Technology profession and indicate their agreement. There were seven items on a one to six scale (1 - strongly disagree to 6 - strongly agree).

1. My academic goal is to select IT as my career choice

2. I have aspirations to choose IT as my career choice

3. Choosing to pursue a career in IT is a goal of mine

4. I want to choose IT as my career path

5. I am considering a professional career in the IT field

6. I think the idea of pursuing a career in the IT field is useful

7. There is no way I would ever pursue a career path in the IT field

About career opportunities in the Information Technology profession

Phase 2 (M = 4.69, SD = 0.75); Phase 3 (M = 4.68, SD = 0.75)

Participants were asked to read statements about the Information Technology profession and indicate their agreement. There were eight items on a one to six scale (1 - strongly disagree to 6 - strongly agree).

1. There are many job opportunities in IT

2. The future of the IT profession is promising

3. A degree in IT provides me with numerous job options

4. Studying IT would help me find a better job

5. All the IT jobs will soon be outsourced

6. Even if I get an IT job, sooner or later, I will be laid off

7. With a degree in IT, it will be difficult to find a job

8. A degree in IT makes me a stronger candidate on the job market

About demands in the Information Technology profession

Phase 2 (M = 4.03, SD = 1.27); Phase 3 (M = 4.10, SD = 1.29)

There were seven items on a one to six scale (1 - strongly disagree to 6 - strongly agree). Participants were asked to state their agreement with "I think I can…"

1. Solve difficult IT problems

2. Accomplish all IT-related tasks designated to me

3. Efficiently deal with unexpected IT-related events

4. Use my resourcefulness with technology to successfully handle unforeseen situations

5. Remain calm when facing IT-related difficulties

6. Find the best possible solution when confronted with an IT-related problem

7. Handle whatever comes my way when dealing with IT

About stereotypes on the Information Technology profession

Phase 2 (M = 3.80, SD = 0.99); Phase 3 (M = 3.84, SD = 0.90)

Participants were asked to read statements about the Information Technology profession and indicate their agreement. There were seven items on a one to six scale (1 - strongly disagree to 6 - strongly agree).

1. If someone called me a geek I would consider it an insult

2. I think that other people think of me as a geek

3. I don't consider myself a geek

35

4. Having some of my friends that are geeks is cool

5. My family and friends see me as a computer geek

6. I don't mind being stereotyped as a geek

7. Being seen as a geek by others is not a problem for me

Table A.1. below presents the means and standard deviations for the independent variable "Major" across phases 2 and 3.

	Phase 2				Phase 3			
	Major				Major			
	IT		Non-IT		IT		Non-IT	
	M	SD	M	SD	M	SD	M	SD
Attitude	6.02	.85	6.35	.77	5.74	.96	5.82	1.05
Attitude Strength	5.84	1.07	6.23	.88	5.78	1.09	6.08	.93
Career Attitude	4.67	.56	3.60	.71	4.64	.63	3.66	.70

**Table A.1. Group Means (M) and Standard Deviations (SD)
for Independent Variable "Major" across Phases 2 and 3**

APPENDIX B: INOCULATIVE AND ATTACK MESSAGES

Inoculative Message

"As Information Technology becomes more widespread in organizations and the need for information professionals grows, the general public has a stereotyped and misleading image of the occupations.

Some of those ideas are negative and may cause you to rethink your interest for the profession.

A common idea about the IT professions is that there are many extreme and unusual demands, such as "Keeping up with technology". In other words, IT professionals must continue learning about the newest technologies throughout their careers.

However, there are similar demands in many professions and fields. For example, if a business (such as manufacturing, transportation, medical, etc.) wants to be competitive, it needs to keep up with the latest innovations – this is not limited just to IT professionals."

Attack Message

"As Information Technology becomes more widespread in organizations and the need for information professionals grows, the general public has a stereotyped and misleading image of the occupation.

A feature of the information professions often mentioned as overwhelming is the constant need for information professionals to keep up with technology.

"I am here because my dad wanted me to study IT, but as soon as I can, I am transferring to education. I hate the idea of always having to keep up with technology. This is not the kind of life I want," said a freshman female IT student."

36