INNOVATIONS IN ACADEMIC SUPPORT Factors Influencing Student Adoption of Synchronous Videoconferencing for Online Support in High-Risk STEM Courses

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INTRODUCTION

The low retention rates of students in science, technology, engineering, and mathematics (STEM) and STEM-related majors threaten the ability of the United States to maintain its prominence in science and technology and meet economic demand (Executive Office of the President, President's Council of Advisors on Science and Technology, 2012). Low retention rates also have the potential to influence institutional funding (Gonzalez, 2012; U.S. Senate Committee on Health, Education, Labor & Pensions, 2012) and accreditation (Council of Regional Accrediting Commissions, 2009; Middle States Commission on Higher Education, 2011; U.S. Department of Education, Office of Postsecondary Education, 2008; Wilson, 2012). Reasons provided for these low retention rates include student unpreparedness (Executive Office of the President, President's Council of Advisors on Science and Technology 2012; U.S. Department of Education, National Center for Educational Statistics, 2011), changing student demographics (Consortium for Student Retention Data Exchange Center for Institutional Data Exchange, 2012; National Science Board, 2012; Tossi, 2012; U.S. Department of Education, National Center for Educational Statistics, 2011), and the need to find innovative uses of information technology that enable interactive real-time feedback and decrease educational costs (Executive Office of the President, President's Council of Advisors on Science and Technology, 2012).

Online tutoring through synchronous videoconferencing provides institutions with an alternative form of academic support for students with divergent needs that is effective and interactive. Research in the area of academic support for students at a distance, however,

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remains a relatively underresearched area in this rapidly developing field (Jopling, 2009, 2012; Martinovic, 2009; Shelley, White, Baumann, & Murphy, 2006). Particularly lacking is the identification of factors that influence students to adopt online academic support through synchronous videoconferencing (Dammers, 2009). Since student participation in academic support is typically voluntary, this information can help institution develop online academic support programs more likely to be adopted by its students.

This article presents findings of a qualitative study conducted to understand influences that affected students adoption of an online academic support program delivered through videoconferencing. Theory-driven directed content analysis framed with the diffusion of innovations theory was used to answer the main research question: What are the factors that influence student adoption of online academic support through videoconferencing?

THEORETICAL FRAMEWORK: THE DIFFUSION OF INNOVATIONS

Rogers's (2003) diffusion of innovations theory and Wejnert's (2002) conceptual framework of the diffusion of innovations theory were the theoretical frameworks used to identify adoption influences. According to Rogers, "Diffusion is the process in which an innovation is communicated through certain channels over time among the members of a social system" (p. 5). During this process, when an idea/innovation is introduced and/or invented, it will diffuse and then be adopted or rejected. The extent, rate, outcomes, and consequences of this diffusion can vary according to environmental conditions, the characteristics of the decision making unit, and the characteristics of the innovation (Rogers, 2003; Simonson, 2012). Wejnert (2002) expanded on Rogers's theory, proposing a framework that conceptualized, integrated, and grouped diffusion variables into three concepts: (a) the environmental context, (b) the characteristics of innovations, and (c) the characteristics of innovators that will influence an individual's probability of adopting the innovation.

The Influences of Environmental Context

The first component in Wejnert's (2002) framework describes characteristics of the environmental context that "modulate diffusion via structural characteristics of the modern world[–]geographical settings, societal culture, political conditions, and global uniformity" (p. 297), that can influence an innovator's adoption of an innovation. These influences may be related to trends, economics, funding, barriers, and demand. These influences may also be interwoven with characteristics of the innovation and innovator, such as available resources, previous experience, perceived needs and/or problems, degree of innovativeness, and accepted norms (Rogers, 2003; Simonson, 2012).

Innovation-Based Influences

The second component in Wejnert's (2002) conceptual framework is characteristics of the innovation that can influence an individual's decision to adopt an innovation, such as perceived benefits versus costs and consequences. Rogers (2003) identified five attributes that influence these characteristics: relative advantage, compatibility, complexity, trialability, and observability.

Relative advantage, which is the ratio of expected benefits to the costs of the innovation's adoption (Rogers, 2003), can be influenced by characteristics that are important to users, such as economic profitability, low cost, convenience, decrease in discomfort, social prestige, savings in time and effort, and incentives. An additional factor influencing adoption is the compatibility of the decision-making unit's, or innovator's, values, experiences, and needs with the complexity, trialability, and the observability of the innovation (Rogers, 2003; Wejnert, 2002). That is, the

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more difficult it is for individuals to find a product, understand what it does, and/or use it, the less likely they are to adopt. In contrast, "The easier it is for individuals to see [observe] the results of an innovation, the more likely they are to adopt" (Rogers, 2003, p. 17).

Innovator-Related Influences

The last component of Wejnert's (2002) conceptual framework is the characteristics of innovators that influence their perceptions of the costs and benefits of adopting the innovation. The susceptibility of individuals to these influences may be related to the potential adopter's demographic status, familiarity with the innovation, and/or socioeconomic status (Wejnert, 2002). Marketing strategies, change agents, and social networks are some of the influences that have been effective in motivating target markets to investigate an innovation (Rogers, 2003).

METHODOLOGY

Two forms of qualitative data were used to develop a more complete understanding of factors that influenced student adoption of online academic support through videoconferencing: participant observation of all groups and processes during the semester, and a semistructured interview of students and academic tutors at the end of the semester.

Participants and Setting

The site of the investigation was an academic support center that services students enrolled in courses offered by the College of Science and Health. This college is located within a 4-year public Hispanic-serving university in the Northeast serving approximately 11,500 students (William Paterson University, 2015).

Student participants were selected using purposeful, nonprobability sampling of all students enrolled in a science or statistics course at the university during the Spring of 2014 who received a minimum of 1–1.5 hours of online academic support. Twenty-one students satisfied these criteria and participated in the study. Twenty of these participants finished the program and gave interviews. The average age of these online students (25) was significantly greater than students who used face-to-face tutoring (22). There was no significant difference between the average GPA of students who came for tutoring online (2.85), compared to students who chose face-to-face (2.96) tutoring (Potacco, 2015; Potacco, Orellana, Chen, & Salazar, 2016). Tutor participants were selected using purposeful, nonprobability sampling of all tutors who tutored at least one student 1 or more hours online through the online tutoring program, had previous experience tutoring students in high-risk science courses face-to-face at the academic support center, and had a GPA greater than 3.0. Five tutors fulfilled these requirements and participated in the study.

Data Collection Procedures

The researcher visited high-risk science courses during the first 2 weeks of the spring semester in order to recruit student participants. Tutors were recruited at the beginning of the semester by an individual at the center who had no authority over them. Thereafter, participants were asked to attend an orientation in the use of the online tutoring platform, Blackboard Collaborate (BBC), using the computer and equipment they intended to use for their online sessions. The majority of orientations were given onsite at the center. Students unable to attend face-to-face orientations were provided with a synchronous online orientation using BBC. Tutor orientations, which were more comprehensive, were all face-to-face. After the orientation, the researcher scheduled an online academic support session for each student with a trained tutor proficient in the subject. The types of STEM courses tutored online were in the disciplines of chemistry, mathematics, biology, physics, anatomy,

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and physiology. Whenever possible, applicants were scheduled to join an existing online study group, provided the course and their schedules were compatible.

Participant observation was used to study participant activities and interactions with the program and each other in the physical and technological environment (Creswell, 2013) and to gain the trust of other participants (Glesne, 2011). An unstructured observational protocol was used to capture a holistic perspective of the setting (Zacharias, 2012) and detect unanticipated, but important, phenomena and themes of interest (American Association for the Advancement of Science, 2012; McKechnie, 2008). An observational journal was used to record events, social interactions, activities, insights, and reflective field notes (Creswell, 2013; Glesne, 2011).

Within 2 weeks of the student's termination of online academic support, a one-on-one semistructured interview of approximately 1 hour was scheduled with each student in order to provide participants with an opportunity to reveal alternative perspectives and/or perceptions and acquire information that was not observed (Glesne, 2011). Most interviews were held face-to-face. It was necessary, however, to interview several student participants synchronously through BBC due to their inability to meet face-to-face. All interviews were in the presence of a peer observer who took notes from an unobtrusive area in the office or online.

An interview protocol was followed in order to increase reliability by providing a constant structure that guided the research and reduced the potential of data collection inconsistencies between interviewees. The interview questions and protocol were developed and refined through a pilot test of respondents representative of the target populations (Creswell, 2013). Students and tutors were given participant-specific preambles and interview questions.

At the end of the interview, the researcher used member-checking to go over the response notes with the participant and peer observer to verify the accuracy of these notes (Creswell, 2013). Student participants who completed at least one academic support session and the interview were compensated at the rate of $3.00 per tutoring session and $15.00 for the interview. Students receiving online academic support also received documentation of tutoring attendance through a coupon point that could be exchanged for credit in some courses. Consistent with the center's coupon program, this incentive was also provided to face-to-face students. Tutors were compensated per their normal salary structure.

Data Analysis

Data generated from observation and the interviews were analyzed using theory-driven directed content analysis. This form of analysis uses a deductive strategy in which the initial coding scheme is developed before data analysis, based on theory or relevant research, and refined during the analysis (Elo & Kyngäs, 2008; Gläser & Laudel, 2013). Following is a description of the four stages of this data analysis:

Stage 1. The data were deidentified with a number coding scheme, then extracted to one or more of the categories and subcategories of the initial coding scheme by question and participant group using a code-recode procedure in order to augment coding reliability.

Stage 2. A final coding scheme was created by modifying, eliminating, and/or renaming categories and subcategories to more accurately describe responses in the data. Coding validity of this final scheme was augmented through the use of low-inference descriptors, such as direct quotations to validate themes, and triangulation (Kimberlin & Winterstein, 2008).

Stage 3. Inductive analysis was used to identify themes within and across the participant groups that emerged from the deductively derived categories and subcategories. Thereafter, these data were reduced with the intention of retaining each respondent's perspective, while striving for clarification, understanding, and explanation. These nine themes and exam-

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TABLE 1
Adoption Influences

Inductive Themes	*Relationship*	*Example*
Pedagogy	Online teaching methods and instruction	"The tools … actually worked pretty effectively in answering my questions and teaching the material."
Interaction	Communication dynamics, and/or transactional distance factors	"[The program] made it easier for me to e-mail questions to the tutors and ask about it the next session."
Technology	Characteristics of the online platform.	"I didn't like how long the images took to load."
Technical support	Online technical support factors	"Once I came into the center and the coordinator showed me how to use it on my phone … my confidence was restored."
Convenience	Influences related to time, effort, scheduling, commuting, etc.	"My tutor was also available by e-mail and text if we had a problem."
Logistics	The operation and management of the program	"There were too many people on too many levels … if there were three academically close students in the same session, I would have benefited more."
Demographics	Characteristics of adopters that emerged within and across categories and subcategories.	"I used Skype in the past … well, my generation … because I am always on my computer doing e-mail and homework. I figured I should use that."
Reward	Extrinsic and intrinsic incentives	"The tutoring session allowed me to always get the As no matter where I was."
The future	Adopters' perception of the impact of adoption on their future.	"Videoconferencing will be regularly used in education, business, and our personal lives in the future."

ples of text coded to these themes are provided in Table 1

Stage 4. All results were integrated through a triangulation of the data in order to compare and contrast findings; identify patterns, issues, corroborations and discrepancies of perspective between the participant groups; reveal gaps in the research that merited further investigation; derive a more comprehensive understanding of the findings; and increase the validity and reliability of the data.

RESULTS AND DISCUSSION

A complex interaction of factors related to the environmental context of the adoption, the characteristics of the innovation, and the characteristics of the innovator influenced students' adoption of online academic support through videoconferencing. It was also evident that, within each category, there were subcategories with the potential to enable or impede adoption in a complex, interactive process that involved various stakeholders. Figure 1 provides an overview of this interaction of adoption influences.

Environmental Context

Issues related to the environmental context that influenced student adoption of the innovation encompassed marketing, training, the platform, technical support, culture, attitudes, trends, and connectedness.

Marketing. The marketing strategies that were most effective in motivating students to investigate the program were classroom visitation and referral by professors and classmates. Extra credit points provided through the center's coupon program were also identified by all participants as a primary motive for student adoption of the online program. This finding is consistent with previous studies (Potacco & De Young, 2007; Potacco, Chen,

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Adoption influences

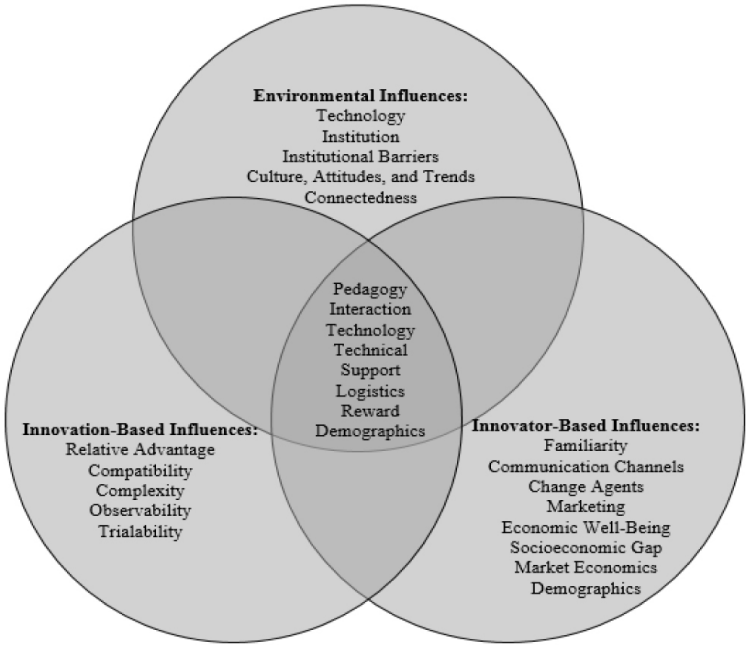

FIGURE 1
Interaction of Factors Influencing Students' Adoption
of Online Academic Support Through Videoconferencing

Desroches, Chisholm, & De Young, 2013) that have demonstrated the ability of the coupon incentive program to motivate students to seek academic support face-to-face. The practice of using incentives to increase academic performance and task interest has also been documented by others (Ash, 2008; Brewer & Klein, 2006; Haywood, Kuespert, Madecky, & Nor, 2008). In addition to the extra credit, many adopters were influenced by innovation-centered incentives, such as the ability to "get help," improve their grades, convenience, and/or the ability to "save money."

Training. The orientation appeared to influence continued adoption, since students who had an orientation attended a significantly greater number of sessions on average, than students who did not attend an orientation (Potacco, 2015). The tutee orientation provided the staff with the opportunity to develop a relationship with the tutee and discuss the roles and responsibilities of the tutor, tutee, and technical support. The orientation also provided students with a more realistic image of the online experience in agreement with Bozarth, Chapman, and LaMonica (2004).

Students valued learning how to log into the room, set up audio, switch between screens, copy and paste pictures, text in the chat box, and use drawing tools to write on the whiteboard. Tutors valued learning how to use the online platform and develop the pedagogical skills needed to communicate effectively in the online environment, as described by Richardson (2009) and Stickler and Hampel (2007).

The Platform. Gunawardena and Duphorne (2000) suggested that the features of an online platform are one of the best predictors of learner satisfaction. Participants in this study commented that the online platform was

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"easily accessible … easy to download" and appreciated the ability to log into the program from various locations and devices. The mobile phone became a dependable default that could be used when audio issues arose or students could not access a computer. The increasing use of mobile devices by students has also been reported by Dahlstrom (2012, 2013); Johnson, Adams, and Cummins (2012); and Johnson, Adams Becker, Cummins, Estrada, Freeman, and Ludgate (2013).

Relative to utility, participants indicated that the platform was effective in presenting content, providing feedback, and facilitating learning. Users in this study were particularly impressed with the wide range of tools available in the platform. The activities that were most valued included drawing and solving problems on the whiteboard, and the ability to work together using audio and visual features. The importance of the audio and visual characteristics of the medium for the adoption and use of technology in distance education was also emphasized by Gunawardena and McIsaac (2004).

In contrast, technological issues resulted in participant frustration and acted as barriers to adoption, in agreement with previous studies (Liu, Gomez, Khan, & Yen, 2007; McBrien, Cheng & Jones, 2009; Shea, Pickett, & Li, 2005). The most common technical issues encountered were delays in audio, room, and content loading; the inability to launch the room; and connection and audio issues. Microphone problems and difficulties signing onto sessions have also been reported by others (Little, Passmore, & Schullo, 2006; McBrien et al., 2009).

Technical Support. Researchers have reported the importance of reliable technical support and training in influencing an online learners' ability to achieve successful outcomes (e.g., Jopling, 2012; Liu et al., 2007 [Citation not listed in references; McBrien et al., 2009; Rice, 2006; Selvi, 2010; Simonson, Schlosser, & Orellana, 2011; Tallent-Runnels, Cooper, Lan, Thomas, & Busby, 2005, Tallent-Runnels et al., 2006). Thus, a substantial effort was made to provide expedient, efficacious support to program participants that included orientations, tutor mentoring in online pedagogy, and technical support before and during sessions. Subsequently, tutees commented that support positively impacted their confidence by "clearing up any questions," showing them "what to do to be able to communicate," and explaining "how to use the applications." Tutors commented that the orientation, staff feedback, and other online tutors helped them gain confidence and support students' efforts to log in, use the program, and negotiate technical issues. These findings are consistent with Tallent-Runnels et al.'s (2005) observation that, with support, instructors could also learn how to help students with minor technical problems.

Culture, Attitudes, Trends, and Connectedness. Two environmentally based perceptions influenced participant adoption from a broader societal or global perspective. One perception was that most people in their age group had a "good general knowledge" of online applications and regularly communicated with others through videoconferencing. The second perception was that students needed to be able to communicate with others through videoconferencing for education and business. Students' perception that technology had the ability to help them achieve their academic goals and prepare for future academic and workplace activities was also reported by an ECAR survey of 113,035 students (Dahlstrom, 2013).

Program adoption was also motivated by connectedness in that many tutees reported that they began the program as a result of referral by a classmate, professor, or center staff member. Continued program adoption was motivated by the development of relationships between the tutee with other tutees and the tutor within their online learning community.

Innovation-Based Influences

Characteristics of the innovation that influenced adopters included the relative advan-

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tages and consequences of adopting the innovation, and the compatibility, complexity, and perceptions perceived by the student through observation and/or trial.

Relative Advantage. The relative advantage of online tutoring perceived by participants was influenced by demographics and demands related to work, family, physical disability, scheduling, and/or travel. As an example, one tutee reluctantly began online tutoring because she was in academic jeopardy, but could not attend tutoring face-to-face because of a 3-hour commute and the need to stay home with her children. Although this student expressed reluctance to use the technology, she adopted online tutoring because it provided a relative advantage, compared to the consequence of not being able to get academic support.

Relative advantage can also be perceived by distance learners through the reduction of transactional distance enabled by synchronous videoconferencing. McBrien et al. (2009) suggested that transactional distance is a complex phenomenon, however, influenced by numerous overlapping elements that should be studied holistically, along with factors related to interaction. Interactions affecting the adoption of online tutoring are discussed in the three categories described by Moore (2007, 2013): learner-learner, learner-media, and learner-instructor.

Learner-Learner. Social presence and the extent to which the technology enables the learner to interact with other learners and instructors has been identified as important to the adoption and use of a technology at a distance (Gunawardena & McIsaac, 2004). In agreement, tutors engendered social presence by uploading amusing welcome screens, using their cameras, texting emoticons, responding to tutees by name, maintaining a positive atmosphere, and motivating group work. The practice of creating a welcoming online environment using these strategies has also been recommended by others (Hastie, Chen, & Kuo, 2007; Little et al., 2006; Packham, Jones, Thomas, & Miller, 2006).

The use of cameras also helped to create a more personable environment. Gunawardena and McIsaac (2004) suggested this action contributes to the level of intimacy of the communications medium. Hastie et al. (2007) discussed the ability of the webcam to help online students, who may not have the same opportunities as face-to-face students, interact and develop a community with their peers. Webcams also served the purpose of providing tutors with paralinguistic cues. One tutor noted, "Since there was no visual of their [the tutees'] face, it was hard to tell if they really understood … one had to constantly ask if they understood or not." Another tutor remarked that "it was like I was talking to the whiteboard. I think it definitely makes a difference because there is that interaction that you are actually talking to someone." Consistent with these findings, previous studies have recognized the challenge of communicating with students online without seeing facial expressions or paralinguistic cues (Chen, Liao, Chen, & Lee, 2011; Kersaint, Dogbey, Barber, & Kephart, 2011; McBrien et al., 2009; Ng, 2007).

The need for webcams was also influenced by group size. Tutees in larger groups that did not use cameras complained that tutees talked over one another and commented that it was difficult to determine "who knew what" and "who was doing what." Consequently, tutors did not know who was confused, participating, asking questions, and/or in need of attention. Group size also affected interaction. Although participants appreciated the opportunity to share, explain, and discuss information learned with peers through group work, as discussed by Hunt, Eagle, and Kitchen (2004) and Ozkan (2010), participants commented that the smaller groups were more personal. As one tutor commented, "If you are in a smaller group, you have more interaction with a tutee."

Students had mixed opinions concerning the use of webcams. Some students missed seeing body language during sessions when tutees did not use cameras; other students indicated they felt more comfortable asking ques-

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tions without other people looking at them. The ability for synchronous online platforms to allow shy students to feel more comfortable expressing their opinions was also discussed by McBrien et al. (2009).

Learner-Media. The argument that media is a vehicle that delivers content and that learning gains result from instructional design theory and practice began with Clark (1994, 2001) and has continued to be discussed rigorously by others (Holden & Westfall, 2010; Simonson et al., 2011). Bernard et al. (2004) described technology as a tool that enables collaborative and complex learning if appropriate activities and strategies are employed through guided, interactive communication. Aragon, Johnson, and Shaik (2002), suggested novel, engaging, and entertaining activities appeal to learners with different learning styles and preferences. Sorensen and Baylen (2009) found that active learning tools, such as animations, graphing, problem-based learning, and games, increased student participation and engaged students with diverse learning needs. Isaksen and Ramberg (2005) discussed using cases, games, simulation, chat, and other involvement activities, as well as frequent and immediate feedback, to increase interactivity.

Participants drew, chatted, took snapshots, used digital resources, and/or shared software applications to interact with each other. Media-enabled interactivity most valued included watching videos, taking practice tests, interacting with diagrams and slides, sharing online graphics, and discussing concepts with each other through the chat box. Two activities particularly appreciated by this STEM population were the abilities to work together on scientific and mathematical problems using the whiteboard and external technology programs using application sharing.

Technology-related variables related to the media can also affect interaction. Holden and Westfall (2010) cited the importance of portability, visual clarity, the ability to update content quickly, and bandwidth in the utility of technology. In agreement, interaction was supported by high quality audio and visual effects. Participants appreciated that communicating with the online platform was "like talking face-to-face" and "the same as sitting in front of someone with my notes and books open." In contrast, interaction was negatively affected by content and audio delays, resulting from bandwidth issues. Students also needed to be able to access the media portably from laptops and through smartphones.

Learner-Instructor Interaction. Gunawardena and McIsaac (2004) suggested that students can be motivated through learner-instructor dialogue and feedback that facilitates learning and reduces transactional distance. Macintyre and Macdonald (2011) found that students' connection to their tutor could mediate perceptions of remoteness. In agreement, tutees commented that their online experience "inspired" them to "stay in the room after the session to work together," and/or "study more … to be better prepared to interact in online tutoring session activities."

A multimodal learning environment and alternative teaching techniques, strategies, and equipment can also be utilized to enhance interactivity (Aragon et al., 2002; Johnson & Aragon, 2003; McBrien et al., 2009; Moreno & Mayer, 2007). Concomitantly, tutees commented on the diversity and effectiveness of techniques and tools used by their tutors during sessions. The instructional strategies most commonly lauded by tutees were "taking content and breaking it down into something I could understand," "explaining it [concepts] in a different way," "using anecdotes and life situations," "feedback," "application sharing," "group problem-solving on the whiteboard," and interacting with "practice tests, games, and videos."

Consequences. Consistent with Hadfield, Jopling, Royle, and Southern's (2009) suggestion that the adoption of a technology is related to its perceived utility and applicability to the adopter, the predominant consequences that influenced adoption were convenience, interaction, extrinsic reward, and the technology.

The convenience of being able to find help anywhere, anytime was an important positive

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consequence of online tutoring, consistent with previous findings (e.g., Gunawardena & McIsaac, 2004; Little et al., 2006; Means, Toyama, Murphy, Bakia, & Jones, 2010; Ng, 2007; Rice, 2006; Smith, Salaway, & Caruso, 2009; Stanford-Bowers, 2008; Tallent-Runnels et al., 2006; Wilson, 2012). In general, students expressed the inability to attend face-to-face sessions due to work, physical disability, family responsibilities, schedule conflicts, and/or other challenges, such as commuting. Numerous students commented that the flexibility of online tutoring enabled them to avoid traffic, distance, and time on the road. As one tutee commented, "What really influenced me to do this program was my commuting status. I live far away." Another tutor noted,

> It was hard getting to school this winter with all the potholes and snow apocalypse. I feel a little nervous taking my car places when I don't have to … all the stress involved in commuting and getting gas. I could just focus on what I needed to do.

Another tutee who needed to use his phone and online tutoring due to his work schedule and a long commute commented, "The tutoring session allowed me to always get the As no matter where I was … whether I was in the car in south Jersey or north Jersey."

Positive academic and social consequences were also attributed to online tutoring. Academically, students acknowledged that online tutoring "helped me stay on a routine," "motivated me to keep studying," and "helped me to improve my grades." Socially, students revealed that online tutoring provided them with the ability to interact with their peers online "just like in person" and "feed off of other classmates." Tutors agreed that tutees benefited through their ability to work with other students in groups. Rewards, such as bonus points, grade improvement, more effective studying habits, and videoconferencing expertise were other positive consequences discussed by participants. Perceived tutor benefits included "helped me reinforce content previously learned," "was a great opportunity to have a different method to tutor," "increased my confidence to communicate online," and "can be used in my education, profession, and personal life."

Compatibility. Compatibility of the program with the needs and wants of a potential adopter can promote adoption (Rogers, 2003). Accordingly, the availability of academic help was compatible with the needs of students unable to obtain face-to-face academic support due to work, family, commuting, physical disability, and other challenges. Additionally, the efficacy of the platform was compatible with students' need for an effective medium that could be used to learn collaboratively, access online resources, and improve academic outcomes (Potacco, 2015).

Observability, Trialability, and Complexity. There is a multifaceted relationship between the observability, trialability, and complexity of an innovation and its familiarity to the innovator. That is, complexity has the potential to be a barrier to adoption, but it can be reduced through familiarity with the innovation resulting from observation and trial. Furthermore, if the trial or observation is perceived as a positive consequence and familiar to the student, adoption is more likely. In accord with this rationale, most participants indicated that their decision to adopt the innovation was based on other videoconferencing programs previously observed, used, and valued.

Based on participants' comments that the program was easy to download and use, the complexity of the platform was not an issue. However, since more students continued adoption of the program when an orientation and technical support was provided, the orientation may have influenced these perceptions. This suggestion was corroborated by tutees who expressed increased confidence as a result of "hands on" instruction and receiving guidance from the staff during their orientation and tutoring sessions, and tutors who expressed confidence with the platform and online pedagogy as a result of practice and mentoring. This suggestion is also consistent with Shea et

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al.'s (2005) finding that technical and human support can help online instructors overcome complexity issues that can impede technology adoption.

Innovator-Related Influences

Innovator-related factors that influenced adoption included communication channels, change agents, pedagogy, and socioeconomics.

Communication Channels and Change Agents. The program's most successful marketing efforts were made through peers, tutors, the program administrator, and professors. Peers in social networks persuaded classmates to join their sessions. Tutors acted as change agents by providing their tutees with "guidance," "feedback," and support, through their roles as mentor, role model, and coach. The program administrator acted as a change agent by directing the attention of students and professors to the program, providing them with information about the program(s), and supplying technical support to participants. Professors acted as change agents by motivating their students to seek academic support through referral and the coupon incentive program. As one student remarked, it was "definitely the coupon points because my professor gave us the opportunity to gain points toward the exams."

Pedagogy. Tutees acknowledged that tutors motivated them to continue their adoption of online tutoring through tutoring strategies and activities used during sessions and the effect these strategies had on their academic outcomes. All tutors participated in an orientation; however, pedagogical expertise developed experientially. As recognized by Bernard et al. (2004) and Wang (2005), most of our instructors were unaware of the unique pedagogy of online education and continued traditional face-to-face practices during initial tutoring sessions. With practice, however, the pedagogical proficiency of the tutors improved. As noted by one tutee, the tutor "grew with us and her teaching style got better as we had more sessions." Concomitantly, tutors acknowledged that student and staff feedback helped them integrate face-to-face and online approaches and gain confidence using the online pedagogy

Socioeconomic Characteristics. Socioeconomic characteristics influencing adoption included demographics, market economics, economic well-being, and the socioeconomic gap.

Demographics. There was no significant difference in gender, class standing, commuter status, or ethnicity between students who chose online tutoring versus face-to-face tutoring. There were significant differences, however, in the proportion of commuters and age of students who chose online tutoring versus face-to-face tutoring (Potacco, 2015; Potacco et al., 2016). This finding is in agreement with Radford (2011) who described online learners as undergraduate students who are older, have dependents, a spouse, full-time employment, and/or mobile disabilities and Chen, Gonyea, and Kuh (2008) who cite the demand for distance learning by commuters. As noted by one tutee, "I have two part-time jobs that require me to work 40 to 50 hours per week and I am a full-time student … it takes me 1 hour and 30 minutes to get from my home to school."

Another student, restricted to a wheelchair and with a limited ability to write, stated:

> Online tutoring provided solutions to some physical problems that I had due to my muscle disease. It was difficult to hold the phone up and sometimes difficult to write.… If I had a tutor in person, there would be more writing for me and that would be difficult because my hands get tired. In this way, I just have to type.

Technology experience also influenced adoption, based on the large proportion of participants (91%) declaring previous experience with videoconferencing and other technologies. Concomitantly, almost all participants demonstrated the ability to learn the program quickly, suggesting familiarity and confidence with the technology used in this program. The

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positive relationship of previous computer experience with online use has also been recognized by others (Holcomb, King, & Brown, 2004; Hunt et al., 2004; Smith et al., 2009; Tallent-Runnels et al., 2006).

Market Economics. Market economics influenced participants attempting to position themselves more strategically in their profession. Students revealed that their STEM courses were required for a profession in health care, and that their entry into these programs required competitive grades and time-intensive volunteer activities in medically oriented endeavors. Online tutoring was perceived as a means to acquire the academic help needed to reach these goals while fulfilling their family and/or work responsibilities. As one student commented, "I hoped it would help me get to my ultimate goal, which is to go to medical school … so I would hope it would help me get a good grade." This finding is consistent with Tallent-Runnels et al.'s (2006) suggestion that online students were older, highly motivated, and focused on achieving specific learning outcomes. From another perspective, many tutors and students also believed it was "important to be comfortable with videoconferencing and technology" and discussed the future economic benefits of learning a technological skill that had the potential to help them "in their future education, career, and personal lives."

Economic Well-Being. Most tutees stressed that the program enabled them to get the help they needed while they continued to maintain the economic well-being of themselves and their families. For this reason, most tutees needed to schedule their sessions late at night, 8:00 p.m. or 9:00 p.m., after their children were put to bed or they finished working. Additionally, online participants cited the ability to avoid costly travel expenses.

Socioeconomic Gap. The majority of tutees reported fewer opportunities to access face-to-face academic support due to their family responsibilities, demanding work schedules, transportation challenges, and/or conflicts in course schedules. Another subset of tutees had no access to technology or inferior broadband capacity, as previously discussed by Wenger White, Smith, and Rowe (2005). These conditions can precipitate a socioeconomic gap that results in disparities between the academic outcomes and retention of students who can and cannot find academic support compatible with their needs. Consistent with this finding, Tinto (2006) stated that students from low income families have fewer opportunities to attend college full time, not work, and attain their bachelor's degree within 6 years. Online tutoring with this mobile platform helped bridge this socioeconomic gap by providing these students with an equal opportunity to receive efficacious academic support.

LIMITATIONS

The results reported by this study were derived in a real-world environment where variables could be observed naturally and threats related to novelty effects, characteristics of the stimulus and settings, and experimental conditions are minimized to increase external validity (Gravetter & Forzano, 2011). In an effort to minimize negative internal validity effects, environmental and program variables were kept consistent, and multiple methods and sources were used to enhance the validity, reliability, and trustworthiness of these findings, including member checking, code recoding, and the triangulation of the findings. Since participants in this study were exclusively involved with science and statistics courses at one higher education institution, results may vary across groups in other disciplines and in other higher education institutions differing in structure, setting, and geographical location. Furthermore, since practical and ethical considerations prohibited random assignment of participants, students were self-selected and may have been exposed to both face-to-face and online tutoring. Possible exposure in these cases may have influenced perceptions and/or resulted in more informed responses.

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CONCLUSIONS AND RECOMMENDATIONS

A complex interaction of characteristics related to the environmental context of the program, the program, and the student influenced students' adoption of online academic support through videoconferencing.

The Platform. Important considerations in the selection of a platform should include visibility, reliability, user friendliness, and hardware requirements. The platform should also offer a wide range of tools that enable synchronous modes of communication, such as videoconferencing, application sharing, whiteboard, and Internet access.

Demographic Groups. Institutions should strategically target the demographic groups most likely to adopt online tutoring in order to maximize their allocation of resources. Students who adopted online academic support were previous adopters of other technologies who had experience with videoconferencing; commuters; mature; and challenged by family, work, and/or physical disability.

Marketing. A number of marketing techniques were effective in promoting adoption. Recommendation by professors and peers, and the incentive of extra credit points for active participation in academic support were the most productive strategies. Adoption was also influenced by effective academic assistance that students perceived helped them improve their academic outcomes.

Tutors, Training, and Technical Support. Tutors should have good content and technical expertise and be willing to acquire the necessary technological and pedagogical expertise needed to be effectual in the online environment. Institutions providing online tutoring through videoconferencing need to make the commitment to provide training and orientations for program participants. Additionally, technical support should be time sensitive, taught to tutors during the orientation, and available as a service from the institution and/or platform provider.

Pedagogy and Interaction. Tutors should be encouraged to use a wide range of online teaching tools and strategies that is appropriate for the discipline. Tutors should be required and students encouraged to use Webcams. Participants in online groups should be at the same academic level, studying the same academic content, and limited in size.

This program provided students with divergent needs and enrolled in STEM courses with alternative form of academic support that was effective and interactive (Potacco, 2015; Potacco et al., 2016). It also enabled students, who did not have the same opportunities as face-to-face students to interact and develop a community with their peers. This research also identified factors that influenced students to adopt this program. A consideration of these factors can be used by institutions to design, develop, and support an efficacious online tutoring program that is more likely to be adopted by its students.

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