TEST OF A STRUCTURAL MODEL TO INVESTIGATE THE IMPACT OF INSTRUCTOR KNOWLEDGE, ATTITUDES, AND CONTEXTUAL CONSTRAINTS ON INTENT TO USE WEB 2.0 IN ONLINE COURSES

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DEDICATION

This effort is dedicated to all autodidacts, past and present. May we soon lose our outlier status and join the main-stream.

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ABSTRACT

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A growing number of demographically diverse, globally-conscious students demand instant access and flexibility when it comes to formal learning. Institutions of higher education are hard pressed to respond, and often cling to old delivery methods and pedagogy. Learner-directed use of Web2.0 applications to locate, organize, and evidence individualized learning could be the bridge between the need for institutional change and implementation of that change. The purpose of this study was to determine how instructor attitudes and traits regarding learner self-direction and theorized covariates affect the instructional interest in, intent to use, and ultimate use of Web2.0 applications in formal learning environments. A conceptual model of these relationships was developed based on existing theory and knowledge in the realms of self-directed adult learning, technology acceptance, and diffusion of innovation. Data were collected from 285 North Carolina community college online instructors to be analyzed as identifiers of the eight latent variables in the conceptual model. Specifically, the latent variables were instructional attitudes toward learner self-direction (SD), instructional technology

acceptance (TA), instructor innovativeness (IA), knowledge of Web2.0 applications (KNOW), interest in Web2.0 applications (INT), intent to use Web2.0 applications in online classes (BI), contextual constraints (CC), and current use of Web2.0 applications in online classes (USE). Eight research hypotheses were generated. The conceptual model was tested by analyzing its fit to the data. This process was completed using the principles of structural equation modeling (SEM) which required confirmatory factor analysis on the measurement model and path analysis on the structural model. During this process it was determined there was not enough variability in the data nor was there a level of current use to reach a conclusion about the impact that intent to use Web 2.0 applications has on use of those technologies. As a result the USE variable was dropped from the final model as allowed by SEM path deletion procedures. Once a final model was determined, research hypotheses were retained or rejected based on evaluation against that model. Results included the determination that knowledge of Web2.0 applications can predict instructor interest in those applications and that the interest can predict instructor intent to use Web2.0 applications in online classes. Results also indicated some hypothesized relationships were not significant. Specifically, attitudes and traits related to learner self-direction, instructional technology acceptance, and innovativeness do not significantly predict interest in Web2.0 applications. Similarly, contextual social and facilitative constraints do not significantly predict instructor intent to use Web2.0 technologies. The implications of these findings, in addition to adding empirical evidence to the body of knowledge, highlight areas for professional development, instructional design changes, and institutional changes as well as possibilities for future research.

CHAPTER ONE: INTRODUCTION

One of the primary challenges facing higher education is the seemingly unending spiral of expectations regarding changes in the ways colleges and universities must operate. The 2007 Horizon report on future trends for higher education, for example, noted the depth of immediate change required by a growing population of demographically diverse students who demand flexibility in course delivery as well as "instant access and interactive experiences" (The Horizon Report, 2007, p. 3). Current and emerging technologies collectively referred to as Web2.0 applications, such as blogs, wikis, social networks, and others can be an important component in implementing the required change (Lu, Ma, Turner, & Huang, 2007; Scholes et al., 2004; Weller, Pegler, & Mason, 2005) and offer a wide backdrop of possibility for knowledge creation particularly when combined with self-directed learning. Implementation, however, requires faculty understanding and endorsement of both the emerging technologies and their implementation in a learner-directed pedagogy which depends on faculty attitudes toward technology and innovation. This study gathered, analyzed, and reported data from a sector of higher education instructors to determine relationships between faculty attitudes and their interest, knowledge, and use of Web2.0 technologies as self-directed learning tools.

Background

Conventional higher education learning environments are characterized by desks, white boards, and lecture halls, and by knowledge creation based on traditional research criteria published years after the initial discoveries. Current interactive web technologies, however, make possible learning environments that are wholly self-directed by the learner and which feature the creation of extensive collaborative knowledge that can be instantaneously disseminated on a global, virtual basis, requiring no connection to formalized educational institutions. The possibilities of and requirements for merging the two may be bound by instructor facilitated learner self-direction.

To illustrate, consider the following scenarios. Both describe ENG111, Expository Writing, a North Carolina community college class offering. Both must meet objectives specified by the system-wide standardized course description, which has been carefully worded to maintain its transferability with state universities:

> This course is the required first course in a series of two designed to develop the ability to produce clear expository prose. Emphasis is placed on the writing process including audience analysis, topic selection, thesis support and development, editing, and revision. Upon completion, students should be able to produce unified, coherent, well-developed essays using standard written English. (North Carolina Community College System, 2009)

Scenario: Traditional, *Instructor Control*

Day one of the course begins as the instructor distributes pre-printed copies of the syllabus. This document includes course objectives and instructor-created timelines, activities, assessments, and resources through which the learning objectives will be met. The review of the syllabus is singularly conducted by the instructor, who points out important details, policies, and deadlines, including the work required or expected for each grading level.

Based on the content of the syllabus, the semester continues as the class works through the material, usually anchored by instructor lectures and text-book readings. In-class activities and homework are homogenous in their preparation for the assessments, each of which is a completed paper in one of two genres. Each student will submit an essay and a full research paper on or before the established due date, which will be graded by the instructor based on instructor-determined criteria. Success in the class is measured by the instructor's evaluation of the submitted material as defined in the syllabus.

Scenario: Learner-directed, Web2.0 Integrated

Now consider the same class conducted from a learning environment enhanced by Web2.0 applications and the principles of learner self-direction. Day one of ENG111, Expository Writing starts with a review of the institutionally dictated course objectives as specified by the standardized course description. An interactive discussion as to why these objectives are important and development of some choices as to how achievement might best be documented are critical elements of the review. A course-wide Ning social network is established where a recording of the discussion is uploaded for future reference. Next, all students complete a needs-assessment document, using a template placed by the instructor in Google Docs which will help them determine the extent of prior knowledge, as well as their strengths and weaknesses relative to meeting the course objectives. Each student shares this needs assessment with a group of classmates, with a mentor chosen from a list of students from a recently completed ENG111 class, and with the instructor. Students receive feedback from classmates and mentor, refine their needs assessments, and individually meet with the instructor in the Elluminate web-conferencing environment where a learning contract is outlined through the use of Bubbl.Us, documented in Google Docs, and summarized and shared in the Ning.

Guided by their learning contracts, learners utilize resources suggested by the instructor, classmates, mentors, and contacts gleaned from individually-selected Web2.0 applications to work towards the contracted output. Specific possibilities available from this web of resources are limitless. Content can be found based on keyworded Twitter postings, or on content-rich websites like Connexions. It can be generated via discussion to a blog maintained by an expert, or viewed from a YouTube or iTunes University lecture, to name only a few examples. Direct collaboration with experts and others interested in a subject might be carried on through RSS-fed blog postings or membership in Facebook or Ning groups. Wolfram and other specialized search engines can point to online resources that enhance research to a degree not utilized when relying on pushed information only. Depending on the learning contracts, results of research can be shared on wikis or published by Scribd or submitted for publication to any of a host of online-only professional journals. Self-assessments and progress can be documented as reflections in Penzu, or as flash cards in CoboCards or FunnelBrain, as a narrated slide presentation posted to SlideShare, or as a self-produced video posted to any number of video hosting sites.

Each student will submit an essay and a full research paper on or before the established due date, to the Ning. Each paper will be peer-reviewed, self-assessed, and reviewed and graded by the instructor based on criteria established in the learning contract. Success in the class is measured by a combination of student self-assessment, peer assessment, and facilitator assessment.

The second scenario, which culminates with individualized learning, makes extensive use of Web2.0 technologies. The social, read-write technological landscape of

Web2.0 was a focus of the Spellings report (U.S. Department of Education, 2006), which noted a need for colleges and universities to “adapt to a world altered by technology, changing demographics, and globalization” (p. viii). One of the main findings was related to the inability of current higher education practices to respond to or embrace innovative approaches to content delivery or instructional methods. Recommendations included the following:

> With too few exceptions, higher education has yet to address the fundamental issues of how academic programs and institutions must be transformed to serve the changing needs of a knowledge economy. We recommend that America’s colleges and universities embrace a culture of continuous innovation and quality improvement by developing new pedagogies, curricula, and technologies to improve learning. (p. 24)

Similarly, the report from a working group created by the Commission on the Skills of the American Work Force to research and identify educational challenges (Tough choices, 2007) pointed to the unfilled need in formal education’s role for teaching the technology-driven literacies required for global competitiveness. The report concluded that, fundamentally, current educational activities have not changed to keep pace with the technologies which are increasingly the foundation of our information-driven economy:

> The core problem is that our education and training systems were built for another era, an era in which most workers needed only a rudimentary education. It is not possible to get where we have to go by patching that system. There is not enough money available at any level of our intergovernmental system to fix this problem

> by spending more on the system we have. We can get where we must go only by changing the system itself. (p. 9)

Blogging professionals have also postulated about the nature of literacy in the future, linking the need to use the new technologies in formalized instruction to the requirement for student preparation to "enter the ongoing stream of global conversation, information production, and creation" (Fisher, n.d., para 3). That this new emerging definition of literacy requires increasing innovative use of emerging technologies, including what are now termed Web2.0 applications, predicts an almost certain requirement for a shift in instructional approach from teacher-directed to student-directed in order to effectively utilize these new tools.

Self-direction in Adult Learning and Teaching

One of the basic assumptions underlying adult learning theory is that learning-centered environments, where learner self-direction and control are the focus, lead to higher-order thinking and knowledge creation (Gorham, 1985). Tough's model of self-planned informal learning, the self-directing components of Knowles' theory of andragogy, and research surrounding these and similar models have served as the basis for much of the confirming study in this area (Merriam & Caffarella, 1999). A basic tenet of adult learning theory is that adult students create knowledge when appropriately learning-centered and self-directed (e.g., Brockett & Hiemstra, 1991; Knowles, Holton, & Swanson, 2005). These natural preferences extend beyond learning skills. For example, Ricard (2007) found that "learners must be able to think divergently as well as linearly, to see in a different way, and to imagine and create" (p. 57).

Theoretically, the instructional preferences in formal adult learning environments should complement and orient toward learner self-direction as instructors help students learn to learn and increasingly require less didactic instruction. In this way instructors and those who design content take advantage of the adult learner's natural preference for self-direction. That is the goal described by the authors of a study related to the foundations of creativity: "Teaching styles most conducive to the fulfillment of creative potential are those which encourage student responsibility through ownership, trust and low levels of authoritarianism, providing individual attention and opportunities for independent learning" (Dineen & Collins, 2005, p. 46). The variety of books on the market devoted to teaching styles, such as Weimer (2002) and Finkel (2000), further illustrate the current conceptualization of this extension.

Despite the extensive literature devoted to learner preferences for self-direction, instructors of adults continue to prefer instructor-centered approaches. Reasons for this tendency have been hypothesized by several researchers. Taylor (2006) suggested this preference may exist because instructors typically teach what they know in the manner in which they were taught, presenting material from the context of their own basis of understanding, rather than from a foundation of student experience and knowledge. Knowlton (2000) postulated that teacher-centered control occurs because some teachers believe such pedagogical methods are the most effective, while other instructors view the teacher-centered approach as more efficient. Additionally, instructional preference for assessment that relies on recall and memorization, such as quizzing and testing, while not the best evaluation of student-controlled learning, might explain why instructors prefer to maintain a teacher-centered instructional environment. (Giles, Ryan, Belliveau, De

Freitas, & Casey, 2006). For whatever reason, higher education faculty generally maintain traditional, teacher-centeredness instructional approaches even as they move into nontraditional technology-enhanced, learning environments.

Use of Technology Tools to Redirect Learning Environments to Student Focus

Computers and the Internet have become mainstream tools in workplaces, educational settings and personal environments. Their theoretical potential as devices for facilitating self-directed learning is great:

> The traditional teacher-centered, transmission approach to instruction is initially reinforced with the use of technology, and then gradually replaced by more student-centered learning experiences. When teachers become comfortable with technology to the point where they can integrate it more effectively, they use it in ways that emphasize a more constructivist, learner-centered approach. (Matzen & Edmunds, 2007, p. 419)

Reluctance to transition to student-centered learning environments persists, however, even when technology offers benefits to do so. Such attitudes may be a function of instructor preparation and perspective. Adult educators are typically (a) subject matter experts and may be slow to adopt technology because doing so is outside their comfort level, (b) time constrained such that learning enough about the technology to adapt it seems unfeasible, and (c) not trained educators so that understanding learning ramifications of the technology is not the norm (King, 2003).

Online classes have initiated some movement toward student-centered learning approaches because transactional distances force some self-direction. Empirical evidence related to instructional style in distance education courses, however, indicates a continued reluctance to shift from teacher-centeredness as instructors continue to direct most aspects of learning (Barrett, Bower, & Donovan, 2007; Dupin-Bryant, 2004). Further, an assessment of faculty attitudes toward technology and learning in the Kentucky state university system revealed that while faculty were interested in using technology to help students learn, they did not feel that doing so at a distance was a relevant instructional strategy (Wilson, 2005).

Innovation Diffusion and Web2.0 Implications

The emergence of Web2.0 makes a technology-driven, learner-centered environment more plausible than ever before. The Horizon Report (2007, p. 5), pointed to “user-created content and social networking” as one of the most critical issues to be faced by institutions of higher education. The report also described the educational value of social networking which is a core component of Web2.0 applications. Dede (2008), in a speech delivered at the Florida Educational Technology Conference, noted that learning can be "centered around Web-based communities, where the central theme is to facilitate creativity, collaboration, and sharing ... Web2.0 is a major paradigm shift in the way people think" . Potential advantages to integrating Web2.0 applications as formal learning tools include:

1. Current and future traditionally-aged students are already well-versed in, and often expect, their use (Jenkins, Clinton, Parushotma, Robison, & Weigel, 2008).
2. The tools are best suited for a self-directed environment which is a core component of all major adult learning theories (Mejias, 2006).

3. Their use helps prepare students for future jobs, many of which have not yet been invented (Tough choices, 2007).

If Web2.0 applications are to be used to help institutions of higher learning accomplish the change so urgently needed, these innovative applications must be incorporated by instructors as formal learning tools. The most effective use of Web2.0 applications is in a learner-directed manner which prescribes an instructional approach favoring learner self-direction. Thus, favorable instructor attitudes toward and facilitation of innovative, technology-driven learner self-direction as an instructional strategy are imperative and will have an impact on the effectiveness and chronology of any academic change regarding the use of Web2.0 applications as learning tools. An understanding of traits and attitudes held by those who currently teach in a web-based environment would add much to understanding the path to change facing the rest of higher education.

Purpose of the Study

The purpose of this study was to determine how instructor attitudes affect the class content use of emerging technologies known as Web2.0 applications. Additionally, the impact of administrative and knowledge-based constructs on those attitudes was evaluated. These relationships were studied through the identification, comparison, and analysis of the current uses, understanding, and attitudes of North Carolina community college online instructors.

Specifically, the study sought answers to the following research questions:

1. To what extent do instructor attitudes toward learner self-direction, instructional technology, and innovation and change predict interest in the use of Web2.0 applications as formal class content?

2. To what extent does an interest in the use of Web2.0 applications predict an intention to use them as formal class content?
3. To what extent does intention to use Web2.0 applications as formal class content predict their actual use?
4. What is the impact of instructor level of knowledge of Web2.0 applications on instructor interest in these applications?
5. What is the impact of contextual conditions such as administrative mandates and personal constraints on instructor intent to use Web2.0 applications?

Significance of the Study

Student self-directed use of Web2.0 applications to locate, organize, and evidence learning could be the bridge between the need for institutional change and implementation of that change. Adoption of Web2.0 applications as formal learning environments would require innovative modification from the structured, controlled learning milieus currently used in higher education, and the barriers are considerable. This study explored the theoretical connections and roles of instructional attitude toward pedagogical integration of learner self-direction and instructional technology as well as instructional innovativeness, adding empirical data, theoretical models, and structured findings to the knowledge base. One of the first challenges was to discover the extent to which these attitudes and traits exist and drive an interest in and integration of Web2.0 application. This information is of significance to those who establish policy related to instructional design and pedagogy, to those creating and delivering professional development activities for instructors, and to instructors who develop content and learning tools for their classes. Additionally, this study will be of use in the construction of a theoretical model for the use of Web2.0 applications as formal, self-directed learning environments.

Methodology

A quantitative, correlational study was used to gather, analyze, and report data collected from online instructors. The study was limited to online instructors within the community college system of North Carolina. Data were gathered from a sample of 285 online instructors via web-based survey, the instrument for which was adapted from prior studies and theory. This survey collected data related to: (a) instructional attitudes about learner self-direction, (b) instructional attitudes toward educational technology, (c) instructional attitudes toward innovation and change, (d) extent of instructor knowledge of Web2.0 applications, (e) interest in adopting Web2.0 applications, (f), the behavioral intention to use Web2.0 applications, (g) contextual constraints related to the intention to use these technologies, and (h) the current use of Web2.0 applications in North Carolina community college online classes. structural equation modeling was used to test the theoretical model of relationships among the constructs in this study.

Conceptual Framework

The conceptual framework depicted in Figure 1 portrays the hypothesized relationships between variables that may predict instructor interest, intention, and ultimate adoption of Web2.0 emerging technologies as part of online class content and activities.

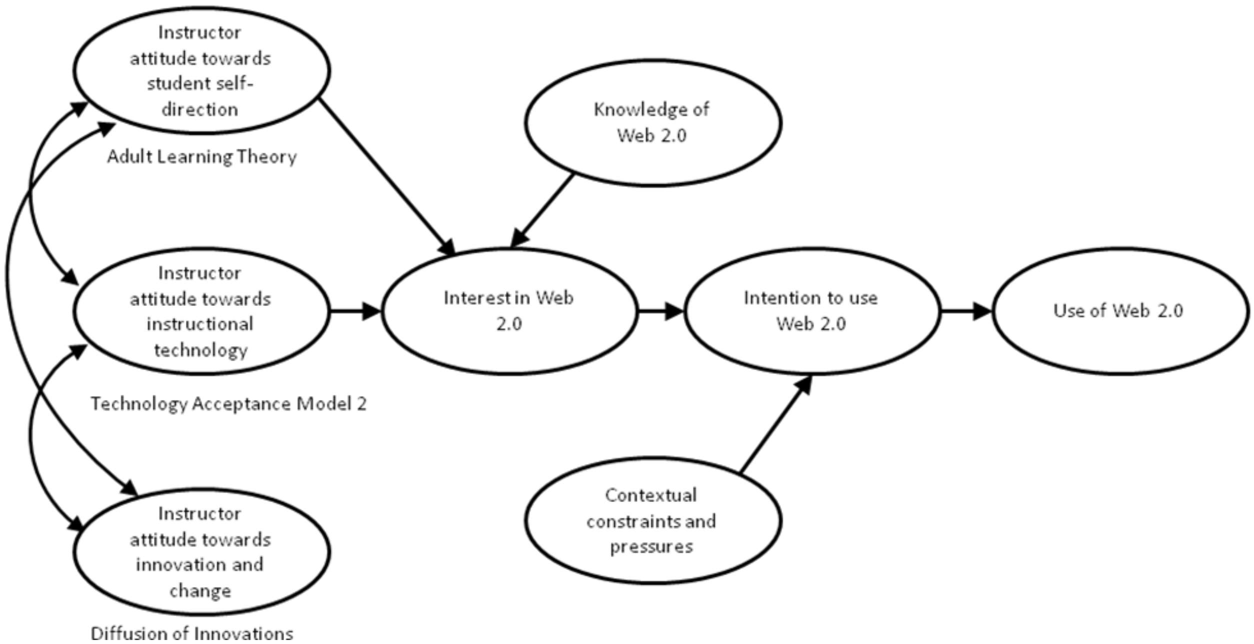


Figure 1. Conceptual framework for study

The first three of the exogenous variables, instructor attitude toward student self-direction, instructor attitude toward instructional technology, and instructor attitude toward innovation and change, were determined from adult learning theory (Brockett & Hiemstra, 1991; Gibbons, 2002; Knowles et al., 2005), technology adoption theory (Davis, 1989; Venkatesh & S. Brown, 2001; Venkatesh & Davis, 2000), and diffusion of innovations theory (Agarwal & Prasad, 1998; Rogers, 2003). Other constructs were determined from expected relationships with these exogenous variables and with each other. This theoretical foundation has been used to fashion the study by providing a connection between the review of existing knowledge related to the variables and the research questions for this study (Smyth, 2004).

Learner self-direction and control of the learning experience has long been a basic tenet of the prevalent adult learning theory models (Gorham, 1985). Too, learner self-direction and control are central to the learning possibilities offered by the use of Web2.0 applications (Mejias, 2006) so that instructional attitudes regarding learner self-direction were theorized to have an effect on an instructor’s interest in the use of Web2.0 applications in online class content.

Technology, including the Internet and the advent of online classes, offers increasing opportunities for instructional styles to embrace student-centered, self-directed activities. The technology acceptance model (TAM), originally developed in 1989 and updated in 2000 to TAM2 (Venkatesh & Davis, 2000), defined variables that predict technology acceptance. This latest theory was cited in 174 journal articles and proceedings papers listed by the Web of Science (ISI Web of Knowledge, 2009) and 164 journal articles, book chapters and dissertations listed by the Psych Info database (PsychInfo, 2009) The TAM and TAM2 indicate that the perceived usefulness and perceived ease of use of a technology are the core predictive factors of positive intention to use technology, which in turn predicts actual use of the technology. Instructional attitudes measured by the factors defined in TAM2 were expected to have an effect on interest in the adoption of Web2.0 applications into formal learning environments.

Instructor attitudes regarding innovation adoption as defined by the diffusion of innovations theory (Rogers, 2003) may be a determinant of interest in the adoption of Web2.0 applications The theoretical definition of innovation is “an idea, practice, or object that is perceived as new by an individual or another unit of adoption” (Rogers, 2003, p. 12). An instructor’s innovativeness was theorized to have an impact on the interest in the adoption of Web2.0 applications into formal learning environments.

The endogenous variables related to instructor interest in, intention to use, and usage of Web2.0 applications form a logical progression from the possibility of using to the actual use of Web2.0 applications in conjunction with formal learning environments. The theories related to technology acceptance and innovation diffusion generally propose behavioral intent to change or adapt or incorporate as the outcome variable (Agarwal & Prasad, 1998; Venkatesh & Davis, 2000). A recent exploratory study of faculty attitudes toward adoption of Web2.0 applications (Ajjan & Hartshorne, 2008) extended the model to include actual usage as the outcome variable predicted by behavioral intent. This extension was included in the current study, in which it is additionally theorized that interest would precede and predict behavioral intent.

Two other exogenous variables, knowledge of Web2.0 applications and contextual constraints, were measured as possible intervening factors. Examples of contextual constraints include lack of support for integration of Web2.0 applications and reward policies that reinforce managerial encouragement for innovation.

Conceptual Definition of Terms

Web2.0. Web2.0 is a coined phrase generally attributed to web media innovator Tim O'Reilly, although a formal definition has not yet been established (N. Anderson, 2006). For purposes of this study, the definition offered by the Italian author and blogger at L'Independente, Dario de Judicibus was utilized: "Web2.0 is a knowledge-oriented environment where human interactions generate contents that are published, managed and used through network applications in a service-oriented architecture" (de Judicibus, 2008).

Web2.0 applications. Web2.0 applications are built on web-based architecture that "leverages user-generated content and the force of many to create advantage and build network effects" (O'Reilly & Battelle, 2004, slide 12). Applications are categorized in four levels ranging from level three programs which only function on the web to level zero programs which function equally well in both online and offline environments. (O'Reilly & Battelle, 2004; unni, 2008). The applications mentioned in the scenario earlier in this chapter are examples of current Web2.0 applications and are defined as follows:

1. Ning social network: Social networking service founded in 2004 by Gina Bianchini and Marc Andreessen which can be customized and secured for educational uses (Ning homepage, 2009).
2. Google Docs: Google domain website where documents, spreadsheets, and presentations are created, collaboratively edited, shared, and published (Welcome to Google Docs, 2009).
3. Elluminate: Web conferencing tool for real-time interaction with voice-over-IP, whiteboard, file transfer, web touring, and chat among other functionalities (Elluminate homepage, 2009).
4. Bubbl.Us: Mindmapping tool used for collaboration, brainstorming, and planning (bubbl.us homepage, 2009).
5. Twitter: "Real-time short messaging service that works over multiple networks and devices" (About Twitter, 2009, para. 1).

6. Connexions: “A place to view and share educational material made of small knowledge chunks called modules that can be organized as courses, books, reports, etc” (Connexions homepage, 2009, para. 1).
7. You Tube: Google domain website used to upload, share, comment on, and respond to videos. Divided into channels, including an Education channel where institutions of formal learning are encouraged to share instructional video (YouTube, 2009).
8. I-Tunes University: “Free service hosted by Apple that allows instructors, administrators, and affiliates to manage, distribute, and control access to educational audio and video content for students within a college or university using Apple's iTunes Store infrastructure” (iTunes U, 2009, para. 1).
9. Facebook: Social networking site that displays streams of posts from members of user-created friend networks including applications, news feeds, pictures, and links (Welcome to Facebook! , 2009).
10. Wolfram: Computational knowledge engine that performs curated searches on queries entered in everyday language from a user-input generated web page (Wolfram|Alpha news, 2009).
11. Scribd: “Social publishing site, where tens of millions of people share original writings and documents” (Scribd, 2009, HTML Metadata).
12. Penzu: Journal and diary creation and hosting site (Penzu homepage, 2009).
13. Cobocards: “Web-based flash card application with an emphasis on collaboration [for creation of and social study from] a set of flash cards alongside friends or fellow students” (Cobocards homepage, 2009, para. 3).

14. FunnelBrain: “Academic social learning web site that provides an environment for collaborative online learning and free multi-media flashcards built entirely by users [and including] photos, videos, audio voice recordings and math equations” (What is FunnelBrain, 2009, para. 1).
15. SlideShare: Hosting site that allows users to upload, present, and share PowerPoint presentations and their audio narrations, as well as Word and PDF formatted documents (Slideshare homepage, 2009).

Blog. Authored web sites similar to diaries or journalistic columns presented with latest posting first. “The type of information contained within a blog varies greatly from individual to individual. Authors of blogs (known as bloggers) can describe day-to-day observations in their lives, or more specific topics of interest to them” (2005, p. 4). A typical characteristic of a blog is its potential for creation of global distributed discussion as bloggers cite other bloggers and blog readers comment on individual postings, all of which is linked together via HTML-based hyperlinks.

Wiki. “Wiki is a piece of server software that allows users to freely create and edit Web page content using any Web browser. Wiki supports hyperlinks and has a simple text syntax for creating new pages and crosslinks between internal pages on the fly. Wiki is unusual among group communication mechanisms in that it allows the organization of contributions to be edited in addition to the content itself” (Cunningham, 2008).

RSS syndication. “RSS is an XML-based vocabulary that specifies a means of describing news or other Web content that is available for ‘feeding’ (distribution or syndication) from an online publisher to Web users” (RSS, 2008, para. 1). A Web site author who wants to ‘publish’ some of its content, such as news headlines or stories, creates a description of the content and specifically where the content is on its site in the form of an RSS document. The publishing site then registers its RSS document with one of several existing directories of RSS publishers. A user with a Web browser or a special program that can read RSS-distributed content (an RSS aggregator or browser) can read periodically-provided distributions.

RSS aggregator. “In computing, a feed aggregator, also known as a feed reader, news reader or simply aggregator, is client software or a Web application which aggregates syndicated web content such as news headlines, blogs, podcasts, and vlogs in a single location for easy viewing” (Wikipedia. n.d.).

Social bookmarking. “Social bookmarking is the practice of saving bookmarks to a public Web site and ‘tagging’ them with keywords” (Educause Learning Initiative, 2005). Visitors to web sites that host social bookmarking can search all bookmarks by, among other criteria, tag or person, resulting in a social network of bookmark contributors with the same interest. (See, e.g., Delicious, n.d.).

Social networking. Social networking, as defined within the context of Web2.0 applications, “establishes interconnected Internet communities (sometimes known as personal networks) that help people make contacts that would be good for them to know, but that they would be unlikely to have met otherwise” (What is social networking?, 2006, para. 2).

Delimitations of the Study

Participation in the study, while generated from a purposefully selected sample of the available population, was voluntary from both an institutional and an individual level. There is a possibility that institutions which agreed to participate differ from those which declined or were not asked to participate. Additionally it is possible that those instructors who agreed to take part in the study may differ in ability, initial attitude, or in some other way from the demographic of a sample where the original selections are compelled to participate.

The subject of this study includes emerging topics, many of which have not been addressed in the mainstream, traditional literature. While extensive writings on all of the concepts are available, they exist in online journals, blogs, wikis, and other forms of Web2.0-generated environments. These sources cannot be ignored as components of the body of knowledge related to the study and have been incorporated as part of the existing research on the topic where applicable.

The purpose of the study included the determination of the relationship between instructional attitudes toward learning self-direction and interest in, intention to use, and actual use of Web2.0 applications. That the current interest, intent, or use of Web2.0 applications may not be in a learner-directed context was not considered nor should such effective use be assumed.

Remaining Components of This Report

This report contains four additional chapters. Chapter two delineates the review of the current body of knowledge related to the conceptual framework of this study. Empirical evidence suggesting the efficacy of student self-direction as an instructional strategy was analyzed and evaluated as was evidence to the contrary. Studies of instructor preferences regarding student-centered strategies and research surrounding the use of instructional and emerging technologies and, specifically, Web2.0 applications as formal learning tools were evaluated as were theories related to innovativeness and technology acceptance.

Chapter three identifies and discusses the methodology employed for the study. The population and sampling plans and outcomes are discussed. The instrument, including theoretical foundations and issues related to its validity and reliability is presented and data collection procedures are specified. Derivation and detail of specific research hypotheses are presented. Definitions and details related to structural equation modeling (SEM) application of the conceptual model are presented.

Chapter four discusses the findings of the study. Descriptive statistics from the data are reported. Detail of the SEM two-step application to identify a measurement and structural model fitted to the data is described. Each research hypothesis is evaluated against the final data-fitted model and retain or reject conclusions reached.

Chapter five is comprised of a discussion of the overall findings of the study within the context of the research questions. Significance of the findings as they relate to the existing body of knowledge is discussed. Recommendations for practice and future research are proposed.

CHAPTER TWO: LITERATURE REVIEW

"The Renaissance marked a determined break with the medieval worldview, a break that was made possible by a succession of technical innovations and accomplishments." – Sir Ken Robinson.

The purpose of this study was to determine how instructor attitudes affect the class content use of emerging technologies known as Web2.0 applications. Additionally, the relationships between those attitudes and the impact of external administrative and knowledge-based constructs were evaluated. This was accomplished through the identification, comparison, and analysis of the current uses, understanding, and attitudes of North Carolina community college online instructors. In this chapter, the results of a review of the existing literature related to learner self-direction, technology acceptance, and innovation and change are reported along with studies related to the use of Web2.0 in formal learning environments.

Past research on concepts within this framework includes extensive empirical study and expansion of self-directed adult learning theory. Additionally technology acceptance, in general and specifically, has received research focus as has innovation diffusion and the impact of contextual issues and instructor prior knowledge related to these. The use of Web2.0 applications as formal learning tools is an emerging topic with little mention in main-stream resources. Further, while one exploratory study of possible predictors of the use of Web2.0 applications in formal learning environments was recently published, that is the extent of empirical evidence regarding this research.

Self-Directed Learning

Adult learning theory manifests in many adjective-predicated models, most of which include a core component of adult preference for self-direct learning. Five adult learning types categorized by Merriam and Caffarella (1999) included: “behaviorist, cognitivist, humanist, social learning, and constructivist” (p. 250). The first, grounded by researchers such as Skinner and Thorndyke, is a skills-based, didactic instructional approach to learning where content related to learning objectives is imparted by an expert for synthesis by a learner and does not integrate learner self-direction. The four remaining learning models all contain a fundamental component related to learner-centric, self-direction. Brookfield (1984), in fact, suggested “the exercise of autonomous self-direction in learning is proposed as the distinguishing characteristic of adult learning” (p. 25).

Consensus as to the need for adult learners to self-direct their learning does not predicate consensus as to theoretical definitions of self-directed learning in general, or, more specifically to learner self-direction as an instructional style in formal settings. Merriam (2001) asserted model identification and construction of self-directed learning theory is ongoing and still emerging. Owen (2002) conducted a literature review and attributed the confusion he noted to “haphazard nomenclature” (p. 1) resulting in the multiple and evolving learning theories in which self-directed learning is incorporated. The facilitation of self-direction has an even weaker theoretical framework. Candy and Brookfield (1991) commenting on the lack of congruous theory, said: “The belief that adult learners should, to a significant degree, be able to conduct their own education is widespread in the field of adult education. However, practitioners differ sharply as to how this capability might be enhanced, if at all" (p. 318). As noted, the existing literature presents a mixture of opinions, strategies, and theories for teaching in a learner self-directed environment.

That a coherent theory for facilitating learner self-direction is undelineated is not surprising, given the state of its underlying theoretical framework. Too, the concept of teaching self-directed learners seems contradictory by nature; if learning is self-directed, the usefulness of a teacher is not obvious. However, particularly in a formal setting, instructors play a critical role in the process, albeit a murky one when it comes to specific theory. To bring focus to the theoretical instructional role in a learner-directed environment, four specific studies were located, each of which included at least partial theory for instructing for learner self-direction.

The first study where pedagogy of learner self-direction was a component was the Personal Responsibility Orientation (PRO) model proposed by Brockett and Hiemstra (1991) to define what they referred to as "self-direction within learning" (p. 24). The PRO combined the concepts of learner personal responsibility and the personal traits of the learner with a pedagogical approach leading to self-directed learning. Garrison (1997), building on the PRO, suggested that self-directed learning combines not only the shift in control from teacher to learner, but includes learner responsibility requirements with cognitive responsibility as well. Toward this end, the Garrison model reflected three integrated dimensions, one of which, self-management, is where pedagogical control shifts were theorized to occur. Gibbons (2002) proposed a model for the facilitation of learner self-direction based on assumptions related to individuality, life-long learning applications, active learning activities, and skills development. The fourth model with specific pedagogical relevancy was put forth by Grow (1991), who offered the Staged Self-Directed Learning model (SSDL) based on Situational Leadership theory (Blanchard, Zigarmi, & Zigarmi, 1985) which had a focus on varying instructional approaches based on learner readiness for self-directed learning.

Pedagogical Facilitation of Self-Directed Learning

Coherence from the splintered theory components which together form the basis of an instructional style for maximized self-directed learning requires a roadmap. The framework for pedagogical facilitation of self-directed learning was constructed as part of this literature review to help define the common components found in the existing literature. This compiled framework is depicted in Figure *2*. The synthesized theory underlying the pedagogical facilitation of self-directed learning has been summarized into three categories, the environment in which it is facilitated, the areas of learner control, and the specific instructional roles that optimize learner self direction.

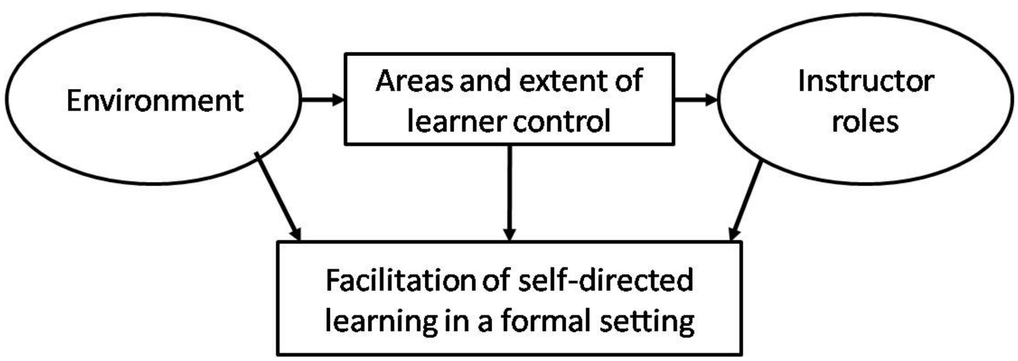


Figure 2. Framework for pedagogical facilitation of self-directed learning

Environment. Instructional attitudes toward learner self-direction are evident in the learning environments they create. A teacher who ascribes to a didactic, behaviorist-based theory of learning in a formal classroom creates an atmosphere of teacher control over all aspects of the learning. Conversely, informal, self-directed learning is completely controlled by the learner where the learning milieu twists and turns at the whim of the learner. Self-directed learning in a formal learning environment requires some mediation of these two extremes where “the control over management of learning tasks is realized in a collaborative relationship between teacher and learner” (Garrison, 1997, p. 23). Knowles, Holton, and Swanson (2005) reviewed existing theory and summarized the climate in which self-direction is fostered as one characterized by deference for individuality, shared decision-making and responsibility, and independence of expression.

A learning environment based on individuality was a common theme among the four theories. Gibbons (2002), for example, defined a climate for self-directed learning partly as one that is “adapted to the maturation, transformations, and transitions that students experience” (p. 9). Garrison (1997) based much of his model on the premise that each learner is different and as such, shared control alone could not create the atmosphere required for maximized learning, but that motivational factors, and the self-monitoring abilities of each student must also be incorporated. The SSDL (Grow, 1991), too, used student distinctiveness as a basic premise, calling for instructional awareness of each student’s progress from “dependency to self-direction” (p. 127). Similarly, student uniqueness was a basic component for the PRO (Brockett & Hiemstra, 1991), an example of which is the emphasis on early completion of individual needs statements in each class and for the reconciliation of those statements to the course goals.

Shared decision-making as a component of the environment surrounding the facilitation of student self-direction was ubiquitous within each of the identified models, although the proscribed parameters were not uniform. Shared control in some models was proscribed in the nature of a collaboration between instructor and learner, where ultimate control was maintained by the instructor, with shifts between the two based on instructional and institutional goals. The PRO (Brockett & Hiemstra, 1991) falls in this category and included a premise that adult learners require some measure of teacher control in all formal settings. Too, both the PRO and Garrison's model (1997) addressed the need for instructors to identify and manage the over-arching goals of the learning to insure quality. On the other hand, the ultimate goal in the Gibbons (2002) and Grow (1991) models was for the eventual complete shift of decision-making to the learner, although Gibbons (2002) noted a need for learning activities to be conducted in an appropriate setting, which implies some level of continued instructor-only decision-making, and Grow (1991) suggested that the learning stages, ranging from dependent to self-directed, are teacher-controlled where, for example, stage one learners "depend on teachers to make decisions they themselves will later learn to make." (p. 130).

Another consistent environmental characteristic in all of the listed models was that of shared responsibility, again with mixed constraints similar to those related to shared control. All of the models called for the shift of responsibility for learning to the learner. Garrison's (1997) self-monitoring domain related specifically to learner responsibility, starting with the self-determination of what constitutes meaning and including individual responsibility to "construct meaning through critical reflection and collaborative confirmation" (p. 24). Similarly, the PRO (Brockett & Hiemstra, 1991) included learner responsibility as the "cornerstone of self-direction in learning" (p.27) where the advantages of choice and collaboration come with the "responsibility for accepting the consequences of one's thoughts and actions as a learner" (p. 28).

The fourth of the shared environmental elements related to effective self-direction had to do with freedom, specifically as it relates to the flow of expressed ideas and the availability of resources. Freedom was a pervasive element of Gibbons' (2002) theory from program development that "adapts [to learner] maturation, transformation, and transition" (p. 10) to learning that employs "a full range of human capacities, including our senses, emotions, and actions as well as our intellects" (p.10). The PRO (Brockett & Hiemstra, 1991) stressed freely available resources as a requirement for maximized learning. Much of Garrison's (1997) model was based on theories of critical and reflective thinking, which, by their nature, portend the need for freedom of expression.

Areas and extent of control. The second component of the framework for pedagogical facilitation of self-directed learning relates specifically to the shared control of a self-directed learning environment. The extent of learner control and in what areas learners exercise control over the various aspects of the learning, impact the nature of the overall learning experience. Candy and Brookfield (1991) synthesized the research on the topic of learner control, noting the various dimensions and opinions expressed. Summarily, they identified a structure of four areas where learner control should be maximized, including what is to be learned, how the learning is to be accomplished, how the learning is to be assessed, and the timing of learning activities and assessment. Brockett and Heimstra (1991) generalized this structure as the "expected formal relationship between a learner or group of learners and an instructor" (p.105) and identified nine variables they thought can be controlled by learners. These nine learning variables fall into the Candy and Brookfield four-component structure as depicted in Table 1.

Table 1

Reconciliation Between Structure of Control and the PRO Learning Variables

Summarized structure of control[a]	PRO learning variables per the PRO[b]
What is to be learned	Identification of learning needs
	Learning goals
	Expected outcomes
	Documentation methods
	Selection of learning experiences
	Variety of learning resources
How learning is accomplished	Optimal learning environment
Learning assessment	Evaluation and validation methods
Timing	Learning pace

[a]As synthesized by Candy and Brookfield, 1991
[b]As proposed by Brockett and Heimstra, 1991

The other three models reviewed were more general when it came to the specific structure of learner control, but the commonality was apparent. All agreed, for example, that learner control over what is to be learned in a formal learning environment must realistically be mitigated by institutional dictates related to course competencies and standards. However, given an environment based on individuality, learner control in this area can be maximized by taking into account the individual needs, previous knowledge, and experiences of each learner. For example, the Gibbons (2002) model suggested learners should have control over "as much of the learning process as possible" (p. 11) and included negotiated learning contracts which, in part were “a design for action that requires students to set their goals and explain them” (p. 20) within the context of established course competencies. As another example, Garrison’s (1997) model included a motivational domain partly based on the premise that “students will have a higher entering motivational state if they perceive that learning goals will meet their needs and are achievable” (p.27).

Learner control over how the learning is to take place was much less constrained within the four listed theories. All four included maximized learning activity control as elemental to the concept of self-direction. Additionally, all four called for the preparation of learners to control their learning activities. Gibbons (2002), for example, discussed the need to “teach students the skills and practices” (p. 15) necessary to self-direct their learning activities. The stages in the Grow (1991) model were predicated on preparing learners to fully control all learning activities after they had progressed to stage four, having used the earlier stages to learn how to effectively plan for and identify activities appropriate to their goals and propensities.

The theorized extent of learner control over assessment was varied among the four listed theories, and, as with other areas of control also varied based on institutional-mandated constraints such as required testing. Gibbons (2002) indicated that “students [must] learn to assess themselves and report on their own achievement because it is an essential part of the self-directing process” (p. 21) and specified tools such as a section of the learning contract, instructor-supplied rubrics detailing levels of proficiency, and the use of learner created portfolios to demonstrate skills and knowledge acquired. Grow (1991), too, offered examples of shared assessment control by stage three where learners had matured and were interested in self-direction. These examples included learning contracts, collaboratively generated checklists, and assessment criteria.

The timing of the shift toward learner control is another component in the structure of the learning process and one upon which all four of the listed theories provide consensus. Ultimately, when control shifts from instructor to learner is a function of learner readiness. Grow's (1991) model is the most specific illustration of this element where learners progress from a stage one, dependent mode which relies heavily on didactic teaching approaches, through stage two, which is implemented when learners are prepared enough to be motivated and interested in some measure of self-direction. Stage three is reached once learners have evolved to be able to "see themselves as participants in their own education" (p. 133), and learners enter stage four when they no longer require a hands-on instructor in order to reach course goals.

Instructor roles. Given the structure and environment to maximize self-directed learning, each of the listed models offered descriptions of instructional roles. The PRO (Brockett & Hiemstra, 1991) derived a 13-point list of characteristics that comprise the role of a formal educator in a self-directed environment. These roles were basically facilitative and included assistive, resource-building, and assessment components. Grow (1991) and Garrison (1997), too, included concise instructional roles, depending on the domain in which the learning was taking place. For example, in Garrison's self-management domain, which was hypothesized to be that part of the learning process where control shifts occur as it "is intended to reflect the social setting (resource management) and what learners do during the learning process" (p. 23), instructional roles were identified as those required to maintain balance in the collaborative partnership between teacher and learner and those required to assess and negotiate to help assure a sound learning outcome. Instructor roles in other domains of the Garrison model included management of feedback and coaching for motivation. In the case of Grow, instructor roles were tied to the stage of self-directed learning into which the learner fell calling for “authority coach(ing)” (p. 129) in stage one when the student is dependent on the instructor, “motivator and guide” (p. 129) in stage two when the student is interested, facilitator in stage three when the student is involved, and “consultant and delegator” (p. 129) in stage four when the learning is fully student self-directed.

Gibbons (2002), while incorporating the essence of all of these roles and offering specifics regarding the planning for and execution of self-directed learning tasks, offered five essential elements as guideposts for the roles instructors should fill:

1. Student control over as much of the learning experience as possible
2. A focus on skill development
3. Students learning to challenge themselves to their best possible performance
4. Student self-management – that is management of themselves and their learning enterprises.
5. Self-motivation and self-assessment (pp. 11-12).

The current study includes statements of instructor attitudes toward facilitating for self-direction in formal learning settings. Overall, theory related to such facilitation is a piece-meal concoction, buried in broader theories related to self-direction. Synthesis of the underlying literature documented above illuminated a composite framework from which such attitudes could be compiled.

Efficacy of Self-Directed Learning

The preponderance of empirical evidence supporting self-directed learning theory was gleaned from studies of student attitudes and learning results rather than tests of facilitator theory. However, the studies located related to the broader theory did include much evidence as to the overall efficacy of self-directed learning. For example, Ellis (2007) studied student perceptions of the self-directed learning environment where 161 graduate students were surveyed twice while completing a self-directed module created based on the PRO model (Brockett & Hiemstra, 1991). In addition to the surveys, the grades for the module were evaluated to determine learning outcomes. Ellis concluded that students were satisfied with the approach and that the grades, which were predominantly As and Bs, were evidence that effective learning had occurred. No comparison between student satisfaction with the self-directed environment and the grade earned was documented.

Matzen and Edwards (2007) suggested that technology integration might be the impetus for a shift toward student control in formal learning environments. Some relationships between technology and self-directed learning environments were summarized by Hannafin and Lamb (1997). Citing educational theorists including Dewey, Piaget, and Vygotsky, this summary accumulated the existing theoretical and empirical knowledge to conclude that effective use of educational technology had a positive impact on learning in non-didactic environments if such environments were theoretically grounded in five domains: “psychological, pedagogical, technological, cultural, and pragmatic” (p. 172). In a test of the Hannafin and Lamb theory, Lu, Ma, Turner, and Huang (2007) assessed the impact of the availability of wireless Internet in college classrooms on student self-direction and concluded that the availability of this technology significantly improved student self-directed learning. Findings included significant correlations between improved self-direction and self-sought resources, adaptation to learning style, support for critical thinking, improved opportunities for collaboration, and enhanced learner engagement.

Another meta-analysis of 32 experimental studies was undertaken by Rosen and Salomon (2007) to determine differences in reported outcomes between “technology-intensive constructivist-based learning environments (CTILEs)” (p. 2) and traditional, didactic learning environments in math instruction. In the study, the literature was screened for reported results from quantitative studies involving an experimental group which utilized CTILEs and a control group which did not utilize CTILEs. Between-class comparisons of reported effect sizes were analyzed and the conclusion reached was that increased learning in CTILEs over traditional learning environments was achieved.

In a study with Web2.0 implications, Weller et. al (2005) qualitatively analyzed student evaluations from an experimental class that used Web2.0-based communication alternatives such as blogging, instant messaging and audio conferencing in an online class and allowed extensive student control over what they would learn and which of the technologies they would incorporate. The learning material was categorized into four modules and was presented in the form of 155 learning objects, each of which were mapped to specific learning objectives. The study investigated the student perceptions of the technologies, and relevant conclusions reported that the choice allowed in the selection of the technologies was an enhancing factor to the overall positive perception of the technologies.

Further evidence of the efficacy of learner self-direction was provided by Miller (2007) who investigated the effect of student focus and self-direction on creativity, learning, and quality of output in a web-delivered class. Forty-two graduate level education students in three classes participated in the mixed methods study. Data were collected from student reflection on pre-existing knowledge and preferences as part of the learning cycle, and all learning responsibility was placed on the learners. Twenty students from one class completed their coursework on a self-directed basis, facilitated by their instructor. The control group of 22 participants in two classes completed their coursework under the tutelage of lecture-based, teacher-centered instruction. All participants completed a self-assessment before and after the courses and quantified scores were analyzed to determine the extent to which changes related to personal growth had occurred. Student attitudinal averages reflected significant increases in the treatment group with no significant changes reported from the control group. Stronger evidence of learning improvements were reported from the qualitative analysis of the projects submitted by the two groups. Projects submitted by the treatment group revealed more diversity of format and individualism than those submitted by members of the control group. Further, interviews with the instructor determined that the quality of the submitted work from the treatment group was superior, in general, to that of the control group.

Positive learning outcomes related to self-directed learning were not always found, as was noted by the mixed results reported by Costa, van Rensburg, & Rushton (2007), who conducted an experiment where 77 medical students were randomly assigned to one of two groups, both of which covered identical learning objectives in an identical amount of formal learning time. The classes attended by the control group were conducted by an instructor and consisted of media-aided didactic lecture. The classes attended by the treatment group were facilitated by the instructor, but contained no lecture or formal instructor-created content. Instead, the class activities required the students to identify and discuss salient learning points within the weekly topics. At the conclusion of the course, students were assessed by written examination and oral report, both identical between groups, and were surveyed as to personal evaluation of content and presentation. The researchers found no significant inter-group differences in oral presentation grades or content, though the treatment group did report significantly better written grades and evaluation of presentation.

One explanation for mixed outcomes in studies like the one listed above may be because context, learner abilities, and expectations were ignored. For example, Schoen (2007) noted that varying knowledge types require varying levels of learner interaction. The homogenous application of an instructional approach to a mixture of learners means that, while the approach may be suitable for some of the learners, it will not be best suited for the entire class. Too, some iterations of learner self-direction activities center on the external control feature almost exclusively, ignoring the learner preparation for such independence. Garrison described this type of misapplication of learner self-direction as one where “the learner exercises a great deal of independence in deciding what is worthwhile to learn and how to approach the learning task, regardless of entering competencies and contextual contingencies” (1997, p. 18).

Many theorists (Candy, 2000; Candy & Brookfield, 1991; Gibbons, 2002) suggested the implementation of a self-directed learning continuum where students must first be taught to self-direct and then encouraged to perform increasingly more of the identified elements until they have reached the learner-controlled stage where didactic structure and control is no longer required. The lack of this preparation may explain the results of research based at a Scottish medical school which suggested that upper-level medical students learned more when directives and activities were specifically assigned than when flexibility was allowed in those areas (Ibrahim, Ogston, Crombie, Alhasso, & Mukhopadhyay, 2006). The study randomly assigned 138 volunteers to one of two groups for the course work in a pediatric rotation. The control group met in what the authors described as “structured learning” (p. 241) where instructors assigned which clinics the students were to attend, when they were to attend them, and the specific medical problems they were required to observe. Members of the treatment group were given almost complete flexibility in all of these decisions with no faculty intervention or facilitation, although students were free to meet with an instructor to clear up any questions. All members of both groups were tested at the beginning and end of the course using identical assessments, the results of which were statistically analyzed. There were no significant differences reported for the pre-test, but significant differences were noted in the end-of-course test where the structured learning control group reported significantly higher scores than the treatment group. Part of the explanation for this unexpected finding might be, as indicated above, that the students were not prepared to self-direct in this instance. Additionally, the complete lack of structure for the treatment group may have affected the outcome of the experiment.

In another study, the maturity and learning habits of the students were suggested as the reason student perceptions of active learning activities with wireless laptops were not positive (Barak, Lipson, & Lerman, 2006). The mixed study analyzed, among other variables, student perceptions of active learning. The sample of convenience included 318 volunteer computer programming students who were supplied with wireless laptops to use during lecture to flexibly experiment with presented concepts. The authors concluded that overall student perception of the active learning component of the research was not positive which they indicated "might be explained by the fact that the students, being familiar with traditional teaching, found it odd to be active and solve problems in class" (p. 257). Further, lack of readiness to self-direct may also partly explain the result. Researchers had predetermined that the sample was not homogenous as to participant grade level or abilities related to technology and so employed post-hoc tests to determine if there were sub-group differences and noted that seniors were significantly more positive about the active learning element than were students at other academic levels.

A final example of the varying forms of mixed results in studies of the efficacy of student self-direction was indicated by a 2003 qualitative, ethnographic study of university students and faculty in Oman (Al-Harthi & Ginsburg, 2003) which sought to discover if the use of the Internet by both students and faculty shifted the educational control from learner passivity to learner empowerment. The research involved various qualitative methods including questionnaire, class and lab observation, interviews with students and faculty, and several focus groups. Thematic findings indicated that Internet use was pervasive but was used in instructor-defined ways to obtain instructor-defined information and so did not provide a basis for a shift from the traditional didactic instructor-controlled learning environment. Specifically, a majority of student respondents to the questionnaire indicated the Internet to be a more important source than the professor or the class text book and were derisive about textbook requirements which they viewed as less current. Even so, a majority of students identified their professors and text books as most commonly used sources of knowledge, above that available from the Internet, mainly because these traditional sources of knowledge drove the content of the course assessment. “Therefore, since students viewed ‘valuable’ sources of knowledge as those that were relevant to passing examinations, they tended to discount themselves, the library, and the Internet as sources of knowledge in relation to courses” (p. 11).

The varied results of the efficacy of self-direction in a formal learning environment have many reasons. However, it seems from the literature reviewed that the primary variables related to efficacy are student readiness and appropriate environment. Thus, when implemented with students who are prepared to self-direct within environments conducive to such learning, there is evidence that self-directed learning may lead to improved outcomes and student satisfaction.

Instructional Style and Self-Directed Learning

The study of outcomes and student perceptions of self-directed learning indicate positive efficacy of self-directed learning. Synthesis of the theory underlying this learning approach indicates the instructional attitudes, including willingness to create the necessary individualized, free environment and to fill the facilitative and assistive instructional roles required to maximize learning, are an important component. No studies were located which specifically tested for only instructional attitudes related to self-directed learning in formal learning environments. However a limited amount of literature with a focus on the relationship between instructional approaches and student learning was noted. One of the few recent reports was a 1999 quantitative study

(Trigwell, Prosser, & Waterhouse). A model to identify instructional approaches was utilized and included one instructional approach aimed at encouraging learner-centeredness in a pedagogical context. Factor analysis to determine relationships between instructional approach and level of student learning revealed negative loading of a variable measuring deep learning and positive loading for variables measuring surface learning and teacher-centered instruction. This was an indication of a relationship between surface learning and teacher-centered instruction. Similarly, the deep learning variable and a student-centered approach were reported as positive loading with surface learning negatively loaded. Cluster analysis confirmed surface learning from didactic learning environments, but the relationship between deep learning and student-centered instruction was not significant in this analysis.

Pedagogical beliefs of 4th – 12th grade faculty related to both the use of technology and a student-directed learning environment was one of the research topics in a 1998 national survey of teachers. (Becker, 1999). Responses from 2,250 teachers were summarized and categorized based on responses to scaled questions designed to identify the extent of constructivist leanings in the teacher attitudes including the self-directed components of constructivist theory specified in the report as belief in approaches that "emphasize the student's own responsibility for designing their own tasks, for figuring out their own methods of solving problems, and for assessing their own work—all as a means of making learning tasks more meaningful to students" (p. 21). Survey response summaries showed that Internet in the classroom was essential to twice as many of the respondents categorized as "very constructivist" than those categorized as the most "traditional" and the "very constructivist" teachers mean score for Internet usage was more than twice that of “traditional” teachers’. Analysis in the study revealed that constructivist instructional attitudes were a significant predictor of educational use of the Internet. That instructional attitudes predicted educational technology use elicited the following observation from the author of the report:

> One conclusion of this finding is that scaling up Internet use to higher numbers of teachers may depend in part on changing the relevance that teachers perceive the Internet holding for their primary instructional goals—which in turn may require changing teachers’ instructional priorities. Teachers who regard education as primarily the distribution of facts and skills to students according to a fixed curriculum sequence are much less likely to exploit the Internet than more ‘constructivist’ teachers. (Becker, 1999, p. 29)

Transactional distance forces some learner self-direction, so the advent of online classes, by extending transactional distance, have initiated some movement toward student-centered learning approaches initially predicted when technology-based tools became available. However, such shifts may not have manifested in shifts in faculty attitudes. Empirical evidence related to instructional style in distance education courses indicated no significant shift from teacher-centeredness. For example, when 203 university instructors, teaching in the interactive television environment were surveyed to determine their preferred instructional style, 80% reported at least a tendency toward teacher-centered approaches with 47% in the strong to extreme teacher-centered categories. Conversely, only 4% of participants reported the strong to extreme learner-centered instructional styles (Dupin-Bryant, 2004). Similar results were reported from Florida (Barrett et al., 2007) where 292 of that state’s online community college instructors were surveyed to determine their preferred instructional style. Results from both studies reported almost identical sample means which were lower than the normative mean proscribed by the instrument.

That instructional approach in higher education trends toward teacher-centeredness may explain the findings of a Penn State study (Litzinger, Wise, Lee, & Bjorklund, 2003). This study was undertaken to determine if graduating students are more prepared for lifelong learning, by way of being more self-directed, after they have completed nine semesters of undergraduate study and are enrolled in the open-ended capstone project in their program. The study surveyed 174 engineering students using an instrument designed to measure the self-direction skill level. Results showed there was no significant difference in preparation for lifelong learning between entering and exiting students, which may be further evidence of the didactic nature of the higher education classroom.

One of the constructs in the current study is instructor attitude toward student self-directed learning as the effective use of Web2.0 applications requires such self-direction. There is wide and varied theoretical literature suggesting the adult learner's preference for a learner-centered approach to instruction (e.g., Brockett & Hiemstra, 1991; Brookfield, 1984; Candy, 2006; Knowles et al., 2005). The confirming research which reports positive and mixed results has a predominant focus on the student perspective. In studies where mixed results were reported, consensus was that learners require preparation to become self-directed. Empirical investigation of self-directed learning from the context of instructional attitude is limited except when embedded in studies on general instructional style. In the self-directed components of those empirical studies, preference for teacher-centeredness pervades the literature.

Technology Acceptance

Technology acceptance and adoption have become increasingly important with pervasive use and the advent of progressively more effective educational technologies. In the context of the present study, an online instructor's attitude toward accepting technology is expected to affect interest in the emerging technologies known as Web.2.0.

Evidence of faculty resistance to technology integration was noted in the Educause 2002 report on wireless Internet networks at institutions of higher education (Arabascz & Pirani, 2002). This report described challenges and satisfactions related to the use of the technologies based on qualitative analysis of surveys and case studies of selected institutions. Student self-direction was noted as an unquestioned advantage of the availability of the technology, as was enhanced collaboration, improved communication, and improved student engagement. However, these advantages resulted from usage outside the classroom and frequently did not involve the instructor, other than to communicate by e-mail. Representative of faculty resistance to this technology, one of the respondents who was an associate vice-president at Indiana University was quoted as follows:

> Anecdotally, there have been some faculty that are resistant to the idea of having connected machines in conference rooms and classrooms. Students have yet another thing to distract them; [they worry] that these devices are taking away from the students the ability to concentrate. (p. 66)

Similarly, in a 2002 interview about wireless Internet installations at higher educational institutions (Syllabus, 2002), Lawrence Levine, director of computing at Dartmouth College (which was a case study institution in the Educause report; Arabascz & Pirani, 2008) indicated his opinion that instructional attitudes had not varied as a result of the ubiquitous availability of wireless Internet access and pointed to continued instructional reliance on didactic tools such as instructor lecture, occasionally asking for an Internet reference but rarely requiring student laptops in class.

Technology Acceptance Theory

The theoretical framework for the measurement of faculty acceptance of educational technology is constructed by the technology acceptance model (TAM) (Davis, 1989; Venkatesh & Brown, 2001), which evolved from the theory of planned behavior. This framework, like its predecessors, was based on perceived ease of use and perceived usefulness factors and has become a mainstay in the social sciences when studying changes in information systems (Chen & Corkindale, 2008). The initial TAM proposed that ease of use and perceived usefulness are direct predictors of the intent to accept technology. The model has been extended, combined with other models, and amended by its authors (Venkatesh & Davis, 2000) to include social norm, which depicts the influence of peers and supervisors, as a direct predictor of behavioral intent, moderated by voluntariness.

A recent example of reinforcing research related to education was found in a 2008 study (Chang & Tung) which used an adapted form of the TAM to study student intentions to make use of websites available from their online learning environments. The survey was constructed using previously designed and tested instruments and was answered by 212 undergraduates. The data were analyzed using structural equation modeling. Reported results substantiated basic model theory that perceived usefulness and ease of use affect student intention to use the web sites, noting significant standardized path coefficients to substantiate the model.

The extension of the TAM to include voluntariness and social norm as predictors of behavioral intent was longitudinally tested in 2000 (Venkatesh & Davis, 2000) with four case studies, two of which involved voluntary technology acceptance and two of which involved mandated technology acceptance. Data were gathered by survey at three separate points in the technology adoption period. The report from the study concluded that subjective norm significantly added to the explanation of the variance in behavior intention when participation was mandatory, but not when it was voluntary.

Not all studies related to technology adoption in education utilized the concepts presented in the TAM. However, from a theoretical standpoint, tested constructs can be referenced to or are synonyms for the basic TAM variables of perceived usefulness, perceived ease of use, and social norm as mediated by voluntariness. For example, a study of faculty self-assessment of attitude related to the use of educational technology (Dusick & Yildirim, 2000) reported faculty will not use technology with which they do not have familiarity and confidence in their skills. This correlational design used surveys, both qualitative and quantitative, to determine predictors for faculty technology use and included findings of significant correlation between faculty computer use and their attitude, competency, and courses taught and those who reported owning a computer at home.

Similarly, the literature review undertaken for the 2007 model construction for measurement of the impact of technology on current practices in higher education (Price & Oliver, 2007) revealed several areas of faculty consternation related to technology integration. The reported areas included feelings of uncertainty because of the absence of skill or understanding, the blurring of roles and responsibilities for the curriculum, and the evolving role of the teacher in a technology-enhanced learning environment. One of the variables in the present study is instructional technology acceptance. The literature related to integration of technology into instructional practices indicates reluctance to utilize the technology, which may prove to be a factor in instructional use of Web2.0 technologies.

Innovation

Innovativeness is defined as “the degree to which an individual or other unit of adoption is relatively earlier in adopting new ideas than other members of a system” (Rogers, 1995, p. 252). In the context of this study, an instructor’s innovativeness may have an impact on an interest in adopting Web2.0 applications into the content of online classes. The diffusion of innovations is the “communication and influence [which] alter an adopter’s probability of adopting an innovation” (Wejnert, 2002, p. 297) and has been much studied in many fields, predominantly rural sociology, marketing, and communications (Burns, 2007; Rogers, 1995, 2003). Consumer innovativeness is the basic stepping stone for diffusion and is the most studied component of the underlying theory, accounting for 58% of Rogers’ reported typology in 1995 and 67% in 2003.

The measurement of innovativeness required the identification of standardized adopter categories, developed as mutually exclusive labels for the various stages of innovativeness. The adopter categories were identified based on adopter characteristics related to "socioeconomic status, personality values, and communication behavior" (Rogers 1995, p. 268). Wejnert (2002), in a synthesis and integrated framework compilation of previous research, expanded these to six components and identified them as:

> societal entity, familiarity with the innovation, status characteristics, socio-economic characteristics, relative position in social network, personal characteristics that are associated with cultural variables that modify personality characteristics of actors at a population level. (p. 302)

The standardized adopter categories included the Innovator as the earliest adopter, followed by the Early Adopter, the Early Majority, the Late Majority, and the Laggards. When measured by time, these groups tended to follow a normal frequency distribution, each adopter group falling a standard deviation away from the ones next to it (Rogers, 2003). For purposes of the current study, the degree to which a respondent's attitude reflects Innovator status is of most interest, particularly as it relates to technology acceptance and adoption.

Innovativeness and Technology

Innovativeness has been studied from many perspectives. Germaine to the current study is the 1998 conceptual framework created to measure personal traits of innovativeness within the context of information technology (Agarwal & Prasad). These collective traits were termed Personal Innovativeness in the Domain of Information Technology (PITT). In the exploratory study it was hypothesized that PITT moderated the consequences of the perceptions in the TAM and other technology adoption models suggesting “an individual with higher PITT would require fewer positive perceptions than an individual who is less innovative” (p. 208). Initial testing by the authors involved collecting responses from 175 non-traditional, part-time graduate students to four items designed to test PITT as related to the adoption of the (then) innovation called the World Wide Web. Results reported were that there was no moderating effect on the perceived use or perceived ease of use as they effected behavioral intent. A significant correlation between PITT and behavior intention was reported.

Subsequent use of the PITT concept for empirical study included research to investigate the impact of PITT on computer efficacy and computer anxiety (Thatcher & Perrewe, 2002). In this study of 211 university students, PITT was found to have a significant negative impact on computer anxiety and a significant positive effect on computer efficacy. Another study (Pearson & Pearson, 2008) utilized PITT as part of research to determine the relationship between individual differences, such as personal innovativeness when using technology, and web site usability components. Results indicated variability in PITT made a positive difference in the relationships between the download speed of a website or website accessibility and the perceived usefulness of the website.

A model created to predict variables leading to employee innovative use of complex computer systems included PITT as a possible predictor of such willingness (Wang, Butler, Po-An Hsieh, & Sheng-Hsun, 2008). Data were collected via survey of 200 employees of a manufacturing concern in China where a complex computer system had been installed two years before the research, indicating usage had become normalized. Results of the analysis using structural equation modeling confirmed that

PITT directly explained part of the variance noted in the outcome variable, IT Innovation, and indirectly explained some of this variance via its impact on perceived usefulness (PU), which was an antecedent of the outcome variable.

Innovation and Self-Directed Learning

Limited research related to the relationship between innovativeness and self-directed learning was found in the literature. One qualitative study of entrepreneurs and others identified as innovators in France was completed to determine what traits comprise an innovator (Bary & Rees, 2006). A main emerging theme from the interviews was a strong ability to self-direct learning, which the authors defined as "any learning process, whatever its degree of formalization, that is sought, planned and conducted by the trainee in an autonomous way" (p. 76). Self-directed learning within this context involved the generation of self-information, the need for hands-on learning, and a similar requirement for collaborative learning. A similar study (Gibbons et al., 1980) identified 40 common characteristics of innovativeness based on interviews with 20 experts who had not completed any formal higher education. The conclusions drawn from this endeavor were the groundwork for the subsequent definitions and descriptions of the elements of a self-directed learning environment (Gibbons, 2002) upon which some of the self-directed learning construct in this study are based.

Web2.0 Applications as Formal Learning Tools

Web2.0 applications currently represent a category of emerging technologies which is predicted to have a major impact on how education is delivered and documented. The 2008 Horizon report (The Horizon Report, 2008) noted "the growing use of Web 2.0 and social networking - combined with collective intelligence and mass amateurization - is gradually but inexorably changing the practice of scholarship" (p. 5). So pervasive are these technologies that many predict that learning to use them is as crucial as learning to read or write or do basic math. A formal learning environment that uses a social media web site like Ning or Facebook in place of a Learning Management System, the results of RSS shares in place of current events reviews, or web-casting environments in place of face-to-face discussions are just a few examples of the integration of Web2.0 applications possible, and in some cases already in use.

Blogging professionals have postulated about the nature of future literacy, attributing the need to formalize the use of the new technologies so that students are prepared to "enter the ongoing stream of global conversation, information production, and creation" (Fisher, n.d. ¶ 3). Toward that end, the Fisch Bowl, a blog created by the faculty and staff at Arapaho High School, has documented a preliminary experiment where one instructor has incorporated student-discovered Web2.0 resources instead of outside book assignments, student presentation on the results of the independent learning, and blog documentation (Creating PLNs, 2007, September 18).

The use of Web2.0 applications to form informal learning communities has been preliminarily studied. In Scotland, stakeholders for a land trust experimented with building a network comprised of user-created content such as blogs, wikis, including entries to Wikipedia, podcasting, live-feed picture sharing, and global positioning system-based mapping information to increase community participation and enthusiasm for the tourism-based project. The initial phase of this grounded theory research reported positive results related to informal learning and sense of community despite extensive learning barriers related to the technology (Mason & Rennie, 2007). Future phases are planned for data collection and analysis where quantitative measurement will include statistical analysis of web-site hits to identify areas that generate the most interest and analysis of survey data to determine the effectiveness of training workshops. Qualitative data will be gathered from interviews and focus groups. These future phases may generate a theoretical framework for the use of Web2.0 applications to form learning communities.

Along these same lines, the Open University in Great Britain utilized some of the components of Web2.0 to create modular, reusable “learning objects” (Weller et al., 2005, p. 62), each of which was “sufficiently rich and complex to achieve a specific learning outcome” (p. 62). In this case study, students chose which of four learning modules to use to achieve self-selected learning objectives in order to satisfy core class objectives. The learning modules utilized blogging, audio conferencing, instant messaging, and a Harvard University-generated bulletin board product. The integration of the four separate technologies was examined and student evaluations were reviewed for emerging trends. Student reaction was overwhelmingly positive, although some students reported problems with some of the technology.

With the advent of RSS as a Web2.0 application, self-directed learners could locate, evaluate and subscribe to learning resources across the web since RSS technology delivers new content to the subscribed reader rather than forcing the reader to visit each separate web page to determine if there is new content. Other Web2.0 applications would be used to document, expand, and socialize the individual learning (Guhlin, 2005). Dr. Tony Karrar, an e-learning professional, has designed and implemented a pilot course related to the design and use of collaborative learning environments using Web2.0

applications. The class was based on the concept that high-level learning does not require a classroom, but does require an understanding of the intentionality to learn and of the technologies (Karrer, 2006).

A main component of the current study is to determine the relationships between attitudes related to technology acceptance and innovation and an interest in using Web2.0 applications in the formal learning environment. A single article related to these three constructs was located (Ajjan & Hartshorne, 2008). This exploratory study, based on the theory of planned behavior, was completed to, “assess faculty's awareness of the potential of Web2.0 technologies to supplement the classroom learning and to assess their adoption of such technologies” (p. 71). The authors hypothesized that perceived usefulness and perceived ease of use impact attitude, which, together with subjective norm and perceived behavioral control affects behavioral intention to use Web2.0 in university classrooms. Additionally, antecedents to social norm and behavioral control were hypothesized and tested. A sample of 135 instructional personnel from the researchers’ home institution was surveyed and 11 of the 13 independent variables were noted to significantly contribute to the explanation of the variables they were hypothesized to impact. Two hypothesized predictors related to facilitating conditions were found to not significantly affect the social norm construct.

The Ajjan and Hartshorne (2008) research was similar to the current study as both test instructor attitudes toward Web2.0 applications and their use in a formal learning environment. Too, the TAM, upon which the technology acceptance construct is predicated, was adapted from the theory of planned behavior, which was the basis for the 2008 study. As such, the current study and the Ajjan and Hartshorne study share the following constructs: perceived usefulness, perceived ease of use, and behavioral control. Additionally, while not a separate construct in the current study, social norm is a documented determinant of perceived usefulness in the TAM, and was reaffirmed as such in the 2008 Ajjan and Hartshorne work. A major difference between the current study and the existing 2008 research is that the pathways to Web2.0 application use in the current study are not limited to technology acceptance attitudes, but also include major constructs for attitudes related to learner self-direction and innovativeness. Another difference is the sampling frame. Ajjan and Harshorne sampled from university instructional personnel. The current study identified a sampling frame from community college instructors with a specific focus on online course delivery.

Summary of Chapter

This review of the literature indicates that self-direction and its many apparent synonyms have been the focus of much research related to the learner and the skills required to self-direct. Research on instructional attitudes and styles indicate instructors, who have a direct impact on the depth of learning, tend to favor the control of teacher-directed environments. Technology tools have helped transition instructional focus toward one with more student-centeredness, but activities and direction still tend to be teacher-controlled even in current distance learning environments. No existing literature was found marking a relationship between instructional attitudes toward learner control and an interest in using Web2.0 applications. Additionally, reviewed literature indicated that teachers in higher education have neither generally adjusted for nor integrated instructional technology beyond rudimentary levels. Pertinent to the current study, however, research was located confirming the technology acceptance model and its constructs for predicting behavioral intention to adopt technology in formal learning settings. There is some evidence that innovativeness of a technology adopter can predict the adoption rate and that innovativeness and self-direction are related, though evidence is limited. More research is needed to explore the determinants of the intention to use and the actual usage of Web2.0 applications in online classes.

CHAPTER THREE: METHODOLOGY

The purpose of the this study was to determine how instructor attitudes affect the class content use of emerging technologies known as Web2.0 applications. Additionally, the relationships between those attitudes and the impact of external administrative and knowledge-based constructs were evaluated. This was accomplished through the identification, comparison, and analysis of the current uses, understanding, and attitudes of North Carolina community college online instructors.

Specifically, the study sought answers to the following research questions:

1. To what extent do instructor attitudes toward learner self-direction, instructional technology, and innovation and change predict interest in the use of Web2.0 applications as formal class content?
2. To what extent does an interest in the use of Web2.0 applications predict an intention to use them as formal class content?
3. To what extent does intention to use Web2.0 applications as formal class content predict their actual use?
4. What is the impact of instructor level of knowledge of Web2.0 applications on instructor interest in these applications?
5. What is the impact of contextual conditions such as administrative mandates and personal constraints on instructor intent to use Web2.0 applications?

Research Design

The design for this project was a quantitative, correlational, prediction study to collect measures on seven independent variables:

1. instructional attitudes related to learner self-direction (SD)

2. instructional attitudes related to technology acceptance (TA)
3. instructional attitudes toward innovation adoption (IA)
4. instructor interest in Web2.0 applications (INT)
5. instructor behavioral intent to implement Web2.0 applications as formal learning tools (BI)
6. extent of instructor knowledge of Web2.0 (KNOW)
7. contextual conditions (CC)

Data were collected on one criterion variable, the extent of the current use of Web2.0 applications in community college online classes (USE). Data collected were analyzed to (a) determine relationships between all variables, (b) measure the extent to which SD, TA, and IA predict INT, (c) measure the extent to which INT predicts BI, (d) ascertain the impact KNOW and CC have on INT and BI, respectively, and (e) measure the extent to which BI predicts USE. These variables and relationships were identified from the theoretical framework.

Correlational prediction designs are used to identify possible relationships between variables and to measure the extent to which those relationships predict the occurrence of the criterion variable (Creswell, 2005). The correlational prediction design was chosen for a number of reasons. Primarily, the multiple variable analysis inherent in the design allows for constructs to serve as both dependent variables when identifying relationships and independent variables when identifying the extent of correlation and predictive value related to the criterion value. For example, data related to INT were aggregated and analyzed as the dependent variable when searching for its correlation with SD, TA, IA, and KNOW, and in turn was also used as an independent variable when testing for its predictive effect on BI. The research indicates that technology integration, particularly with online-delivered course work, offers a good environment for self-directed learning (e.g. Hannafin & Lamb, 1997), which in turn is a requirement for the effective use of Web2.0 applications in formal learning environments (e.g. Mejias, 2006). Similarly, existing knowledge suggests a relationship between attitudes toward technology adoption and innovation (e.g. Chang & Tung, 2008; Yau-Jane Chen & Willits, 1998). None of the research, however, tested for predictive correlations between the five exogenous variables and interest, nor interest and intent, nor intent and use of emerging technologies such as Web2.0 applications.

Population and Sample

Data related to the variables were gathered from a sample of online instructors in North Carolina's community colleges. For purposes of this study, online instructors were deemed to be any full- or part-time instructor who taught at least one fully online class during the current academic year. The accessible population from which the sample was drawn included all instructors of online classes in the North Carolina community college system (NCCCS). This population was chosen for this study for a number of reasons. Selection of instruction delivered from a single state helps control confounding variables due to political and bureaucratic differences. North Carolina was chosen as the state of study because it constitutes a decentralized network of 58 institutions which collectively serve the local needs of every county in the state. As such, the system includes all sizes of institutions with diverse population constituencies ranging from very large, urban colleges to very small, rural ones. All 58 community colleges in the NCCCS deliver online classes supported, in part, by personnel at the system level and all receive their budgets from the system level.

The accessible population described above was not available as an intact sampling frame as no detailed information related to the instructors of the individual online classes delivered through its member institutions is maintained system-wide. Accordingly, the sampling frame was developed from within the accessible population based on each institution's overall full-time equivalent (FTE) earned from online classes as an estimate of the relative institutional effort for the online delivery method. Greater relative institutional effort toward online class delivery can be reasonably assumed to represent the general importance of the delivery method to the institution. Based on this logic, a purposeful sample of as many online instructors from as few institutions as possible was garnered.

Selection of Institutions

Accordingly, a sample consisting of nine NCCCS institutions from which to request faculty participation in the study was initially selected based on the review of FTE earned from online classes as compared to total FTE earned at the institution. The researcher's home institution met the criteria for selection, but was discarded from the sample and replaced with the next highest-rated college. This was done to help eliminate bias in survey responses. Additionally, there was one non-responding, and one declining institution from the initial selection. They were replaced by schools next on the calculated relative institutional effort list. One of the replacement schools also declined and was replaced by the next school on the list. Lastly, a tenth institution, the next one on the list of relative institutional effort, was added during the process in an effort to increase response rates.

The resulting purposeful selection of institutions yielded a cross-section of ten NCCCS institutions including one of the largest and one of the smallest FTE producers based on 2007-2008 statistics (North Carolina Community College System, 2008). All areas of the state were represented. All online instructors at the selected institutions as identified by the institutional administrator constituted the sampling frame for this study.

Selection of Instructors

Permission from Western Carolina University to undertake this study was granted and its Institutional Research Board approval was obtained. Subsequently, contact information for all distance education directors, or their equivalents, was requested from and supplied by the system-office administrative staff . These distance education administrators at the institutions were contacted and contact information for current online instructors was requested and received for each selected institution. The initial request for a list of online instructors at each institution was made by e-mail. The sample size that resulted from the process was comprised of those instructors who responded. Overall, the sampling frame amounted to 663 online instructors of which 285 responded. The response rate was 43%.

Data Collection

The survey process was implemented based on the Tailored Design Method designed by Dillman (2006) and was e-mail-initiated and web-delivered. All instructors at the selected institutions have access to the system-wide Groupwise e-mail system and, since all are online instructors, adequate knowledge to receive and respond to e-mail and to complete the web-based survey was assumed. Existing literature indicated that web surveys yield response rates similar to mail surveys when prior notice of the survey is conveyed (Dillman, 2006; Kaplowitz, Hadlock, & Levine, 2004). This prior notice was conveyed by the distance administrator at each institution as discussed later in this chapter. The surveys were conducted between May and July, 2009.

The Tailored Design Method (Dillman, 2006) was founded in social exchange theory and first introduced in 1978. It has been specifically designed to reduce survey errors related to sampling, coverage, measurement, and non-response with particular focus on the latter two. This survey method requires attention to each phase of the process and is grounded by the assumption that self-administered survey responses require thought and motivation on the part of the respondents who respond based on feelings of trust and "perceptions of increased rewards and reduced costs for being a respondent" (p. 27). A further assumption in the method is that acceptable response rates are achieved with more than one contact with respondents. The basic elements of the Tailored Design Method relate to (a) question writing, (b) questionnaire construction, and (c) survey implementation. Question writing and questionnaire construction aspects are addressed in the Instrumentation section of this chapter.

Survey implementation proscribes a three-contact, incentive-based strategy to maximize response rate. The first contact was pre-notice of the survey which was extended from the institutional administrators to each of the instructors included on the lists received from the selected institutions. This pre-notice was delivered via e-mail one or two days before the survey details in order to forestall unread deletions from recipient inboxes. For the same reason, the pre-notice was "brief, personalized, positively worded, and aimed at building anticipation in the survey" (Dillman, 2006, p. 156) and was sent from the e-mail account and over the digital signature of the applicable distance education director to add perception of reward.

Other incentives which might add to the perception of reward were difficult to define in the web-based survey environment. Dillman (2006) indicated the dearth of available financial incentives when using a digital process for surveys and indicated an expectation "that creative efforts will be made to find incentives that can be delivered effectively by e-mail" (p. 400). There is no estimate in the existing literature as to the effectiveness of a digital incentive. However, since all potential respondents are online instructors it is assumed such digital assets would be viewed as useful. As such, the researcher designed digital badges in png format for display on a web page or online class, and offered them for download at the completion of the web-based survey. Mention of these digital badges was first made in the pre-notice.

The second contact with potential respondents was an individual e-mail personalized for each potential respondent so that "none are part of a mass mailing that reveals either multiple recipient addresses or a listserv origin" (Dillman, 2006, p. 368). This was accomplished through the use of the Microsoft Word mailings functionality where a Microsoft Excel worksheet containing the instructor information was used as input data. The second contact email included both:

1. the link to the electronic survey instrument, and
2. instructions for receiving a paper copy of the survey.

Offering the choice of response methods is Principle 11.4 of the Tailored Design Method (Dillman, 2006, p. 369) and is another strategy designed to improve response rate. The second contact e-mail which is included as also included a reference to the digital decorative badge incentive.

The third contact constituted a follow-up of the initial request for survey completion. This follow-up e-mail was sent to all non-respondents, as reported by the survey software, and was sent a week after the initial request. It included a brief restatement of the importance of recipient participation in the study as well as the description of the ways the survey could be completed along with all researcher contact information. The detail of all survey recruitment notices and replicas of the digital badges offered as incentives are presented in Appendix E.

Use of the Tailored Design Approach for implementation and survey construction was expected to maximize response rate to this survey. The target response rate was 60%, which is consistent with the expected response rate for web-developed surveys where prior notice is given and incentives offered. (Dillman, 2006; Kaplowitz et al., 2004). That response rates for digital surveys appear to be declining (Kittleson & Stephen L. Brown, 2005) is a situation that mirrors that of traditionally delivered surveys (Sheehan, 2001) and was a concern in this study as variability in the data was essential. As noted above, the response rates were monitored over the course of the process, and a tenth institution was added in an attempt to improve the rates.

Instrumentation

Data for this study was collected using a survey comprised of closed-ended, ordered-response questions. This type of question was selected because each of the items is a “well-defined concept for which an evaluative response is wanted, unencumbered by thoughts of alternative or competing ideas” (Dillman, 2006, p. 44).

Survey Contents

The survey instrument consisted of 34 questions adapted or designed to gauge instructor attitude toward each of the constructs in the conceptual model. As discussed below, items related to TA, IA, BI, and USE were adapted from well-tested instruments gleaned from the existing body of knowledge. The data for the remaining constructs were collected using theoretical and researcher-generated items. Items related to SD, TA, and INT were statements to which the respondent was asked to indicate individual level of agreement based on a 7-point Likert-type scale ranging from strongly disagree to strongly agree. Items related to CC were statements to which the respondent was asked to indicate individual level of agreement based on a 5-point Likert-type scale ranging from strongly disagree to strongly agree. Both scales are consistent with the adapted items and with the research described in chapter two.

Items related to KNOW, INT, BI, and USE were created around categories of popular Web2.0 applications as defined by the annual Webware 100 contest (2009 Webware 100, 2009) conducted by Yahoo-owned C-Net. The categories were filtered to include those most likely to be useful in educational settings, such that categories of Commerce, Infrastructure and Storage, and Location-based Services were not included in the survey. Additionally, the applications in the Search and Reference category were the same as those in the Browsing category, so only the latter was used in the survey.

Self-directed learning. SD data were gathered using statements of attitude based on the six essential elements for teaching in a self-directed environment generated by Gibbons (2002). As discussed in chapter two, research related to self-directed learning generally has a focus on the attributes required for the learner rather than instructional attitudes that facilitate self-direction in learners. Instruments related to specific studies of instructional attitudes using constructs described as student-focused, humanistic, and instructional style were reviewed. However, these existing instruments measured attitudes regarding all phases of adult learning theory so that adapting possible items related only to learner self-direction would alter the consistency, reliability, and validity reported for the underlying instruments. Instead, the Gibbons attributes reflect the common elements that define the necessary instructional attitudes for learner self-direction (Brockett & Hiemstra, 1991; Brookfield, 1991; Candy & Brookfield, 1991; Grow, 1991; Knowles et al., 2005). As such, these six elements form the items used to measure SD, attitudes for which were collected on a 7-point Likert-type scale ranging from strongly disagree to strongly agree. Item and scale quality were tested as part of the overall instrument validation process described later in this chapter.

Technology acceptance. Individual statements from the survey items formulated by the theorists in their testing of the latest iteration of the TAM (Venkatesh & Davis, 2000) were used to measure TA with slight adaptation for usability in this study. The original TAM measured Perceived Usefulness (PU), Perceived Ease of Use (PEU), and Behavioral Intention (BI) as factors leading to technology acceptance and has been used extensively in studies related to technology adoption (Jeyaraj, Rottman, & Lacity, 2006; Venkatesh & Davis, 2000). The 2000 extension of the model resulted in the addition of constructs that included Social Norm (SN) and Voluntariness (V). Survey items used to measure all components of the updated TAM model were adapted from prior studies. Internal consistency tests were reported “across studies and time period” (Venkatesh & Davis, 2000, p. 201) with Cronbach’s α ranging from .80 to .97 reported. Additionally, the survey items were tested with a focus group of experts prior to their use in the study related to the latest version of the TAM. This validity testing was in addition to that carried out in the studies using the various iterations of the TAM (e.g., Ajjan & Hartshorne, 2008; Bueno & Salmeron, 2008; Gallego, Luna, & Bueno, 2008; Shin, 2008). Attitudes regarding the statements were measured on a 7-point Likert-type scale ranging from strongly disagree to strongly agree which is the same as the original scale.

Innovation and change. Item statements for the IA section utilize the PITT items developed by Agarwal and Prasad (1998). The PITT is comprised of four statements designed to measure personal innovativeness specific to the adoption of information technology and has been used in theoretical and empirical studies including current work. Construction of the items was completed based on valid, reliable scales used in previous studies on innovation and on technology adoption and acceptance. The original instrument consisted of four items which were measured on a 7-point Likert-type scale, the responses to which were combined for analysis of innovativeness levels. Internal consistency was evaluated by its authors based on Cronbach's α, with a reported standardized value of .84. Construct validity was determined utilizing both exploratory and confirmatory factor analysis using the PITT items and those from an instrument which were deemed to be similar, but different from the PITT items. Results of this analysis were a conclusion that "the indicators account for a large portion of variance in the hypothesized latent construct and provide strong support for the validity of the measure" (p. 211).

Interest, knowledge, behavioral intention, and usage. INT, KNOW, BI, and USE data were collected using the adapted Webware 100 (2009 Webware 100, 2009) categories as described earlier in this chapter. Respondents were presented with a category, the statement of which included examples of applications within the category, and asked to indicate their knowledge of the category. The scale for each category was 1-3, where one indicated no knowledge, two indicated knowledge of applications within the category, and three indicated knowledge of the functionality. Hence, the KNOW variable was measured on a scale from 0-15 where 0 would reflect non-response in all five KNOW categories and 15 would reflect knowledge of functionality in all five categories. Respondents indicating no knowledge of the category were presented with the next category.

Those indicating knowledge of a category were asked to note their interest in, plans to use, and current use of the category. These three constructs used yes/no responses operationalized by categorical scales of 0-1 where 0 was a no answer and 1 was a yes answer. Combined then, the variables measuring interest, intent, and use had a scale of 0-5 where 0 reflected non-response in all five categories and 5 reflected a yes answer in all five categories. Statement and answer quality for KNOW, INT, BI, and USE have been included in the overall instrument validation process as described later in this chapter.

Contextual conditions. Items developed to measure the impact of CC on BI were derived from the facilitating conditions proposed in the Thompson, Higgins, and Howell (1991) model. This model was devised to test variables affecting utilization of personal computers in a business environment, including the impact of facilitating conditions and social factors on the use of personal computers. Hypotheses germane to the CC construct of the current study were :

(a) “positive relationship between social factors … and use” (p. 125) representing organizational support

(b) “positive relationship between facilitating conditions … and use” (p. 130) representing technical support.

Eight survey items, adapted from prior research and measured on a 5-point Likert-style scale from strongly disagree to strongly agree, were used to test the two hypotheses. The internal consistency of the entire instrument, including the questions regarding facilitating conditions, was evaluated using Chronbach’s α which ranged from .54 to .90 for the items. The authors noted that the construct measuring social factors tended to load as facilitating factors which the authors thought was because respondents did not distinguish between social and facilitating factors. Other than this issue with the factor loadings, no other construct validity issues were noted. The current study used the eight items from this Thompson, Higgins and Howell (1991) work to measure CC. As such, the original issue with the factor loadings for the social factor was not expected to affect the operationalization of CC. These questions were included in the overall instrument validation process as described later in this chapter.

Survey Format

The digital construction of the survey was accomplished based on Dillman’s (2006) “Principles for Constructing Web Surveys” (p. 376) which include the following:

1. The survey was introduced via a welcome window with text that is “motivational, emphasizes the ease of responding, and instructs respondents about how to proceed to the next page” (p. 377). In an effort to further

humanize the study, the researcher's picture was placed at the top of each page starting with the welcome window.

2. An individualized password was assigned to limit responses to those in the sample.
3. The first question was designed to be easy to answer with a simple radio button array to establish the simplicity of the questions and to capture respondent interest. In this regard, the questions began with the SD portion, as that was thought most likely to generate interest.
4. All questions were presented in a standard format, sequentially numbered and easily recognizable as to how to answer the question.
5. Color was only used as a structural reinforcement within the question list to highlight each question and as a consistent background for the survey.
6. The survey displayed consistently, independent of user platform, browser, screen resolution.
7. All required computer mouse actions were specifically described.
8. No drop-down boxes were used in the survey.
9. Users were not required to answer one question before moving on to another.
10. No questions required a manual skip based on an answer. All such navigation was handled by the survey software and was transparent to the respondent.
11. Dillman suggested that all survey questions be contained within a single, scrollable window, eliminating the need for the user to push "continue" or "forward" buttons. This structure was not possible with the current instrument given the varied nature of the scales. Additionally, the pilot test results and

suggestions for the instrument revealed a need to break the windows such that the scale headings remained in view without the need to scroll. As such, constructs SD, TA, INT, and CC were each presented on an individual screen with distinct, consistently-placed buttons for moving forward or backward through the survey. Each category of KNOW was presented on a separate screen, with identical navigational buttons visible to the respondent.

12. No answer choices exceeded the number that can be displayed in a single column.
13. All questions were close-ended, with no multiple answer types included.

The web-based survey was delivered from the Stanly Community College secure server using the Remark, version 4 web-based survey software, owned by that institution and was created and administered by the researcher. The survey questions are presented in Appendix A.

Pilot Test Procedures

The instrument used to gather data for this study was a compilation of items based on and adapted from a variety of sources, including items to measure SD, KNOW, INT, BI, and USE that were based on theory, but had not been used as survey items. For this reason, the entire survey was reviewed by a panel of experts to ascertain content-related validity evidence. The expert panel was comprised of five distance education specialists from institutions within the North Carolina university and community college systems. The expert panel was apprised of the theoretical background for the constructs and the members were guided as to the role of the constructs within the current study. Additionally, each panel member received instructions and a checklist to use to document their review. Panelists were asked to assess for clarity each survey item, the instructions to the respondents, the response alternatives, and the navigational elements of the survey. They were also asked for their impressions as to how well the survey would fulfill the purpose of the study. Responses from the panel were summarized and minor wording changes made to item phrasing and order of items as a result of their review. The checklist sent to the expert panel is appended to this document as Appendix B

Once the survey was amended for changes suggested by the expert panel, it was pilot tested with a group of online instructors at the researchers' home institution, none of whom were included in the sampling frame for the study. Specifically, 53 volunteers completed the draft survey, which included space for comments about each question. Results were reviewed for internal consistency and construct-related validity evidence through the calculation of each coefficient α (Creswell, 2005), all of which were at or above the benchmark of .70. Based on multiple comments related to the KNOW, INT, BI, and USE constructs, the format of the questions were reworded to include categories and examples of Web2.0 applications, and the navigation was altered so that only respondents who indicated some level of knowledge about the category were presented with INT, BI, and USE questions.

The resulting survey was distributed to the instructors at the ten schools described in this chapter. As with the pilot data, Chronbach's α values for each item within each scale were computed and evaluated for internal consistency of the items. Alpha values ranged from .80 to .92 indicating solid internal consistency. Additionally, bivariate correlations of scale items were evaluated with no substantial inter-scale correlation noted. These statistics for the survey items are presented in Appendix A.

Research Hypotheses

The data were analyzed utilizing an application of structural equation modeling (SEM) which is a hypothesis-testing technique. Accordingly, the following research hypotheses were developed based on the conceptual framework presented in Figure *3*.

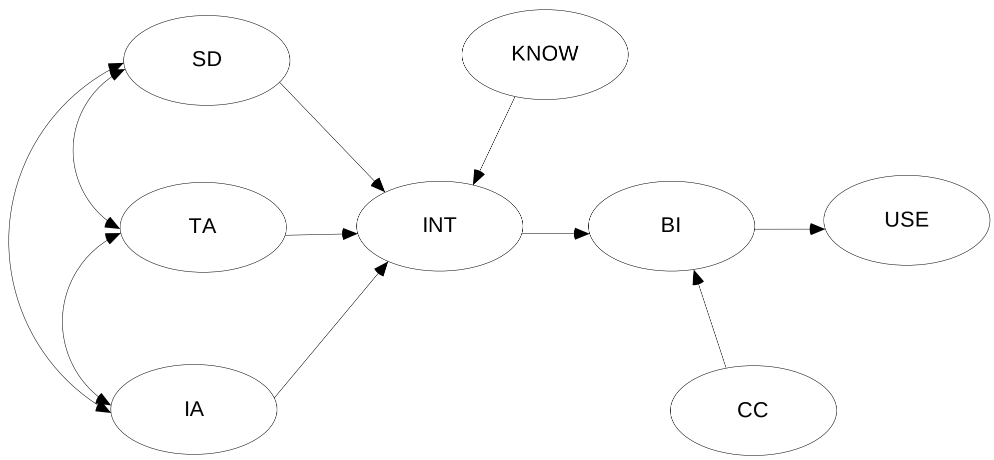


Figure 3. Research model for SEM analysis

Instructor attitude toward student self-direction (SD on INT). Facilitation for student self-direction involves a shift of control from teacher to learner, together with fostering a learning environment while maintaining a focus on learner self-actualization (Gibbons, 2002). The use of Web2.0 applications for learning requires self-direction and so, it is hypothesized that a positive view toward instructional facilitation of learner self-direction affects that instructor's interest in Web2.0 applications:

H1. Positive instructor attitudes toward learner self-direction positively affect instructor interest in Web2.0 applications.

Instructor attitude toward technology acceptance (TA on INT). Web2.0 applications represent emerging technologies, an interest in which may be predicted or affected by an instructor's willingness to accept new technologies.

H2. Positive instructor attitudes toward the acceptance of new technologies positively affect instructor interest in Web2.0 applications.

Instructor attitude toward innovation and change (IA on INT). The use of Web2.0 applications in formal learning environments represents innovation in pedagogical design. An instructor's attitude toward innovation and change may predict or impact that instructor's interest in Web2.0 applications.

H3. Positive instructor attitudes toward innovation and change positively affect instructor interest in Web2.0 applications.

Knowledge of Web2.0 applications (KNOW on INT). Instructors who have been introduced to the concepts of Web2.0 applications through professional development or some other means hold knowledge of Web2.0 which may impact their interest in the latter. Instructors who have not been introduced to these concepts are not knowledgeable about the applications and may be less interested in them.

H4. Knowledge of Web2.0 applications will have a positive impact on instructor interest in Web2.0 applications.

Contextual constraints and pressures (CC on BI). Administrative mandates and level of support, resource availability, expectations from peers and students, and technology ability may affect the interest or intention reported by an instructor. This impact would be expected to be positive if the pressure or constraint is positive and negative if the pressure or constraint is negative.

H5. Contextual constraints and pressures will have an impact on the intention to use the applications in formal learning environments.

Interest in Web2.0 (INT on BI). Interest in Web2.0 can logically be expected to effect an instructor's intention to use the applications associated with it.

H8. Higher levels of instructor interest in Web2.0 applications positively affect instructor intention to use those applications as learning tools in the that instructor's classes.

Intention to use Web2.0 applications (BI on USE). Behavioral intention as a construct identifies the motivations that result in an action or outcome for the theories such as the TAM (Venkatesh & Davis, 2000), the Theory of Reasoned Action (Becker & Gibson, 1998), and the theory of planned behavior (Ajjan & Hartshorne, 2008). It is expected that positive behavioral intention will have a direct impact on the ultimate use of Web2.0 applications.

H9. Positive behavioral intention to use Web2.0 applications have a positive impact on use of those applications in the formal learning environment.

For purposes of this study, the causes of the exogenous variables of SD, TA, and INT are unknown. As such, associations between these variables, while assumed to co-vary, remained unanalyzed as suggested by the SEM principles utilized to depict pathways and variance explanation for the model (Kline, 1998).

The nine listed research hypotheses were evaluated against the research model after it was respecified to fit the data as described in chapter four. Respecification was accomplished through the application of structural equation modeling. Kline's procedures for specifying models and evaluating model fit were followed.

Data Analysis

Data analysis began with data cleaning techniques and assumption assessment. Detailed analysis and evaluation followed and were conducted using the principles outlined for structural equation modeling. Structural equation modeling is a two-stage approach to model fit which makes use of confirmatory factor analysis (CFA) to fit the measurement model to the data and path analysis to fit the structural model to the data.

Data Cleaning

Survey results for all items were imported from the survey program into the SPSS version 17 computer program for data cleaning and subsequent analysis. To clean the data as proscribed by Creswell (2005), a frequency distribution was generated for each question, and histograms and boxplots were created to allow visual inspection for out-of-range data, missing values, or input errors. As expected given the design of the survey instrument, missing data were not significant and substitute values (means) were programmatically inserted for the 23 responses (.14% of cases) that warranted this treatment. One respondent had missing data for an entire construct and was excluded from evaluation of that construct using pair-wise deletion methods in SPSS.

No input errors were expected or noted as the file was input from the survey software such that human-generated mistakes were avoided. One negatively worded item (IA-3) was reverse coded to maintain comparability with the other items in the scale. The data were then imported into AMOS, version 17 for initial analysis of measurement modality. There were no cases reflecting outliers identified by substantial gaps in the calculated Mahalonobis d^2 and none were deleted (Byrne, 2009).

Assumptions Assessment

As with all quantitative statistical analysis, data must meet certain assumptions before analysis is effective. For SEM, the continuous and multivariate normality of the data distribution is essential if the fit of the measurement model is to be accurately predicted (Kaplan, 2008). Normality was evaluated by the visual inspection of individual histograms, frequency distributions as calculated by SPSS, and AMOS generated normality statistics including Mahalonobis d^2 and calculations related to skewness and kurtosis.

A second underlying assumption is that the sample size is of sufficient number so that estimate accuracy is maintained. Schumacker and Lomax (1996) reviewed the literature and concluded that a sample size between 250 and 500 cases is required for the effective use of SEM where the complexity of the model increases the required size of the sample. In the current study, the sample numbered 285 which is within the sample size parameters and is appropriate for the relative simplicity of the nonrecursive theoretical model which included eight variables with straightforward theorized relationships.

Structural Equation Modeling

Further data analysis and hypothesis testing were accomplished using structural equation modeling which was used for a number of reasons. First, SEM modeling principles allow for more than one dependent variable, which is desirable for the theorized research model. Initially, INT is the dependent variable as related to SD, TA, and IA. INT is also an independent variable in relation to BI, which is the dependent variable in that relationship, but is the independent variable as regards USE. Secondly, SEM allows mediating variables as predictors. That no mediating effects were theorized in the structural component of the research model does not preclude the possibility that the analysis of the model would result in the identification of such relationships. Lastly, as noted by Schumacker and Lomax (1996), the combination of a measurement model with a structural model allows for clearer theoretical substantiation than other modeling methods because of the CFA approach. CFA accounts for measurement error as part of the analysis of the measurement model where exploratory factor analysis (EFA) assumes no measurement error.

Schumacker and Lomax (1996) recommended a five-step process for SEM modeling. These five steps are (1) model specification, (2) identification, (3) estimation, (4) testing for fit, and (5) respecification (p. 63). The analysis was applied to two distinct modeling endeavors where confirmatory factor analysis was utilized to assure the observed variables accurately described the latent variables in the measurement model. Subsequently, path analysis, and if necessary path deletion, was employed to determine the predictive extent of each of the constructs in the resulting structural model for assessment against the hypotheses stated earlier in this chapter (Anderson & Gerbing, 1988).

Model specification. Model specification occurs when a model is hypothesized based on the literature review and theory (Schumacker & Lomax, 1996). The research model developed for this study was the starting point for this process as it identifies the latent variables for the model. The survey items designed to measure the latent variables are included in the model specification as identifiers of their latent variables. One-way arrows from each latent variable to its respective identifiers represent the concept that some portion of the variance for each identifier is a result of respondent attitude related to the latent variable.

In addition to the latent constructs and their identifying survey items, the measurement error for each identifier is included in the specified model as representation of that portion of the variance in the identifier that was not caused by respondent attitude related to the latent variable. One-way arrows from each error term to its related survey item depicts this relationship. Similarly, disturbance error for each uncorrelated latent variable is reflected, denoting the extent of the variance in the latent construct that is not explained by its identifiers. Two-way arrows between model objects represent hypothesized correlations.

Model identification. Model identification requires satisfaction of certain conditions which, when taken together, indicate that there are unique values for each parameter in the hypothesized model (Schumacker & Lomax, 1996). To assure model identification, the model must be recursive and must satisfy the order condition. A model is recursive, and therefore can be identified, when no parameter creates a feedback loop with a latent variable (Schumacker & Lomax, 1996). The order condition states that "the number of free (or independent parameters) to be estimated must be less than or equal to the number of distinct values in [the hypothesized model]" (Schumacker & Lomax, 1996, p. 101). In other words, the degrees of freedom for the model, which are the difference between the number of distinct values and the number of free parameters, must be a positive number. To meet this condition, generally accepted constraints were applied to the specified model (Byrne, 2009; Kline, 2004). The scale for the regression parameter between one identifier and its latent variable was set to the value of 1 so that a scale can be established to evaluate the relationship between each latent variable and its observed variables. Additionally, regression parameters between all error and disturbance terms and their related variables were constrained to the value of 1.

Model estimation and assessment of fit. In SEM, confirmatory factor analysis is used for the measurement model estimation and path analysis for the structural model. CFA utilizes model estimation algorithms to calculate factor loadings and latent variable relationships as well as disturbance and error variances based on the modeled associations as represented by the data. The process requires the selection of an estimation procedure based on the data description. Maximum Likelihood (ML) was selected for this study because of the multivariate normal data distribution from the moderately sized sample (Flowers, 2009; Kline, 2004). The raw data from SPSS were used as the input to the analysis.

Once estimated, SEM principles require that the measurement model be evaluated for fit. The myriad goodness-of-fit indices produced by AMOS during the estimation process formed the starting point for estimating the fit of the measurement model to the data. A standard benchmark for which indices provide the best measure of a good fit is not available, mainly because measurement error in the observed variables precludes the viability of such a standard. Byrne (2009) noted the decision as to which indices are an acceptable evaluation of goodness-of-fit is complicated because “particular indices have been shown to operate somewhat differently given the sample size, estimation procedure, model complexity, and / or violation of the underlying assumptions of multivariate normality and variable independence” (p. 83). Tanaka (1993), in a review of the research surrounding reported goodness-of-fit indices and their target values, pointed out that “the seminal articles on this topic reach no consensus about what constitutes 'good fit'" (p. 10). Schumacker and Lomax (1996) concurred, highlighting the subjective nature when choosing goodness-of-fit indices. Thus, assessment of goodness-of-fit remains individualized whereby each researcher, armed with an understanding of the various indices, the model, and the data, decide on which indices best describe the model fit and to what extent the described fit is a good one.

Goodness-of-fit indices can be categorized as absolute, incremental, or parsimonious indicators (Ho, 2006). Absolute indices are those which directly compare the hypothesized model with the estimations made based on the data. One such statistic is χ^2. Evaluation of model fit based on χ^2 looks for significance in that statistic since a lower χ^2 indicates less difference between the hypothesized and estimated models. However, use of χ^2 in goodness-of-fit analysis in SEM is problematic because of its tendency to reject a fitted model (Schumacker & Lomax, 1996). Such errors occur because of non-normality in the data, which in turn is expected to occur as sample size increases. This weakness of the statistic as a goodness-of-fit measure is a paradox in SEM models which require larger samples to effectively apply SEM. This requirement means these samples tend toward natural departure from true normal distributions, resulting, generally, in larger χ^2 values and non-significance (Byrne, 2009).

Other absolute fit indices include the GFI, the Root Mean Square Error Approximation (RMSEA), and the χ^2 / df. The GFI estimates model fit measured against a complete non-fit of the data (Ho, 2006). The measure ranges from zero to one, with higher values reflecting better fit. General consensus is that values of at least .89 represent good fit (Flowers, 2009). RMSEA, which is also considered a parsimony index, estimates model fit in the population with smaller values indicating a better fit. Ho (2006) indicated that values from .05 to .08 indicate an acceptable fit, .08 to .10 represent a mediocre fit, and any result greater than .10 suggest a poor fit. Flowers (2009) suggested good fit at values up to .07. Hu and Bentler (1999) recommended .06 or less as the threshold for good fit. The χ^2/df calculation reflects model fit based on a perfect fit of 1 to 1. Arbuckle (2009) articulated its development as a response to the shortcomings of χ^2 as a reliable fit statistic for SEM models. Byrne (2009) described the use of χ^2 / df as “a more pragmatic approach to the evaluation process” (p. 77) and called it “one of the best fit statistics to address [χ^2 limitation] problems” (p. 77). Both Byrne and Arbuckle described a ratio of 2/1 or less as a good fit.

Incremental measures of fit are those that compare the estimated model to a baseline model. In the case of initial fit evaluation, the baseline model is one which was constrained to assure non-fit with any data. The indices in this category reflect comparisons of the estimated measurement model against the baseline model to assess fit improvement in the measurement model. Examples include Normed Fit Index (NFI) and Comparative Fit Index (CFI). Both of these indices report values from zero to one with higher values representing the better fit (Ho, 2006). The NFI is often reported, but has been shown to underestimate small sample fits for which the CFI compensates (Hu & Bentler, 1999). Recommended good-fit values are those greater than .95 for the CFI (Hu & Bentler, 1999) and .90 for the other incremental measures (e.g. Byrne, 2009; Flowers, 2009; Teo, 2009). The Expected Cross Validation Index (ECVI), measures the difference between the model as it fits with the current data and the expected fit from a different, equivalently sized set of data. There is no benchmark value for the index, but instead its calculated value is compared with constrained models whereby the lowest ECVI value is considered to be the best fit (Arbuckle, 2009; Byrne, 2009)

Parsimonious indices of model fit evaluate the estimated model for simplicity. RMSEA, categorized as an absolute fit measure is also considered one of parsimony as it “is expressed per degree of freedom, thus making it sensitive to the number of estimated parameters in the model (i.e., the complexity of the model)” (Byrne, 2009, p. 80). Byrne further postulated that the RMSEA has “been recognized as one of the most informative criteria in covariance structure modeling” (p. 80).

A representative sample of fit indices reported in this study are presented in Table 2 together with their benchmarked values for a good fit as described in the literature. The indices and their criteria were chosen based on the model complexity, data, and sample size. All indices computed as part of the estimation process were evaluated and none were noted that would contradict the description of model fit of these reported indices.

Table 2

Selected Goodness-of-Fit Tests and Indices

Category	Index	Suggested criteria for good fit
Absolute	χ^2	p > 0.01
	GFI	≥ 0.94
	χ^2/df	≤ 2/1
Incremental	CFI	≥ 0.95
	NFI	≥ 0.89
	ECVI	Lower than independence and saturated models
Parsimonious	RMSEA	≤ 0.06

Model respecification. Consistent with the Schumaker and Lomax (1996) application of SEM process, the next step is respecification. “A given model is said to be properly specified when the true model, the one that generated the data, is deemed consistent with the model tested” (p.105). Jöreskog (1993) concurred with respecification, despite seemingly incongruence with the concept of confirmatory factor analysis, indicating that “model generating [situations arise such that] if the initial model does not fit the given data, the model should be modified and tested again, using the same data” (p. 295).

The respecification process used for this study was adapted from the one suggested by Byrne (2009) which included evaluation of modification indices and standardized regression paths for significant critical ratio values for paths related to the exongenous variables, including their observed items, error terms, and disturbance terms.

Additionally, residual covariance matrices were reviewed for indications of improper fit evidenced by negative values or values greater than 2.58 (Byrne, 2009).

Summary

Chapter three described the methodology used for this study. Data for the research were collected by web-based survey which measured the eight variables in the study. The sample of 285 online instructors from institutions in the North Carolina community college system were the survey respondents representing a sampling frame constructed from 10 purposefully chosen institutions. The survey was constructed from previously utilized items and from researcher-generated items. The survey was expert reviewed, pilot tested, and statistically validated. Structural equation modeling was employed for data analysis, the results of which are presented in chapter four.

CHAPTER FOUR: FINDINGS

The purpose of the this study was to determine how instructor attitudes affect the class content use of emerging technologies known as Web2.0 applications. Additionally, the relationships between those attitudes and the impact of external administrative and knowledge-based constructs were evaluated. This was accomplished through the identification, comparison, and analysis of the current uses, understanding, and attitudes of North Carolina community college online instructors.

Specifically, the study sought answers to the following research questions:

1. To what extent do instructor attitudes toward learner self-direction, instructional technology, and innovation and change predict interest in the use of Web2.0 applications as formal class content?
2. To what extent does an interest in the use of Web2.0 applications predict an intention to use them as formal class content?
3. To what extent does intention to use Web2.0 applications as formal class content predict their actual use?
4. What is the impact of instructor level of knowledge of Web2.0 applications on instructor interest in these applications?
5. What is the impact of contextual conditions such as administrative mandates and personal constraints on instructor intent to use Web2.0 applications?

Structural equation modeling (SEM) was used to analyze data collected by survey from 285 online instructors employed by 10 purposefully selected community colleges from within the North Carolina community college system. The research model depicting the eight latent variables is shown in Figure 4:

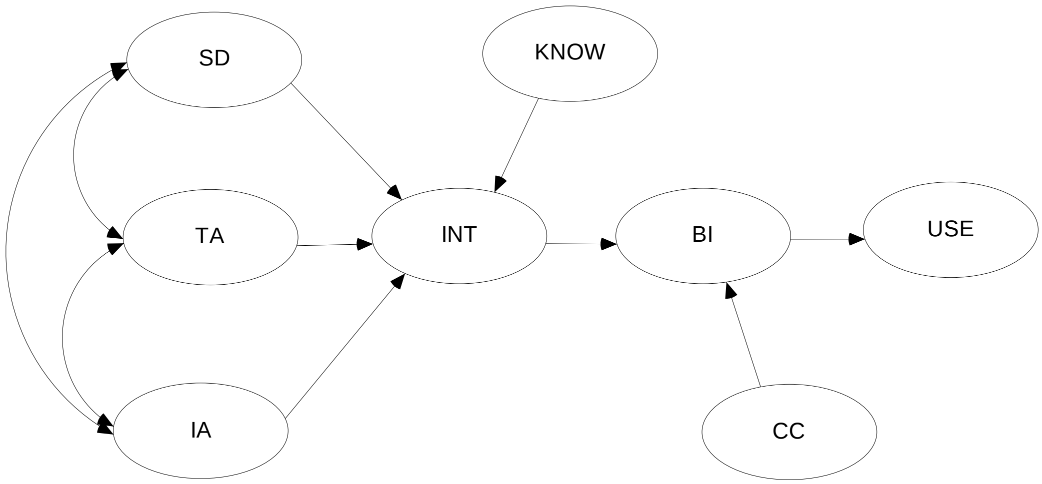


Figure 4. Research model for SEM analysis

Each latent construct depicted in the research model was measured by items on the survey. The items associated with each are presented in Appendix A.

Hypotheses to be tested were generated from the theoretical model as follows:

H1. Positive instructor attitudes toward learner self-direction (SD) positively affect instructor interest in Web2.0 applications (INT).

H2. Positive instructor attitudes toward the acceptance of new technologies (TA) positively affect instructor interest in Web2.0 applications (INT).

H3. Positive instructor attitudes toward innovation and change (IA) positively affect instructor interest in Web2.0 applications (INT).

H4. Knowledge of Web2.0 applications (KNOW) will have a positive impact on instructor interest in Web2.0 applications (INT).

H5. Contextual constraints and pressures (CC) will impact instructor intention to use the applications in formal learning environments (BI).

H6. Higher levels of instructor interest in Web2.0 applications (INT) positively affect instructor intention to use those applications as learning tools (BI) in the that instructor's classes.

H7. Positive behavioral intention to use Web2.0 applications (BI) have a positive impact on use of those applications in the formal learning environment (USE).

Descriptive Statistics

Data were screened and prepared for analysis as described in chapter three. This first entailed the generation and review of the descriptive and reliability statistics from the data set. Descriptive statistics for the individual items are presented in Appendix A. Table 3, here, presents the descriptive and reliability statistics for the constructs in the model. These statistics were calculated based on the scales used in the survey as indicated in the table. As such, reported mean values are relative to the individual scale ranges which varied as described in chapter three. A review of these mean values indicates a relatively high average for the SD, TA, and IA variables, a more moderate average for KNOW, and decreasing relative means for INT, BI, CC, and USE. Alpha scores indicating reliability for each construct were all within acceptable ranges (.66 - .95) given the research hypotheses, although the alpha for USE was lower than the commonly accepted .70 (Garson, 2008). The skew and kurtosis levels did not raise concerns related to the normality of the underlying distributions other than the kurtosis level for the SD variable, which is addressed in the discussion of that measurement model later in this chapter.

Table 3

Descriptives and Reliability Statistics for Constructs

Variable	Scale	*M*	*SD*	*α*	Skew	Kurtosis
SD	1-7	5.83	0.90	0.79	-1.93	6.39
TA	1-7	5.30	0.87	0.95	-0.62	0.56
IA	1-7	5.42	1.19	0.93	-0.65	0.18
INT	0-5	2.72	1.86	0.81	-0.14	-1.39
KNOW	0-15	11.46	2.62	0.80	-0.36	-0.71
BI	0-5	1.16	1.46	0.74	1.11	0.21
CC	1-5	3.12	0.92	0.92	-0.28	0.21
USE	0-5	0.72	1.14	0.66	1.93	3.63

Inter-scale correlations between the constructs were evaluated. The inter-scale correlation matrix for the constructs is presented in Table 4. Larger inter-scale correlations between SD and TA (r = .40, p = 0.01) and TA and IA (r = .37, p = 0.01) were expected as depicted in the theoretical model. The lower correlation value between SD and IA (r = .20, p = 0.01) was an indication that the theorized correlation would not hold true for this set of data. Higher correlations between the exogenous variables (SD, TA, IA, KNOW, and CC) and their respective endogenous variables (INT, BI, and USE) were expected based on the theoretical model. Again, where such correlations were lower than expected was a preliminary indication that expected relationships might be insignificant. The correlations ranged from r = .03 to r = .47, showing only weak to moderate relationships among the scales. The absence of strong correlations provides tentative evidence that the constructs are unique and nonoverlapping.

Table 4

Inter-Scale Correlation Matrix – Constructs

	SD	TA	IA	INT	KNOW	BI	CC	USE
SD	—							
TA	0.40 **	—						
IA	0.20 **	0.37 **	—					
INT	0.10	0.20 **	0.22 **	—				
KNOW	0.12 *	0.15 **	0.32 **	0.34 **	—			
BI	0.11	0.19 **	0.30 **	0.47 **	0.28 **	—		
CC	0.16 **	0.09	0.03	0.03	0.08	0.14 *	—	
USE	0.05	0.16 **	0.30 **	0.17 **	0.44 **	0.22 **	0.12 *	—

** $p = 0.01$
* $p = 0.05$

Measurement Models

After initial descriptive analysis of the data, SEM construction, analysis, and evaluation was completed. As discussed in chapter three, SEM is applied to two separate models, the measurement model and the structural model. The measurement model, which is analyzed first, is comprised of all latent variables, their related disturbances, the survey items that measure the latent variables, and the measurement error terms related to the survey items. The full hypothesized measurement model is depicted in Appendix C.

The five-step process for SEM modeling of (1) model specification, (2) identification, (3) estimation, (4) testing for fit, and (5) respecification (Schumacker & Lomax, 1996, p. 63) was repeatedly applied to each construct. Utilizing AMOS, version

17.0, each latent variable was analyzed separately. The measurement model for each of these constructs was specified and confirmatory factor analysis (CFA) was utilized to test the identification, estimation, and fit of the latent constructs. Table 5 reflects the goodness-of-fit measures and indices selected as described in chapter three.

Table 5

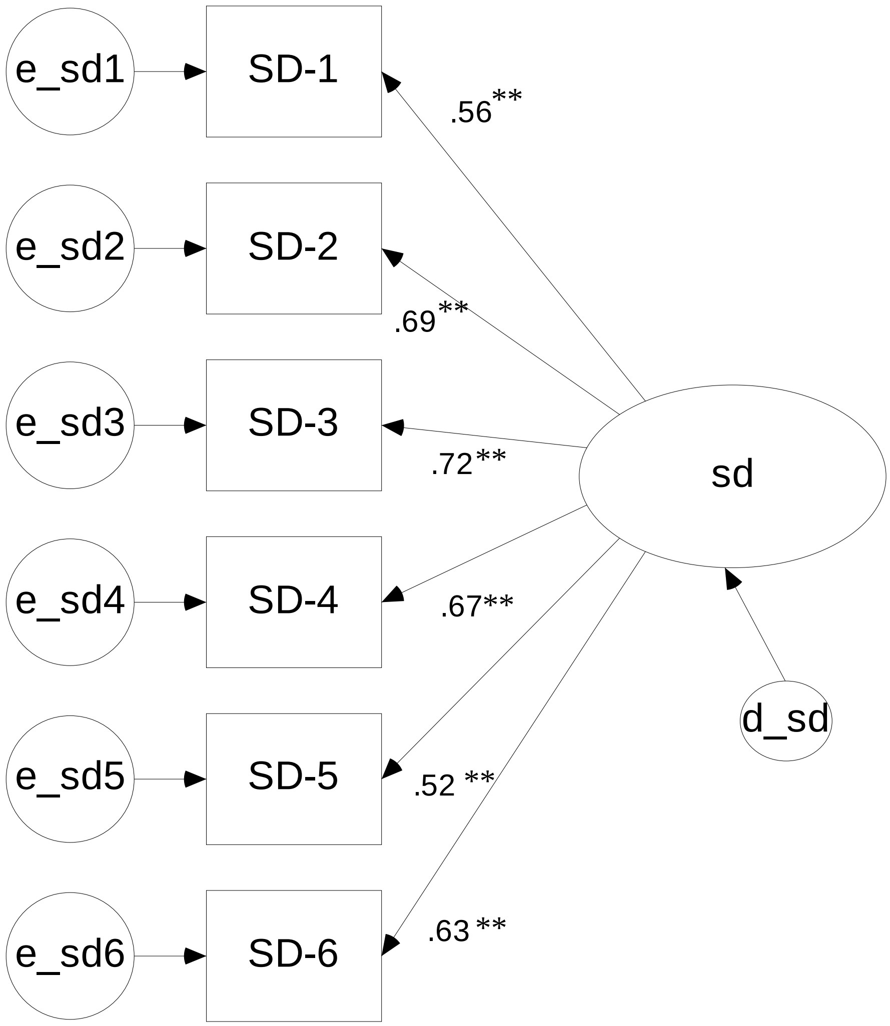
Selected Goodness-of-Fit Indices and Criteria

Category	Index	Criterion for good fit
Absolute	χ^2	$p > 0.01$
	GFI	≥ 0.94
	χ^2/df	$\leq 2/1$
Incremental	CFI	≥ 0.95
	NFI	≥ 0.89
	ECVI	Lower than independence and saturated models
Parsimonious	RMSEA	≤ 0.06

Based on analysis of these goodness-of-fit measures and indices and other indications derived from the AMOS output, each component was then respecified, if necessary, in accordance with the underlying theory. Once optimal defensible fit was estimated, that component was moved to the structural model and the process repeated for the next component. This resulted in a structural model fitted to the data.

SD Measurement Model

The SD component of the measurement model with standardized factor loading is presented in Figure 5. Unstandardized factor loadings and coefficients of determination are presented in Table 6. Unstandardized coefficients are similar to regression weights, expressed in their original scale which, for SD was a Likert-type scale with values 1-7 and are the basis for the determination of significance of the relationship. Standardized coefficients are interpreted in standard deviation units. A review of these standardized factor loadings indicated acceptable relationship strengths for all items, but evaluation of fit indices indicate a poor fit of the hypothesized model to the data (χ^2 (9) = 90.56 $p <$ 0.0001. GFI = 0.90, χ^2/df = 10.06, NFI = 0.83, RMSEA = 0.18, ECVI = 0.40 > saturated model = 0.148).



**p<.001. Parameter values are standardized regression estimates

Figure 5. Hypothesized SD measurement model

Table 6

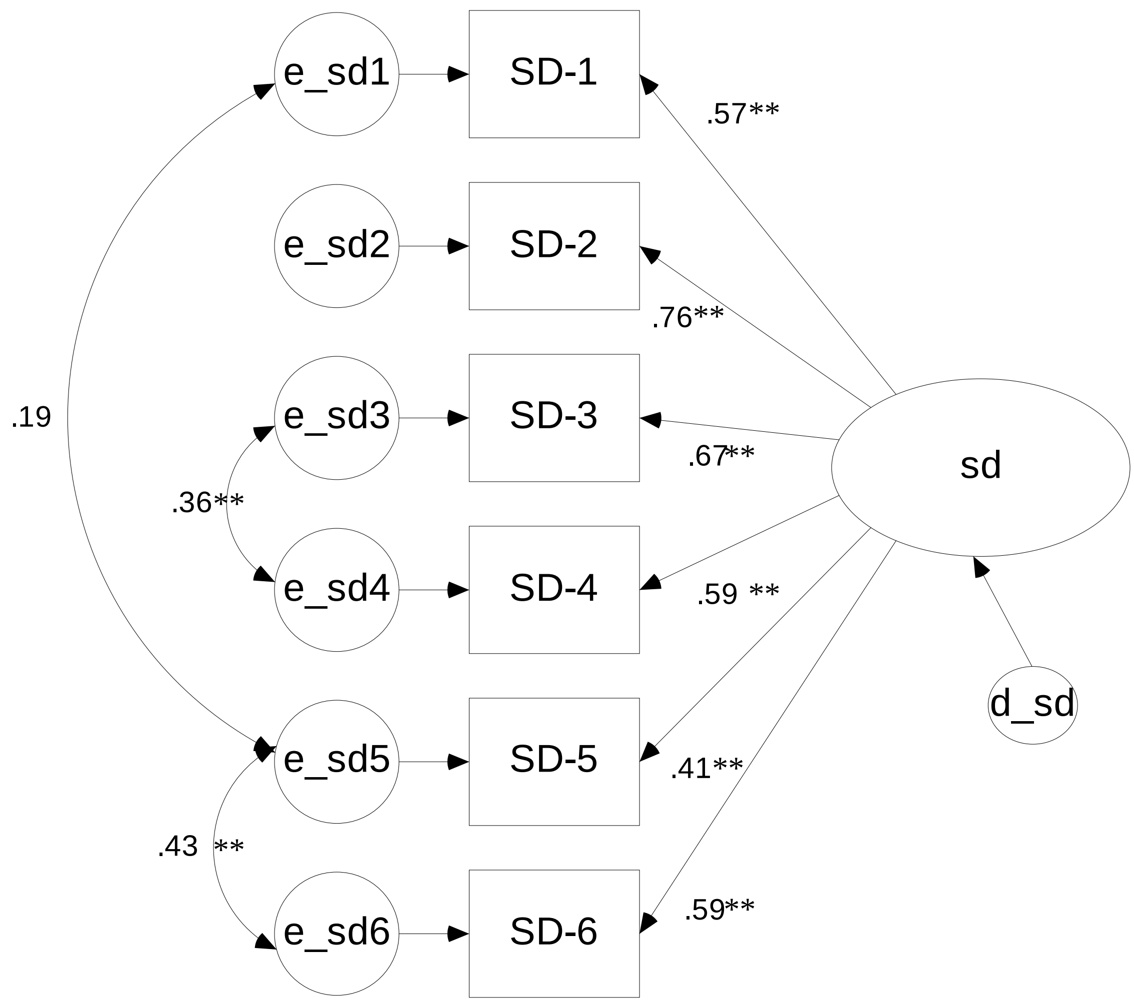
Unstandardized Factor Loading and Coefficients of Determination for Hypothesized SD Measurement Model

Item	Unstandardized factor loading	*SE*	R^2
SD1	0.871	0.107	0.319
SD2	1.000 [a]	—	0.476
SD3	0.850	0.086	0.519
SD4	0.653	0.069	0.451
SD5	0.954	0.126	0.271
SD6	1.011	0.112	0.403

[a] Regression constrained to a value of 1 to initialize factor loading scale. Standard error was not estimated.

Review of the estimated regression weights revealed no insignificant factor loadings. One significant residual relationship was noted and modification indices indicated that covariances between the error terms associated with SD3 and SD4, between SD5 and SD6, and between SD1 and SD5 would result in a significantly better fit. SD3 and SD4 both deal with course structure and student self-direction. SD5 and SD6 both deal with learning objectives and student self-direction. SD1 and SD5 both deal with instructor beliefs. Given these similarities, it is feasible that respondents would have similar reasons, other than their propensity for encouraging student self-direction, for their responses. As such, the respecified measurement model for SD includes these three covariances. Once this respecification was made, there were no further significant residual relationships noted and the indices indicated acceptable fit (χ^2 (6) = 10.21, *p* = 0.116. GFI = 099, $\chi 2$/df = 1.701, CFI = 0.99 , NFI = 0.98, RMSEA = 0.05, ECVI = 0.142

< all). The respecified SD measurement model is depicted in Figure 6 with standardized factor loadings and unstandardized factor loading and Coefficients of Determination are presented in Table 7.



**p<.001. Parameter values are standardized regression estimates

Figure 6. Final SD measurement model

Table 7

Unstandardized Factor Loading and Coefficients of Determinations for Final SD Measurement Model

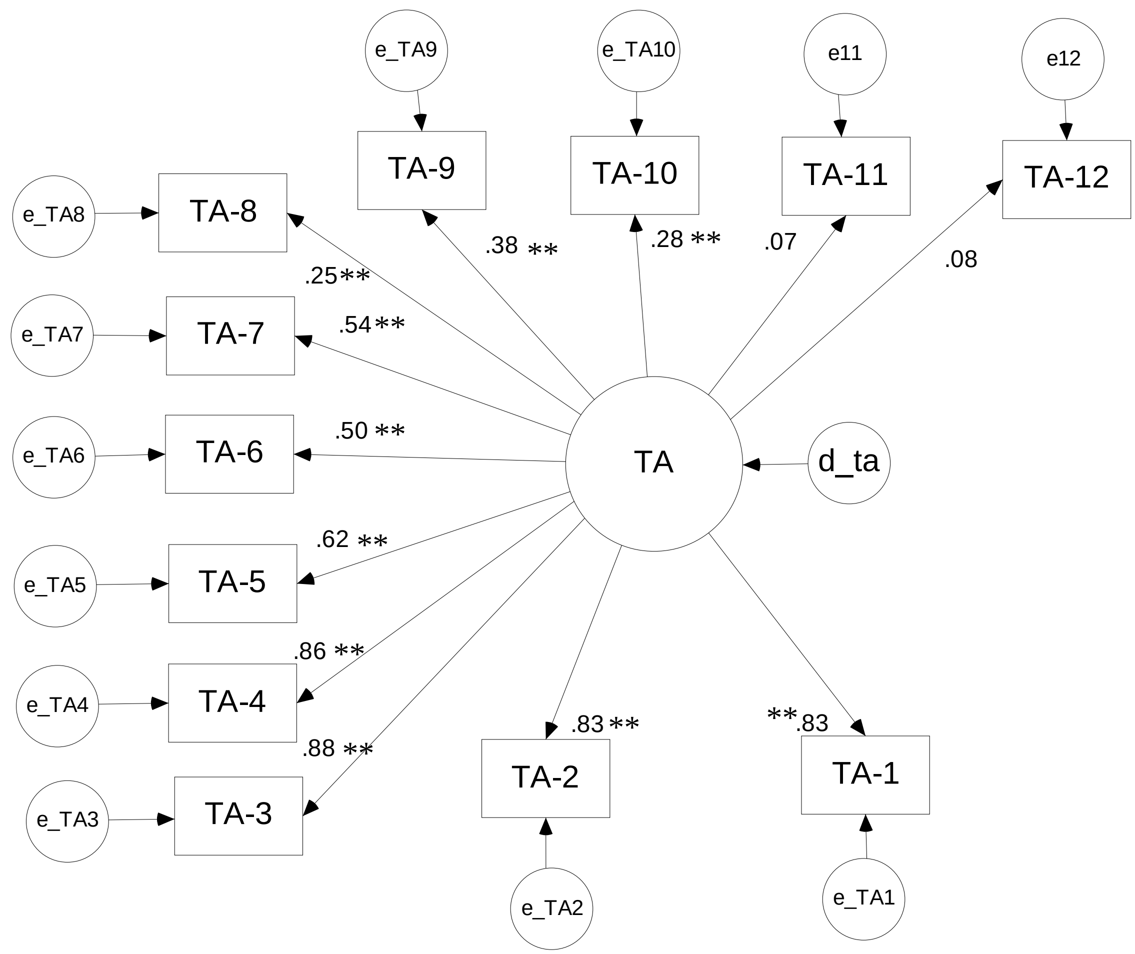
Item	Unstandardized factor loading	*SE*	R^2
SD1	0.791	0.100	.321
SD2	1.000[a]	—	.582
SD3	0.712	0.082	.445
SD4	0.518	0.066	.347
SD5	0.685	0.118	.172
SD6	0.854	0.104	.351

[a] Regression constrained to a value of 1 to initialize factor loading scale. Standard error was not estimated.

Although the factor loading values decreased between the initial and final models all loadings remained statistically significant. There was not a significant increase in the R^2 for any of the identifiers which would have helped to indicate a better fit. However, the standard error values for all identifiers decreased which adds assurance to the reliability of the parameter estimates (Boomsma, 2000) and the number of degrees of freedom were reduced, a further indication of improved parsimony. Considering all of this evidence together with a significant $\chi^2$and improved goodness-of-fit measures all greater than the suggested criteria values, the respecified SD measurement model was accepted as the best theoretically defensible alternative and it was moved to the structural model.

TA Measurement Model

The hypothesized TA component in the measurement model with estimated standardized factor loadings is presented in *Figure* 7. *Hypothesized TA measurement model* and unstandardized loadings, standard error, and R^2 are in Table 8. Goodness-of-fit analysis revealed a poor model fit to this set of data ($\chi^2(56) = 900.08$, $p < .0001$. GFI = 0.66, χ^2/df = 16.67, CFI = 0.57, NFI = 0.56, RMSEA = 0.24, ECVI = 3.36 > saturated = 0.55).



**p<.001. Parameter values are standardized regression estimates

Figure 7. Hypothesized TA measurement model

Table 8

Unstandardized Factor Loadings and Coefficients of Determinations for Hypothesized TA Measurement Model

Item	Unstandardized factor loading	*SE*	R^2
TA1	1.000 [a]	—	0.683
TA2	1.124	0.067	0.697
TA3	1.125	0.062	0.778
TA4	0.842	0.048	0.742
TA5	0.816	0.072	0.390
TA6	0.737	0.085	0.249
TA7	0.747	0.079	0.287
TA8	0.344	0.082	0.064
TA9	0.525	0.082	0.144
TA10	0.477	0.104	0.077
TA11	0.4146	0.126	0.005
TA12	0.160	0.119	0.007

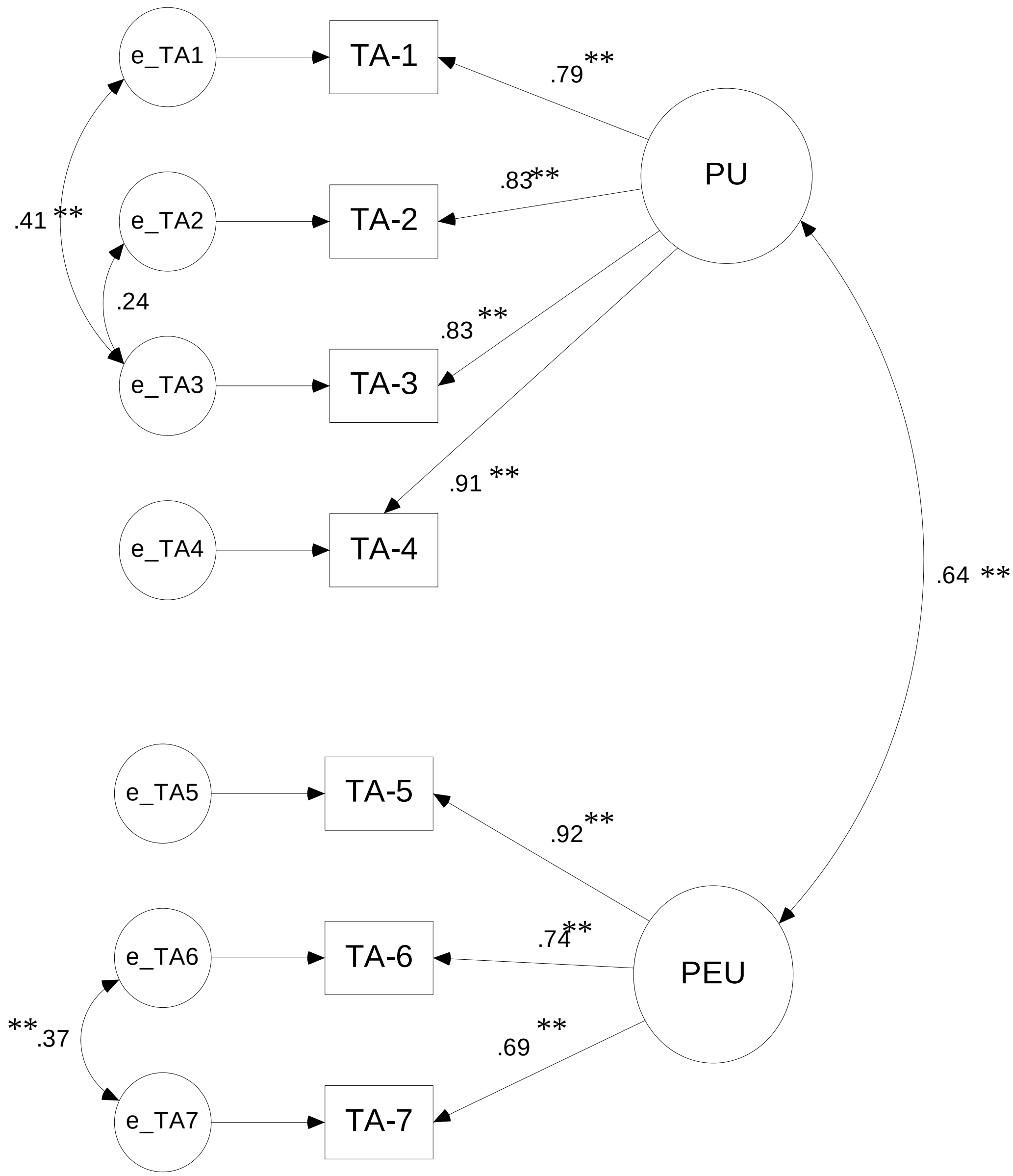
[a] Regression constrained to a value of 1 to initialize factor loading scale. Standard error was not estimated.

Review of the estimated regression weights revealed two insignificant factor loadings. Nine significant residual covariances were noted, there were negative correlations reported in the scalar estimates, and modification indices indicated that 12 different covariances in the observed item error terms might have a major impact on the model fit. Given the magnitude of these issues, it was apparent that the originally conceived model for measuring TA was not appropriate for this set of data. As such the survey items and their derivation were reexamined.

The survey items used to measure TA were adapted from the TAM as discussed in chapter three. The original TAM consisted of two endogenous factors, perceived ease of use (PEU) and perceived usefulness (PU), each of which predicted behavioral intent, which in turn predicted the actual change in behavior. Additionally, PEU affected PU (Venkatesh & Brown, 2001; Venkatesh & Davis, 2000). TAMII, an extension of the original TAM added Social Norm and Voluntariness as predictors of behavioral intent to use technology. As such, items for these two factors were included in the survey for this study. Retrospection and model analysis reveal that these items duplicate those used to measure CC and its impact on intent to use Web2.0 technologies and, as a result, do not measure TA as it is used in this model. Instead, TA is comprised of the two factors, PEU and PU where “PU and PEU are two fundamental belief constructs in the TAM that constitute a significant influence on attitude towards computer use” (Teo, 2009, p. 304). Accordingly, the measurement component originally conceptualized as TA was respecified as two exogenous, covarying latent variables loading from the survey items as created from the TAM. Specifically, items TA-1 through TA-4 loaded to PU and TA-5 through TA-7 loaded to PEU.

Once the two latent variables were identified, examination of residual co-variances indicated no further significant relationships. Suggested modification indices indicated error term correlations between e_TA1 and e_TA3, between e_TA2 and e_TA3. The survey items related to these three error terms measure attitude related instructional improvements brought about by instructional technology use where TA1 is performance, TA2 is productivity, and TA3 is effectiveness. It is reasonable that attitudes about effectiveness of instruction would be related to attitudes about the other two concepts in the same way that outcomes theoretically relate to instruction. As such covariances in these error terms were added to the model. Error term covariance between e_TA6 and e_TA7 was also suggested by the modification indices produced by AMOS. These two survey items both ask about the ease of using instructional technology, each using the word easy. It is feasible that the same unknown factor would be involved in the responses to both questions and the covariance was thereby added to the measurement model.

After the described respecification was made, there were no further significant residual relationships noted and the indices indicated acceptable fit, $\chi^2(10) = 22.81$ p = 0.011. GFI = 0.98, χ^2/df = 2.3, CFI = 0.99, NFI = 0.98, RMSEA = 0.67, ECVI = 0.207 > saturated = 0.197. The respecified model with standardized estimated factor loading is presented in Figure 8 and the unstandardized loadings, standard error, and R^2 are in Table 9.



***p*<.001. Parameter values are standardized regression estimates

Figure 8. Final TA measurement model

Table 9

Unstandardized Factor Loadings and Coefficients of Determination for Respecified TA Measurement Model

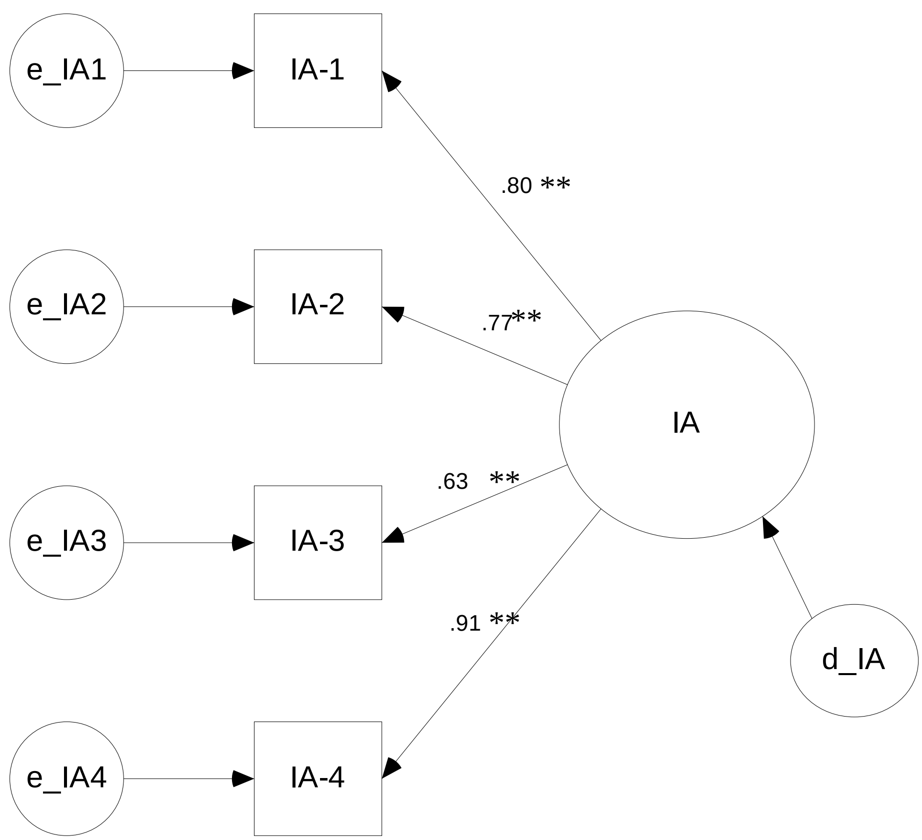
Factor and item	Unstandardized factor loading	*SE*	R^2
Perceived Usefulness (PU)			
TA1	1.000 [a]	—	0.617
TA2	1.174	0.079	0.688
TA3	1.10	0.058	0.683
TA4	0.933	0.059	0.823
Perceived Ease of Use (PEU)			
TA5	1.000 [a]	—	0.855
TA6	0.906	0.083	0.549
TA7	0.792	0.078	0.472

[a] Regression constrained to a value of 1 to initialize factor loading scale. Standard error was not estimated.

Major increases in R^2 for TA4, TA5, TA6, and TA7 provide additional evidence of improved model fit. The parsimony of the respecified TA component was slightly reduced, as indicated by the increase in degrees of freedom and the RMSEA value. This would be expected when moving from a single factor to two-factor solution. The RMSEA for the respecified model still indicates an acceptable fit (.05 to .07: Ho, 2006) although its value (0.67) exceeds that suggested by Hu and Bentler (1999) as indication of good fit. All of this, together with the almost-significant χ^2, the GFI, CFI and NFI all above suggested criteria, and the greatly improved ECVI indicated the model fit the data. As such, the two-factor component was moved to the structural model.

IA Measurement Model

The hypothesized IA component in the measurement model with standardized loading values is presented in Figure 9 and the unstandardized loadings, standard error, and R^2 are in Table 10 ($\chi^2(2) = 1.21$, $p = 0.546$. GFI = 1.00, χ^2/df = 0.61, CFI = 1.00, NFI = 1.00, RMSEA = 0.00, ECVI < all).



**p<.001. Parameter values are standardized regression estimates

Figure 9. Hypothesized and final IA measurement model

A review of the AMOS output for this model indicated there were no significant residuals or modification indices. The goodness-of-fit indices were all well above suggested criteria. R^2 values noted in Table 10 help support good fit conclusions. Factor loading is satisfactory as reflected in Figure 9 and χ^2 is insignificant (p = 0.516). This component of the model was moved to the structural model without respecification.

Table 10

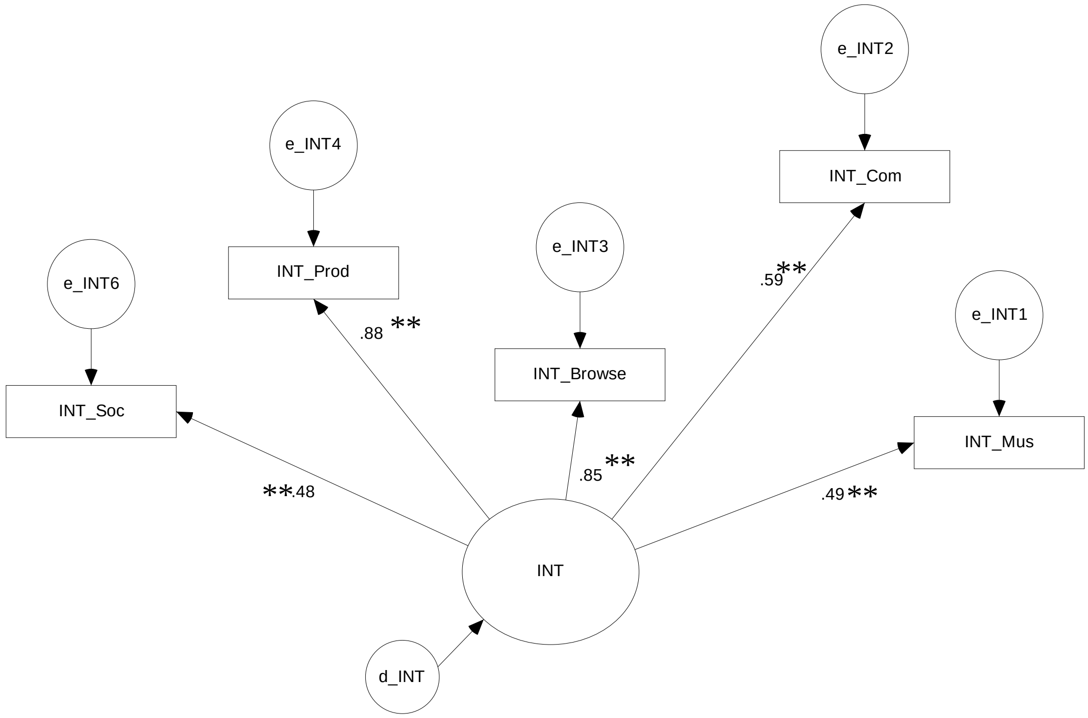
Factor Loadings and Coefficients of Determination for Hypothesized and Final IA Measurement Model

Item	Unstandardized factor loading	*SE*	R^2
IA1	1.000[a]	—	0.642
IA2	1.353	0.098	0.586
IA3	1.177	0.108	0.397
IA4	1.369	0.086	0.828

[a] Regression constrained to a value of 1 to initialize factor loading scale. Standard error was not estimated.

INT Measurement Model

The hypothesized measurement model for the INT component with standardized loadings is presented in Figure 10 ($\chi^2(5) = 75.35$, p = < .0001. GFI = 0.90, χ^2/df = 15.07, CFI = 0.87, NFI = 0.86, RMSEA = 0.22, ECVI = 0.336 > saturated = 0.106). The unstandardized loadings, standard error, and R^2 are in Table 11.



**p<.001. Parameter values are standardized regression estimates

Figure 10. *Hypothesized INT measurement model*

The INT construct was measured based on instructor interest in five categories of Web2.0 applications. These five categories were audio and music (_Mus), communication (_Com), browser (_Browse), productivity (_Prod), and social networking and publishing (_Soc). The INT items and identifiers reflect these categories in their variable names.

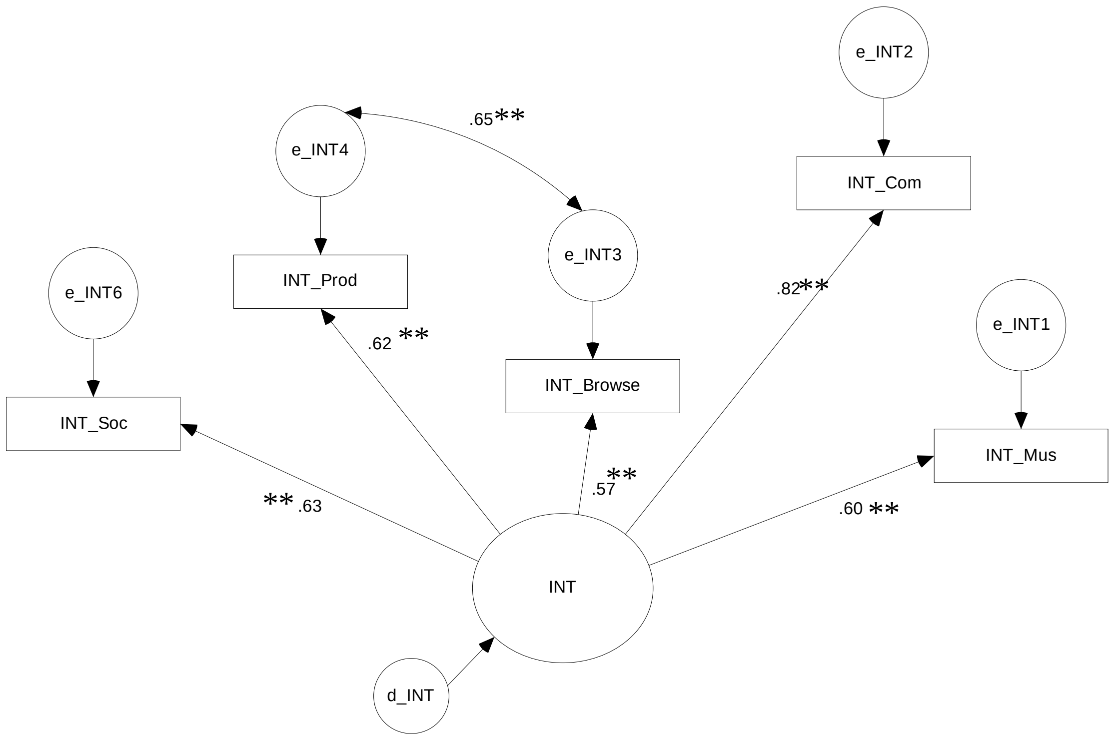
Table 11

Factor Loadings and Coefficients of Determination for Hypothesized INT Measurement Model

Item	Unstandardized factor loading	*SE*	R^2
INT_Mus	1.000[a]	—	0.237
INT_Com	1.213	0.174	0.350
INT_Browse	1.781	0.218	0.722
INT_Prod	1.843	0.225	0.777
INT_Soc	0.995	0.162	0.232

[a] Regression constrained to a value of 1 to initialize factor loading scale. Standard error was not estimated.

Review of the standardized covariance residual matrix revealed two residuals greater than 2.58, which is the criteria suggested by Byrne (2009) and discussed in chapter three. The modification indices indicated substantial covariance between the error terms related to the browsing category and those related to the productivity category. The browsing category represents Web2.0 applications described as browser helpers and were identified as RSS readers, blog aggregators, and specifically mentioned Google Reader. The productivity category is comprised of other helper tools such as Google Docs and Google Calendar. Given these similarities in definition it is feasible that the respondents had similar reasons for their answers other than their interest in the specific Web2.0 applications. As such, the error terms related to the observed items for browsing and productivity were allowed to covary. After this respecification, there were no residuals in excess of 2.58, all factor loadings and covariances were significant, and there were no other substantial modifications suggested. The resulting respecified INT measurement model ($\chi^2(4) = 6.154$, $p = 0.19$. GFI = 0.99, $\chi^2/df = 1.54$, CFI = 1.00, NFI = 0.99, RMSEA = 0.04, ECVI = 0.10 < all) is depicted with its standardized factor loadings in Figure 11.



**$p<.001$. Parameter values are standardized regression estimates

Figure 11. Final INT measurement model

Unstandardized loadings, coefficients of determination, and standard error for the respecified INT measurement model is presented in Table 12. Respecification resulted in lower standard error. R^2 values improved for three of the five factors. The Browse and Prod identifiers decreased, but their initial values were inflated because of the covariance in their error terms. All goodness-of-fit indices and measures drastically improved and all were above benchmarked suggested values after the respecification including an insignificant χ^2 (p = 0.19). As such, the INT respecified measurement model appeared to be a good defensible fit with the data and was moved to the structural model.

Table 12

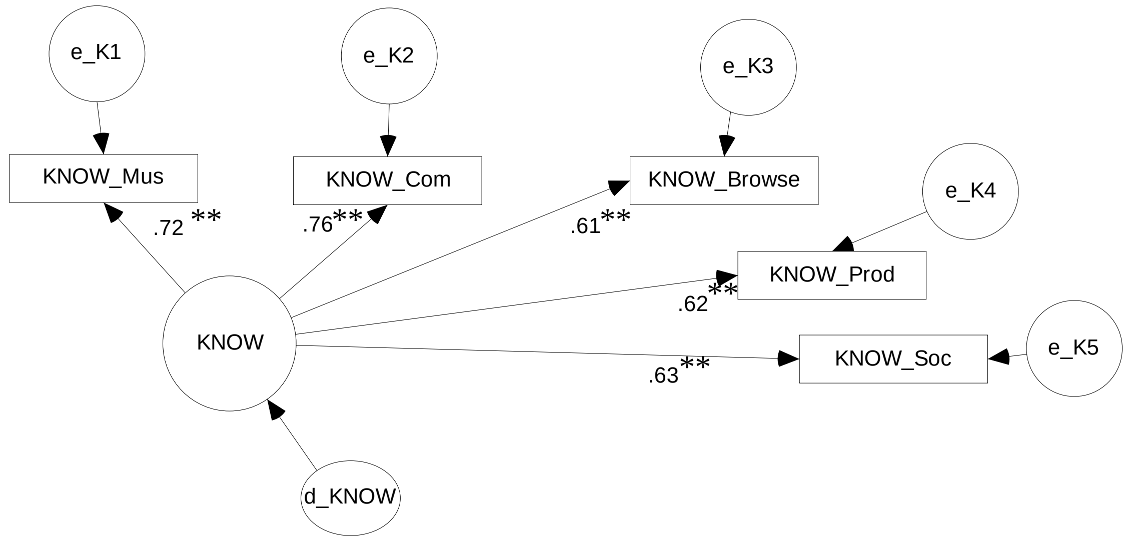
Factor Loadings and Coefficients of Determination for Final INT Measurement Model

Item	Unstandardized factor loading	*SE*	R^2
INT_Mus	1.000[a]	—	0.356
INT_Com	1.371	0.160	0.671
INT_Browse	0.970	0.133	0.321
INT_Prod	10.55	0.136	0.382
INT_Soc	1.056	0.134	0.392

[a] Regression constrained to a value of 1 to initialize factor loading scale. Standard error was not estimated.

KNOW Measurement Model

The hypothesized measurement model for the KNOW component with standardized loadings is presented in Table 13 ($\chi^2(5)$ = 50.23, p = <.0001. GFI = 0.93, χ^2/df = 10.05, CFI = 0.90, NFI = 0.89, RMSEA = 0.18, ECVI = 0.247 > saturated = 0.106). The unstandardized loadings, standard error, and R^2 are in Table 13.



**p<.001. Parameter values are standardized regression estimates

Figure 12. *Hypothesized KNOW measurement model*

The KNOW construct was measured based on instructor interest in five categories of Web2.0 applications. These five categories were audio and music (_Mus), communication (_Com), browser (_Browse), productivity (_Prod), and social networking and publishing (_Soc). The identifiers and items for KNOW reflect these categories in their variable names.

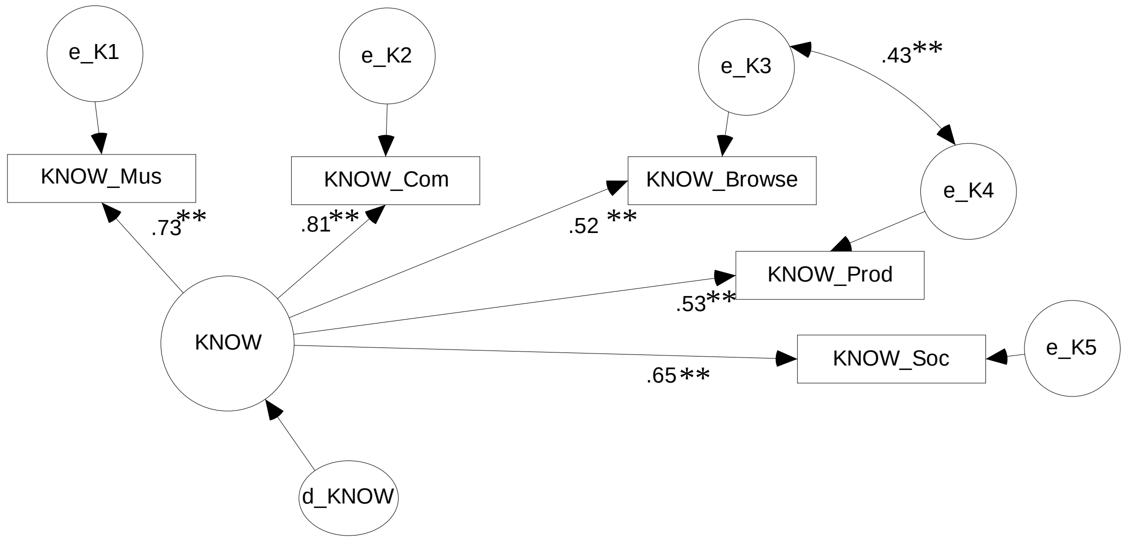
Table 13

Factor Loadings and Coefficients of Determination for Hypothesized KNOW Measurement Model

Item	Unstandardized factor loading	*SE*	R^2
KNOW_Mus	1.000[a]	—	0.523
KNOW_Com	0.958	0.090	0.582
KNOW_Browse	0.984	0.110	0.369
KNOW_Prod	0.983	0.109	0.381
KNOW_Soc	0.693	0.075	0.399

[a] Regression constrained to a value of 1 to initialize factor loading scale. Standard error was not estimated.

Review of the standardized covariance residual matrix revealed the Browse to Prod residual covariance was greater than 2.58. As with the INT measurement model, the modification indices indicated substantial covariance between the error terms related to the browsing category and those related to the productivity category. As such, the error terms related to the observed items for browsing and productivity were allowed to covary. After this respecification, there were no residuals in excess of 2.58, all factor loadings and the covariance were significant, and there were no other substantial modifications suggested. The resulting respecified INT measurement model ($\chi^2(4)$ = 0.580, p = 0.58. GFI = 1.00, χ^2/df = 0.72, CFI = 1.00, NFI = 0.99, RMSEA = 0.00 ECVI = 0.09 < all) is depicted with its standardized factor loadings in Figure 13. Unstandardized loadings, standard error, and R^2 are in Table 14.



**p<.001. Parameter values are standardized regression estimates

Figure 13. Final KNOW measurement model

Evaluation of the respecified KNOW measurement model mirrors that for INT. Improvements in all goodness-of-fit measurements and indices, R^2 and standard error, and the resulting significant χ^2 (p = 0.58) all indicate good model fit. The respecified KNOW measurement model was moved to the structural model.

Table 14

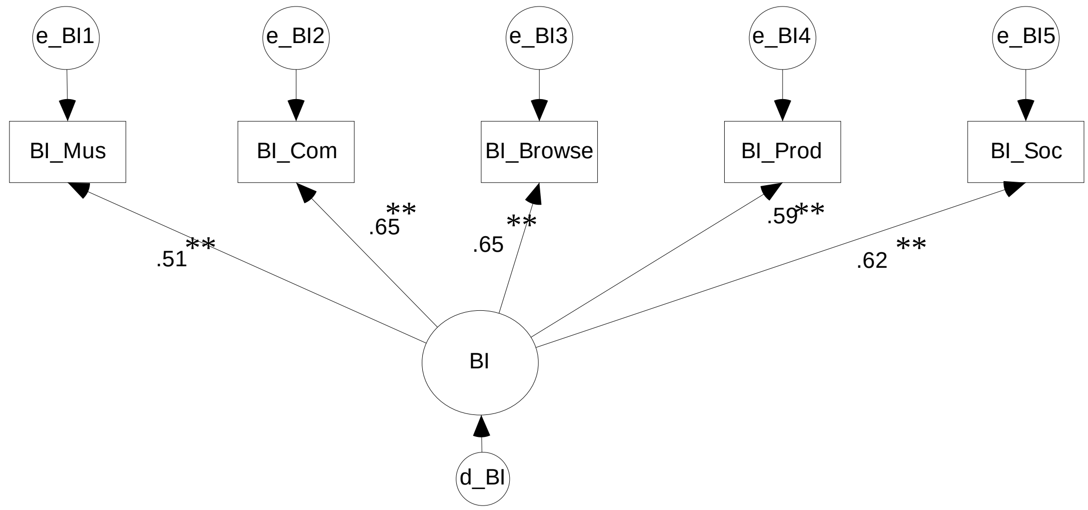
Factor Loadings and Coefficients of Determination for Final KNOW Measurement Model

Item	Unstandardized factor loading	*SE*	R^2
KNOW_Mus	1.000[a]	—	0.531
KNOW_Com	1.004	0.095	0.650
KNOW_Browse	0.837	0.109	0.271
KNOW_Prod	0.841	0.07	0.283
KNOW_Soc	0.709	0.075	0.425

[a] Regression constrained to a value of 1 to initialize factor loading scale. Standard error was not estimated.

BI Measurement Model

The hypothesized measurement model for the BI component with standardized loadings is presented in Figure 14 ($\chi^2(5) = 19.591$, p = 001. GFI = 0.93, χ^2/df = 3.918, CFI = 0.95, NFI = 0.93, RMSEA = 0 .10, ECVI = 0.139 > saturated = 0.103). The unstandardized loadings, standard error, and R^2 are in Table 15.



**$p<.001$. Parameter values are standardized regression estimates

Figure 14. Hypothesized BI measurement model

The BI construct was measured based on instructor interest in five categories of Web2.0 applications. These five categories were audio and music (_Mus), communication (_Com), browser (_Browse), productivity (_Prod), and social networking and publishing (_Soc). The identifiers and items for BI reflect these categories in their variable names.

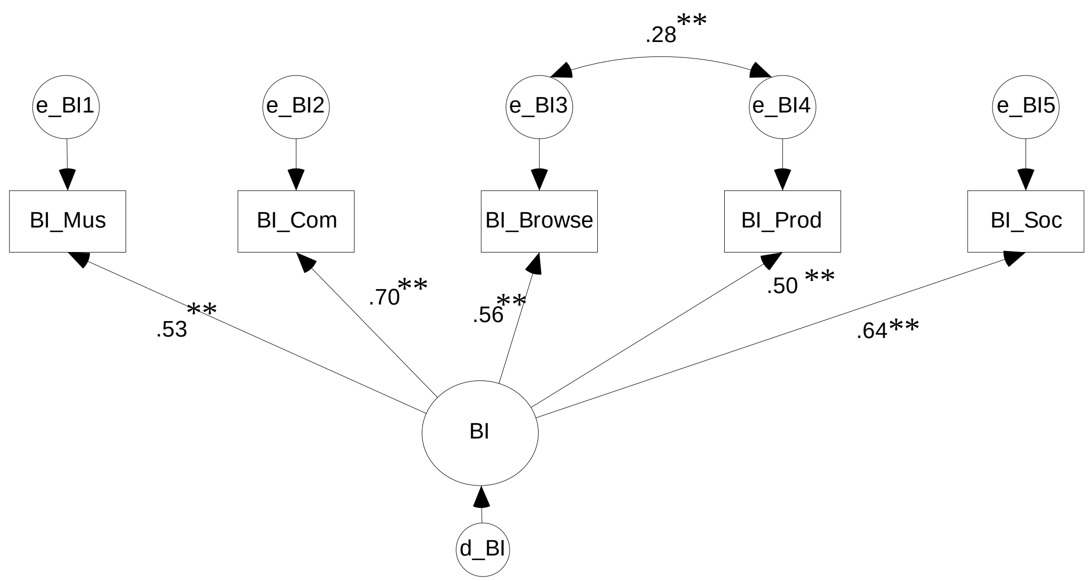
Table 15

Factor Loadings and Coefficients of Determination for Hypothesized BI Measurement Model

Item	Unstandardized factor loading	*SE*	R^2
BI_Mus	1.000[a]	—	0.259
BI_Com	1.268	0.191	0.417
BI_Browse	1.059	0.159	0.423
BI_Prod	0.947	0.148	0.349
BI_Soc	1.092	0.167	0.387

[a] Regression constrained to a value of 1 to initialize factor loading scale. Standard error was not estimated.

Review of the standardized covariance residual matrix revealed the BI_Browse to BI_Prod residual covariance was greater than 2.58, and the modification indices indicated substantial covariance between the error terms related to the browsing category and those related to the productivity category just as with the INT and KNOW models. That this occurred with all three of these constructs adds credence to the feasibility of allowing these error terms to covary. After this respecification, there were no residuals in excess of 2.58, all factor loadings and the covariance were significant, and there were no other substantial modifications suggested. The resulting respecified INT measurement model ($\chi^2(4) = 4.51$, $p = 0.34$. GFI = 0.99, $\chi^2/\mathrm{df} = 1.13$, CFI = 1.00, NFI = 0.99, RMSEA = 0.021, ECVI = 0.93 < all) is depicted with its standardized factor loadings in Figure 15. Unstandardized loadings, standard error, and R^2 are in Table 16.



**p<.001. Parameter values are standardized regression estimates

Figure 15. Final BI measurement model

Table 16

Factor Loadings and Coefficients of Determination for Final BI Measurement Model

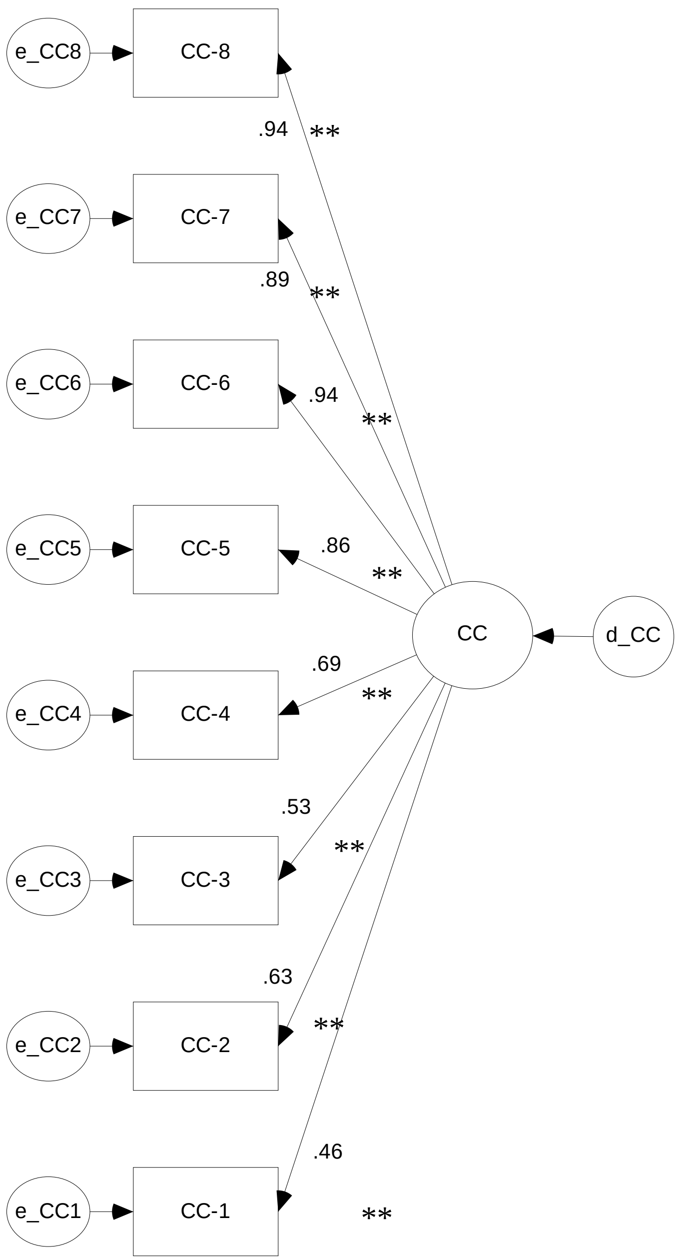
Item	Unstandardized factor loading	*SE*	R^2
BI_Mus	1.000[a]	—	0.279
BI_Com	1.331	0.196	0.494
BI_Browse	0.881	0.143	0.315
BI_Prod	0.765	0.135	0.246
BI_Soc	1.089	0.164	0.414

[a] Regression constrained to a value of 1 to initialize factor loading scale. Standard error was not estimated.

CC Measurement Model

The hypothesized measurement model for the CC component with standardized loadings is presented in Figure 16 and the unstandardized loadings, standard error, and R^2

are in Table 17. Goodness-of-fit indices and measures depict a poorly fitted model ($\chi^2(20) = 264.24$ $p < .001$. GFI = 0.78, χ^2/df = 13.21, CFI = 0.87, NFI = 0.86, RMSEA = 0.21, ECVI = 1.04 < saturated = 0.254).



**p<.001. Parameter values are standardized regression estimates

Figure 16. Hypothesized CC measurement model

Table 17

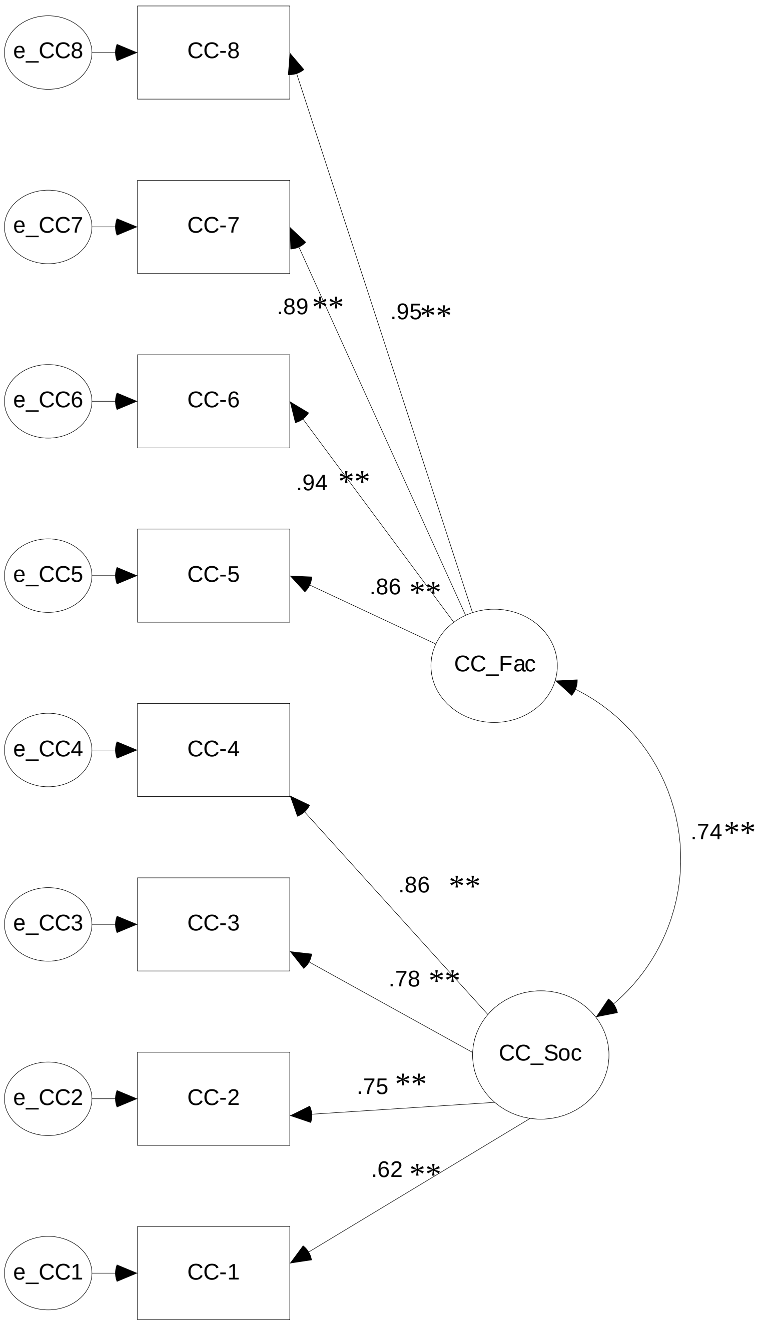
Factor Loadings and Coefficients of Determination for Hypothesized CC Measurement Model

Item	Unstandardized factor loading	*SE*	R^2
CC1	1.000[a]	—	0.228
CC2	1.427	0.190	0.411
CC3	1.144	0.165	0.303
CC4	1.499	0.191	0.493
CC5	2.060	0.241	0.755
CC6	2.384	0.271	0.879
CC7	2.163	0.250	0.801
CC8	2.416	0.274	0.882

[a] Regression constrained to a value of 1 to initialize factor loading scale. Standard error was not estimated.

Review of the estimated regression weights revealed no insignificant factor loadings and no major items were listed as possible impactful changes on the modification indices. However, the standardized residual covariance matrix revealed numerous negative relationships and six residual covariances in excess of 2.58. Additionally, factor loading R^2 values indicated the possibility of two factors rather than a single CC factor. As with the TA variable, the survey items for CC were re-examined.

The eight items used to measure CC were derived items used by Thompson, Higgins, and Howell (1991) to measure facilitating conditions and social conditions that lead to the use of personal computers in the workplace. That model identified, using exploratory factor analysis, the two sets of conditions as separate factors, social and technical support with good data fit. As such, the measurement model for this study was respecified from a single factor representing contextual conditions, to a two-factor solution, notated as CCSoc and CCFac. Consistent with the survey on which the CC items was based, CCSoc was measured by items CC1-CC4 and CCFac was measured by items CC5-CC8. The two factors were allowed to covary, again in a manner consistent with the measurement analysis in the Thompson, Higgins, and Howell (1991) study. Following respecification, no insignificant regression paths or suggested modifications from the AMOS-produced modification indices output were noted. There were several negative residual covariances remaining, but there were no residual variances with absolute values in excess of 2.58. The respecified two-factor measurement model that had been hypothesized as CC with standardized factor loading is presented in Figure 17 ($\chi^2(19) = 74.84$, $p <= .0001$. GFI = 0.94, $\chi 2$/df = 3.94, CFI = 0.97, NFI = 0.96, RMSEA = 0.10, ECVI = 0.38 > saturated = 0.25). Corresponding unstandardized loadings, standard error, and R^2 are in Table 18.



**p<.001. Parameter values are standardized regression estimates

Figure 17. Final CC measurement model

Table 18

Factor Loadings and Coefficients of Determination for Final CC Measurement Model

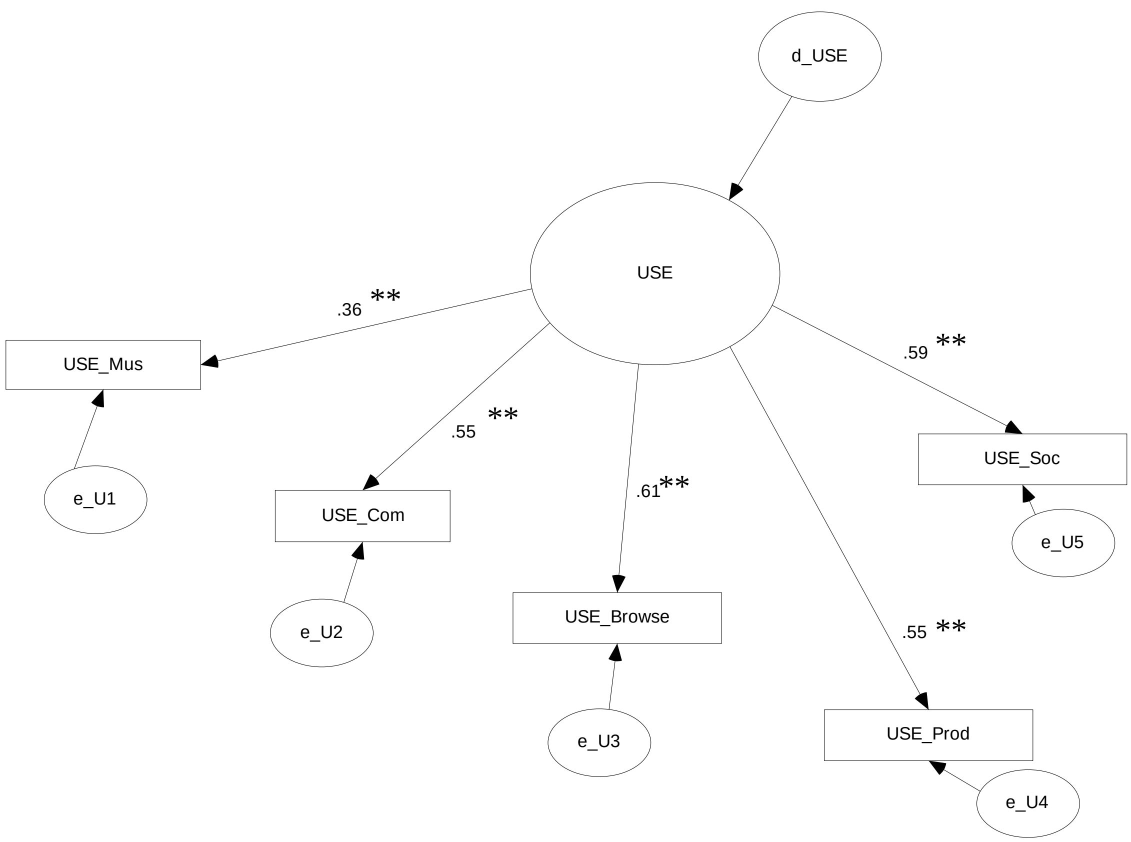
Factor and item	Unstandardized factor loading	*SE*	R^2
CC_Soc – Social Conditions			
CC1	1.000[a]	—	0.383
CC2	1.282	0.128	0.556
CC3	1.238	0.120	0.604
CC4	1.418	0.129	0.747
CC_Fac – Facilitating Conditions			
CC5	1.000[a]	—	0.737
CC6	1.179	0.050	0.891
CC7	1.060	0.050	0.797
CC8	1.195	0.050	0.903

Note. Dash indicates standard error was not estimated.
[a] Regression constrained to a value of 1 to initialize factor loading scale

The respecified model shows improved fit, but several of the indices are still a concern. Parsimony seems to have declined, given RMSEA values, though this was expected given the change to a two-factor solution. ECVI value exceeds the ECVI for the saturated model and $\chi 2$/df is higher than the suggested benchmark of 2.0. However, all of these values are substantially better than the hypothesized model. Too, R^2 values are much higher in general and there was a noted decrease in standard error for the identifiers in the respecified model. Also, the GFI, CFI, and NFI values all improved and are above the benchmarked suggested values. Based on this evaluation, it was determined to move the component into the combined measurement model as the best theoretically defensible fit to this set of data.

USE Measurement Model

This component of the measurement model with standardized factor loading is presented in Figure 18 ($\chi^2(5) = 6.66$, $p = 0.2$. GFI = 0.99, χ^2/df = 1.33, CFI = 0.99, NFI = 0.96, RMSEA = 0.34, ECVI = 0.094 < all). Corresponding unstandardized loadings, standard error, and R^2 are in Table 19.



**p<.001. Parameter values are standardized regression estimates

Figure 18. Hypothesized and final USE measurement model

The USE construct was measured based on instructor interest in five categories of Web2.0 applications. These five categories were audio and music (_Mus), communication (_Com), browser (_Browse), productivity (_Prod), and social networking and publishing (_Soc). The identifiers and items for USE reflect these categories in their variable names.

Table 19

Factor Loadings and Coefficients of Determination for Hypothesized USE Measurement Model

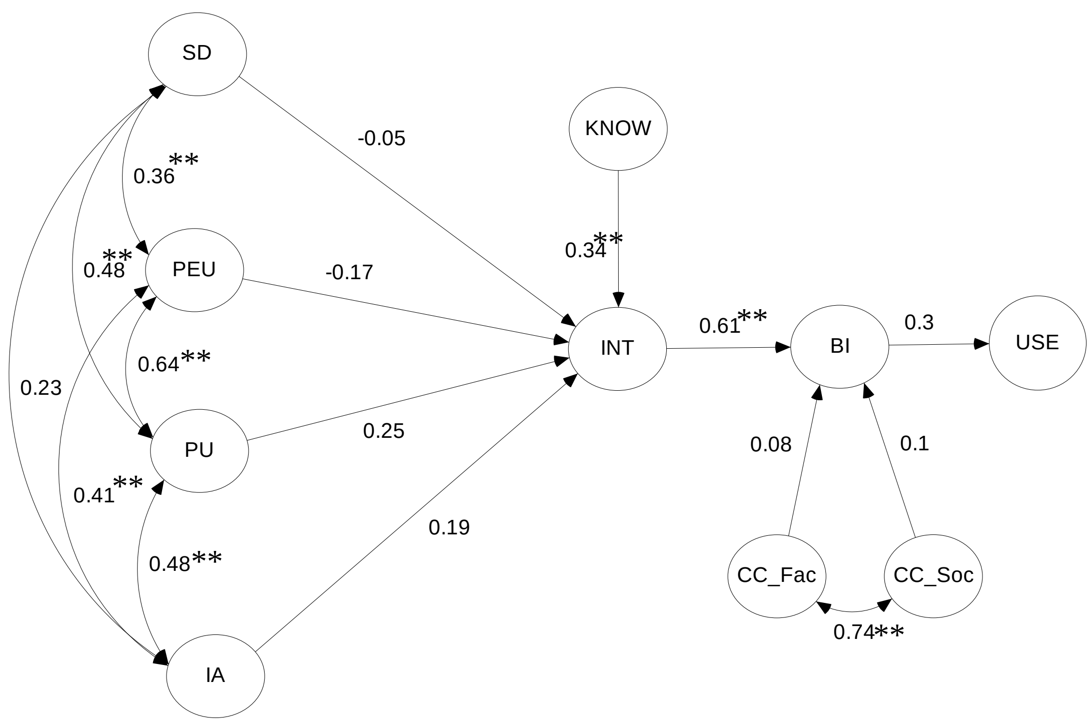
Item	Unstandardized factor loading	*SE*	R^2
USE_Mus	1.000[a]	—	0.133
USE_Com	1.635	0.363	0.306
USE_Browse	1.668	0.361	0.377
USE_Prod	1.183	0.263	0.303
USE_Soc	1.532	0.334	0.352

[a] Regression constrained to a value of 1 to initialize factor loading scale. Standard error was not estimated.

There were no significant residual covariances, no modification recommendations, all factor loadings were significant and goodness-of-fit indices and measurements all exceed suggested benchmarks. Accordingly, the USE measurement model was deemed to be a good fit for the data and was moved to the structural model. This concluded the analysis of the measurement model as all components had been fitted and moved to the structural model. The full model comprised of all components of the respecified measurement model and the hypothesized structural components (Model 1) is presented in Appendix D.

Structural Model

The initial hypothetical structural model, referred to as Model 1, was used for the path analysis between latent variables in a manner consistent with that suggested by Schumacker and Lomax (1996). Specifically, they noted "once latent variables are adequately defined (measured), and only then, does it make sense to examine the latent variable relationships in a structural model" (p. 73). The standardized latent variable relationships estimated by Model 1 ($\chi^2(920) = 1658.21$, $p <= .0001$. GFI = 0.80, $\chi 2/\mathrm{df} = 1.80$, CFI = 0.89, NFI = 0.78, RMSEA = 0.05, ECVI = 6.65 < all) are displayed in Figure 19. Unstandardized parameter values, standard error, and R^2 are in Table 20.



**p<.001. Parameter values are standardized regression estimates

Figure 19. Structural model 1

Table 20

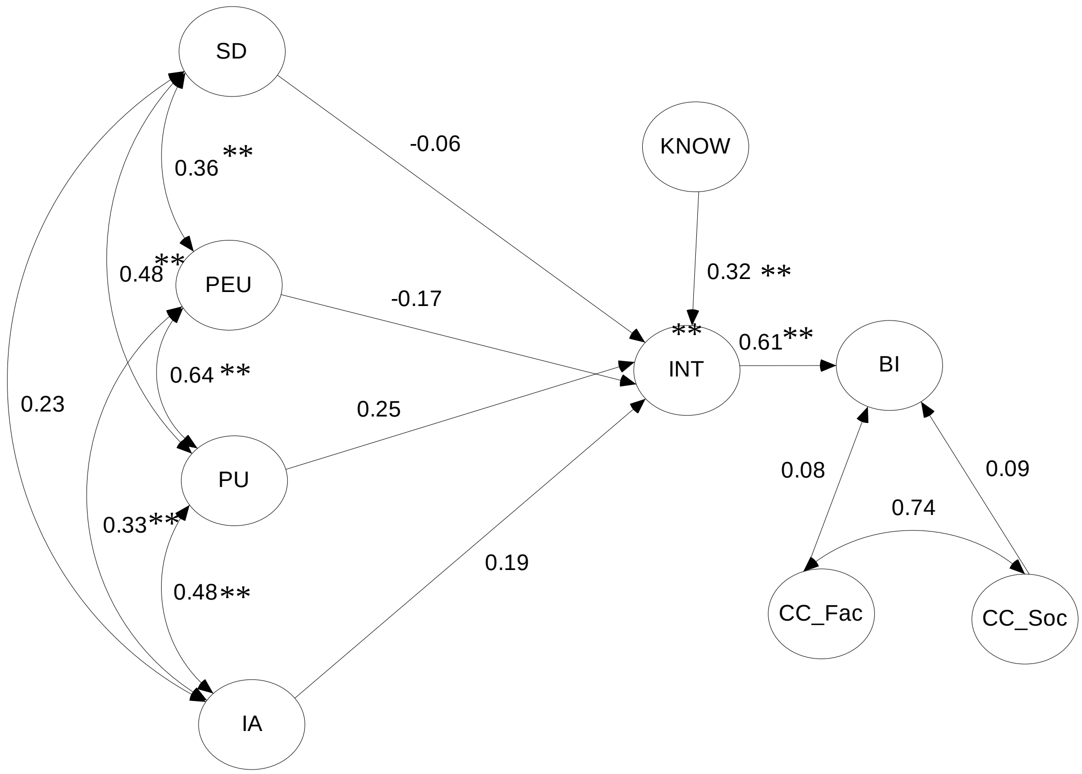
Path Parameters and Coefficients of Determination for Model 1

Variable and parameter	Unstandardized path parameter	*SE*	R^2
INT – Interest in Web 2.0 Applications			0.197
SD	-0.018	0.028	
PU	0.070	0.031	
PEU	-0.039	0.022	
IA	0.061	0.025	
KNOW	0.189	0.044	
BI – Intent to use Web 2.0 Applications			0.405
INT	0.518	0.094	
CC_Fac	0.018	0.025	
CC_Soc	0.038	0.040	
USE – Use Web 2.0 Applications			0.087
BI	0.249	0.077	

As suggested by Byrne (2009), the modification indices and regression estimation output from the AMOS analysis on this model were examined for possible post-hoc revisions to the structural model before the regression values were evaluated against the research hypotheses. The structural part of a SEM model is comprised of the predictive connections between the latent variables. With this in mind, only those suggested modifications related to predictor pathways were considered for the next iteration of the model.

There were no suggested modifications for the structural model. Several of the regression paths were not significant to the model, however, and were considered for deletion as part of the model trimming process included in SEM theory (Byrne, 2009; Schumacker & Lomax, 1996; Kline, 2004). The first path examined was that between BI and USE. A review of the data revealed low variability within the USE construct because of a low endorsement rate for using Web2.0 applications. Specifically, of the 285 survey responses, those indicating current use of Web2.0 ranged between 25 (9%) for the productivity category and 53 (19%) for the communication category. Additionally, there appears to be some dependency in the data between USE categories and between BI and USE. Examination of a count crosstabulation between the 38 respondents who indicate use of social applications, for example, show that they are 20 of the 53 using communication tools, 18 of the 43 who use browsing applications, 14 of 44 who endorsed music applications, and 12 of the 25 who use productivity programs. Further evidence of the data dependency is indicated by a similar review of the BI and USE respondents in each of the five categories. This analysis reveals that between 8 and 16 BI endorsements also answered yes to the USE of applications in the same category. For these reasons, the USE latent variable was dropped from the model.

This second respecified model (Model 2) is displayed with standardized parameter values in Figure 20. Comparison of these values with those of Model 1 show that the USE path deletion had no impact on the other standardized paths. Additionally, the respecification did not change the significance of any of the other paths.



**p<.001. Parameter values are standardized regression estimates

Figure 20. Structural model 2

Unstandardized parameter values, standard error, and R^2 are provided in Table 21. As with the standardized values, USE path deletion resulted in very minor changes to the unstandardized path parameters of the remaining relationships, and standard error reflected almost no change. Correlation coefficients for the endogenous variables both decreased a small, insubstantial amount.

Table 21

Path Parameters and Coefficients of Determination for Model 2

Variable and parameter	Unstandardized path parameter	*SE*	R^2
INT – Interest in Web 2.0 Applications			0.191
SD	-0.019	0.028	
PU	0.070	0.031	
PEU	-0.039	0.022	
IA	0.060	0.025	
KNOW	0.185	0.044	
BI – Intent to use Web 2.0 Applications			0.392
INT	0.506	0.092	
CC_Fac	0.020	0.025	
CC_Soc	0.031	0.040	

Changes in goodness-of-fit measures between Model 1 and Model 2 are reflected in Table 22 which also includes the likelihood ratio test (LRT). This test evaluates the difference in χ^2 of the full model versus the χ^2 of the restricted model, given the difference in degrees of freedom associated with the full and restricted χ^2. If χ^2 from the LRT is not statistically significant, as in this case, that means respecification of the model created a better fit without a significant impact on the parsimony of model.

Table 22

Model 2 - Goodness-of-Fit Tests and Comparisons

Category	Index	Model 1	Model 2	Δ
Absolute	χ^2	1658.21	1267.050	391.16
	p	<0.001	<0.001	
	Df	920	716	204
	GFI	0. 80	0.82	0.02
	χ^2/df	1.80	1.77	0.03
Incremental	CFI	0. 89	0.91	0.02
	NFI	0. 78	0.82	0.04
	ECVI	6.65	5.19	1.46
Parsimonious	RMSEA	0.05	0.05	
	LRT			<.0001

Model 2 appears to be a better fit than Model 1 based on the improvements to the goodness-of-fit analyses. Improvement was noted for every index and measure except RMSEA which still met the criteria for a good fit. The decrease in the number of degrees of freedom as well as the stability of the standardized and unstandardized coefficients, standard error, and coefficients of determination already discussed also indicates an improvement in parsimony. Also improving was the ECVI which, as discussed in chapter three, is an incremental measure with no baseline criteria. Instead, it indicates improved fit if it is lower than the model to which it is compared. Here, the ECVI for Model 2 is lower than in Model 1 indicating that respecification resulted in a better fit. Not improving with respecification were the p values for χ^2 and for the LRT, both of which remained insignificant.

After Model 2, other respecifications were evaluated including the elimination of SD, the elimination of CC_Fac, the elimination of CC_Soc, the elimination of PU, the elimination of PEU, and all combinations thereof. These possibilities were analyzed because of their insignificant predictive parameters. Additionally, a correlation between CC_Soc and PEU was suggested in the modification indices output. This was analyzed alone and in conjunction with the elimination of the insignificant latent variables. None of these possible respecifications, alone or in combination resulted in significant improvement in model fit with greater parsimony. Thus, Model 2 was retained as the final structural model.

Hypotheses Tests

Structural model 2 (Figure 20) was used as the basis for the evaluation of the research hypotheses.

H1. Positive instructor attitudes toward learner self-direction positively affect instructor interest in Web2.0 applications. This hypothesis is rejected. The path between the latent variable representing instructor attitudes toward learner self-direction and the one reflecting interest in Web2.0 applications was not significant in the fitted model (r_{SD*INT} = -.06, .p = 0.506) The estimated effect of an increase of one standard deviation in SD is a negligible (.06) decrease in INT.

H2. Positive instructor attitudes toward the acceptance of new technologies positively affect instructor interest in Web2.0 applications. This hypothesis is rejected. Instructor attitudes, operationalized as perceived ease of use and perceived usefulness, did not generate significant parameters to the latent variable representing instructor interest in Web2.0 technologies. ($r_{PEU*INT}$ = -.17, .*p* = 0.078; r_{PU*INT} = .25, .*p* = 0.022). The estimated effect of an increase of one standard deviation in PEU is an insignificant (.17) decrease in INT. The estimated effect of an increase of 1 standard deviation in PU is an unsubstantial (.25) increase in INT.

H3. Positive instructor attitudes toward innovation and change positively affect instructor interest in Web2.0 applications. This hypothesis is rejected. The parameter between IA and INT was not significant in the fitted model (r_{IA*INT} = .19, .*p* = 0.018). The estimated effect of an increase of one standard deviation in IA is an insignificant (.19) increase in INT.

H4. Knowledge of Web2.0 applications will impact instructor interest in Web2.0 applications. This hypothesis is retained. The parameter between the KNOW and INT constructs was significant ($r_{KNOW*INT}$ = .32, .*p* = <0.001), indicating that an increase of one standard deviation in KNOW had a significant direct effect on INT of .32 resulting in an indirect effect on BI of .20.

H5. Contextual constraints and pressures will impact the intention to use Web2.0 applications in formal learning environments. This hypothesis is rejected. Contextual constraints and pressures were operationally defined as facilitating conditions and social conditions. Neither of these factors demonstrated a significant effect on instructor intent (r_{CC_Fac*BI} = .09, .*p* = 0.407; $r_{CC\_Soc*INT}$ = .08, .*p* = 0.444).

H6. Higher levels of instructor interest in Web2.0 applications positively affect instructor intention to use those applications as learning tools in the that instructor's classes. This hypothesis is retained. The parameter between the INT and BI constructs was significant (r_{INT*BI} = .60, .p = <0.001), indicating that an increase of one standard deviation in INT has a significant direct effect on BI.

H7. Positive behavioral intention to use Web2.0 applications has a positive impact on use of those applications in the formal learning environment. This hypothesis cannot be evaluated from the fitted model. It was determined there was not enough variability in the data measuring the current use of Web2.0 to adequately determine predictive patterns and the USE construct was dropped from the model.

Summary

The five-step process recommended by Schumacker and Lomax (1996) for the application of SEM to a data set was completed for the data set collected for this project starting with the measurement model. Evaluation of the hypothesized model included confirmatory factor analysis between the latent variables and their survey item identifiers, between measurement error terms and their respective observed identifiers, and between factor disturbances and their combined loadings. Based on the initial evaluation of the loadings and their resultant residual covariances as well as a set of goodness-of-fit measures, the hypothesized model was determined to be misspecified for the collected data set. A satisfactorily fitted model was generated from model respecification steps that included analysis of the modification indices, standard error, correlation coeeficients, and the underlying data. The fitted model was then analyzed for structure at which time the model was respecified a second time to remove a latent variable that did not demonstrate sufficient variability to be of use in the predictive model.

The final respecified model was evaluated against the research hypotheses whereby it was determined two of them were supported by the model and were retained.

The remaining five research hypotheses were rejected. The data analysis described in this chapter indicated that prior knowledge of Web2.0 applications can predict an interest in Web2.0 applications. Similarly, interest in Web2.0 applications can predict an intent to utilize them in online classes. Discussion of these findings and their impact on the research questions as well as recommendations and limitations are included in chapter five.

CHAPTER FIVE: DISCUSSION, LIMITATIONS, AND RECOMMENDATIONS

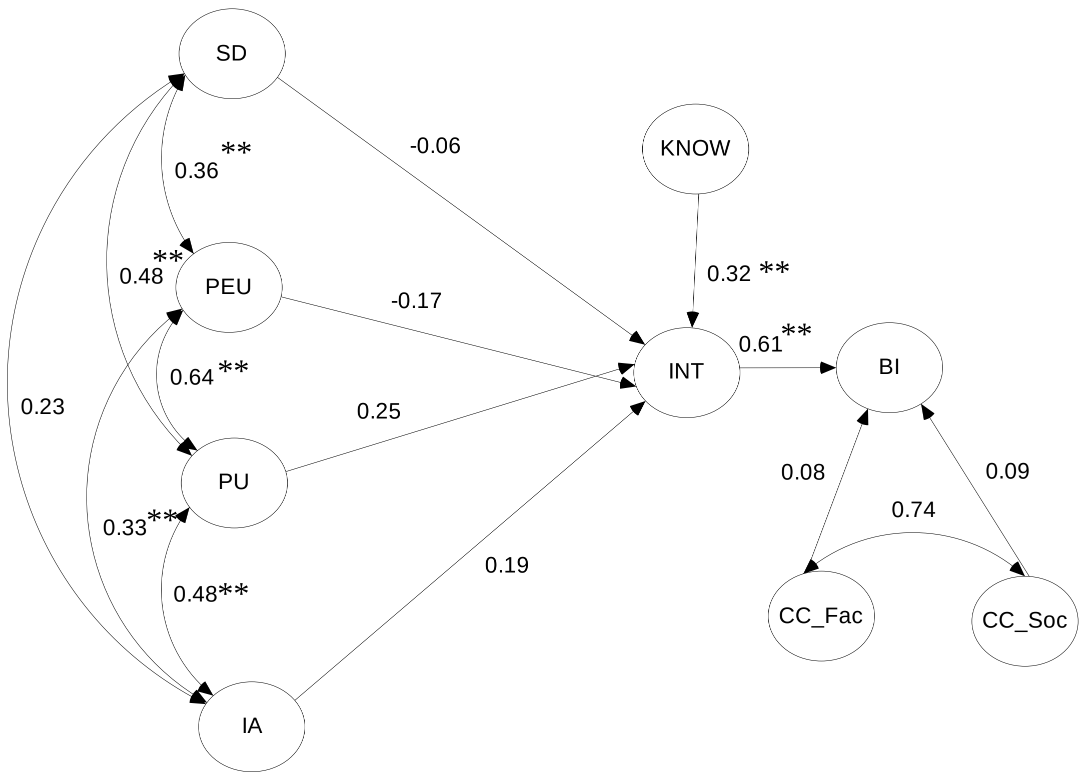
The purpose of this study was to determine how instructor attitudes affect the class content use of emerging technologies known as Web2.0 applications. Additionally, the relationships between those attitudes and the impact of external administrative and knowledge-based constructs were evaluated. This was accomplished through the identification, comparison, and analysis of the current uses, understanding, and attitudes of 285 North Carolina community college online instructors. Specifically, the research questions for the study were answered as described in Table 23 based on the evaluation of the research hypotheses documented in chapter four:

Table 23

Research Questions and Answers

Research question	Answer to research question
1. To what extent do instructor attitudes toward learner self-direction (SD), instructional technology (TA), and innovation and change (IA) predict interest in the use of Web2.0 applications (INT) as formal class content?	The listed instructor attitudes were not statistically significant predictors of interest in the use of Web 2.0 applications.
2. To what extent does an interest in the use of Web2.0 applications (INT) predict an intention to use them (BI) as formal class content?	An interest in Web2.0 applications has a significant predictive effect on intention to use the applications as formal class content. indicating that an increase of one standard deviation in INT had a significant direct effect on BI of .60.
3. To what extent does intention to use Web2.0 applications (BI) as formal class content predict their actual use (USE)?	It was not possible to ascertain an impact of intent to use on the actual use of Web2.0 applications because of low reported rates of usage and a lack of variability in the usage data. This path was removed from the final model.
4. What is the impact of instructor level of knowledge of Web2.0 applications (KNOW) on instructor interest in these applications (INT)?	Instructor knowledge of Web2.0 applications has a significant impact on instructor interest in their use. The parameter between the KNOW and INT constructs was significant, indicating that an increase of 1 standard deviation in KNOW has a significant direct effect on INT of .32 and an indirect effect on BI of .20.
5. What is the impact of contextual conditions such as administrative mandates and personal constraints (CC) on instructor intent to use Web2.0 applications (BI)?	There was no significant impact from reported assessment of contextual conditions (CC) on instructional intention to use Web2.0 applications in online classes (BI).

The hypothesized model was based on theory and the existing knowledge base as described in chapter two. Data for the study were collected by survey from 285 online instructors employed by 10 purposefully selected community colleges from within the North Carolina community college system. Detailed survey methodology is described in chapter three. Structural equation modeling (SEM) was used to analyze the data. The fitted model ascertained from the analysis described in chapter four is depicted in Figure 21.



**p<.001. Parameter values are standardized regression estimates

Figure 21. Final fitted model (Model 2)

Discussion of Findings - Research Question One

The first research question in this study asked to what extent instructor attitudes toward learner self-direction, instructional technology, and innovation and change predict interest in the use of Web2.0 applications as formal class content. As originally hypothesized, the fitted model indicates covariance between the three constructs SD, TA (comprised of PU and PEU), and IA, although the relationship between SD and IA was not statistically significant. Despite the connections between these attitudes and theoretical expectations, the research hypotheses related to the research question were all rejected as detailed in chapter four. The respecified model indicates no statistically significant impact of any of these attitudes on instructor interest in Web2.0. Further examination of the trends within the survey responses and thoughts about possible connections between instructional attitudes and online instructional practices might shed some light on why this set of data resulted in these weak predictor relationships.

Learner Self-Direction

This research hypothesized that an instructor’s feelings about learner self-direction would have an impact on interest in the instructional use of Web2.0 applications. The theory for this hypothesis was derived from the idea that a self-directed pedagogical approach would be required for the effective implementation of student use of Web2.0 technologies in a formal learning environment. Increased student control and choice, it was thought, would best take advantage of the exploding possibilities and dynamic nature of Web2.0 to maximize individual student learning. Too, the nature of these applications seemed a positive means of overcoming historic constraints to implementing learner self-direction in the classroom as students could utilize those programs for which they were individually best prepared and suited.

The responses received from the sample of North Carolina community college online instructors in this study seem to indicate favorable disposition to incorporating learner self-direction into instructional approaches. They generally agreed with the six statements designed to measure the SD construct. The mean of the SD scale was 5.83 (*SD* = .99) on a 7-point scale. A review of response frequencies show 88% of the responses fell between somewhat agree and strongly agree. That the expected relationship was not apparent within this data may be at least partially explained by this lack of variability. Further insight into the lack of the expected relationship between SD and INT, however, might be gained with a deeper look at the data.

The mean for item number five, "as an instructor, I believe learner self-assessment is the best measure of learning objectives met," was the lowest of the SD group (4.74) which is more than one standard deviation away from the mean for the construct. As noted in chapter two, several authors (Brockett & Hiemstra, 1991; Garrison, 1997; Gibbons, 2002; Knowles et al., 2005) have hypothesized about the components required for the effective facilitation of a self-directed learning environment. Student control over assessment of learning outcomes is an important piece of that theory. The lower level of agreement with the concept of student self-assessment as the primary tool for measuring learning objectives might be an indication that responding instructors have a difficult time giving up control of the assessment component or that the rest of the items are easier to embrace. Too, it may be an indication that instructors are intrigued with an abstract concept of learner self-direction but do not implement its student-controlled components into the pedagogical design of their classes.

This possibility is further supported by the negative relationship between SD and INT. Though insignificant from a statistical perspective, the negatively-signed parameter implies that instructional attitudes trending toward teacher control might drive interest in using Web2.0 applications as learning tools. If this is the case, it would seem, on the surface at least, that instructor interest would be to incorporate selective technologies as they see fit, rather than as a network of resources from which their students could pick and choose for optimal, individualized learning experiences. When viewed in this light, responses could be a result of the expanded transactional distance inherent in online classes rather than an embrace of pedagogical integration of learner self-direction. If so, the implied overall agreement with the principles of a self-directed learning environment may not be reflected in the actual instructional practices of these online teachers.

The negative relationship and the lack of a statistically significant predictive effect between SD and INT may also be partially explained by the continuum upon which self-directed learning activities must be implemented and the learner training and readiness that goes along with it. Self-directed pedagogies cannot be willed into existence, no matter how favorably an instructor may view the principles that underlie them. Learners must be coached and taught how to self-direct and, as noted in chapter two, are often resistant to the concept, which is usually the opposite of their educational experience. On the other hand, Web2.0 applications may not be perceived to require such training for learner use. Thus, an instructor’s positive attitude about learner self-direction may work in the opposite direction as that of an interest in Web2.0 applications.

Instructional design of the online classes may also help explain the lack of a significant predictive pathway from SD to INT. The online course content creation practices at the institutions for which the survey respondents teach is not known. Perhaps the design of the online classes is constrained by policy, budget, or instructor time limitations such that implementation of learner self-direction cannot be incorporated. Course redesign is time consuming and expensive and some of the respondents teach their classes on an adjunct basis so that any work on the content would probably be uncompensated. Content constraint would mean that an instructor's attitude toward learner self-direction would not be part of whatever sparks interest in implementing Web2.0 in a class because the implementation would have to fit into the existing class structure, making SD irrelevant to INT. The possibility of content constraint as an explanation for the lack of this significant relationship is furthered when the neutrality with which respondents viewed facilitative contextual constraints (CC_Fac) discussed later in this chapter is considered.

Instructional Technology

Another research hypothesis for this study was that instructor attitudes toward instructional technology in general would impact instructor interest in Web2.0 applications. This hypothesis, too, was rejected as the data suggested a weak relationship between TA and INT. Survey responses to PU- and PEU-related questions indicate strong instructional technology acceptance. The mean value for PU was 5.95 (*SD*: 1.15) based on a 7-point scale. Eighty-five percent of the respondents averaged answers at somewhat agree or above. PEU had a mean of 5.31 (*SD* = 1.31) based on a 7-point scale, and 71% of the respondents averaged responses of somewhat agree or above.

The theory framing this component was the well-researched technology acceptance model (TAM) as described in chapters two and three. The core of the TAM is that perceived usefulness (PU) and perceived ease of use (PEU) drive the intention to use a technology. In the current study model, this was adapted in two ways. First, interest in Web2.0 technologies was placed between technology acceptance and intention to use. Just in case this adaptation was the reason for the insignificant finding, the relationship between the TA factors and BI was evaluated, and was also insignificant.

The second adaptation of the TAM was that PU and PEU were measured based on attitudes toward instructional technology in general, while the theorized impact was toward Web2.0 applications specifically. The implication may be that the lack of the expected significant relationship between the TA factors and INT are a result of differing perceptions between general instructional technology and specific Web2.0 applications. In support of this possibility is the lower rate of agreement with PEU than with PU, which was slight and insignificant, but may be a hint of an explanation. Maybe online instructors do not view Web2.0 applications, which are available directly from the Internet, often at no cost, in the same way they view historically classified educational technology. Classroom-based technology is often installed to the local machine and is subject to the limitations and problems inherent in such systems. It is also susceptible to obsolescence as budgetary concerns preclude consistent upgrades. With this in mind, it would be understandable if instructor perceptions of instructional technology had no impact on their interest in Web2.0 applications.

Similarly, because respondents in this sample all teach in an online environment, acceptance of instructional technology in general may be irrelevant to their interest in technologies delivered from the same venue as their teaching environments. The fact that Web2.0 programs are available from the Internet may be the attraction, rather than their technological basis. This might also help explain the negative standardized coefficient on PEU – INT. Lower ease of use perceptions of, or interest in, historically-defined instructional technology might be expected to drive increased interest in web-delivered technologies which are seen as easier to use.

The disconnect between the general technology acceptance apparent in the sample and its expected effect on interest in Web2.0 applications may also be attributable to the overwhelming speed with which change occurs with respect to web-delivered technology. An online instructor, while technology-accepting when it comes to established applications such as word processing and web browsing, might conceivably have trouble keeping up with the pace with which new Web2.0 applications evolve. Such a feeling akin to the adage “the more one learns the less one knows” could help explain why high technology acceptance does not significantly predict interest in Web2.0 applications. Adding credence to this possibility is the fact that knowledge of Web2.0 applications did result in a significant pathway from KNOW to INT, indicating it is knowledge of the new programs, unaided by acceptance of instructional technology, in general, that predicts an instructor’s interest in the new programs.

Innovativeness

Another research hypothesis analyzed and rejected was that instructor innovativeness would help predict the instructional use of Web2.0 applications. Derivation of this concept arose from the innovative nature of Web2.0 applications and the cutting-edge perception of their use as educational tools. As such it was thought that an instructor would need to be innovative in order to see the benefits of using these dynamic technologies in their online classes. Respondents appear to be generally innovative as 68% averaged responses in the somewhat agree to strongly agree group for survey items measuring this construct and the scale mean was 5.42 (*SD* = 1.19) based on a 7-point scale.

That innovativeness did not drive interest in Web2.0 for this data set was a mystery. One explanation might be that Web2.0 would not be considered by an innovator as an obscure, new concept. The term Web2.0 can be found as early as 1999 and was commonly used by 2003 (Web 2.0, 2009). It is possible that innovators are not particularly interested in the applications because they have moved past Web2.0, having already learned about them and made implementation decisions. In other words, to the highly innovative instructor, Web2.0 may no longer be considered an innovation.

Another possibility has to do with the instructional design process of online classes. As with learner self-direction, perhaps innovators are constrained by policy, time, or budget and are not free to implement innovation into their existing online classes. If this is an accepted barrier among innovative online instructors, it would help explain why the level of innovativeness does not predict the level of interest in Web2.0 applications as formal learning tools.

Discussion of Findings - Research Questions Two, Three, and Four

The next three research questions are discussed as a unit for several reasons. First, their scales were all based on five categories of Web2.0 applications, implications of which affect all three questions. Additionally, in contrast to the rejected hypotheses related to the other research questions, the hypotheses for questions two and four were retained, and there was no conclusion for the question three hypothesis. Research question two studied the impact of an interest in Web2.0 technologies on the intention to use these technologies as formal learning tools, question three looked at the impact of that intention on actual use, and question four examined the effect of prior Web2.0 knowledge on interest, which indirectly then impacted the other two constructs.

Theoretically, it was postulated if an instructor had acquired some knowledge of the Web2.0 technologies, that knowledge would drive an interest in using them as learning tools and that this interest would predict the intent, which would then predict the use of the technologies. As discussed in chapter four, the first three parts of this expectation were confirmed by the data. Knowledge responses were significantly related to the interest responses, which in turn were significantly related to the intention responses. No conclusion could be reached regarding the relationship of the variations between the intention and actual use.

Overall, the respondents indicated substantial knowledge with a mean of 11.46 (SD = 2.62) on a 1-15 scale across the five categories of Web2.0 applications. Forty-three percent of the respondents noted their knowledge went beyond having heard of the programs and included an understanding of the functionality of the technologies while only three claimed no knowledge of any of the listed applications. Interest, overall, was not as high, with a mean of 2.72 (SD = 1.86) on a 0-5 scale. Intention was lower still with a mean of 1.16 (SD = 1.46) and USE was almost non-existent with a mean of 0.72 (SD 1.14) on a 0-5 scale.

Higher rates of knowledge than of interest, interest than intent, and intent than use are an expected phenomenon to some extent. The respondents, as online instructors, are exposed to the Internet through their teaching venue and thus probably tend to pay attention to Web-based novelties without considering them for integration into their instructional techniques. Also, it is reasonable to assume that online instructors would receive or seek out professional development opportunities related to their teaching venue. These opportunities would expose the learner-instructors to the various technologies available from the evolving web. Additionally, as intimated in the discussion of research question one, this overall picture may be blurred to some extent if innovators are no longer interested in Web2.0, looking beyond it for innovation, or if instructional design constraints moderate interest in Web2.0.

That knowledge of the technologies can help predict interest in using them, which can help predict the intent to use them, was an expected relationship supported by the data. However, though statistically significant, only 19% of the variance in interest was explained, leaving a large void in the understanding of what drives an instructor's interest in learning more about Web2.0 applications. The overwhelming speed with which these technologies are introduced and evolve may be part of the answer here. There may be a "comfort factor" involved that is also driving interest where technologies perceived as stable and unchanging may be the ones in which instructors have an interest. Similarly, 39% of the intent variance was explained by interest, again leaving the question open as to what else might help predict instructional intent to use these technologies. Reasons for the lack of actual usage of Web2.0 applications are unknown.

Discussion of Research Question Five Findings

The fifth research question for this study asked about the effect of contextual constraints on an instructor's stated intent to incorporate Web2.0 applications into their online classes. The related hypothesis that these constraints would impact intent was rejected based on the data-fitted model analyzed in chapter four. Neither of the two factors, facilitative (CC_Soc) and social norm (CC_Fac), that emerged from the data for the hypothesized construct had a significant relationship with BI, though they were, as expected, significantly correlated with each other.

It was expected that contextual constraints would be a predictor of intention to use Web2.0 applications based on the idea that the availability of technical support and social pressure from peers would add incentive to adopt Web2.0. Overall, the respondents seemed to be neutral about the levels of support from either a social or facilitative standpoint. CC_Soc had a mean value of 3.1 (SD = 0.86) on a 5-point scale. CC_Fac had similar results with a mean of 3.2 (SD = 1.1). Value number 3 on the five-scale option was "neither agree nor disagree" and this answer was chosen almost 50% of the time for all eight questions measuring this construct.

That such a large number of respondents recorded no opinion to survey items designed to measure the contextual constraints may help explain the absence of impact between the CC factors and BI. It should be noted that during the respecification phase of the structural model fitting process described in chapter four, CC was dropped from the model. However, no significant model improvement resulted from the deletion of this variable and it was reinstated.

Contribution to the Knowledge Base

As described in chapter one, the pedagogical implementation of learner self-directed use of Web2.0 applications to achieve formal learning objectives could help institutions of higher education in their quest to react to the changing educative needs of their students. This study supplies evidence of predictors and relationships theorized as instructional requirements in this endeavor. While some of the expected predictor relationships did not materialize with this set of data, this first-of-its-kind study can be the stepping stone to model refinement and theory-based experiments to solidify pedagogical, professional development, and instructional design practices.

Chapter two documents the review of the existing literature where research related to each of the components of this study are described. No studies related to the combined underlying theory of the current study were located. but a single, similar prior study was found. This was exploratory work reported by Ajjan and Hartshorne (2008) which was based on the decomposed theory of planned behavior (DTPB) and studied predictors of intention to use and current use of specific Web2.0 programs by instructors at a single university. As specified by the DTPB model, hypothesized predictor relationships began with specific antecedents to latent constructs of attitude, social norm, and perceived behavioral control, and from those latent constructs to behavioral intention and from behavioral intention to current use.

In varying degrees, the current study mirrored some of the findings of the prior study. Facilitative conditions in the prior study were found to be insignificant to the model. This is similar to the insignificance of facilitative contextual constraints in the current study. Similarly, the items measuring self-efficacy in the prior study were similar to knowledge of Web2.0 in the current study. Self-efficacy was significant to the model such that it a reader could imply that knowledge was the driving force behind the behavioral control of the user. In this context, the findings coincide, to some degree, with findings regarding knowledge in the current study and its significant relationship with instructional interest.

Other similarities were noted. The prior study measured peer and superior influence which can be compared with the social contextual constraints in the current study. In both cases, a statistically insignificant relationship with intent to use Web2.0 applications was found. Perceived ease of use and perceived usefulness were included in both studies. However, the findings of the two studies differ in that the prior study found both to be a significant attitudinal component of intent. In the current study, neither of these factors was significantly related to interest or intent.

Differences between the two studies include the identification of Web2.0 applications, the mode of data analysis, and the theoretical framework. In the prior study, four specific Web2.0 applications were presented to respondents who were asked their perceptions of learning benefit and whether they use or intend to use the applications. In the current study, five broad categories of Web2.0 applications with popular examples of each were identified for respondents. As to mode of analysis differences, path analysis techniques were employed in the prior study. As such, the detailed evaluation for fit of theory to data inherent to the SEM process was not done for the prior study, nor was the implication of measurement error considered. Both fit and measurement were a part of the current study which utilized the two-stage, CFA and path analysis approach of SEM as described in chapter four. Differences in the theoretical framework arose because of differing research agendas. The purpose of the prior study was to “assess faculty's awareness of the benefits of Web 2.0 to supplement in-class learning and better understand faculty's decisions to adopt these tools” (p. 71). The purpose of the current study was to determine how instructor attitudes affect the class content use of emerging technologies known as Web2.0 applications. The current study, while confirming some of the findings of the prior study, adds to the body of knowledge in the areas of the pedagogy of learner self-direction, instructional technology acceptance, and instructor innovativeness.

Study Limitations

Known limitations related to the current study include the possibility of respondent bias, the use of a “neither agree nor disagree” scale response, and possible restrictions on the generalizability of the survey finding. Specific to the first limitation, the survey phase for this study was completed during the summer months when many of the North Carolina community college instructors are on leave, though most retain access to their e-mail. It is not known to what extent these factors may have led to response bias. The institutional sampling method described in chapter three may have offset certain instructor characteristics that could be sources of bias, since institutions were chosen based on the importance of online classes to overall FTE. Further evidence of mitigation of this limitation is found in the detail of institutional response rates. Instructors from three institutions responded to the survey at rates in excess of 60%. These three schools were medium-sized from a total FTE standpoint, but in the top ten in both categories devised to rank online effort. That is a unique combination which may indicate that the instructors at these schools might be more committed to their online effort since that is where they see the institutional future, which in turn would lead them to respond to the survey. Too, there were three schools with response rates of 30% and below. Two of them were the last ones contacted, just as summer semester was ending, and the third was contacted just as spring semester was ending. As such, it may be that those instructors who did choose to respond are more committed to the online effort and responded in a non-biased way while those who may not be as committed did not respond to the survey. The general positive response patterns to the individual survey items would tend to also support this conclusion. However, since no background information was collected on the responding instructors, it is impossible to empirically evaluate this potential response bias.

Another limitation to be considered is that survey scales included an option for neither agree nor disagree (NAND). SD, TA, and IA were measured on a 7-point scale and CC was measured on a 5-point scale. All ranged from strongly disagree to strongly agree. Except for SD, each were included because they were part of the scales used in the instruments from which this survey was adapted. The SD scale was written to conform with the TA and IA scales. Reliability and validity evidence described in chapter three indicates strong support, but it is not known to what extent scales without the NAND option would have changed the outcome of the study.

A final limitation for this study is that the survey sample was drawn from institutions in North Carolina who agreed to be part of the study. Instructor participation was voluntary. Both of these limitations may restrict the generalizability of the survey findings to all North Carolina community college online instructors and possibly to the online instructors from the 10 responding schools.

Recommendations

Recommendations for Practice

Implementation of learner self-directed pedagogies into online classes was a primary focus of this study. Findings indicate that, while responses were generally positive to the items measuring attitudes toward learner self-direction, these attitudes do not drive an interest in the technologies. This weak relationship may be the result of constraints or philosophical beliefs. Professional development activities should be planned and implemented that concentrate on conveying the principles of learner self-direction, facilitative techniques, and the benefits that can accrue when the learner is taught how to and is encouraged to effectively self-direct. Ongoing support should be available to reinforce instructional practices that can further this effort in online classes and should include a mentoring program to support a cycle of ongoing evaluation, revision, and assistance.

Complexity to providing effective professional development arises when considering the extensive use of adjunct faculty by community colleges. Adjunct instructors are usually employed on a contract basis framed by the hours they spend teaching. Rarely is professional development a component of these contracts. In other words, adjunct faculty are not typically paid to attend professional development sessions and are not typically invited to such sessions. However, if the benefits of self-directed pedagogies combined with Web2.0 applications are to accrue, institutions must assure that all teachers of their students be versed in such implementation. Again, technology may offer a partial solution as training can be offered through asynchronous online pedagogies and web conferencing tools can be used as the platform for synchronous professional development activities allowing adjunct to participate without a required trip to campus. Additionally, web conference meetings can be recorded for subsequent viewing should the synchronous nature of the activities be a barrier to adjunct participation.

To support both full- and part-time instructors, institutional-level policy and procedure reviews should be undertaken to determine where unintended constraints to innovative, learner-directed content and delivery exists. Barriers related to tight budgets, overworked faculty and adjunct instructors, and under-staffed and under-trained support areas may seem insurmountable and might even be a fact of life for many North Carolina community colleges. However, if administrative or procedural bottlenecks are the reasons that instructors are not planning to implement learner self-directed use of usually free Web2.0 applications to meet learning goals, these restraints should be easily removed, once identified. This positive support from the administration may also change the way instructors view contextual constrains, which the findings indicate are currently neutral.

Another essential component of this study was faculty innovativeness and its relationship with interest in using Web2.0 applications. The findings indicated there was no significant impetus from innovativeness driving an interest in the technologies. One reason for this may be that innovativeness is stymied in online class instruction. If so, this obstacle could become an accepted barrier that innovators stop trying to overcome. Such a loss of innovativeness driving interest would be a loss to an institution. To guard against this possibility, special organizational-level effort should be expended to locate, foster, and reward innovators among online class instructors.

Finally, available Web2.0 applications are varied in scope, scale, functionality, and in compatibility with learning management systems. While there was no measurement in this study of where instructors attained their knowledge of these programs, it may be possible to increase interest, intent, and use of appropriate Web2.0 applications in online classes with the institutional publication of an informed, systematic, theoretical review of available applications. This could be a newsletter or podcast highlighting the pros and cons of newly located Web2.0 resources accompanied by suggestions for best use practices, implementation processes, and tips and techniques for ongoing benefits. Of course, publication in a Web2.0-style program where comments and discussion can occur might increase the benefit.

Recommendations for Further Study

Study of actual practices related to pedagogical design for learner self-direction in online classes contrasted with instructional beliefs about learner self-direction might supply some answers as to why the theorized relationship between these beliefs and an interest in integrating Web2.0 technologies did not materialize in this study. Other attitude versus actual practice studies should be undertaken to ascertain how instructors intend to use Web2.0 applications and what constraints related to existing course content and policy currently preclude instructors from implementing individualized self-directed learning pedagogies. It would also be of interest to determine the chronology of innovator interest as it relates to interest in a new technology. It may be that innovators pass judgment on new technologies long before they come to the attention of non-innovators.

Further study is also needed to gather information related to instructor perceptions of technology. Do instructors perceive general instructional technology differently than they perceive the concept of Web2.0 applications? Are there differences in their perceptions when stratified by demographics such as age, time teaching, time teaching in a face-to-face classroom, reasons for teaching online? What practices are in place to assist instructors with staying current with changes in Web2.0 technologies?

This study utilized technology acceptance theory to establish instructional technology attitudes and related those attitudes to interest in Web2.0 technology. No significant impact was noted. Study of instructional perceived ease of use and perceived usefulness of Web2.0 applications in the categories used to measure knowledge, interest, and intent would add to our understanding of these relationships.

This study was undertaken using data gathered from responding online instructors from 10 North Carolina community colleges. Replication of this research using different samples of online instructors from varied geographic regions would add to the knowledge base and help neutralize the possible generalizability limitations. Additionally, future researchers should extend the model to include theorized factors that would explain what else besides knowledge is driving an interest in Web2.0 applications in online community college classes.

Conclusions

This study was undertaken as a first step toward building a model to use self-directed learning pedagogies with flexible Web2.0 technologies to address needs for change at institutions of higher education. Documentation for the need for such change is presented in chapter one where reports from various organizations and researchers all echo the same message. Web2.0 is changing the face of educational requirements and delivery platforms. Understanding the relationships between the attitudes and traits thought to be part of the solution; and interest in, intent to use, and actual use of the technologies, formed the purpose of this study.

It was theorized that attitudes toward the principles of instructing in a self-directed learning environment and toward instructional technology, as well as innovativeness on the part of instructors, would each be a required component for changing from didactic to self-directed learning environments. It was further theorized that these attitudes and traits could help predict an interest in Web2.0 technologies, which would help shape the platform for delivering the learning. Findings from the data collected from North Carolina community college online instructors did not support these theorized effects. While measurements of the attitudes and traits were positive, indicating an innovative, technology-accepting group of instructors who embrace the concepts of learner self-direction, no significant effect on interest in the technologies was noted. Possible reasons for and recommendations related to this phenomenon are discussed in this chapter.

In addition, the data also revealed a high level of knowledge about Web2.0 applications which did have a significant impact on the instructors' stated interest in the technologies, although the rate for the latter was lower than for the former and knowledge explained only a small part of the variation in interest. Further, interest in Web2.0 applications had a significant impact on intention to implement the technologies into online classes, again, however, demonstrating a progressively weaker relationship . There was not sufficient current use of the technologies to draw a conclusion about the impact of intent on actual implementation.

The results of this study form the foundation on which a model to use self-directed learning pedagogies with flexible Web2.0 technologies can be built. Evidence of positive instructional attitudes and innovative traits is encouraging, as is the high rate of knowledge of Web2.0 applications. Continued study and model evolution may offer help to policy makers, instructional designers, and content-producing instructors, all faced with the unending challenge of providing effective learning opportunities to their students.

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APPENDICES

Appendix A: Survey Items With Descriptive Statistics

Appendix B: Expert Panel Checklist

Appendix C: Hypothesized Measurement Model

Appendix D: Respecified Measurement Model

Appendix E: Survey Recruitment Notices

Appendix A
Survey Items With Descriptive Statistics

Table A.1
Survey Items With Mean and Standard Deviation Statistics

Item	Survey item	*M*	*SD*
SD-1	As an instructor, I believe students should have as much control over their learning as possible.	5.67	1.37
SD-2	The courses I teach emphasize development of skills required to independently think, plan, and apply learning topics in ways unique to each student.	6.02	1.28
SD-3	My classes are structured to encourage students to challenge themselves to meet higher standards than what is individually easy or familiar.	6.26	1.04
SD-4	The courses I teach require learner self-management of time, effort, and resources.	6.67	0.86
SD-5	As an instructor, I believe learner self-assessment is the best measure of learning objectives met.	4.74	1.62
SD-6	The courses I teach rely on learner self-motivation such as goal-setting, self-assessment, and progress evaluation to meet learning objectives.	5.61	1.41
TA-1	Using instructional technology improves my performance (teaching activities) as an instructor.	5.91	1.29
TA-2	Using instructional technology improves my productivity as an instructor.	5.85	1.43
TA-3	Using instructional technology improves my effectiveness (outcomes) as an instructor.	5.75	1.36
TA-4	I find instructional technology to be useful to me as an instructor.	6.29	1.04
TA-5	Interacting with instructional technology is clear and understandable.	5.46	1.39
TA-6	Using instructional technology is easy.	5.04	1.57

Appendix A

Survey Items With Descriptive Statistics, continued

Table A.1
Survey Items With Mean and Standard Deviation Statistics

Item	Survey item	*M*	*SD*
TA-7	It is easy to incorporate instructional technology in my teaching environment.	5.42	1.48
TA-8	People who influence my behavior think I should use instructional technology.	5.14	1.44
TA-9	People who are important to me think I should use instructional technology.	5.03	1.47
TA-10	My use of instructional technology is voluntary.	5.20	1.83
TA-11	My supervisor does NOT require me to use instructional technology.	4.29	2.18
TA-12	Although it might be helpful, the use of instructional technology is NOT compulsory at my institution.	4.23	2.05
IA-1	If I heard about a new instructional technology, I would look for ways to experiment with it.	5.76	1.11
IA-2	Among my peers, I am usually the first to try out new instructional technologies.	4.97	1.58
IA-3	In general, I am hesitant to try out new instructional technologies.	5.33	1.67
IA-4	I like to experiment with new instructional technologies.	5.62	1.34
CC-1	Most of my departmental co-workers use a Web2.0 application.	2.89	1.03
CC-2	The senior management of this institution has been helpful in introducing Web2.0.	2.82	1.10
CC-3	My supervisor is very supportive of Web2.0 use in my classes.	3.31	1.02
CC-4	In general, the organization has supported the introduction of Web2.0 applications into online classes.	3.28	1.05

Appendix A

Survey Items With Descriptive Statistics, continued

Table A.1
Survey Items With Mean and Standard Deviation Statistics

Item	Survey item	*M*	*SD*
CC-5	Guidance is available to me in the selection of hardware and software applicable to the use of Web 2.0 applications in my classes.	3.11	1.17
CC-6	A specific person (or group) is available for assistance with Web 2.0 application difficulties.	3.22	1.26
CC-7	Specialized instruction concerning the popular Web 2.0 applications is available to me.	3.11	1.19
CC-8	A specific person (or group) is available for assistance with hardware difficulties related to use of Web 2.0 applications.	3.18	1.26
	Please indicate your current knowledge of the following category of Web2.0 applications:		
KNOW_Mus	Audio and Music - these are applications that help you find and listen to music and audio content such as podcasts. Examples include BlogTalkRadio, iTunes, JamLegend, and Shoutcast.	2.38	0.70
INT_Mus	I am interested in learning more about it:	0.61	0.49
BI_Mus	I do not CURRENTLY use, but plan to use in at least one of my online classes within the next year.	0.30	0.46
USEMus	I currently use in at least one of my online classes	0.15	0.36
	Please indicate your current knowledge of the following category of Web2.0 applications:		
KNOW_Com	Communication - these are tools for person-to-person communication instant messaging, and voice-over-IP. Examples include Yahoo Instant Messenger, Skype, Cisco Webex, and Elluminate.	2.52	0.63
INT_Com	I am interested in learning more about it:	0.61	0.49

Appendix A

Survey Items With Descriptive Statistics, continued

Table A.1
Survey Items With Mean and Standard Deviation Statistics

Item	Survey item	*M*	*SD*
BI_Com	I do not CURRENTLY use, but plan to use in at least one of my online classes within the next year.	0.30	0.46
USECom	I currently use in at least one of my online classes	.19	.390
	Please indicate your current knowledge of the following category of Web2.0 applications:		
KNOW_Browse	Browsing - this category includes browser helpers, RSS readers and other tools to display from the Web. Examples include Bloglines, Google Reader, Chrome, Pageflakes.	1.98	.815
INT_Browse	I am interested in learning more about it:	.46	.499
BI_Browse	I do not CURRENTLY use, but plan to use in at least one of my online classes within the next year.	.18	.381
USEBrowse	I currently use in at least one of my online classes	.15	.359
	Please indicate your current knowledge of the following category of Web2.0 applications:		
KNOW_Prod	Productivity - these are tools for collaboratively working on content. Examples include Google Calendar, Google Docs, and Zoho.	1.99	.800
INT_Prod	I am interested in learning more about it:	.44	.498
BI_Prod	I do not CURRENTLY use, but plan to use in at least one of my online classes within the next year.	.17	.375
USEProd	I currently use in at least one of my online classes	.09	.283

Appendix A

Survey Items With Descriptive Statistics, continued

Table A.1
Survey Items With Mean and Standard Deviation Statistics

Item	Survey item	*M*	*SD*
	Please indicate your current knowledge of the following category of Web2.0 applications:		
KNOW_Soc	Social Networking and Publishing - these are comprised of social networks, both personal and business-focused, and tools to add interactive content to the web. Examples include any form of blogs or wikis as well as sites like Delicious, Digg, Facebook, LinkedIn, MySpace, Ning, and Twitter.	2.60	.552
INT_Soc	I am interested in learning more about it:	.60	.491
BI_Soc	I do not CURRENTLY use, but plan to use in at least one of my online classes within the next year.	.21	.411
USESoc	I currently use in at least one of my online classes	.13	.341

Appendix A

Survey Items With Descriptive Statistics, continued

Table A-2

Frequencies – Knowledge of Web2.0 applications

Variable Name	Category	I have not heard of it	I HAVE heard of it	I am familiar with what it does
Audio and music	KNOW_Mus	35	106	144
Communication	KNOW_Com	21	96	168
Browsing	KNOW_Browse	98	96	91
Productivity	KNOW_Prod	93	103	89
Social networking and publishing	KNOW_Soc	9	96	180

Appendix A

Survey Items With Descriptive Statistics, continued

Table A-2

Frequencies – Web2.0 applications; Interest, Intent, Use

Category: Variable	No	Yes
Audio and Music:		
INT_Mus	111	174
BI_Mus	199	86
USE_Mus	241	44
Communication:		
INT_Com	110	175
BI_Com	199	86
USE_Com	232	53
Browsing:		
INT_Browse	155	130
BI_Browse	235	50
USE_Browse	242	43
Productivity:		
INT_Prod	159	126
BI_Prod	237	48
USE_Prod	260	25

Appendix A

Survey Items With Descriptive Statistics, continued

Table A-2

Frequencies – Web2.0 applications; Interest, Intent, Use

Category: Variable	No	Yes
Social networking and publishing		
INT_Soc	115	170
BI_Soc	224	61
USE_Soc	247	38

Appendix B

Expert Panel Checklist

Thank you for agreeing to perform a subject-expert review of the attached survey to be used to gather data for my doctoral dissertation.

Your review will help to determine that the survey items represent the attitudes they are intended to measure and that they, individually and collectively, meet the analytic objectives of the instrument.

Please use the following form to note your thoughts, observations and suggestions:

Instructions: Please **refer to the survey and summary of the research**, and add your comments in the space provided. You do not have to comment on each item, only those where you have a concern or suggestion. The form is structured with the **general category** at the left, followed by a **specific element of the survey**. For individual questions, the **construct to be measured is the category**, the **survey question number** is referenced as the element, and **specific criteria for review** are listed to the right of that. Comment space is available below each of the criteria.

<table>
<tr><td colspan="2">Reviewer:</td><td colspan="4">Date:</td></tr>
<tr><td>Category</td><td>Element</td><td colspan="4">Comments</td></tr>
<tr><td rowspan="3">Survey</td><td>Instructions to respondents</td><td colspan="4"></td></tr>
<tr><td>Response alternatives</td><td colspan="4"></td></tr>
<tr><td>Navigational elements</td><td colspan="4"></td></tr>
<tr><td>Constructs</td><td>Survey Item</td><td>Wording not clear</td><td>Content does not represent intended attitude</td><td>Content not understood in same way by all respondents</td><td>Other comments</td></tr>
<tr><td rowspan="3">Instructor attitude toward student self-directed learning</td><td>Q1</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Q2</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Q3</td><td></td><td></td><td></td><td></td></tr>
</table>

Appendix B

Expert Panel Checklist, continued

	Q4				
	Q5				
	Q6				
Constructs	Survey Item	Wording not clear	Content does not represent intended attitude	Content not understood in same way by all respondents	Other comments
Instructor attitude toward technology acceptance	Q7				
	Q8				
	Q9				
	Q10				
	Q11				
	Q12				
	Q13				
	Q14				
	Q15				
	Q16				

Appendix B

Expert Panel Checklist, continued

	Q17				
	Q18				
Instructor attitude toward innovation and change	Q19				
	Q20				
	Q21				
	Q22				
Constructs	Survey Item	Wording not clear	Content does not represent intended attitude	Content not understood in same way by all respondents	Other comments
Contextual conditions	Q23				
	Q24				
	Q25				
	Q26				
	Q27				
	Q28				
	Q29				
	Q30				

Appendix B

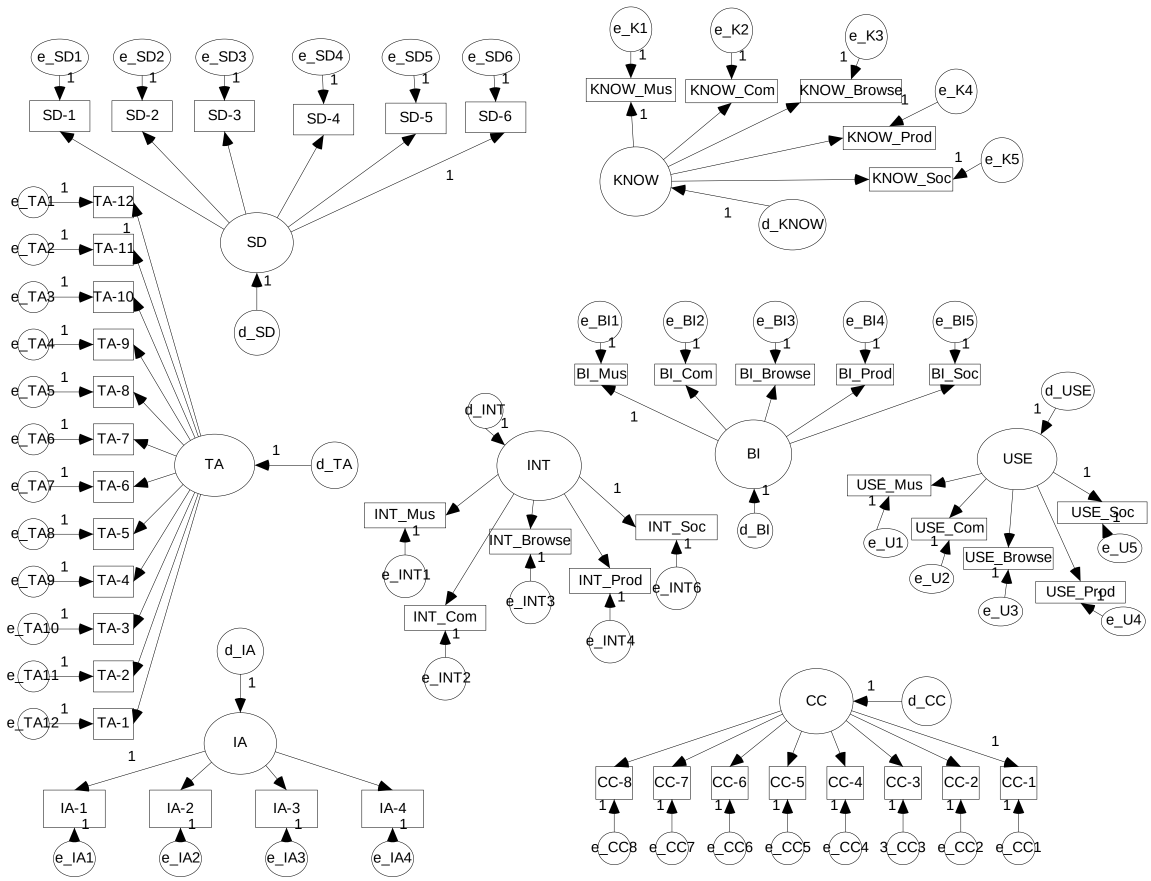
Expert Panel Checklist, continued

Statements regarding interest, knowledge, intent to use, and use of Web 2.0	Q31				
Overall	Survey will fulfill the purpose of the study				

Other comments:

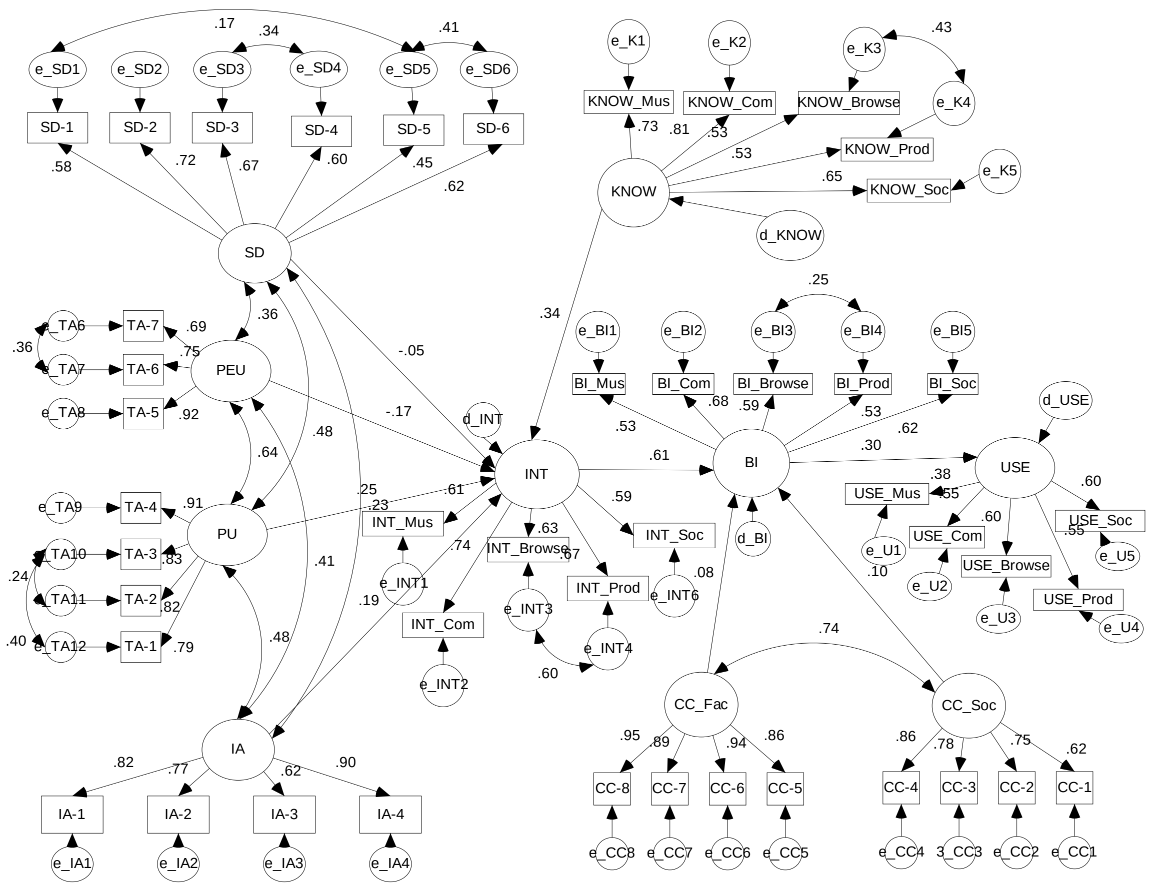
Appendix C

Hypothesized Measurement Model



Appendix D

Respecified Measurement Model With Hypothesized Structural Framework



Appendix E
Survey Recruitment Notices

Pre-notice of Survey

Date and header from distance education administrator

Addressed to individual e-mail address

Subject: Web2.0 study - survey of online instructors

You may have heard of Web2.0 applications such wikis, blogs, podcasts, or RSS feeds. Jana Ulrich, Director of Learning Technologies at Stanly Community College in Albemarle is studying the online instructor use of these technologies as the subject of her dissertation towards an EdD at Western Carolina University.

Within the next few days, you will receive, at this e-mail address, a brief survey from Jana. Please watch for this e-mail and complete the web-based survey as quickly as you can. Your participation in this study is important.

If you have any questions, feel free to contact Jana at julrich7442@stanly.edu or by phone at704-991-0328.

Thank you in advance for your cooperation with this effort.

Administrator digital signature

P.S. In addition to the survey information, the forthcoming e-mail will also include a link to a small token of appreciation as a way of saying thanks for your participation.

Appendix E
Survey Recruitment Notices, continued

Second Contact E-mail

Date and header from researcher

To individual potential respondent

Subject: As promised – Here is the Web2.0 survey of online instructors

Here is the information you need to complete the Web2.0 survey of which you were informed by *distance education administrator* on *date of pre-contact*. As indicated then, this survey is for my dissertation study of online instructor use of Web 2.0 applications . Your participation is voluntary and consists of filling out one 20-minute survey.

There are three ways for you to complete the survey. Please select the method most efficient for you:

1. Click the link to the survey provided on the next line and complete the survey on the web (your PIN # is xxxx):
   <<link to survey>>
2. Right click on the attached Word document and choose Open. Once opened, complete the survey, save it with a file name and location you can remember, and send via e-mail file attachment to me at julrich7442@stanly.edu
3. Reply to this e-mail and request a paper copy of the survey and the address to which it should be mailed. I will send it to you with a pre-addressed, postage-paid envelope for your use in returning it.

Your answers will be kept in strictest confidence and will be used only in combination with responses from others to report results of the research. No individual answers will be reported. There are no known risks involved in your participation. The benefits include the contribution you will be making to professional development activities regarding Web2.0 and online classes.

To thank you in advance for your time and attention, please enjoy the digital decorative badge for use in your online classes. You can claim your badge from the link on the next line:
<<link to incentive>>

Should you have any questions or concerns, you can reach me (Jana Ulrich) at julrich7442@stanly.edu or via telephone at 704-991-0328. You can reach my research advisor, Dr. Meagan Karvonen at karvonen@email.wcu.edu or 828-227-3323. Should you have any concerns regarding your treatment as a participant in this study you can reach the Western Carolina Institutional Research Board at 828-227-7212.

Researcher digital signature<<MS Word-formatted survey attached>>

Appendix E
Survey Recruitment Notices, continued

Third-contact e-mail

Date and header from researcher

To individual potential respondent

Subject: Web 2.0 survey; we need your input

Last week you should have received in you inbox, a survey for online instructors conducted as part of my doctoral dissertation. The survey asks about your attitudes towards instructional approaches, technology, and innovation and will be used to study possible predictors of the use of Web2.0 applications in online classes.

I know I am asking for a precious commodity when your time is concerned. Please know that I have contacted you and other online instructors in order to draw on the expertise only instructors like you can provide and which may help structure future professional development activities.

As I mentioned before, your answers to the survey are confidential and will be combined with others before reporting the results of the research.

There are three ways for you to complete the survey. Please select the method most efficient for you:

1. Click the link to the survey provided on the next line and complete the survey on the web (your PIN # is xxxx):
   <<link to survey>>
2. Right click on the attached Word document and choose Open. Once opened, complete the survey, save it with a file name and location you can remember, and send via e-mail file attachment to xxxx, who is serving as repository agent for the collection of surveys.
3. Right click on the attached Word document and choose Print. Once printed, complete the survey and mail to xxxx, who is serving as repository agent for the collection of surveys.

Should you have any questions or concerns, you can reach me (Jana Ulrich) at julrich7442@stanly.edu or via telephone at 704-991-0328.

Researcher digital signature

<<MS Word-formatted survey attached>>

Appendix E
Survey Recruitment Notices, continued

Digital badges offered as incentives