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# A descriptive case study: Investigating the implementation of web based, automated grading and tutorial software in a freshman computer literacy course

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# A DESCRIPTIVE CASE STUDY: INVESTIGATING THE IMPLEMENTATION OF WEB BASED, AUTOMATED GRADING AND TUTORIAL SOFTWARE IN A FRESHMAN COMPUTER LITERACY COURSE

A Dissertation

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To our friends in Lafayette, Indiana

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# ABSTRACT

Coulthard, Glen J. Ph.D., Purdue University, December 2016. A Descriptive Case Study: Investigating the Implementation of Web-based, Automated Grading and Tutorial Software in a Freshman Computer Literacy Course. Major Professor: Timothy Newby.

Students in higher education require satisfactory computer skills to be successful. While today's students may have greater exposure to technology, research shows that their actual computer knowledge and skills are superficial and narrow. As a result, the freshman computer literacy course remains an important curricular component. This study investigates the implementation of an innovative Web-based technology for delivering software proficiency training for Microsoft Office. Building upon decades of end-user computing satisfaction and technology acceptance research, the purpose of the study is to describe the instructor and student experiences that result from the implementation and use of MyITLab educational software. The nature of the study is descriptive, rather than evaluative, with the following goals: (a) to describe instructors' experiences with the software, (b) to identify patterns of technology usage and utility, and (c) to elucidate levels of computing satisfaction and technology acceptance among users.

The study applies a mixed-method, single-unit, embedded case study design to focus the inquiry on an introductory computer applications course, offered in the Fall 2011 semester at a college in western Canada. The embedded units consist of five instructors, with 322 students enrolled across 10 sections. Data were analyzed from course documents, classroom observations, instructor interviews, and a student survey that produced 149 satisfactory responses. The survey was constructed by adapting instruments based on the Wixom and Todd (2005) integrated research model and the Unified Theory of Acceptance and Use of Technology (UTAUT) model.

Results of the study are summarized into five assertions: 1) MyITLab effectively eliminates or, at least, reduces instructor grading workloads for assignments, 2) MyITLab provides students with frequent corrective feedback on assignments, 3) the step-by-step presentation of instructions in MyITLab may not solely meet the needs of solution-based learning outcomes, 4) instructors should be trained on MyITLab to maximize the software's utility, and 5) the MyITLab solution bank of acceptable responses should be expanded to reduce potential grading inaccuracies. An enhanced Wixom and Todd (2005) model is also presented for future research of educational software. Lastly, the reader is encouraged to reconsider the information presented and generalize it for their own purposes.

# CHAPTER 1. INTRODUCTION

Universities and colleges nationwide currently face a wide discrepancy in the levels of computing literacy and technical software proficiency possessed by incoming undergraduate students. While some students' software skills rival (and, sometimes, exceed) their instructors', other students struggle with the most basic computer tasks necessary for academic success. Over the past two decades, instructional faculty have worked collaboratively with educational publishers in order to introduce new instructional practices and technologies toward helping freshman students improve their computer literacy. At the same time, institutional and administrative stakeholders continue to emphasize concerns over program costs, capital budgets regarding computer labs, and facility utilization (Edmiston & McClelland, 2001). Some institutions have even considered eliminating introductory computer courses entirely (Ciampa, 2013). In partial response to these challenges, leading educational publishers of computer and information technology (CIT) curriculum have been tasked with developing innovative, engaging, and affordable Web-based teaching and learning solutions. Combining simulation-based, multimedia tutorials with online content delivery and reporting, these products provide interactive, self-study lessons aimed at teaching fundamental software proficiency skills for Microsoft Office applications. While network-driven, simulated tutorials for Microsoft Office have been available since the late 1990s, a relatively new Web-based technology has been mainstreamed promoting live, in-application assessments for Microsoft Office, complete with automated grading and feedback. This packaging of in-application grading, personalized feedback, and simulation-based tutorial software may offer a pedagogically-sound and cost-effective solution for undergraduate computer literacy programs.

## Stakeholders in Computer Literacy and Software Proficiency Education

Undergraduate courses in computer literacy and software proficiency are typically grouped under the banner of information and communications technology (ICT) programming. Primarily offered as a single-semester service course in the freshman year of a program or discipline, the ICT course is often mandatory and focuses on either (a) introductory computer and communications technologies, (b) digital information literacy, related to researching and evaluating on-line content, (c) software proficiency, including technical skills for Microsoft Office applications, or (d) a combination of the aforementioned topics. Once the domain of the computer science faculty, most departments or schools now prefer to design and manage the freshman ICT course curriculum and delivery themselves. Therefore, a key stakeholder for the ICT computer literacy course is the department or school that manages the program budget, schedules and maintains the computer labs, and hires personnel (e.g., instructors, teaching assistants, and lab monitors.) The primary objective of this stakeholder group, with respect to the ICT course, is to provide a satisfactory student learning experience, while meeting departmental, financial, capital, workplace, room capacity, and staffing needs.

Faculty members and adjunct instructional staff comprise another key stakeholder group. First, faculty members who instruct ICT courses are the technology-savvy instructors within their respective disciplines that appreciate the relationship between computer literacy, software skills, and academic achievement. While larger schools may assign full-time faculty to teach undergraduate service courses, smaller institutions often choose to hire adjunct instructors who may or may not have optimal levels of content knowledge or teaching experience. In either case, instructors attempt to provide students with engaging learning environments that foster and support successful outcomes. As denoted by the term “service course,” other faculty members within a department or school are significant stakeholders, as they expect specific competency levels in computer literacy from their incoming students. For this stakeholder group, the desire is to receive students who possess the technical skills required to achieve academic success in their particular program area.

Students are the most important stakeholder and the most complex puzzle piece in planning the ICT freshman-level course curriculum. Ever since Don Tapscott’s (1998) book entitled, “Growing Up Digital,” there has been much discourse over the types and technical acumen of students entering higher education. Emphasizing generational differences, Tapscott (1998, 2009) argues that because the “Net Generation” (students born in the 1980s and 1990s) has grown up with computers and the Internet, they naturally possess higher skill levels and aptitude for technology, more so than previous generations. In support of this viewpoint, Prensky (2001a, 2001b) believes that students have been radically changed by their exposure to video games, computers, and the Internet, even to the point where they have been hardwired to “think and process information fundamentally differently” (p. 1). In addition to presuming that incoming students have higher technical skills, Oblinger and Oblinger (2005) summarize several key characteristics of what they coin the "millennial" generation, including:

- higher comfort levels with multi-tasking, especially when using various forms of technology,
- higher levels of visual literacy than previous generations,
- desire for interactivity and fast-paced digital media,
- preference for learning-by-doing, rather than being told what to do, and
- preference for inductive, discovery learning and the social construction of knowledge.

Besides offering competing nomenclature to label this generation of students, it may be important to note that Tapscott ("Net Generation"), Prensky ("digital natives"), and the Oblingers ("millennials") also differ slightly on the birth years covered by each definition. More importantly, however, is the supposition that radical educational reform is required to best meet the needs of this new digital learner (Prensky, 2001a; Tapscott, 1998). Indeed, the speculations and generalizations attached to this generational discourse have been accepted as popular truths by many, to the point of informing instructional design and curriculum development (Reeves & Oh, 2008). Nowhere may these suppositions be felt more acutely than in the design, budgeting, and delivery of the freshman-level ICT computer literacy curriculum.

While most researchers agree that today's students are active users and consumers of technology and digital media, the generational differences argument suffers from a lack of substantive research (Bennett, Maton, & Kervin, 2008; Bullen, Morgan, & Qayyum, 2011; Reeves & Oh, 2008). Furthermore, Kennedy, Judd, Churchward, Gray, and Krause (2008) found significant diversity among first-year students when it came to access, use, ability, and preferences for technology. Jones, Ramanau, Cross, and Healing (2010) found similar variations among students, describing the incoming student body as made up of "complex minorities" that do not align with the commonalities and homogeneity predicted by Net Generation literature. In a Canadian study, Bullen, Morgan, and Qayyum (2011) revealed no empirically-sound basis for most of the digital native claims and no meaningful differences between Net Generation and non-Net Generation students. Even Oblinger and Oblinger (2005) admit that the technological sophistication of today's Net Generation students may be somewhat superficial and concede that "age may be less important than exposure to technology" (p. 2.9).

With respect to ICT computer literacy courses, instructional designers and curriculum developers must be aware of the trends impacting their audience, but should not make the mistake of applying such generalizations to an entire generation. The higher frequency of technology use among today's students does not necessarily translate into higher or more comprehensive and diverse technical skills (Eichelberger & Imler, 2015; Jones et al., 2010). In fact, many researchers over the past decade have found that undergraduate students possess only basic computing literacy and technology skills, even though they are frequent users of email, Web browsing, and mobile devices (Gharawi & Khoja, 2015; Grant, Malloy, & Murphy, 2009; Hanson, Kilcoyne, Perez-Mira, Hanson, & Champion, 2011; Kennedy et al., 2008; Kvavkik & Caruso, 2005; Rondeau & Li, 2009). In the most recent ECAR study of undergraduate students and information technology, the researchers found that, while technology may now be embedded into students' lives, they are not any more (or less) capable of using and applying technology in academia than students from a few years ago (Dahlstrom, Brooks, Grajek, & Reeves, 2015). The study also noted that at least one third of the students “wished they were better prepared to use basic software and applications” (2015, p. 10). Furthermore, while this discussion focuses on students born within the past two decades, universities and colleges are experiencing a growing number of non-traditional students (i.e., mature students) enrolling in first-year classes, which magnifies the diversity within the computer literacy classroom even further. To summarize, computer literacy courses must serve the needs of a diverse student population with varying levels of software proficiency, rather than hoping to cater to a homogeneous generation of multi-tasking, computer literate, and technically competent students.

## Computer Literacy Instruction in Higher Education

Without question, computer literacy instruction has been and continues to be a fundamental part of the undergraduate curriculum. Andrew Molnar is credited with coining the term “computer literacy” almost forty years ago, when he served as the director of the Office of Computing Activities at the National Science Foundation (Gupta, 2006). More recently, Gupta (2006) defines computer literacy as

> an individual’s ability to operate a computer system, have basic understanding of the operating system to save, copy, delete, open, print documents, format a disk, use computer applications software to perform personal or job-related tasks, use Web browsers and search engines on the Internet to retrieve needed information and communicate with others by sending and receiving email (p. 115).

Students’ academic success relies on being able to apply technical knowledge and to perform computer tasks related to their major discipline of study (Grenci, 2013; Gupta, 2006). In his comprehensive investigation of computer literacy in higher education, Epperson's (2010) study noted a movement away from such computer-centric skills toward digital literacy topics, including personal on-line privacy, data security, and digital copyright. Similarly, Hoffman and Vance (2008) have stressed the importance of teaching critical thinking skills and informing students about what technology enables, as opposed to focusing on the performance skills or the technology itself. While these topics are important for information literacy, other researchers remind us that one of the key roles of the computer literacy service course is to meet the needs of other stakeholders by ensuring that outgoing students have the prerequisite skills in selected software applications (Barrera, 2013; Dednam, 2009; Grenci, 2013). The apparent divide between information literacy and specific software proficiency necessitates flexibility in the instructional design, development, and delivery of the ICT course curriculum.

## Software Instruction and Curriculum Development

Since the first introduction of the personal computer in the early 1980s, there has existed a need for computer software instruction. Not many industries have experienced the rapidity of research, development, and growth that hardware and software companies both celebrated and despaired over in the past few decades. What has remained constant is the relentless frequency of software updates, along with ever-increasing feature-sets. While the level of demand for software instruction may have diminished with people's increased exposure to computers, the need for instruction remains, especially if users wish to move beyond the most basic levels of software functionality. While no studies were identified that specify a percentage of features accessed by people in their everyday use of application software, some interesting discussions were retrieved from the

Quora.com discussion website. Specifically, in response to a May, 2011 question, “Do people know how to use Microsoft Office?” Tara Cain, a software trainer in the legal industry, responds:

> Many people have been using Microsoft Office for years and think they have a high level of proficiency when in reality they use just a few basic functions. I don’t think that people are, for the most part, deliberately misrepresenting their skill level but they often don’t know that they are missing out on the most helpful parts of the software (Quora website, 2011).

Garrick Saito offers “I’ve been using Excel for over ten years. I consider myself to be an advanced user, but if someone asks me what percentage of its power I understand, I would answer 10% (i.e., the more you know, the more you realize how little you know)” (2011). Although anecdotal, these statements ring true for many computer users. In order to effectively access and use the software functionality required for most academic programs (as well as in the workplace), students require assistance and support in learning software applications such as Microsoft’s Word, Excel, and PowerPoint (Eichelberger & Imler, 2015).

From the mid-1980s to the mid-1990s, software instruction in higher education largely assumed the traditional lecture plus lab format. In the lecture hall, the instructor would demonstrate the software features and capabilities to be covered that week and then send students to the computer lab in order to complete hands-on exercises, with or without the guidance of a teaching assistant. While some instructors preferred to create their own handouts, educational publishers supplied most of the curriculum materials for lesson content, practice exercises, and summative assessments. By the late 1990s and early 2000s, the enrollment in computer literacy courses had increased significantly and faculty were having trouble keeping up with manually grading hundreds of students' submissions across numerous sections. Because the majority of students did not have access to mobile computing technology, large capital investments were needed for the expansion and staffing of on-campus computer labs (Jake Block, personal communication, 2012).

In 1997, Course Technology introduced SAM (an acronym for Skills Assessment Manager), the first simulation-based Microsoft Office tutorial and assessment software product. Installed locally on the computer's hard disk or on the school's local area network server, SAM offered students the ability to work safely within a confined simulated environment in performing step-by-step software tasks. Arguably, the most important features in this product were the automated assessments and gradebook management tools. Unfortunately, the heralded time-savings and grading efficiencies promised by SAM were quickly eroded amid reports of mis-graded assignments, network crashes, and general software instability. Early-adopting faculty members experienced their in-class role switching from instruction to technical support and subsequent adoption of the technology slowed dramatically. Sensing a competitive opportunity, other educational publishers developed and introduced their own products to a skeptical marketplace over the next several years – SimNet by McGraw-Hill Higher Education, Train & Assess IT (TAIT) by Prentice Hall, and, lastly, MyITLab by Pearson Education. By the mid-2000s, these simulation-based tutorials and task-based assessments had matured greatly, capitalizing on Web-based connectivity for content delivery and full integration with campus learning management systems (LMSs). With efficiencies finally being realized from the software, along with declining and more manageable enrollment levels in the mid-2000s, the typical class structure also began to move from the lecture plus lab format to one or two computer lab meetings per week, focused mainly on gaining hands-on software proficiency in Microsoft Office applications.

After a few years of experience with these simulation products, instructors and students began to question the value of the prescriptive and somewhat superficial step-by-step tutorial and grading approach. Was the software truly teaching and assessing students' software proficiency or simply supporting and evaluating their ability to follow directions? Once again, educational publishers moved quickly to retain market share by developing a more realistic "live" or "in application" assessment tool. This innovative technology built upon the Web-based administrative and content delivery network already established, but allowed students to prepare a contextualized response to an exercise using a local and live session of Microsoft's Word, Excel, PowerPoint, or Access. Rather than grading each individual step, the new technology promised to grade project outcomes (in this case, an entire document.) Furthermore, this "live" functionality allowed students to search through menus and ribbon controls (as they would in a real world context) to find what they needed, without being penalized for selecting incorrect options. Since the outcome or result was graded rather than the individual steps taken, it was presumed that students would feel more comfortable to explore program features and apply their favorite methods (e.g., keyboard or menu) to perform tasks. Unfortunately, like SAM's initial introduction, the new live technology was plagued by errors, a limited choice of gradable exercises, and various technical issues (Scott Davidson, personal communication, 2012). By 2010, however, each of the major educational publishers had re-introduced an in-application, automated grading and simulated tutorial solution, and started the journey of winning back favor from faculty and students. According to company publishing representatives at McGraw-Hill Higher Education, many schools continue to patiently evaluate these innovative products on the sidelines, trying to determine their potential impact on current course offerings and faculty workloads (Scott Davidson, personal communication, 2012).

## Statement of the Research Problem

More than ever before, students require adequate computer skills in order to be successful in their undergraduate programs and in their careers (Eichelberger & Imler, 2015; Gupta, 2006). While today's traditional college student may have spent more time working on computers than any previous generation, their actual computer knowledge and skills seem to be both superficial and narrow in scope (Creighton, Kilcoyne, Tarver, & Wright, 2006; Dednam, 2009; Gharawi & Khoja, 2015; Grant et al., 2009; Hanson et al., 2011; Hardy, Heeler, & Brooks, 2006; Rondeau & Li, 2009; Wallace & Clariana, 2005). In other words, their time spent surfing the Internet and participating on social media sites does not necessarily translate into the computer literacy skills required for academic or workplace success.

Microsoft Office remains the most popular software application used in both higher education and business. To become successful undergraduate students and future employees, freshman students need to improve upon their entry-level computer literacy skills, and gaining software proficiency through instruction in Microsoft Office is an optimal starting point. While introductory lab-based computer classes have existed for decades, the emergence of Web-based, automated grading and tutorial software for

Microsoft Office is a relatively new phenomenon. The effectiveness and efficiency of these products has not been rigorously examined (Varank, 2006). Furthermore, the impact that these innovative educational products have on the design and delivery of curriculum in traditional classrooms is not well documented. Toward filling this gap in literature, this case study will pursue the following goals: (a) to describe how faculty may use Web-based automated grading and tutorial software within a traditional computer literacy classroom, (b) to identify the opportunities, challenges, and experiences perceived by faculty in implementing automated grading and tutorial software within the computer literacy course context, and (c) to determine the levels of technology acceptance and satisfaction experienced by students with respect to using automated grading and tutorial software for Microsoft Office.

## Purpose and Significance of this Study

The purpose of this study is to provide insight into the impact on teaching and learning that results from the implementation of Web-based, automated grading and tutorial software. The research focusses on describing the perceived experiences of faculty and students with this innovative technology within the context of a freshman computer literacy course. It is important to note that the purpose of this study is not to evaluate the technology, faculty, or students. Rather, the goal is to describe users' experiences with the technology, to elucidate levels of usefulness and satisfaction, to determine patterns of usage, and to generate insights that may be used to direct instructional design, curriculum development, implementation planning, and the development of evaluation instruments and strategies for future computer literacy courses.

The significance of this research is that it informs administrators, faculty members, instructors, curriculum developers, and instructional designers of the perceived benefits, challenges, and experiences related to adopting automated grading and tutorial software for Microsoft Office. By contributing to stakeholders' knowledge and understanding in this area, future implementation and evaluation plans may be impacted positively. To summarize, this study builds upon decades of technology acceptance and evaluation research in the investigation of an innovative Web-based, educational technology, within the important and unique context of a freshman computer literacy course.

## Research Questions

The primary research question reads: How has the implementation and use of Web based, automated grading and tutorial software for Microsoft Office impacted the freshman computer literacy course? Specifically, the following research objectives will be achieved:

1. To describe the ways in which instructors are incorporating automated grading and tutorial software into their computer literacy classrooms.
2. To identify the perceptual gaps between instructors' expectations and in-class experiences using automated grading and tutorial software.
3. To identify the opportunities and barriers perceived by instructors with respect to the continued use of automated grading and tutorial software.
4. To describe students' perceptions of system quality, feedback information quality, and overall satisfaction level with the automated grading and tutorial software.
5. To describe students' perceptions of usability, usefulness, and overall attitude toward the automated grading and tutorial software.

Each of these objectives speaks to the purpose of the research by providing contextual insight, as well as responding to the research problem and goal statements for informing future implementation initiatives and designing more applicable evaluative models.

# CHAPTER 2. REVIEW OF LITERATURE

A review of past research for college-level computer literacy courses and web-based automated grading and tutorial systems elicited several key areas for investigation and discussion. First, this literature review begins by formulating a comprehensive, yet finite, definition of computer literacy, and then proceeds to assess the past and current state of research for computer literacy training in higher education. Focusing on software skill proficiency, research into simulation-based tutorials and automated grading systems is summarized with respect to blended instructional practices and automated feedback. Next, key metrics and constructs referenced in computer literacy research are defined, including computer skill proficiency, computer self-efficacy, perceived usefulness, perceived ease-of-use, and end-user satisfaction. In order to evaluate the strengths and weaknesses of potential measurement instruments, several theoretical models for technology acceptance and user satisfaction are described that may be used to assess impact for web-based, automated grading and tutorial systems. Concluding the chapter, a theoretical framework is selected and then linked back to the current research question and study objectives.

## Computer Literacy as a Research Discipline

Research into computer literacy education stems back nearly four decades, shortly after Andrew Molnar first used the term "computer literacy" in 1972 (Gupta, 2006). Epperson

(2010) noted in his comprehensive literature review that most of the computer literacy research occurred prior to 2000, with less than a dozen studies being submitted to the Association for Computing Machinery (ACM) Digital Library in the past decade. Of the 770 articles that Epperson identified using the keywords “computer literacy in higher education,” the majority of studies centered on computer literacy definitions, skill and competency requirements, and descriptions of course revisions (2010). A further review of research studies from sources outside of the ACM Digital Library mirrors these findings and, as a result, will serve as a classification framework for discussing computer literacy as a research discipline.

## Defining Computer Literacy

Two distinct approaches for defining computer literacy appear in research. The first approach is to focus on the effective and efficient operation of a personal computer or mobile computing device; that is, the proficient use of hardware technology and software applications. This performance-centered or skills-based approach typically reveals a definition of computer literacy that emphasizes action-oriented verbs and product-oriented outcomes, such as “to create a newsletter” or “to construct a cash-flow budget.” Gupta’s (2006) definition provides an excellent example: Computer literacy refers to “an individual’s ability to operate a computer system, … print documents, format disks, and use computer applications software…” (Gupta, 2006, p. 115). In fact, the terms “computer literacy” and “computer proficiency” are often used interchangeably to refer to students’ knowledge and ability to use specific computer applications (Grant et al., 2009).

A second approach to defining computer literacy is to focus on understanding how computer technology and digital media affects one's life, career, society, and the world. Distinct from the skills-based approach, this philosophical tact emphasizes higher-order, critical thinking skills (e.g., assessment of digital media and Internet-based content), problem-solving capabilities (e.g., technology's role in personal privacy and security), and socio-cultural awareness of the impact that computer technology has on society and the globe (e.g., social media and groundswell journalism) (Bartholomew, 2004; Hoffman & Vance, 2005; Venables & Tan, 2009). Banerjee and Kawash (2009) argue that it is "no longer acceptable to consider computer literacy in post-secondary education as merely knowing how to use a computer" (p. 1). Instead, the researchers believe that the term "computer literacy" embodies a "style of thinking," learning, and living (2009, p. 1). Other researchers similarly extend the definition beyond the basics of hardware terminology or the use of software applications to encompass computer fluency and information literacy (Hoffman & Blake, 2003; Hoffman & Vance, 2005; Kalman & Ellis, 2007). According to the National Research Council (NRC), a person with computer fluency possesses contemporary skills in information technology (IT) applications, a sound understanding of foundational IT concepts, and the intellectual capabilities for reasoning and problem solving IT issues (Hoffman & Blake, 2003).

Just as Bloom's Taxonomy (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956) differentiates between cognitive learning at the lower levels (e.g., Knowledge and Comprehension) versus the higher levels (e.g., Application through Evaluation), computer literacy definitions emphasize either lower-level skill proficiencies or higher-order critical thinking skills. This particular study is interested in assessing the impact of an educational technology on students' learning and mastery of specific software skills. Targeted at the lower levels of Bloom's Taxonomy (1956), computer literacy in this context emphasizes software proficiency more so than computer fluency and information literacy.

For the purposes of this study, computer literacy is defined as an understanding and appreciation of personal computer hardware, software, and communications technologies, along with specific skill proficiency in a variety of software applications, toward the productive use of such technologies within home, academic, and workplace settings. Regardless of the type of operating system software or physical form of the hardware device (e.g., smartphone, tablet, laptop, or desktop computer), a computer literate individual is able to copy, move, delete, and otherwise manage their digital files, whether stored locally, on a private network, or on the Internet using cloud-based applications. They are competent users of productivity software applications for word processing, analyzing spreadsheet data, and preparing presentations. They are also competent users of Internet-based tools for information retrieval, communication, and publishing, including Web browsers, email clients, and communications software. Lastly, they are technically savvy users who understand the dangers of malware, social engineering, hacking, and other security threats, especially when participating on the Internet. Computer literate users, in summary, are able to safely, efficiently, and effectively use a variety of hardware devices, software applications, and communications technologies to get stuff done.

**Evaluating Software Skills and Levels of Proficiency**

In order to design an effective, goal-oriented curriculum for computer literacy training, educators must first identify the knowledge, skills, attitudes, and abilities already possessed by their prospective audience (Smith & Ragan, 2005). In fact, one of the most commonly asked questions in computer literacy research seems to be whether such a course is truly necessary, given students' ever-increasing exposure to and ownership of technology at younger ages (Ciampa, 2013; Courier & Papp, 2005; Dednam, 2009). To this point, much of computer literacy research focuses on assessing incoming students with respect to their familiarity and competency in using various hardware and software technologies. Two key assertions may be gleaned from this well-researched area: first, students' experience with and knowledge of technology varies greatly and, second, students' increased exposure to technology does not necessarily translate into increased computer knowledge or skill proficiency (Jones et al., 2010; Kennedy et al., 2008; Kvavik & Caruso, 2005; Murray, Hooper, & Perez, 2007; Rondeau & Li, 2009). Students may believe themselves to be above and beyond the freshman-level computer literacy course, but the research proves otherwise (Creighton et al., 2006; Grant et al., 2009; Hanson et al., 2011; Jones et al., 2010; Wallace & Clariana, 2005). Several studies report that while freshman students possess basic skills in the areas of word processing, email, social media, and Web surfing, they lack the breadth and depth of software skills necessary to succeed in their academic programs or in the workplace (Courier & Papp, 2005; Creighton et al., 2006; Dednam, 2009; Eichelberger & Imler, 2015). In her study of 1310 students, Dednam (2009) explains that any increases in practical computer experience seem to relate more to "passive Internet use" rather than the active or creative use of common software applications (p. 26). Similarly, Hoffman and Blake (2003) found that students “come to us as simple consumers” of technology, and are unable to take advantage of the production opportunities it affords (p. 222). In their workforce readiness study, Kaminski, Switzer, and Gloeckner (2009) felt that students’ computer fluency and understanding of technology was disappointing and that students were ill-prepared for their careers. In her recent dissertation, Stewart (2016) reported that students’ computer self-efficacy was much greater than their actual knowledge and computer literacy, and concluded that students are not entering college with the needed foundational computer skills. From these studies, it seems apparent that the freshman-level computer literacy course remains an important curricular component in fostering academic success and preparing students for their workplace careers.

Research over the past decade shows clearly that the majority of freshman students are not computer literate or proficient in the use of productivity software applications. In the Hardy, Heeler, and Brooks (2006) study, incoming students were pre-tested on the fundamentals of using Microsoft Office application software. Application results were 64.68% for word processing, 47.5% in spreadsheet use, 68.15% for presentation software, and 42.88% in database management, with an overall mean score of 55.81% (2006). Given that greater than 60% was deemed necessary to show proficiency and greater than 80% was required to show mastery, the results were clear in demonstrating the need for additional training. The Grant, Malloy, and Murphy (2009) study reveals similar results with students achieving 85% when performing basic Microsoft Word tasks, but 54% for intermediate-level and 4% for advanced-level tasks. In Excel, the results were 38%, 17%, and 2% for basic, intermediate, and advanced-level tasks, respectively. More recently, Gharawi and Khoja (2015) reported that students' self-reported efficacy scores for Word and Excel were 75.6% and 50.2% respectively, yet their actual test scores were 44.7% and 21.8%, clearly showing that students do not know what they do not know. Although specific to one's academic program, post-graduate studies also report the need for student proficiency in the use of Microsoft Office applications throughout their academic program (Courier & Papp, 2005; Gupta, 2006) and workplace careers (Kaminski et al., 2009). Therefore, not only is the freshman computer literacy service course necessary, but research demonstrates the need for specific software training in the use of Microsoft Office applications as an important curricular component across academia.

**Computer Literacy Curriculum and Automated Grading Systems**

Given the skill-level diversity among freshmen students and the constantly changing technology landscape, designing curriculum to meet the demand for computer literacy training is like throwing darts at a moving target. Hoffman and Vance (2005) argued that the pace of change had been so rapid in this area that survey results from previous years were of little value in supporting future curricular changes, and emphasized the need for ongoing research. Consequently, a common research emphasis in computer literacy education is the comparative assessment of alternative content and delivery mechanisms, as well as instructional pedagogical practices and technologies (Edmiston & McClelland, 2001; Hasan & Ali, 2004; Hoffman & Blake, 2003; Johnson, Bartholomew, & Miller, 2006; Kalman & Ellis, 2007; Martin & Dunsworth, 2007; Palvia & Palvia, 2007). Another research emphasis focuses on the use of computer-based and web-based instruction, along with interactive practice activities, as effective methods for teaching computer literacy (Martin, Klein & Sullivan, 2007). Lee, Shen, and Tsai (2010) used web-mediated feedback in a blended learning environment to help students achieve a higher pass rate than traditional students on industry standard software certification exams. Other researchers have incorporated simulation-based software tutorials and automated proficiency exams in the classroom with mixed results (Bretz & Johnson, 2000; Murray et al., 2007; Rondeau & Li, 2009; Tesch, Murphy, & Crable, 2006; Varank, 2006). Two common themes are present across these studies: first, there is a need for ongoing research into instructional practices and innovative technologies for computer literacy education and, second, there is a need to keep the computer literacy curriculum current and stakeholder-focused, in order to meet the changing demands of academia and the workplace.

**Simulation-Based Tutorials and Automated Grading Systems**

As in other disciplines, there has been a continuous stream of innovative instructional practices and Web-based technologies deployed over the past two decades for computer literacy and application software training in higher education. The first simulation-based Microsoft Office tutorial and assessment software products arrived on campuses in the late 1990s; although widespread adoption of these technologies in North America did not take place until the mid-2000s (Scott Davidson, personal communication, 2012). Each of the major educational publishers currently offers a simulation-based technology solution for Microsoft Office training and assessment, targeted at freshman-level computer literacy courses. Pearson Education, the educational technology leader in this area, offers the MyITLab software product (http://www.MyITLab.com/); McGraw-Hill Higher Education provides SimNet (http://successinhighered.com/cit/simnet/); and

Course Technology markets SAM – the Skills Assessment Manager (http://www.cengage.com/sam/). This section summarizes relevant research in the field of simulation-based tutorial, practice, and assessment software, with a focus on blending Web-based technology learning solutions into the traditional freshman-level computer literacy course.

**Key Characteristics of Simulation-based Tutorials**

A simulation is a "special kind of model, representing a real system" (Crookall, Oxford, & Saunders, 1987). A Web-based, computer simulation is an executable program accessed through the browser that stores, processes, and delivers this model in the form of a dynamic system or interactive process (de Jong & van Joolingen, 1998). For simulation-based software tutorials, such as MyITLab and SimNet, learners are guided through a replication of an application program's real environment and directed to perform tasks, whilst being provided with supporting resources and feedback along the way. Gatto (1993) labels this type of instructional activity a "procedural simulation," whereby learners recall, perform, and practice a series or sequence of pre-determined actions within a manufactured environment. Simulation-based software tutorials for Microsoft Office provide learners with an opportunity to interact with and "try out" the application programs from any location with Internet connectivity, without having the physical limitations or restrictions of having to purchase or install the real software on their own computers. This educational technology provides high-levels of user interactivity, automation, and remedial feedback – all key aspects in learning a rules-based software system (Dipietro, Ferdig, Boyer, & Black, 2007; Kirriemuir & McFarlane, 2004). Furthermore, simulation technology provides learners with the opportunity to safely manipulate and explore application software programs without fear or consequences of ruining the system or losing precious data (Aldrich, 2005).

**Educational Rationale for Simulation-based Tutorials**

The traditional instructor-centered transmission model for teaching computer literacy through lecture and demonstration faces many challenges. According to Ruben (1999), there are several key limitations of the instructor-centered paradigm, including: (a) the implication that teaching and learning are inseparably linked activities – that one cannot exist without the other, (b) the belief that the ultimate test of knowledge and skill is in the reproduction of content and processes, rather than the application and transfer of knowledge into performance, (c) the reliance on an expert's transmission of knowledge to novice-students, rather than fostering a social, collaborative, peer-based supportive environment, (d) too much rigidity and emphasis on intentional, fact-based learning, rather than unintentional, exploratory, and informal processes, and (e) the fact that traditional show-and-tell lecture practices are boring. The inadequacies of the traditional information-transfer approach seem to be amplified in the computer literacy classroom, where students expect to use the technology in hands-on situations, confer with and assist their peers, and to learn-by-doing with time-on-task practice activities. Balasubramanian and Wilson (2005) support this viewpoint; writing that today's students are "cognitively more sophisticated and want learning to be fun, engaging, hands-on, challenging, interactive, empowering, and thought provoking" (p. 1). Students crave learning opportunities to create and do, rather than passively watch and listen. They crave interaction and personalization; they are highly visual and adverse to reading (Aldrich, 2005). The need to move away from the traditional lecture-demonstrate model for computer literacy training has never been so clear, as with this generation of learners. Fortunately, simulation-based tutorials can provide flexibly adaptive learning for all types of learners, and support various levels of competency in using Microsoft Office software.

**Simulation Technology in Blended Learning Environments**

Along with the benefits of appealing to today's learners, there exist several practical reasons for implementing Web-based software simulations into higher-education learning environments (Aldrich, 2005; de Jong, 1991; Gatto, 1993), including:

- simulations may be less expensive than alternative strategies, as is often the case in large service-oriented freshman courses.
- simulations may be safer and less risky than working with real-world data in actual software programs.
- simulations can be less stress-invoking, by allowing learners to focus on their exploration and learning rather than real-life consequences.
- simulations can present career-focused product outcomes and case-based scenarios that learners would be unable or unlikely to experience directly at their current level of knowledge, skill, or ability.
- simulations can adjust (speed up or slow down) the time-scale and automate intermediate steps so that learners can better visualize the progression from the starting point to the final outcome.
- simulations can highlight the intent of an instructional interaction, removing other distractions and technical complexities.

- simulations can provide instructional scaffolding, especially in terms of personalized feedback and supporting materials, which may not be available or readily accessible in the real world.

To take advantage of these potential benefits, simulation-based software tutorials should be incorporated into the curriculum wisely, following proven strategies and guidelines gleaned from blended learning research (Bonk & Graham, 2006). Akilli (2007) reminds us that the "relative ineffectiveness of instructional technology thus far has been caused by the application of the same old methods in new educational media" (p. 2). Fortunately, there are well-documented principles for designing effective blended learning environments that combine classroom instructional practices with computer-mediated and online instructional elements (Boettcher, 2007; Bonk & Graham, 2006; de Jong & van Joolingen, 1998; Herrington & Oliver, 1999).

**Simulation-based Assessments for Software Proficiency**

An integral component of the simulation-based software tutorial solution is the assessment and grading system. Currently, simulation-based products provide two separate approaches to evaluating learner proficiency in using Microsoft Office software. First, learners may be assessed by performing tasks within the same simulated environment as provided by the tutorial lesson component. In this component, learners are directed to perform step-by-step tasks within a confined software environment and then provided with a summary report of their results, as well as an optional feedback report and recommended remedial lesson path. A second approach is to allow learners to perform tasks within a live software application, in which they follow outcome-focused directions and then upload their work for assessment into an automated grading system.

The live or in-application approach provides a real-life contextual evaluation of a learner's proficiency, with the same reporting and feedback options offered by the simulated assessment. While simulation-based assessments for software training have been well-studied over the past decade to measure students' proficiency using Microsoft Office (Grant et al., 2009; Murray et al., 2007; Rondeau & Li, 2009; Tesch et al., 2006), the live or in-application assessment approach is relatively new.

**Automated Grading and Feedback Systems**

Because of the technical constraints, Web-based automated grading for computer software training has been challenging for both educational publishers and academic institutions. However, computer-based automated testing in the traditional sense has been implemented in other program areas over the past few decades. For the most part, computer-based testing has been found to give similar outcomes to conventional, written tests (Zandvliet & Farragher, 1997). Such automated testing systems may be classified as diagnostic, formative, or summative (Jenkins, 2004). Simulation-based software proficiency exams, for example, would be diagnostic when used to ascertain the skill level of incoming freshman students. These same exams would be classified as formative when used during in-class practice exercises, and summative when used for final course grades. Jenkins (2004) reports on several advantages of computer-based automated grading systems, which include: repeatability, immediacy of feedback to students, immediacy of feedback to faculty, reliability and equitability, timeliness, student motivation, and flexibility of access. These advantages are increasingly important given students' desire to receive more detailed feedback, faster and more personalized than ever before (Peat & Franklin, 2002). As noted by Chickering and Gamson (1987), students need appropriate and timely feedback on their performance in order to self-assess their knowledge and competence. Automated grading and feedback systems can provide more consistent, helpful, constructive, and frequent feedback than is possible manually (Debuse, Lawley, & Shibl, 2007). In a follow-up study, Debuse, Lawley, and Shibl (2008) found that automated feedback systems also had a positive impact on instructors' workload, costs, and time requirements, and that instructors were highly satisfied and intended to continue using their automated grading and feedback system.

Feedback plays an important role in assessment and teaching (Mory, 2004) with many learning theorists positing that it is essential to students' learning (Driscoll, 2005). Higgins, Hartley, and Skelton (2002) noted that timely and high-quality feedback helped students become actively engaged in the content, as well as in the learning environment itself. As mentioned previously, one of the primary advantages of using a Web-based, automated grading system is the ability to provide immediate feedback for individual student responses. In addition to helping learners identify errors, assessment and feedback systems also provide a significant factor in motivating further learning (Mason & Bruning, 2001; Mory, 2004; Narciss & Huth, 2004). Specifically, effective feedback provides verification that the learner knows how to perform a task correctly, along with explanation or elaboration details that guide the learner to the resources necessary for correcting their behavior (Kulhavy & Stock, 1989; Shute, 2008). For both formative (i.e., lesson practice) and summative (i.e., exam) assessments in simulation-based grading and tutorial software systems, the majority of feedback is also topic-contingent, directing (or linking) the learner back to remedial lessons for more practice.

While Azvedo and Bernard (1995) demonstrated in their meta-analysis of computer-based feedback that achievement levels were greater for students receiving feedback, it is the individual student's motivation to actually utilize the feedback system that becomes the critical determining factor (Morrison, Ross, Gopalakrishnan, & Casey, 1995). Kulhavy and Stock (1989) feel that the greater the difference between a student's self-efficacy and actual performance, the higher their motivation to actively utilize and process the feedback. Morrison et al. (1995) found that students' motivation to utilize feedback for increased learning was greater with performance-based incentives (e.g., grades) over task-based incentives (e.g., course credit). However, Shute (2008) cautions that feedback research remains a controversial and imperfect science and that several studies (Bangert-Drowns, Kulik, Kulik, & Morgan, 1991; Mory, 2004) have reported that "feedback has either no effect or debilitating effects on learning" (Shute, 2008, p. 156). One of the reasons for this inconsistency posits Shute (2008) is that the effects of feedback may be a "function of individual differences among motivational prerequisites" (p. 176). While self-regulated learners have the ability to be metacognitively, motivationally, and behaviorally active in their own learning (Zimmerman, 1990), other students may lack the skills necessary to apply self-regulated learning strategies or utilize the feedback provided in a learner-controlled, blended environment. Therefore, in assessing automated grading and tutorial software systems, it may be important to elucidate the role that students' perceptions, motivations, self-efficacy, and self-regulative abilities play in the adoption and use of the educational technology.

## Assessing Computer Literacy Performance, Practices, and Technologies

Another interesting aspect of computer literacy research involves the methodologies and instruments used to measure technical skills and competencies. In several computer literacy research studies, results are obtained either by surveying a convenient sample of students within pre-existing classes or by introducing a new instructional practice or simulation-based technology and then comparing summative examination grades to previous classes. This section reviews and describes some of the common constructs measured in the study of information technology, information systems, computer literacy, and application software training.

### Computer Skill Proficiency

Many higher-education programs assess incoming students' computer proficiency using a self-evaluation survey of their expertise with various technologies, including email, Web browsing, computer graphics, and office productivity software (Ciampa, 2013; Courier & Papp, 2005; Gharawi & Khoja, 2015; Goodfellow & Wade, 2007; Grant et al., 2009; Gupta, 2006; Hoffman & Vance, 2005; Hanson et al., 2011; Perez, Murray, & Myers, 2007). Other programs use hands-on, simulation-based assessment tools to determine incoming students' skill proficiency with specific applications, such as Microsoft's Word and Excel (Rondeau & Li, 2009; Tesch et al., 2006; Wallace & Clariana, 2005). While self-evaluation surveys seem to be non-standardized and program-specific, the hands-on, computer-based assessments are more structured but, arguably, confined by the questions available in the simulation-based software. In other words, educational publishers determine and create the questions that are stored in the software assessment tools, and then instructors select the desired items to present to students from the pool of available questions. In a personal communication (September, 2011) with Scott Davidson, the publisher of McGraw-Hill's SimNet product, the test bank of skill proficiency questions for their simulation software is developed using the Microsoft Office Specialist (MOS) certification guidelines. Both the core- and expert-level guidelines for MOS certification in Microsoft Word, Microsoft Excel, and Microsoft PowerPoint are available online at http://www.certiport.com/ (Certiport Inc., 2012). The majority of universities and colleges providing a freshman-level computer literacy course require that tutorial and assessment content be provided for at least the core-level certification objectives in Microsoft Office (Scott Davidson, email communication, 2011).

**Computer Self-Efficacy**

The pervasive use of self-evaluation for determining students' level of computer literacy and software proficiency requires further discussion. These surveys require individuals to self-assess their knowledge and skill in using computer hardware and software toward achieving a goal (e.g., performing a mail merge); measuring a construct known as computer self-efficacy (Compeau & Higgins, 1995). Derived from the self-efficacy research of Albert Bandura (1977, 1993), computer self-efficacy represents "an individual's perceptions of his or her ability to use computers in the accomplishment of a task…" and has been identified as a key motivational construct in terms of technology adoption and computer use (1995, p. 191). Karsten and Schmidt (2008) studied incoming business students' computer self-efficacy between 1996 and 2006 and found that, although students' experience with technology had increased greatly, their computer self-efficacy scores had actually decreased. The researchers cautioned that computer self-efficacy is a "domain-specific, dynamic construct that changes over time" and that it is the “kind of experience, and not computer experience per se, that influences self-efficacy perceptions” (2008, p. 446). In their review of nearly 8,000 students, Poelmans, Truyen, and Desle (2009) found that the more students interacted with the Internet, the higher their perceived degree of computer literacy, especially among males. Moreover, a majority of researchers have found that incoming college students’ computer self-efficacy is far greater than their actual knowledge levels (Stewart, 2016), with scores as much as 20 points higher than their actual computer skill proficiency (Johnson et al., 2006). Although based on subjective self-assessment, the computer self-efficacy construct is another key factor in understanding and explaining students’ motivation, usage behavior, and attitude towards a web-based, automated grading and tutorial software system.

**Behavior-based Measures of Technology Acceptance**

Perceived usefulness and perceived ease-of-use are two well-researched constructs used to inform and assess technology acceptance and usage (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989; Venkatesh, Morris, Davis, & Davis, 2003). The perceived usefulness construct measures the “degree to which a person believes that using a particular system would enhance his or her job performance” (Davis, 1989, p. 320). Perceived usefulness has also been shown to directly impact the sustained use of a technology (1989). The perceived ease-of-use construct measures the “degree to which a person believes that using a particular system would be free of effort” (1989, p. 320). If a technology is difficult to use or learn, the physical or mental effort required may outweigh the benefits realized by the technology. Although Davis (1989) found that both constructs were significantly correlated with technology adoption and usage, the most significant relationship occurred between usefulness and usage. In other words, technologies that offer advantages in terms of productivity and workflow are evaluated more favorably by users, regardless of whether they may be somewhat challenging to learn or use. Furthermore, Davis (1989) suggests that ease-of-use may actually be “an antecedent to usefulness, rather than a parallel, direct determinant of usage” (p. 334). The technology acceptance model (TAM), along with survey instruments developed by Davis, may be used to measure the impact and acceptance of new Web-based, educational technologies.

**Object-based Measures of End-User Satisfaction**

End-user satisfaction is an attitudinal measure of the feelings held by a person towards a particular technology (DeLone & McLean, 2003). Within technology and information systems research, user satisfaction is typically measured using a survey instrument consisting of various characteristics or attributes, including system quality (e.g., accessibility, timeliness, and flexibility), information quality (e.g., accuracy, reliability, and completeness), and service quality (e.g., vendor support, response time, and technical competence) (DeLone & McLean, 2003; Doll & Torkzadeh, 1988; Mahmood, Burn, Gemoets, & Jacquez, 2000; Palvia & Palvia, 2007). In their meta-analysis of end-user satisfaction studies, Mahmood et al. (2000) found three main categories impacting satisfaction – perceived benefits, user background and involvement, and organizational attitude and support. Among the most significant variables identified, perceived usefulness and user experience were among those with the highest effects (2000). While user satisfaction studies consistently show that one’s behavioral beliefs and attitudes influence their perceptions of a technology’s ease of use and usefulness, user satisfaction itself has been found to be a relatively weak predictor for usage behavior

(Wixom & Todd, 2005). Furthermore, user satisfaction by itself is not necessarily related to performance improvement or proficiency (Palvia & Palvia, 2007). However, it is an important construct to keep in mind when selecting a theoretical framework for investigating the impact of an educational technology, but it may serve more as a contributing, descriptive element rather than a determining, causal factor.

## Theoretical Models for Assessing Acceptance of an Educational Technology

There are several theoretical models that have been widely researched with respect to determining the adoption and usage of innovative educational and information technologies. To begin, the theory of reasoned action (TRA) by Fishbein and Ajzen (1975) provides the foundational constructs, which are then applied to technology acceptance research in (a) the theory of planned behavior (TPB) (Ajzen, 1991), (b) the technology acceptance model (TAM) (Davis et al., 1989), (c) the unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al., 2003), and (d) the integrated research model proposed by Wixom and Todd (2005). This section describes these models and then determines the best fit for assessing impact on student usage behavior and satisfaction levels with respect to a Web-based, automated grading and tutorial software system.

### Theory of Reasoned Action (TRA)

The theory of reasoned action (TRA) posits that an individual’s actual behavior (e.g., their trial and continued use of an educational technology) derives from their intentions to act or behave in a certain way (Fishbein & Ajzen, 1975). As shown in Figure 2.1, these intentions are formed by the individual’s attitude toward the particular behavior, along with the presence of any subjective norms or social pressures. Fishbein &

Ajzen (1975) define attitude as the individual's positive and negative feelings toward the behavior and their expectations of consequences related to the behavior. TRA would suggest that faculty and students will continue to use an automated grading and tutorial software system if their initial experience with the product has been positive and if peers, mentors, or other key referents communicate their support for the technology. A significant limitation of the model, however, includes the potential for confounding between attitude, subjective norms, and an individual's personal motivations to perform. Furthermore, the model assumes that an individual is free to act once the intention to behave is formed, regardless of any time, cost, or environmental barriers that may exist.

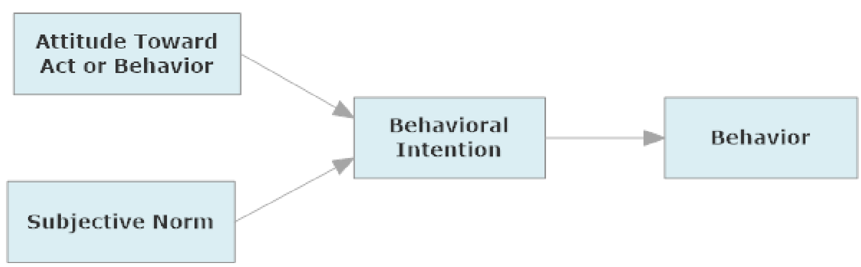


*Figure 2.1.* The Theory of Reasoned Action (Fishbein & Ajzen, 1975)

**Theory of Planned Behavior (TPB)**

In response to the above limitations, Ajzen (1991) later developed the theory of planned behavior (TPB), shown in Figure 2.2. TPB posits that, in addition to the other influencing factors, behavioral intentions are also formed by an individual's perception of the ease with which the act or behavior can be performed. In other words, TPB implies a continuum of behavioral control from an action that is easily performed to one that is difficult, time-consuming, or resource intensive. With respect to faculty and students, TPB suggests that an educational technology may be more readily adopted if it is easy to learn and use, relatively inexpensive, and/or easily deployed and maintained.

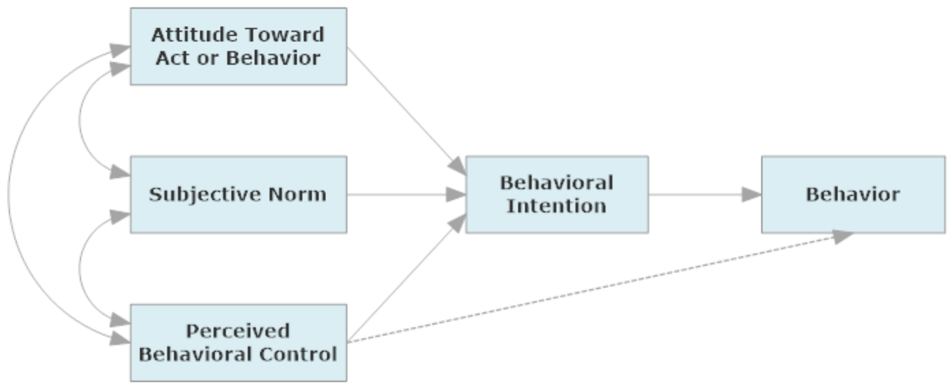


*Figure 2.2.* The Theory of Planned Behavior (Ajzen, 1991, p. 182)

**Technology Acceptance Model (TAM)**

The technology acceptance model (TAM) is an adaptation of the theory of reasoned action (TRA) model created to predict and assess the adoption and acceptance of information technology and information systems (Davis et al., 1989). As shown in Figure 2.3, TAM posits that an information system's actual usage is determined by one's behavioral intention to use the technology, which is in turn formed by their attitude toward using the system and their perception of its usefulness. Similar to the theory of planned behavior (TPB), TAM accounts for the behavioral control continuum by measuring an individual's perception of the system's ease of use and accounting for external factors which may impact one's beliefs (Venkatesh et al., 2003). While TAM has been frequently used in studies of technology acceptance over the past decade, the explanatory predictive power of the model has been found lacking with only a 50%

accounting of the variance in actual system usage (Park, 2009; Venkatesh & Davis, 2000). Regardless, TAM has been well-documented and empirically supported in numerous information technology and system studies.

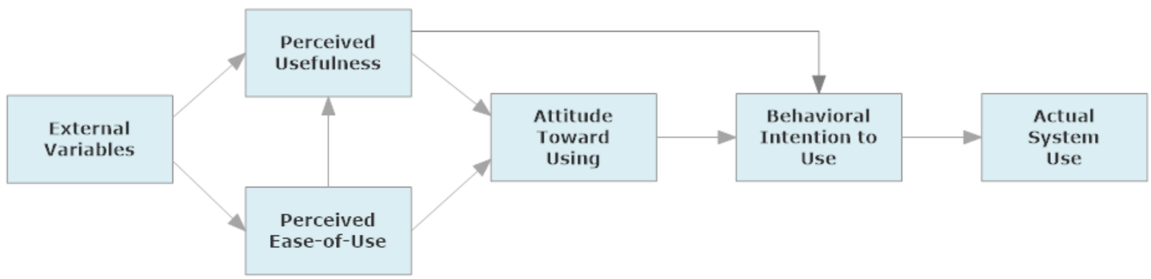


*Figure 2.3.* The Technology Acceptance Model (Davis, 1989, p. 985)

**Unified Theory of Acceptance and Use of Technology (UTAUT)**

The unified theory of acceptance and use of technology (UTAUT), shown in Figure 2.4, attempts to consolidate constructs from eight prominent theories in order to better explain information systems usage behavior (Venkatesh et al., 2003). UTAUT posits that there are four key constructs – performance expectancy (i.e., usefulness), effort expectancy (i.e., ease-of-use), social influence, and facilitating conditions – that act as direct determinants of an individual's behavioral intention to adopt and use a particular technology (2003). Along with these direct determinants are four mediators – gender, age, experience, and voluntariness of use – that either enhance or diminish the impact of the key constructs (2003). Analyzing these constructs across a longitudinal study, Venkatesh et al. (2003) were able to achieve a 70% accounting of variance in usage intention for an information system. With its strengths as a unified, evidence-based model, UTAUT has become one of the most popular ways to evaluate users' acceptance of a technology.

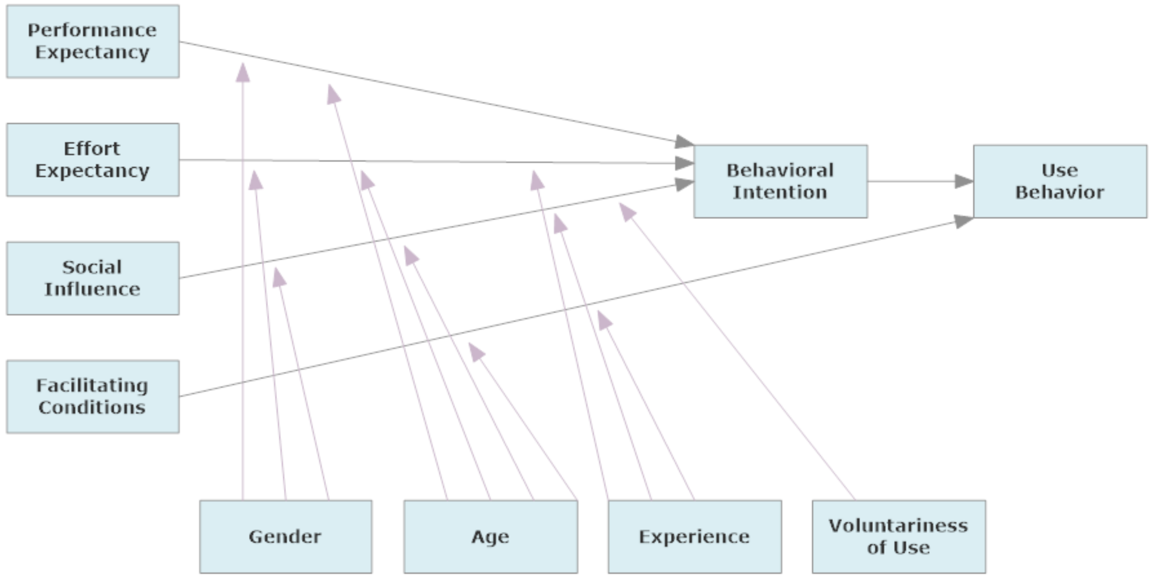


*Figure 2.4.* The Unified Theory of Acceptance and Use of Technology Model (Venkatesh et al., 2003, p. 447)

While technology acceptance literature has successfully predicted usage behavior of educational technologies based on attitudes and beliefs of the system's ease-of-use and usefulness (Chauhan & Jaiswal, 2016; Lakhal & Khechine, 2016; Nistor, Gogus, & Lerche, 2013), an analysis of the impact of system design and information attributes on end-user satisfaction is lacking. Furthermore, the aforementioned models rely on individuals' perceptions of how they might use an information system in the future, based upon limited exposure to the actual technology. User satisfaction research for information technology fills this gap by focusing on the information and system design characteristics that may promote the ongoing usage of a technology or information system (Benbasat & Barki, 2007). Although technology acceptance and user satisfaction literature have largely evolved as parallel research streams, the two approaches have been successfully integrated more recently by Wixom and Todd (2005).

**Wixom and Todd Integrated Research Model**

Wixom and Todd's (2005) research model, shown in Figure 2.5, builds out the technology acceptance model by incorporating measures for information satisfaction and system satisfaction. These object-based attitudes are both "assessments of the consequences of using a system to accomplish a task" and are influential on and predictive of behavioral dispositions towards technology acceptance (2005, p. 90). The information satisfaction construct, as depicted in Figure 2.5, derives from an individual's beliefs about the quality of information, assessed according to its completeness, accuracy, format, and currency. The level of satisfaction with information quality impacts an individual's performance expectancy and perception of the usefulness of the system. System satisfaction is formed from beliefs about the quality of the system; specifically, its reliability, flexibility, integration, accessibility, and timeliness of reporting. An individual's level of satisfaction with system quality impacts their effort expectancy (i.e., beliefs regarding ease-of-use) and, in turn, their overall satisfaction with the system. Wixom and Todd (2005) believe that these information and system characteristics may be manipulated in the design and implementation of an information system or technology, in order to improve overall satisfaction and to promote continued and heightened usage behavior.

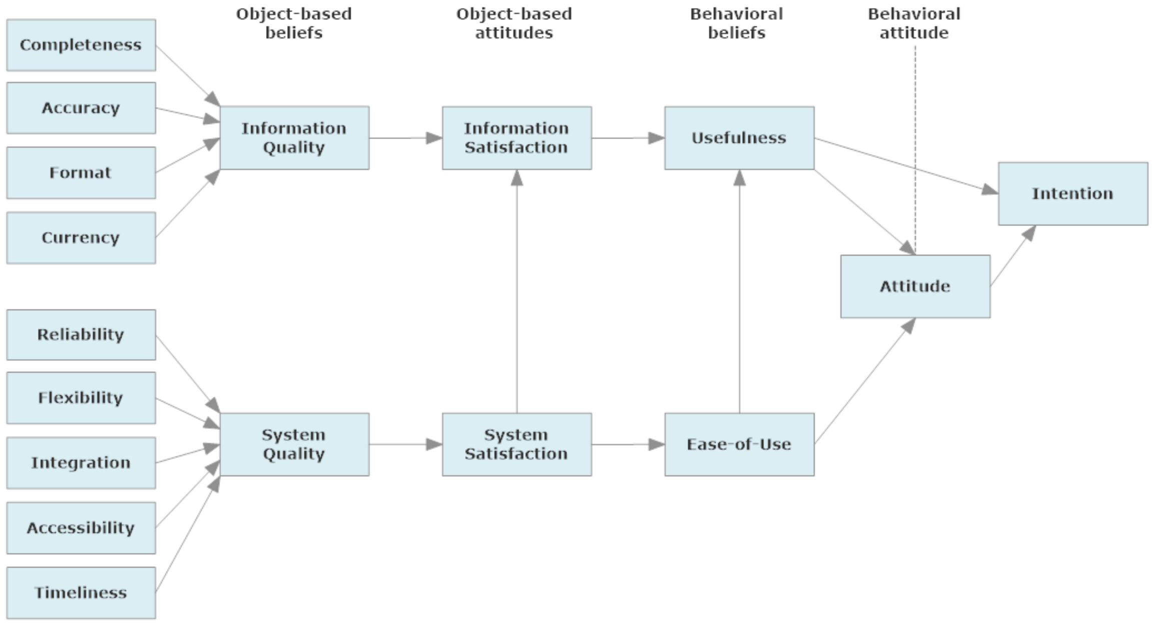


*Figure 2.5.* The Integrated Research Model (Wixom & Todd, 2005, p. 90)

**Summary of Measures for Technology Acceptance and Usage**

In summary, the impact and acceptance of an educational technology solution may be explained by measuring and evaluating the beliefs and attitudes of existing users, in a manner that is consistent in both time (e.g., a semester) and context (e.g., freshman computer literacy class) (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980). Especially when combined with measures of user satisfaction, a comprehensive understanding and appreciation for the external factors influencing users' beliefs and attitudes towards a technology may be derived (Wixom & Todd, 2005). Unfortunately, each student's experience cannot be assumed to be identical and generalizable given the voluntary nature of the technology's use and implementation within the context of a class section. Therefore, the selection of a theoretical framework for data collection, analysis, and interpretation becomes crucial in terms of compiling an informed description of the perceived impact of this technology on a computer literacy course.

## Determining Impact of an Educational Technology on the Computer Literacy Course

Past research demonstrates that computer literacy education is an important curricular component and that the majority of incoming freshman students do not possess the level of computer competency required for academic or workplace success. Furthermore, most of the research conducted in the area of computer literacy relates to either evaluating incoming students' computer self-efficacy and skill proficiency or comparing student grade outcomes after the adoption of an instructional technology. While research into educational simulations, blended learning environments, and feedback can inform the area of automated grading and tutorial software, there remains the need for a holistic study of the perceived impact on instructors, students, and the classroom environment.

### Identifying the Theoretical Framework

The theoretical underpinnings for this study are grounded in past research. First, for assessing the perceived impact on students when introducing new technologies into traditional situations, the well-documented theoretical models for technology acceptance (Venkatesh et al., 2003) and end-user satisfaction (DeLone & McLean, 2003; Doll & Torkzadeh, 1988) provide guidelines for both data collection and analysis. The integrated research model by Wixom and Todd (2005) presents a reasonable merger of these models and provides a proven measurement tool for the necessary constructs. Second, for assessing the impact of contextual variables on the aforementioned results, a qualitative approach is well-suited for describing the variation in people's perceived experiences with the technology. The nature of the research is to understand how individuals experience important aspects of their learning environment, with the results being pooled for analysis at the collective level in order to inform future practices. Because instructors may voluntarily implement, use, and reference the automated grading and tutorial software differently within their classes, the qualitative orientation provides an appropriately holistic perspective for understanding and explaining potential variations, as measured by the quantitative instrument results from the Wixom and Todd integrated research model (2005).

**Restating the Significance of this Study**

With the diverse and, at times, disappointing technology skills of incoming freshman students, the computer literacy course is an ongoing-concern for various stakeholders in higher education, including program directors, faculty members, curriculum developers, instructional designers, and future employers. To better manage this skill diversity, many colleges and universities have adopted student-centered, simulation-based tutorials and software proficiency exams for Microsoft Office. Past research has competently measured the skill proficiency of incoming students and the grade outcomes associated with implementing simulation-based tutorials. However, these quantitative measures and self-assessment surveys do not adequately describe the experience of instructors and students when implementing a Web-based, automated grading and feedback system. Nor do these past studies describe students' perceptions and behavioral intentions towards using an automated grading system for software training. This study focuses on better understanding the impact of this technology on the computer literacy classroom toward the goal of informing curriculum development and instructional design, as well as the development of future technology products for computer literacy education and evaluative instruments for future research studies.

# CHAPTER 3. METHODOLOGY

The case study research methodology was selected to investigate the experiences of instructors and students when introducing automated grading and tutorial software into a freshman computer literacy course. This strategy provides an "all-encompassing method" for systematically studying and describing a phenomenon (in this case, the implementation of an educational technology) within a real-life context (Yin, 2003, p. 14). Furthermore, the case study method provides an empirical framework for collecting, analyzing, and triangulating multiple sources of quantitative and qualitative evidence, including documents, interviews, observations, and surveys (2003). And, most importantly, the case study method was chosen because the goal is to expand and generalize on theoretical propositions of technology acceptance by investigating an innovative educational technology within a unique context.

The case study research strategy also provides an excellent methodological framework for performing mixed-method research studies in the social sciences (Merriam, 1998; Yin, 2003). As an evidence-based strategy, the case study method furnishes the researcher with a proven set of procedures for investigating an empirical topic within a naturalistic setting (2003). In this particular study, the context of the freshman computer literacy course, along with the implementation of an innovate technology, is hypothesized to impact both instructor and student experiences. A descriptive case study successfully provides multiple sources of qualitative and quantitative evidence for triangulating such experiential data in an all-encompassing manner (2003). Yin (2003) also suggests that the case study method is appropriate “when a ‘how’ or ‘why’ question is being asked about a contemporary set of events, over which the investigator has little or no control” (p. 9). This study’s research question aligns well with this viewpoint, asking how an innovative technology impacts the computer literacy classroom, and why instructors and students experienced the technology the way they did. Rather than a traditional mixed-methods study that selects independent approaches to data collection and analysis, the case study method offers an integrated, structured approach for a more holistic and descriptive result. As a method of inquiry, the case study approach is further supported by the theoretical framework of technology acceptance and user satisfaction to orient the data collection, analysis, and interpretation of data.

## Case Study Design

A mixed-method, single-unit, embedded case study design strategy has guided the decisions, planning, and implementation of the research methodology. This design strategy focuses the inquiry on a single context (e.g., a course), but requires collecting and analyzing data from multiple units (e.g., instructors or course sections) within that context. These embedded subunits are analyzed both separately and corporally in response to the stated research questions. The analysis does not, however, focus solely on the individual subunits, but returns to inform the wider perspective of investigating and describing the perceived impact of an innovative educational technology on instructors, students, and the classroom culture. This methodological approach also supports the collection and analysis of qualitative and quantitative data from course documents, classroom observations, instructor interviews, and student surveys.

## Unit of Analysis and Sampling

This single-unit, embedded case study design strategy was employed to study the perceived impact of an automated grading and tutorial system called MyITLab, produced by Pearson Education. The specific context for this study is a freshman computer literacy course entitled “BuAd 128 – Computer Applications I,” offered by the School of Business at Okanagan College in British Columbia, Canada. As a required freshman course for both the 2-year diploma and 4-year Bachelor of Business Administration (BBA) degree, BuAd 128 receives annual enrolments of over 400 students, translating into more than ten sections of 40 students (maximum) each Fall semester. This 3-credit course is taught in 40-station computer labs, typically in two hour sessions twice per week, and also offered via distance education. An approved syllabus from the 2011/2012 academic year, complete with learning outcomes (and redacted instructor names for confidentiality), is provided in Appendix A.

Instructors in the School of Business at Okanagan College fall within two employee groups: (a) continuing or full-time professors and (b) part-time or adjunct lecturers. Both groups are members of the faculty association and, as such, protected from potential abuses arising from research conducted within classrooms. In order to receive permission to enter a classroom and conduct observations or interviews, a research proposal and formal request was presented to the Research Ethics Board (REB) at Okanagan College in September, 2011, and approval received in October, 2011. The Okanagan College REB aligns their ethical review process with the Tri Council Policy

Statement of ethical conduct for research involving human participants (Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, and Social Sciences and Humanities Research Council of Canada, 2010). In order to analyze the data archived from the 2011/2012 academic year, an application was made to the Institutional Research Board (IRB) at Purdue University in April, 2016. Approval for exemption status was summarily received in May, 2016 (see Appendix B).

Having already selected BuAd 128 as the single-unit under study, the individual class sections were then grouped by instructor as the embedded units for analysis. Arguably considered a census for the single-unit course population, these embedded instructor units are more clearly defined as a purposeful sample from a convenient population. A purposeful sample focuses on information-rich cases to yield insights and depth of understanding, while a convenient sample is often void of such strategic goals (Patton, 2002). While access to class sections at one's home institution may be convenient, the case study's ultimate goal is to develop and refine analytic generalizations within the context of a freshman computer literacy course, which aligns well with Patton's (2002) definition of the purposeful, typical-case sampling approach.

Data were collected during the Fall semester of the 2011/2012 academic year. There were five instructors and 322 students included in the study, as shown in Table 3.1. Each of these instructors were personal colleagues, and had previous experience teaching BuAd 128. Speaking to the continued relevance of the study between the data collection and reporting periods, four of these instructors have continued to teach BuAd 128 using the MyITLab Grader software up to and including the Fall 2016 semester. Two distance education sections of BuAd 128 (19 students) were left out of the study, as the research purpose centers around the in-class experiences of instructors and students. Maintaining the principle of beneficence and, specifically, respondent confidentiality, instructor names were changed to pseudonyms upon data collection (Corti, Day, & Backhouse, 2000). The five pseudonyms were selected using an Internet-based random baby names generator, available at http://randombabynames.com. These names were applied sequentially to replace the existing instructor names, keeping consistent with the actual gender distribution. Other identifying information, such as location and setting characteristics, were also removed to ensure respondent anonymity (2000).

Table 3.1

*Embedded Units of Analysis for BuAd 128 (Fall 2011)*

| Instructors | Sections | Students |
|---|---|---|
| Andrew | 3 | 92 |
| Brenda | 2 | 63 |
| Peter | 2 | 71 |
| Scott | 2 | 61 |
| Susan | 1 | 35 |
| Total | 10 | 322 |

## Document Collection and Analysis

The course syllabi and application quizzes for BuAd 128 were collected in November, 2011, via personal email from the five instructors. Each syllabus was provided as an Adobe Acrobat PDF file, and later confirmed to be the same document that was posted to students through the college’s Blackboard Learning Management System (LMS). While the majority of courses in the School of Business share a common syllabus between sections, instructors are free to customize the course schedules and section resources. Therefore, a comparative content analysis was performed on the syllabi to identify any significant differences. This process entailed reviewing the four-page documents next to one another and then manually highlighting any inconsistencies or additions for further investigation during the personal interviews. Furthermore, a course syllabus from the 2015/2016 academic year was collected and analyzed to determine if the course description, learning outcomes, and course objectives had changed significantly over the past four years. Finding only minor cosmetic changes (e.g., version numbering updates) and wordsmithing, the relevancy of the study's context remains intact for this particular course.

The application quizzes were also provided as digital files. For the Microsoft Word application quiz, three files were provided from each instructor: one Word Quiz instruction document, one Word Quiz source document, and one target PDF output file. For the Microsoft Excel application quiz, a single Excel workbook from each instructor was collected for analysis. These files were then compared side-by-side to determine if any differences appeared in the quiz instructions, question content, and/or difficulty level. As with the syllabus, quiz documents for Microsoft Word and Microsoft Excel were collected from the Fall 2015 semester. While some contextual content had been changed or updated within the document files, the examined skills were almost identical to the Fall 2011 assessments.

In January, 2012, a formal request was made to the Dean of the School of Business for an institutional Grade Point Average (GPA) report for the Fall 2011 semester of BuAd 128. Approval was confirmed and received within one week via email and the request was then forwarded through inter-office mail to the Okanagan College

Institutional Research Area. By mid-February, 2012, the GPA grade analysis report was received via email from the Institutional Research Area. This two-page document summary provided final enrolment and grade statistics for the semester, broken down by instructor. The data were cataloged and recorded as another piece of confirmatory evidence for triangulating results from the student survey.

## Instructor Observations and Interviews

The five instructors provided the primary source of evidence for this case study. The development of the interview protocol was guided by the research questions and theoretical framework. Furthermore, classroom observations were conducted prior to the interviews in order to clarify the direction, language, and depth of questioning. Although the qualitative analysis had not yet occurred, the analytic memos and familiarity assisted in the development of the instructor interview protocol. These observations also provided an important confirmatory data source for describing the ways in which instructors incorporated the MyITLab Grader software into their lessons. The personal interviews with each instructor focused on the technical aspects of course preparation, lesson delivery, assessment, and, more importantly, any perceptual gaps that existed between instructors’ expectations and their perceived in class experiences with MyITLab Grader. Informed by the classroom observations, these interviews also provided a flexible and extensible vehicle for discussing potential opportunities and barriers with respect to the continued use of MyITLab Grader in BuAd 128.

### Role of the Researcher

Documenting the researcher’s roles, perceptivity, and potential biases is especially important when conducting qualitative inquiry that employs observations and interviews (Charmaz, 2003; Patton, 2002). While not affecting the collection, measurement, or analysis of quantitative data, a researcher's epistemological beliefs, values, knowledge, and experience inarguably impact the interpretations of faculty-student interactions, lecture styles, and classroom management. Furthermore, disclosing the background, expertise, and potential biases of the researcher can enhance the trustworthiness and credibility of the analysis (2002).

With respect to the computer literacy discipline and specific Microsoft Office content area, I am a recognized expert with over 20 years of experience in computer software training and assessment. I have been the lead author and editor for a successful series of college-level, computer textbooks, published by McGraw-Hill Higher Education. I have also reviewed articles and trade books and presented at conferences and symposiums as an instructional expert for Microsoft Office applications. Currently, I am a faculty member in a large Canadian college, responsible for teaching introductory and advanced computer literacy and information technology courses for the School of Business. I also have several years of experience teaching the course entitled "BuAd 128 – Computer Applications I," which has been selected as the primary unit of analysis for the case study. Since the data collection period during the 2011/2012 academic year, I have taught an additional eight sections of the course prior to commencing data analysis.

In addition to my technical writing and teaching experience, I have been integrally involved in planning, promoting, and designing software simulations and e learning programs for higher education. Over the past decade, I have been an early adopter of software simulations and other innovative technologies for classroom use. Along with such experiences comes a certain degree of bias towards the appropriate implementation and use of technology within the computer literacy context. I am definitely a proponent for using instructional simulations and automated grading systems, and I believe that they offer a safe, engaging, and practical learning environment for students.

In summary, my prolonged experience, knowledge, and expertise in this area provides a unique opportunity for describing how an educational technology is implemented, used, and perceived by faculty and students in a freshman computer literacy course.

**Classroom Observations**

Classroom observations were conducted in late November, 2011. Instructors were first contacted in early November via telephone and a mutually-acceptable observation date was scheduled for later in the month. Other than a confirmation email the week before the observation, there was no other contact with or instructions given to the instructor. The chosen methodological approach was a naturalistic, direct observation of one complete session from each instructor’s classroom. The purpose for these observations was twofold: first, to better understand and capture the context within which instructors and students experienced using the MyITLab Grader software (Patton, 2002) and, second, to inform the development of questions and probes for the interview protocol. Another benefit would be the insights gained with respect to differentiating the selective perceptions of instructors (collected during interviews) from the researcher’s emic perspective moderated through direct observations (2002).

Before each observation, the researcher met with the instructor and explained the purpose of the study and how the collected data would be used, stored, and kept secure.

The instructor then read and signed the informed consent form (Appendix C) for both the observation and personal interview protocols. The observations themselves were conducted in an overt fashion, beginning with a brief introduction to the researcher by the instructor. Observations were conducted without a formally written protocol, following the observer-as-participant model. As suggested by Merriam (1998), the purpose of the observation was sensitized to and guided by the research questions and theoretical framework. Positioned near the back corner of the computer lab, the researcher used the Cornell note-taking method (Cornell University, 2015) to record a handwritten, direct narrative of events, along with procedural and analytical memos. The observations were not videotaped or audio-recorded, in order to meet the strict personal protection guidelines set out by the Research Ethics Board (REB) of Okanagan College for observing employees and students within the college setting. Each of the five classroom observations took place for the duration of the two-hour class. After completing the observation, the instructor met briefly with the instructor to review the notes and to confirm that the observed class session was typical for the semester, especially with respect to the activities and interactions with students and software.

Within one week after each classroom observation, the handwritten notes and memos were scanned into the data archive for safe-keeping and then transcribed into Microsoft Word. Procedural and content memos were added to the narrative as Microsoft Word comments. The observation documents were then exported as Rich-Text Format (RTF) files for subsequent analysis using the ATLAS.ti and MAXQDA qualitative data analysis software programs (ATLAS.ti Scientific Software Development GmbH, 2016; VERBI GmbH, 2016).

**Instructor Interviews**

Instructor interviews were conducted in mid-January, 2012. To prime the instructors for the discussion, a pre-interview survey was sent out to each instructor via email, requesting their response to several open-ended questions (see Appendix D). Only two of the five instructors responded to the survey email request. Fortunately, the purpose of this email was not for data collection, but to remind instructors of the interview topics and to provide them with some rumination time before the actual interview. The formal interview protocol was finalized in early January, after completing a brief analysis of the observation data (see Appendix E). The protocol focused on four key discussion areas around the instructor’s use of the MyITLab Grader software: 1) Class Preparation, 2) Teaching and Administration, 3) Student Learning, and 4) Perceptions and Expectations. These categorizing areas were formulated in response to the research objectives, while the observation analysis assisted with wording and phrasing. Once the interview protocol had been finalized, the instructor interviews were requested and scheduled individually via telephone for a mutually convenient time and location.

Each instructor interview lasted approximately one hour, ending with an additional 15 minutes of informal and unrecorded debriefing. The interviews were conducted and recorded using an Olympus WS-320M digital voice recorder (along with a smartphone for backup). Handwritten notes were also used for taking procedural, analytical, and content memos, and for recording potential probe questions that could be used during the interview. The audio recordings were uploaded into the data archive and then transcribed into Microsoft Word within two weeks of the interview date. Shortly thereafter, each instructor was sent their interview transcript via email for member-checking and instructed to use Microsoft Word's Track Changes feature when adding, modifying, or deleting content. After another week, follow-up emails were sent to those instructors who had not yet returned the transcript, until all were finally received. Upon reviewing and accepting the document changes, the files were exported to a Rich-Text Format (RTF) in preparation for analysis using the qualitative data analysis software.

**Analysis of Qualitative Data**

This case study generated folders of both digital and paper-based document files, over five hours of recorded (and transcribed) instructor interviews, and nearly 10 hours of handwritten notes (also transcribed) from classroom observations. Preparing only a descriptive account of these data sources, while a necessary beginning, would not do justice to the story of instructor experiences (LeCompte, Preissle, & Tesch, 1993). A more structured approach to the analysis would be required, which began formally in April, 2016 after receiving the appropriate approval from Purdue University's Human Research Protection Program (HRPP). The following coding strategy provided a solid foundation for data analysis (Saldana, 2009):

1. organizing and preparing the data for analysis,
2. coding and describing the data,
3. classifying and categorizing themes,
4. connecting and interrelating the data, and
5. interpreting and making sense of the data.

With the observation and interview data already stored digitally in Rich-Text Format (RTF) files, they were readily imported into the ATLAS.ti Computer-Assisted Qualitative

Data Analysis Software (CAQDAS) for coding and analysis (ATLAS.ti Scientific Software Development GmbH., 2016).

Whether manually on paper or using a CAQDAS program, the process of coding is “primarily an interpretive act,” and must acknowledge the subjective role that the researcher plays in transitioning the data into information and knowledge (Saldana, 2009, p. 4). The researcher uses codes, which can be made up of words or phrases, to “symbolically assign a summative, salient, essence-capturing” attributes to written or digital media (p. 3). One of the key objectives in coding is to summarize the data in order to both illuminate patterns and to generate explicit categories, implicit themes, and analytic generalizations. Such patterns can be characterized by the similarities, differences, frequencies, sequences, correspondence, and/or causation apparent in the data (2009). Specific to this study, a comparative lens was applied to focus the search for patterns on the similarities and differences in people’s in-class experiences using the MyITLab Grader software.

For the observation data, an “Eclectic Coding” approach was employed using both Descriptive and Initial “First Cycle” coding techniques (Saldana, 2009). In Descriptive coding, the data are summarized and categorized using topic- versus content-based codes, which seemed appropriate given that the specific lesson content was unimportant. After generating and recording the main topical tags, an inductive Initial coding approach was used to focus attention on the words, sentences, and paragraphs used to describe the in-class procedures and experiences. Recommended by Saldana (2009) as a starting point for developing descriptive, yet provisional codes, this approach was selected in order re-engage line-by-line with the archived notes and memos that comprised the observation data. In the “Second Cycle” of coding, the Focused coding approach was selected to search for the most frequent and significant codes and categories that made the most analytic sense. Using streamlined Axial coding techniques, these individual codes and categories were confirmed, reassembled, and then connected to one another in hopes of generating themes (Charmaz, 2003).

Two coding methods were selected for the purposes of “First Cycle” coding and analysis of the instructor interview data. First, the Structural Coding method is recommended for coding interrogative transcripts and for use in within-case and cross-case analysis (Saldana, 2009). A structural code is a “content-based or conceptual phrase representing the topic of inquiry” and serves as a way to both label and index interview data segments (2009, p. 66). Second, the Provisional Coding technique was used to align the qualitative analysis with Wixom and Todd’s model and the theoretical frameworks of Technology Acceptance (TAM) and End-User Computing Satisfaction (EUCS). In Provisional coding, a predetermined starting list of codes is developed based on past research, literature reviews, the theoretical framework, your research questions, analytic memos, an interview protocol, and/or the researcher’s previous knowledge and experiences (2009). In some ways the antithesis of the Initial or Open coding approach, Structural and Provisional coding provide another triangulating methodological process for the purpose of informing the case study’s analytic generalizations.

While the qualitative analysis began using the ATLAS.ti CAQDAS software, the decision was made to move the observation and interview data to MAXQDA, which yielded a more graphical interface for coding, reporting, and analysis (VERBI GmbH., 2016). Once the conversion was complete, the documents and code book were subjected to further scrutiny, reduction, and analysis. Lastly, a comparative lens was once again applied to highlight the unique instructor experiences related to the implementation and use of MyITLab Grader.

**Trustworthiness and Credibility**

As with quantitative data collection and analysis, qualitative research requires checks and balances to ensure that the standards of scientific inquiry are met. Rather than validity and reliability, qualitative research often uses terms like trustworthiness, credibility, and authenticity (Creswell & Miller, 2000). Trustworthiness results from the rigor used in systematically collecting and analyzing data for the purpose of describing or explaining phenomena as accurately and completely as possible (Patton, 2002). Credibility refers to the confidence one has in the truth of the findings (Merriam, 1998). Authenticity, on the other hand, turns the mirror upon the researcher to provide reflexive opportunities to disclose personal perspectives and biases (2002). Additional criteria, also referenced by Patton (2002), support the strength and believability of qualitative research, including transferability (the ability of other researchers to apply the findings to their own work), dependability (the stability of findings over time), and confirmability (the internal coherence of data in relation to findings and interpretations).

In order to meet the foundational measures of trustworthiness, credibility, and authenticity, Creswell (2003) provides eight primary strategies for qualitative scientific inquiry.

1. Triangulate with different data sources.
2. Use member-checking for both raw data collection and interpretations.
3. Use rich, thick descriptions to convey the findings.

4. Clarify the bias of researchers through self-reflection.
5. Present negative or discrepant information that counters themes.
6. Spend a prolonged time in the field.
7. Use peer debriefing to enhance accuracy.
8. Use an auditor to review the research.

This particular study employs the first four of these strategies. With respect to triangulation, this single-unit case study collects and analyzes data from a variety of sources, including documents, observations, and interviews, and does so across multiple embedded units of analysis. Member-checking of the transcribed interviews provided instructors with an opportunity to correct or expand upon thoughts and comments. While triangulation provides a means of corroboration from the researcher's perspective, member-checking improves the truthiness of participants' accounts (Creswell & Miller, 2000). Furthermore, rich or thick descriptions were used in describing the setting, participants, and themes in the study, as opposed to thin, fact-only descriptions. This reporting style provides a context-based appreciation for the phenomena and sensitizes readers, reviewers, and other researchers to participants' experiences. Lastly, the role of the researcher has been fully disclosed providing a transparent and reflexive account of the assumptions, beliefs, and biases held by the researcher in documenting the instructor and student experiences. Given that the researcher is the primary instrument in qualitative research, this step is crucial in documenting potential strengths and weaknesses of the stated interpretations and conclusions (Merriam, 1998).

## Student Acceptance and Satisfaction Survey

Towards holistically describing the classroom experience with MyITLab Grader, a student survey was conducted electronically through the Okanagan College Blackboard Learning Management System (LMS). The survey was designed and assembled using constructs and items from the Wixom and Todd (2005) Integrated Research Model, but also from research employing the Unified Theory of Acceptance and Use of Technology (UTAUT). These two models build directly upon the intentions of the Technology Acceptance Model (TAM) (Davis, 1989; Davis et al., 1989), and have appeared in numerous IS research studies. Furthermore, these models provide vetted survey instruments with question items that have proven both valid and reliable in measuring technology acceptance and user satisfaction (Legris, Ingham, & Collerette, 2003; Marangunic & Granic, 2015; Xu, Benbasat, & Cenfetelli, 2013; Wixom & Todd, 2005).

### Defining the Key Constructs

The Wixom and Todd (2005) Integrated Research Model combines constructs from the technology acceptance literature (Davis, 1989; Venkatesh et. al, 2003) with characteristics from the user satisfaction literature (DeLone & McLean, 2003). Their model evaluates six main constructs as antecedents to determining users' attitudes and intentions-to-use an information technology solution. While these constructs were originally designed to measure employees' perceptions and attitudes toward workplace information systems, they also provide a well-balanced framework for investigating student perceptions and attitudes toward educational technologies, including automated tutorial and grading solutions.

For the purposes of this study, the main constructs measured in the student survey are defined in the following paragraphs.

**Information Quality (IQ).** Information quality is an object-based belief about the completeness, accuracy, and format of information presented by the system. With respect to the student survey, the focus is placed on students' perceptions of the quality of feedback provided by MyITLab Grader.

**Information Satisfaction (IS).** Information satisfaction is an object-based attitude toward the information presented. For the student survey, the focus is placed on measuring students' overall satisfaction level with the feedback provided by MyITLab Grader.

**System Quality (SQ).** System quality is an object-based belief about the reliability, integration, and accessibility of the system. The focus for the student survey is placed on students' perceptions of the user interface, integration between the grading and tutorial components of the software, and the uptime and availability of the online MyITLab Grader software.

**System Satisfaction (SS).** System satisfaction is an object-based attitude toward the system. Students' overall satisfaction level with the software itself is the focus of this construct.

**Perceived Usefulness (PE).** Perceived usefulness (or performance expectancy) is a behavioral belief or expectation regarding the technology's usefulness and its ability to help users complete common tasks. In other words, it is the degree to which a person believes that using a technology will enhance his or her performance (Davis, 1989; Venkatesh et al., 2003). Furthermore, numerous studies provide evidence that perceived usefulness is a primary predictor of technology acceptance and usage (Davis, 1989; Ong, Day, & Hsu, 2009; Venkatesh & Davis, 2000). The student survey focusses on students' perceptions regarding the ability of MyITLab Grader to help them learn and improve upon their Microsoft Office skills, using the tutorial and feedback information available.

**Perceived Ease-of-Use (EU).** Perceived ease-of-use (also known as effort expectancy or usability) is a behavioral belief or expectation regarding the ease associated with using a technology and the effort required to learn and apply it to common tasks. Ease-of-use may also be defined as the degree to which a person believes that using a technology would be free of effort (Davis, 1989; Venkatesh et al., 2003). While not as impactful as perceived usefulness on a person's attitude toward or intention to use a technology, the perceived ease-of-use construct may be especially important to beginner and novice users (Venkatesh & Davis, 2000; Xu et al., 2013). The student survey focuses on students' perceptions of how easy MyITLab is to both use and learn.

Wixom and Todd (2005) argue that these main factors impact users' behavioral attitudes toward a technology solution, which in turn influence users' desire to continue using or to recommend such a solution. Due to the nature of the educational (as opposed to workplace) setting, the intention-to-use and intention-to-recommend factors are separated into specific items in the student survey. The rationale is that students may not be able to afford an online subscription once the course ends (i.e., intention-to-use), but they may well recommend that the software be used in future courses.

Forming the foundation of the student survey, the Integrated Research Model was later enhanced with items from the Unified Theory of Acceptance and Use of Technology (UTAUT) model (Venkatesh et al., 2003). Specifically, these additional items include categorization variables for the respondents' gender, age, and prior technical experience, along with perceptual items related to peer-influence and social norms (2003). In fact, several studies have added the Social Norms construct to the Technology Acceptance Model's (TAM) variables, in order to better describe the association between social and peer influences (also referred to as subjective norms) on attitudes toward technology adoption and use (Legris et al., 2003; Mathieson, 1991; Park, 2009; Punnoose, 2012; Taylor & Todd, 1995; Venkatesh & Davis, 2000; Venkatesh et al., 2003). This construct was also necessary in order to more accurately describe the use of MyITLab within a classroom, as opposed to a mandatory workplace setting.

While the categorization items are self-explanatory, the remaining constructs that form the foundation of the survey are defined in the following sections.

**Social Norms (SN).** Social norms (also known as subjective norms or social influence) are behavioral beliefs regarding the attitudes and expectations held by an influential or social peer group toward a technology or one's use of that technology. Fishbein and Ajzen (1975) define this construct as an individual's perception that people who are important to him think he or she should engage in a certain behavior. The noteworthy point is that a person's behavior is influenced by the way others will view them for using a technology (Venkatesh et al., 2003). Research has shown that this construct has direct influence on a person's intention to use an innovative technology solution, but primarily when that use is mandatory and not voluntary (Venkatesh & Davis, 2000). For the student survey, the focus is placed on students' perceptions and beliefs about how peers and instructors will view them for using MyITLab Grader, as well as how these influential persons will view the technology itself.

**Attitude (AT).** Attitude is a behavioral disposition toward the technology. In other words, an individual's positive or negative feelings (evaluative effect) about an object or performance behavior (Fishbein & Ajzen, 1975). The student survey focuses on students' overall attitude towards MyITLab Grader, especially with respect to its perceived ability to impact their learning and skill-level through continued use and assignment completion.

**Intention to Use (IU).** Intention to use is a behavioral attitude toward the system with specific emphasis on usage patterns and future recommendations. For the student survey, the focus is placed on students' continued, post-course use of the software, as well as their overall recommendation with respect to using MyITLab Grader in future courses.

Referencing user satisfaction literature (Delone & McLean, 2003; Doll & Torkzadeh, 1988), Wixom and Todd (2005) considered various system and information characteristics as potential influencers on users' perceptions of quality. In their seminal data warehousing study, they introduced nine antecedent factors from user satisfaction theory into their model to demonstrate the impact on users' object-based beliefs (2005). For technologies such as MyITLab Grader, some of these factors do not apply within the educational context. And, for this reason, an adjusted Wixom and Todd model was prepared that removes three of the nine factors; namely, Currency, Flexibility, and Timeliness. Currency represents the "user's perception of the degree to which the information is up to date" (2005, p. 91). For MyITLab Grader, the informational content for a particular version of the software does not change over time; thus, there is no currency property to measure. Flexibility relates to an information system's ability to adjust and adapt to changing business requirements and environmental conditions. Once again, the MyITLab Grader software is a fixed (i.e., inflexible) software technology that delivers a set of predefined curriculum content, and employs a preprogrammed grading algorithm. Lastly, Timeliness refers to the responsiveness of the technology in replying to user requests. As described later in this section, feedback solicited during a student pre-test of the instrument revealed a consensus that this factor overlapped with (and was therefore redundant to) the Reliability and Accessibility factors. Obviously students want the MyITLab software to be reliable and accessible (e.g., website is not down), but their interaction with the site would not be centered around time-sensitive content-retrieval activities, as would be required in data mining or online shopping scenarios. Therefore, the Timeliness factor was removed to simplify the model and to reduce confusion among student respondents.

An adjusted Wixom and Todd model was prepared for the student survey and is presented in Figure 3.1.

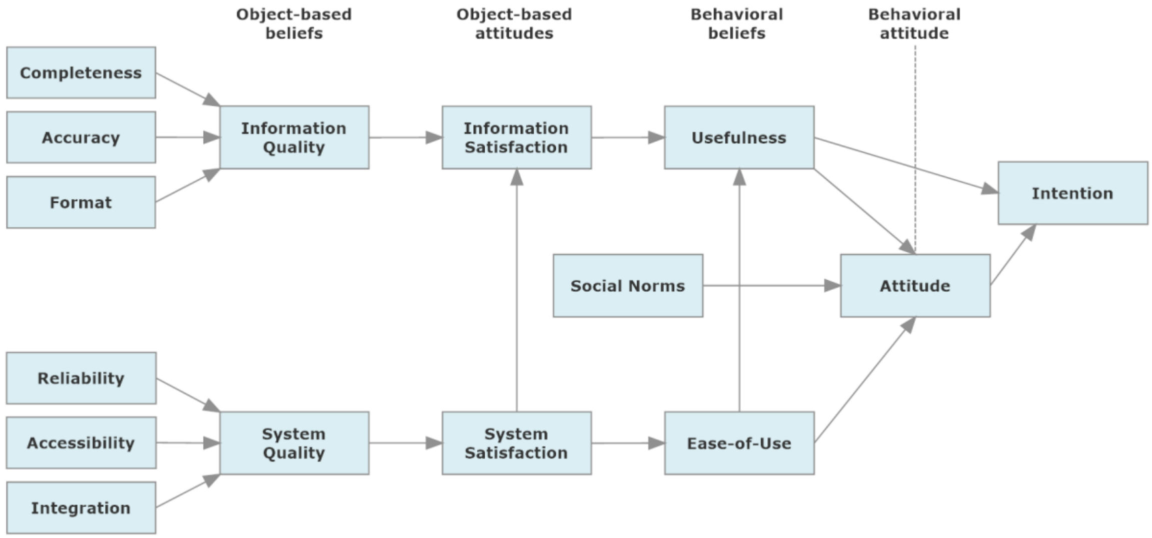


*Figure 3.1.* The Adjusted Wixom and Todd Integrated Research Model

For measuring Information Quality, three antecedent or determinant factors remain, including Completeness, Accuracy, and Format.

**Completeness (IQ01).** Completeness refers to the provision of information at the appropriate level of granularity for the given task (Baltzan & Welsh, 2015). If information is missing, task performance may suffer, especially in terms of decision-making. If too much information is presented, information overload may occur and productivity suffer. For the student survey, the focus is placed on measuring users' perception of the completeness of feedback information presented by MyITLab Grader.

**Accuracy (IQ02).** Accuracy directly impacts the trustworthiness of the system and its data. If the information being received from a system is incorrect, users will question all of the system's output or stop using the system altogether. For the student survey, the focus is placed on users' perceptions of correctness with respect to the grading output and feedback provided.

**Format (IQ03).** The presentation or format of information is often as important as the data itself. Compare a colorful column chart, for example, to a monochromatic table of numbers when needing to analyze trends or patterns. Assuming that the data is both complete and accurate, this factor now measures users' perceptions of how well the data is presented. For the student survey, the focus is placed on the presentation format of feedback information from MyITLab Grader.

For measuring System Quality, the three remaining antecedent and determinant factors are Reliability, Accessibility, and Integration.

**Reliability (SQ01).** Reliability refers to the dependability of the software or system to function correctly on a consistent basis, often measured in terms of uptime for online or network-based operations (Baltzan & Welsh, 2015). For example, a software product or system that crashes frequently would not be considered reliable. However, for Web-based software, reliability is often incorrectly assessed on the access speed and throughput of the local area network to the Internet (2015). Since users rarely care about the cause of a system degradation or failure, the student survey does not differentiate between software versus network reliability. Instead, the survey focuses on students' overall perceptions of the reliability of MyITLab Grader.

**Accessibility (SQ02).** Accessibility refers to "the ease with which information can be accessed or extracted from the system" (Wixom & Todd, 2005). For Web-based software, this factor informs on the responsiveness of the user interface (UI) to specific device characteristics (e.g., screen size of smartphones, tablets, laptops, and desktop computer monitors). Furthermore, this factor references the technical requirements for MyITLab Grader, including software (e.g., operating system and Web browsers) and hardware (e.g., processor, RAM, storage, and graphics capabilities). For the student survey, the inquiry focus is placed on students' ability to access the software between their home and school computers.

**Integration (SQ03).** Integration refers to the way that data is accessed both within the software and between different systems. In the Wixom and Todd (2005) study, data warehousing solutions would require high-levels of data integration. However, in MyITLab Grader, the integration aspect centers around navigational options, such as hyperlinks provided within and between lesson content and assessments. Also important is the ability of MyITLab Grader results to be integrated with or exported to the college's learning management system (LMS). For the student survey, the focus is placed on the navigability of the UI and students' ability to access lesson content directly from within an assessment module or feedback response.

## Developing the Survey Instrument

The student survey instrument was constructed by listing the key constructs and then gathering groups of validated question items from previous research instruments. The majority of question items were extracted directly from Wixom and Todd's instrument (2005, pp. 93-94). Because the Social Norms construct was added to the adjusted survey model, this group of questions needed to be included from items used in estimating social influence in the UTAUT model (Venkatesh et al., 2003, p. 460). Six singular (as opposed to composite or grouped) question items were selected from other instruments in place of Wixom and Todd items, as their wording more closely aligned with online e-learning technologies (Koh, Prybutok, Ryan, & Wu, 2010, p. 199; Lee, 2008, p. 1436). Lastly, four categorical response items were provided for classifying class sections, and for collecting demographic information, such as gender, age, and prior Microsoft Office experience (Venkatesh et al., 2003). A complete listing of the survey constructs, measurement items, and referenced instruments appears in Appendix G.

With the survey being delivered online at the end of the semester (a busy time for students), the number of compiled items was reduced from 37 down to 25, in order to improve the potential response rate. As the survey would be analyzed for descriptive purposes, and not for proving the inferential power of the adjusted model, this reduction was not deemed threatening to the survey's validity or reliability. Specifically, individual question items were removed from each of the six determinant factors (i.e., completeness, accuracy, format, reliability, accessibility, and integration) appearing to the left of the object-based beliefs in Figure 3.1. As Wixom and Todd did not report itemized measures for correlation or internal consistency, the most appropriate items were retained with respect to context and the item's perceived explanatory power for the object-based belief it served. In the end, the object-based beliefs (i.e., information quality and system quality) retained four items each that could be summed or averaged to create a composite Likert-scaled item for statistical analysis.

Once the structure of the survey had been finalized, the wording of each item was edited to reference the instructional context, learning experiences (as opposed to job performance), and students' perceptions regarding the use of MyITLab Grader (Moore & Benbasat, 1991; Xu et al., 2013). The intent of the questions was not changed, so as not to deviate from the previously defined constructs. Five questions were also rewritten as negatively-keyed items, phrased in the semantically opposite direction of most other items in the survey. The rationale for including these negatively-keyed items was to maintain students' attentiveness and to reduce boredom, but also to reduce the so-called acquiescence or "yea-saying bias" (Couch & Keniston, 1960). Except for the categorization questions, the survey employed 7-point Likert-type response items, ranging from 1 (strongly disagree) to 7 (strongly agree), similar to the Wixom and Todd instrument (2005). Specifically, the Information Quality, System Quality, Social Norms, and Attitude constructs present four measurement items each, so that a composite Likert-scale score may be calculated for analysis. Other constructs employ single- or dual-item responses for measuring Information Satisfaction, System Satisfaction, Usefulness, Ease-of-Use, and Intention.

**Pre-Testing the Survey Instrument**

The student survey instrument was initially developed and printed in Microsoft Office Word 2010. It was then pre-tested in September, 2011, by four second-year business students at Okanagan College. Each of the students was selected purposefully, as they were all past students of the researcher in BuAd 128, and had experience using MyITLab Grader the previous year. In addition to recording the time required to complete the survey, handwritten notes were compiled in an informal focus-group atmosphere with respect to clarity of wording, length of the instrument, scale format, and the students' overall comprehension of each survey question. The pre-test meeting completed in just over one hour and the four volunteers were presented with $10 gift cards to a local coffee shop. Some minor adjustments were made to the survey questions as a result of the students' pre-test comments and suggestions, and the resulting instrument was deemed ready for conversion to the online survey delivery system.

**Delivering the Student Survey**

The student survey instrument was hosted on the researcher's personally-managed Canadian Web server, with adherence to strict Canadian privacy laws and security guidelines. A free, open-source solution called LimeSurvey (http://www.limesurvey.org) was selected as the survey management software after an extensive evaluation of several products. The first step in preparation for online delivery was to divide the paper-based survey instrument into seven individual screens. First, the survey's Welcome screen was prepared with information about the survey and its purpose, along with a respondent consent form, required by the Research Ethics Board (REB) of Okanagan College. The Welcome content reminded students that their participation in the study was anonymous, voluntary, and uncompensated, and that they could withdraw at any time by simply closing their browser window. As with the classroom observations and instructor interviews, the student survey had to adhere to the Tri-Council Policy Statement of ethical conduct for research involving human participants (Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, and Social Sciences and Humanities Research Council of Canada, 2010).

Immediately following the consent form, four categorical questions were posed to classify students according to their instructor, gender, age, and a self-assessment of their prior Microsoft Office skill-level. The following four screens presented the 25 Likert-type survey questions. A concluding screen thanked respondents and provided further information on how to contact the researcher directly. After successfully performing multiple trials of the online delivery and database scoring system, a URL hyperlink was provided to the BuAd 128 instructors for posting to their course pages within the

Blackboard learning management system (LMS). To improve the student response rate, a prepared email announcement was sent to instructors for dissemination to their class roster through the LMS. The launch date for the survey was Monday, November 28th, 2011, with a closing date of Friday, December 9th, 2011.

**Analysis of Quantitative Data**

The student survey instrument serves an exploratory and descriptive function toward better understanding how students' feel about MyITLab Grader's usefulness and utility. The general approach to producing descriptive statistics entails preparing, organizing, and then summarizing numerical data (Gall, Gall, & Borg, 2007). For the student survey, the data set was downloaded from the LimeSurvey website and then prepared and validated using Microsoft Excel, which involved "cleaning" the data by removing any empty rows and columns and adding appropriate heading labels. Fortunately, there were no data items with incomplete results, so all data could be used in the analysis.

The survey data set was imported into IBM's SPSS Statistics software (IBM Corporation, 2016). As the level of measurement for a variable determines which descriptive statistics and mathematical techniques may be performed, a beginning step in SPSS was to view the variables and confirm the appropriate measures as Ordinal for categorical variables and nominal for Likert-type items (Weinberg & Abramowitz, 2008). Next, the five negatively-keyed Likert-type items were reverse-coded using the SPSS Transform feature, in order to standardize on a positively-keyed coding schema (2008). Completing the preparation, four new Scale variables were created for the Likert-scale interval constructs (Information Quality, System Quality, Social Norms, and Attitude), by summing the Likert-type variables within the construct and then dividing by the number of items to return average values. The combined constructs were computed using average values for comparative purposes with the Likert-type items.

The first step in examining the data set was to explore the univariate distributions using frequency and percent tables and graphics. Bar graphs and histograms were also produced, along with descriptive statistics for calculating measures of central tendency (e.g., mean, median, and mode), measures of variability (e.g., standard deviation, variance, and range), and skewness. After reviewing and analyzing these results, five number summaries and boxplots were produced for each variable, grouped by instructor for comparative purposes. As a widely-used measure for computing test score reliability, Cronbach’s alpha coefficient was calculated for the four Likert-scaled constructs to test for internal consistency (Gall et al., 2007).

**Validity, Reliability, and Bias**

By modeling the student questionnaire after the proven Wixom and Todd integrated research model (2005), the trustworthiness and credibility of the student survey instrument are greatly enhanced. Validity refers to the ability of an instrument to measure what you think it is measuring, while reliability measures the repeatability or consistency of the measurement (Gall et al., 2007). Evidence for the validity and reliability of the student survey is provided by the fact that the survey builds upon generally accepted standards for studying technology acceptance and user satisfaction (Davis, 1989; DeLone & McLean, 2003; Venkatesh et. al, 2003; Wixom & Todd, 2005). Rather than re-validating individual items and proving its predictive power, the survey results are used instead to describe overall student satisfaction and technology acceptance of MyITLab Grader within a particular case and context.

As the survey is for descriptive purposes of the BuAd 128 students, the population is defined as all in-class students within this particular course, as opposed to all computer freshman students of a computer literacy course. By definition, this survey was delivered as a census in an attempt to enumerate the entire student population. There were no probability sampling methods applied and, therefore, no need for inferential statistics. Similar to sampling, however, there remain opportunities for non-sampling administrative errors and respondent bias in a census, and especially for online surveys (Moore & McCabe, 2005). With respect to administrative error, some members of a population may be undercounted, under-represented, or duplicated, based on the methods and effort used to reach them (Gall et., 2007). In this study, the online survey was not able to restrict access to students or computers (filtered by IP address) from completing the survey more than once. Furthermore, some instructors set aside class time for students to respond to the survey (in effect, changing voluntary to mandatory), while other instructors asked students to complete the survey on their own time. As a result, the total responses may be over-represented for some instructors (i.e., the embedded units under study) and under-represented for others. Second, online voluntary surveys commonly suffer from self-selection bias, whereby people with stronger opinions select themselves to respond while “typical” members of a population do not bother (2005). Measuring the extent of voluntary response bias is very difficult in online surveys, and often results in further under-representation for certain groups. Given the unknown extent of these errors, any attempt to generalize outside of the course would obviously be severely limited; therefore, only descriptive statistics are analyzed and reported.

With respect to the relevance of measuring student acceptance and satisfaction for a four-year old product, MyITLab Grader is a relatively static product, having not released a major update to the user interface since 2010 (Kathaleen McCormick, personal communication, 2016). To illustrate, the 2011 MyITLab Grader assignment screen for Office 2007 appears in Figure 3.2 and the 2016 MyITLab Grader assignment screen for Office 2013 appears in Figure 3.3. For all intents and purposes, MyITLab Grader's current user experience for delivering tutorials and taking assessments is virtually identical to the software's user experience four-years ago. While informational content may have been updated with version changes of Microsoft Office, the survey results and analysis remain as valid and relevant today as when the survey was first conducted.

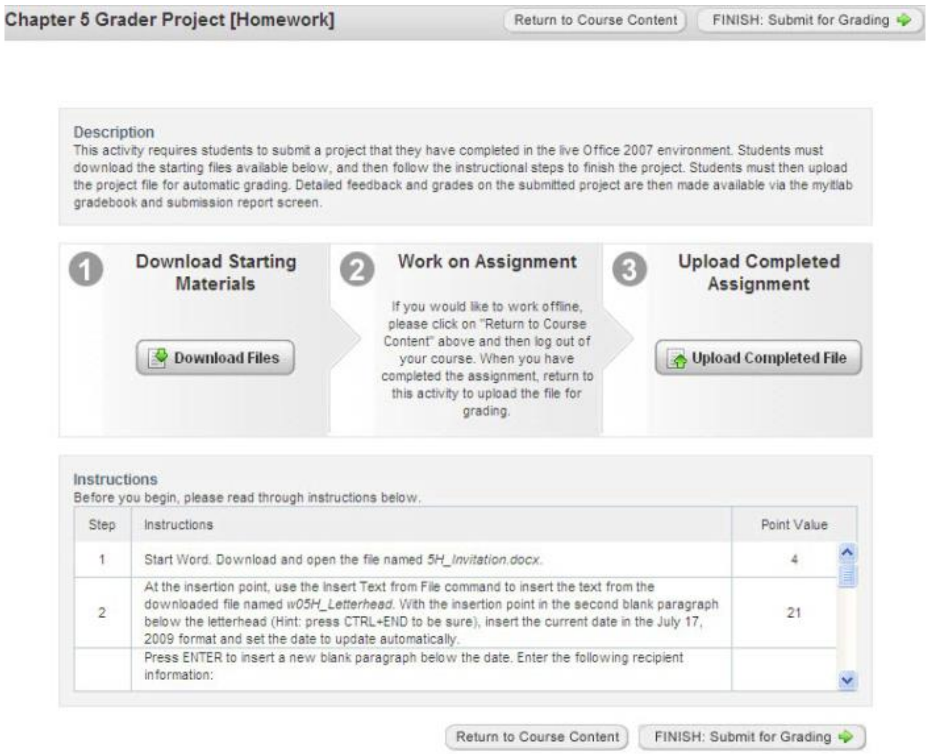


*Figure 3.2.* 2011 MyITLab Grader Assignment Interface for Office 2007.

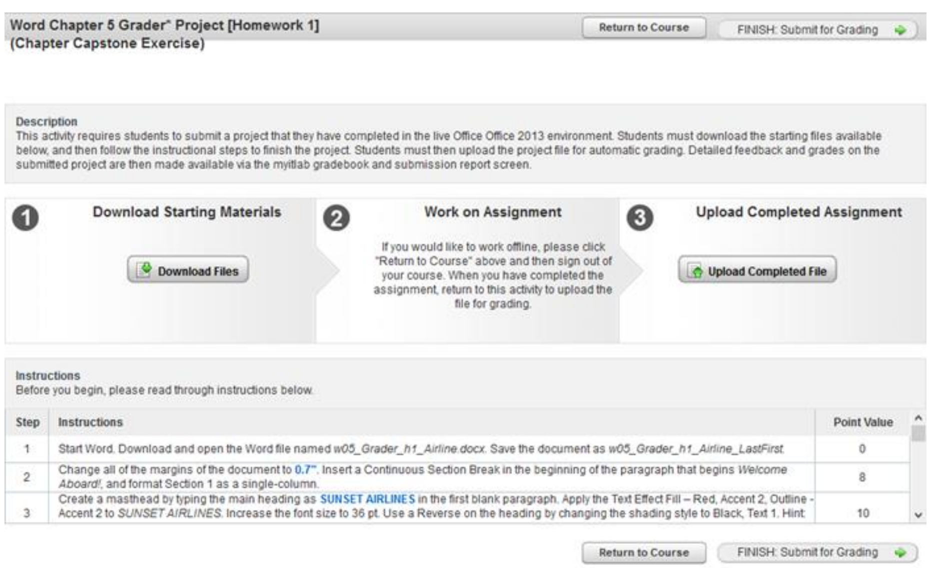


*Figure 3.3.* 2016 MyITLab Grader Assignment Interface for Office 2013.

# CHAPTER 4. RESULTS

Data analysis and summation for case study research consists of "examining, categorizing, tabulating, testing, or otherwise recombining both quantitative and qualitative evidence" (Yin, 2003, p. 109). In this chapter, data from documents, observations, interviews, and surveys are analyzed using techniques appropriate to the methodological approach used for data collection and aligned to the research purpose. The resultant goals or outcomes for the analysis include elaborative descriptions and pattern matching that will speak to instructor and student experiences in using the automated grading and tutorial software known as MyITLab Grader. The following chapter then discusses the results collectively in forming analytic generalizations, reflexive assertions, and responses to the specific research questions.

## Document Analysis

Data were collected in the form of syllabi, assignments, and exams from each of the five instructors of BuAd 128 – Computer Applications. Using a simplified approach to comparative content analysis, these documents were visually and electronically compared to one another both in paper form and using software to review the original data files. For example, the syllabi were collected in Adobe's PDF format and printed out for comparison, while the Excel workbooks were opened and compared side-by-side across multiple monitors using Microsoft Excel 2013. This comparative process focused on the differences between the artifacts for each instructor.

Impacting this analysis, the School of Business at Okanagan College had recently initiated a “consistency across the curriculum” policy for learning outcomes in first- and second-year courses, according to the department chair, Laura Thurnheer (personal communication, 2012). The most significant element of this standardization policy entailed assigning an experienced, continuing (tenured) professor to each course as the “course captain,” responsible for preparing the syllabus, assignments, and calendar schedule for all sections taught in that particular semester. As a result, the BuAd 128 Fall 2011 course sections were captained by one of the instructor participants in this study (pseudonym withheld for confidentiality). This instructor explained, during the interview, that he/she was responsible for the following duties:

- Revising and distributing the course syllabi to the other instructors,
- Preparing the MyITLab online content modules with help from Pearson Education,
- Selecting the MyITLab quizzes and Grader projects to be completed by students, and
- Compiling and distributing the exam instructions and data files for Microsoft Word, Microsoft Excel, and Microsoft PowerPoint.

Further communication with the department chair uncovered additional responsibilities for the course captain including training instructors on the best (or preferred) practices for teaching the course, and responding to instructor questions or concerns with respect to content and grading.

In the analysis of syllabi and course documents, it became apparent that there were few, if any, differences among the instructor sections. In fact, the course syllabus was distributed to instructors by the course captain as an Adobe Acrobat PDF document (as opposed to a Microsoft Word document) to dissuade instructors from making their own modifications (see Appendix A). Confirmed during the interview, the course captain also supplied instructions to each instructor for copying a BuAd 128 Blackboard Template Module into their personal Blackboard sections. Furthermore, the course captain selected and prepared the MyITLab online quizzes and Grader assignments for BuAd 128, so that the other instructors could import the content into their own secure areas. Preparation of the exam files followed a similar pattern, revised and then distributed by the course captain to the other instructors for use in their course sections. These files were verified as being identical to one another, both on paper and digitally. In summary, the BuAd 128 Fall 2011 sections provided the same course documents and exams – the sections were purposefully identical, except for the instructors, students, rooms, schedules (i.e., days of the week and time of day), and experiences that resulted over the duration of the semester.

## Analysis of Classroom Observations

The goal of qualitative data analysis is a sense-making exercise in order to better understand and appreciate the collected data (Patton, 2002). One of the first steps entails the process of coding to discern the important data from the peripheral noise. Using the research questions and theoretical framework to guide and focus the analysis, coding strategies were selected for both the classroom observation notes and instructor interviews. The transcribed data files were organized and prepared as Word documents, stored in Rich Text Format (RTF) for analysis, and then imported into computer-assisted qualitative data analysis software (CAQDAS) for coding, describing, and reporting on the data.

The analysis of classroom observations began with an “Eclectic Coding” strategy that required a two-pass approach for the “First Cycle” coding of data, as advocated by Saldana (2009). First, using Descriptive coding, topical tags such as DEMONSTRATION, OPEN LAB, and TROUBLESHOOTING were used to label and summarize what was going on during the observations. For the second pass, the Initial (also called Open) coding technique was used to focus line-by-line on the data, generating codes such as STUDENT-STUDENT INTERACTION, SHARING PERSONAL EXPERIENCE, and QUESTIONING “WHY”. The MAXQDA (version 12) software was then used to select, arrange, and print data segments for the 31 generated codes (VERBI GmbH., 2016). After several sweeps of the data, the most appropriate codes were chosen, combined, and/or renamed during the “Second Cycle” of Focused coding to yield the five major categories of 11 codes appearing in Table 4.1. The data segments assigned to these categories were then analyzed and summarized by instructor with respect to the similarities and differences that presented themselves, grounded in the data.

Table 4.1

*Code Summary for Classroom Observations*

| Code Identifier | Categories and Codes |
|---|---|
| D01 | **Setting** |
| | **Participants** |
| D02 | Attitude |
| D03 | Engagement |
| | **Interactions** |
| D04 | Student-Student |
| D05 | Instructor-Student |
| D06 | **Demonstrations** |
| | **Lab Time** |
| D07 | Troubleshooting |
| D08 | Working from Textbook |
| D09 | Working on MyITLab Quizzes |
| D10 | Working on MyITLab Tutorials |
| D11 | Working on MyITLab Grader |

**Setting and Participants**

Most computer labs at Okanagan College are equipped similarly with 40 networked workstations, one instructor workstation, a digital projector and screen, laser printer, white boards, and fluorescent lighting. However, Susan's classroom was scheduled in an awkwardly-configured computer lab with 30 workstations. Her room was long and narrow with three banks of 10 computers each, separated by a wide walkway down the center of the room. The instructor workstation was placed in the top right-hand corner (assuming one is facing the projection screen), far away from students in the bottom left-hand corner of the room. With an enrolment of 35 students and only 30 workstations, Susan had to ask students to bring their personal portable computers from home, in order to complete the assigned work. Furthermore, she began the observed class by informing students that the building was once again experiencing "Internet connectivity problems," so patience would be needed.

While registrations ranged from 26 to 35 students per class section, the observed attendance figures were between 16 and 25 for each of the five instructors. For the most part evenly split by gender, students were primarily Caucasian, in their early 20s, and with relatively few visible minorities or international students. At this late point in the semester, friendships had already been formed as students clustered into pods of two to four people around the computer lab. Generally speaking, half of the students brought their textbooks to class; however, only six of the 23 students did so in Andrew's class.

**Lecture Demonstration and Student Engagement**

All of the instructors began their class by introducing the session's agenda, and then proceeded through a guided demonstration of the content lasting between 45 minutes to one hour. The remainder of the two-hour class was left for "Open Lab" time to complete the assigned work. With the application software projected on the screen under dimmed lighting, most instructors used a "Show Me/Guide Me" method for lecture and demonstration purposes. Students were directed to download and open data files, and follow along step-by-step as the instructor performed the exercise from a workstation at the front of the room. Andrew and Peter were the only instructors who used their own data files and examples, while other instructors simply selected an exercise out of the textbook. Because of Susan's awkward room layout, she appointed a student to perform the designated steps from the instructor's corner workstation. She then stood at the front of the room and used the whiteboard to write down steps from the textbook pages and from her own notes. For the demonstration portion, Brenda asked students to turn off their monitors and watch her perform the steps, using a one-way “Show Me” approach. After 30 minutes of passively watching, students were then invited to turn on their monitors and follow along through a “worked example” from the textbook.

Engagement during the lecture demonstration portion was measured by student attentiveness to the instructor and exercise, ability to follow along and keep up with the instructions, and the noise-level of off-topic peer chatter. The majority of students appeared to be respectful of the instructors and tried to follow along with the steps being presented. However, as the demonstration portion neared completion or as the difficulty level of the topic increased, students became noticeably restless and the noise-levels increased. Not surprisingly, the longer the demonstration portion, the higher the incidence of students browsing other websites (e.g., YouTube) and texting on their smartphones. Only in Susan’s classroom was it noticeable that students lacked engagement with the “student” demonstration portion, using their computers to work on projects for other courses, chatting with peers, and accessing websites such as Gmail.

**Lab Time and Student Productivity**

Once the demonstration portion transitioned to the open lab time to work on assignments, there were always a few students from each class that immediately packed up and left the classroom. While some stayed to work on assignments for other courses, the majority of students split their time between working on the hands-on exercises from the textbook, MyITLab multiple-choice quizzes, MyITLab simulation tutorials, and MyITLab Grader projects. Across all instructors, the lab time appeared to be focused on the collaborative completion of individual submissions, with multiple-choice quiz answers being thrown loudly around the room between students and groups.

Except for a few "loner" students, the decision of what to work on during lab time seemed to come from the pods of clustered students, with most choosing to work through the MyITLab Grader projects. These projects were typically completed in groups of two to four students working lock-step through the twenty or so Grader instructions. While a handful of students from each class would print out the Grader's instruction sheet, most students would vertically tile the instructions, displayed in a Microsoft Word window, next to the application window in which they were working (mostly Microsoft Excel). Students would then discuss with one another what the instruction was asking them to do, perform the step together on their own computers, and check the work of their peers to ensure that everyone had the same result. The most commonly overheard phrases were "What are they asking for here?" followed by "Is this right?". Once completed, they would then upload and submit their work for grading and then confirm that their grade was similar (if not identical) to their peers' results. If there was a discrepancy, students would scan the MyITLab grading report to direct them to the faulty areas and then contrast their work with their peers'. If satisfied with their score, students would often pack up and leave the computer lab early. By the end of the lab time, there were usually fewer than half of the original student count remaining.

**Peer and Instructor Interactions**

As mentioned, there exists a very collegial and supportive atmosphere among students in the BuAd 128 computer labs. Students would help one another catch up to the instructor during the guided demonstration and complete the assigned work together during lab time. Only in Susan's classroom was peer interaction noticeably focused on social conversations, rather than on the content and assignments. Having said this, peers across all of the observations were the first point of contact for support; only when problems could not be solved was the instructor called over for assistance. In fact, students' frustrations toward MyITLab were often voiced loudly as "calls for help" to the other students near them. "I don't get it!", "This sucks, it's really hard.", "It didn't work. I give up.", and "I'm so confused. I have no idea what I'm supposed to be doing." are just some of the statements heard in each of the classrooms.

The instructor's role during lab time seemed to entail walking between the clustered groups, answering "how do I" questions, and troubleshooting issues with MyITLab Grader's grading accuracy. Some common comments from students included "So why did it mark me wrong?", "What are they asking for?", and "Will this be on the test?" While most classrooms operated similarly, Brenda spent the majority of her time sitting at the instructor's station reviewing and adjusting students' grades in MyITLab. There was also a noticeable difference in the level of comfort students had with Brenda, calling her "Professor", as opposed to using her first name, as was observed regularly in the other classrooms. Regardless, Brenda seemed to be available and willing to help students when asked for assistance.

**Summary of Classroom Observations**

An important goal for the classroom observations was to develop additional insight into the classroom experiences of both instructors and students. Clearly understanding the environment, structure, and interactions within the classroom enables a more attuned instructor interview process, as well as providing confirmatory evidence to the instructor interviews and student survey results. The primary differences in terms of themes or patterns that arose in the analysis seemed to center on Brenda's and Susan's classrooms. The three male instructors seemed to share similar rooms, teaching styles, lab processes, and interactions with students. Brenda's classroom, on the other hand, seemed more passive and structured, almost sterile. While the demonstrated content seemed competently delivered, the student-student interactions during lab time were quieter, and the instructor-student interactions were less frequent than in other classrooms. Susan's classroom experience seemed to be challenging for both herself and her students. Located in a new building apart from the other classrooms, Susan had to deal with a poorly-configured computer lab, network connectivity issues, and a student cohort who did not seem engaged with the material. Another prevalent theme was the expressive voicing of student frustrations with MyITLab to one another. While these viewpoints may have been announced prominently for the benefit of the observer, meetings with the individual instructors after each observation confirmed that it was a "typical class" and those were "typical comments." These summations will serve to further inform the analysis of instructor interview data, which follows.

## Analysis of Instructor Interviews

As with the observation data, the interview transcripts were imported, organized, and coded using the MAXQDA software (VERBI GmbH., 2016). The analytical process followed the guidelines presented by Saldana (2009) for employing Structural and Provisional coding of interview data. Table 4.2 summarizes the structural codes revealed after several passes through the "First Cycle" coding of transcripts. The four code categories mirror the line of questioning presented in the interview protocol, but with the addition of experiential magnitude codes for each category. The most frequently-used codes were PROCESS-oriented, while the most informative were arguably the EXPERIENCE codes. Table 4.3 presents the seven categories of provisional codes summarized from the 19 original codes adopted from the Wixom and Todd model. Not all constructs were discussed during the interviews, so some codes do not appear in the code book. For example, codes for INFORMATION QUALITY FORMAT and SYSTEM QUALITY INTEGRATION were removed, as these topics were not covered in the protocol. After compiling the data segments separately by structure and then by the model's provisional codes, the data were summarized with respect to similarities and differences, and then specific quotes pulled for descriptive purposes.

Table 4.2

*Structural Code Summary for Instructor Interviews*

| Code Identifier | Categories and Codes |
|---|---|
| | **Class Preparation** |
| S01 | Process |
| S02 | Experience (+/-) |
| | **Teaching & Lab Support** |
| S03 | Process |
| S04 | Modification |
| S05 | Experience (+/-) |
| | **Student Learning** |
| S06 | Process |
| S07 | Modification |
| S08 | Experience (+/-) |
| | **Expectations** |
| S09 | Pre-Conception |
| S10 | Experience (+/-) |

Table 4.3

*Provisional Code Summary for Instructor Interviews*

| Code Identifier | Categories and Codes |
|---|---|
| | **Information Quality** |
| P01 | Completeness |
| P02 | Accuracy |
| | **System Quality** |
| P03 | Reliability |
| P04 | Accessibility |
| | **Perceived Ease-of-Use** |
| P05 | Instructor |
| P06 | Student |
| | **Perceived Usefulness** |
| P07 | Instructor |
| P08 | Student |
| P09 | **Social Norms** |
| | **Attitude** |
| P10 | Instructor |
| P11 | Student |
| P12 | **Intention-to-Use** |

**Course and Class Preparation**

While a few instructors discussed their need to "play with" the new Office version and MyITLab prior to the semester's start date, the course captain had already prepared the curriculum and assessments, along with the LMS shell and MyITLab application modules. As Andrew put it, "the content was essentially the same for everybody… so I just had to adjust the timing and stuff of when my things were due." In fact, all of the instructors described their course preparation process in terms of the "week before" class, rather than "pre-semester" preparation. Apparently, the typical approach to class preparation was for instructors to select exercises and data files that would be used for demonstrations that week, and then to prepare the lecture notes of what needed to be covered, assigned, and completed.

Regarding MyITLab, three of the instructors (Andrew, Brenda, and Peter) completed the first few Grader projects to confirm the trustworthiness of the system, with Peter stating “just the first few, and just out of curiosity, to make sure that it was grading properly; as did a couple of other profs, and they found the same thing. It was grading just fine.” Scott and Susan, on the other hand, commented that they felt the need to complete each and every student assignment in MyITLab, in order to be able to respond to student questions in-class. Susan was the only instructor to mention how her class preparation changed “part way through the semester,” to cover “more about what I thought was important” rather than the prepared curriculum. She had also struggled with the MyITLab Grader projects, stating “I would always submit it for grading and I couldn’t figure out why I was losing marks, because I was pretty sure that I did everything right. And, I’m going, well if I can’t figure it out, they’re going to be totally frustrated!” Susan did concede, however, that she had not taught the course in six years, unlike her peers, and was less comfortable with the Office software and technical aspects of the material.

When asked to compare the level of preparation to previous semesters, the instructors did not perceive any significant differences in either the time or effort required to prepare for the semester or for the weekly classes. Andrew explained, “…working with MyITLab didn’t really impact the content delivery.” Scott concurred that moving to

MyITLab "didn't really add to the workload" in terms of class preparation, as did Brenda who thought that it was "about the same" as previous years.

**Teaching and Lab Support**

Four of the five instructors followed a similar pattern with respect to their in-class lesson structure and instructional approach. The majority described demonstrating the most important and relevant software features to students in the first 45 minutes to one hour of class time, and then "letting them loose" in the second hour to apply these features and to work on their assignments (e.g., MyITLab Grader projects). For demonstrations, Andrew attempted to introduce "real world experiences" and "as many different things as I can get my hands on" to keep students engaged, including past workbooks that he had created for clients. Being the odd person out, Susan found that her students were attending the Wednesday class, but often skipping Friday afternoons. Therefore, her solution was to emphasize the teaching of new content on Wednesdays, and to provide only review and lab time on Fridays. In reflection, Susan divulged "I really struggled with the whole course… I never found a method [or structure] that worked for them…, and it wasn't [long before] they had figured out that I wasn't going to teach them anything new on Friday." Both Peter and Scott also revealed that they had changed their classroom approach for teaching Microsoft PowerPoint. The two instructors had dropped the MyITLab Grader projects and produced their own examples and exercises to focus the class on specific content that they felt students needed to know. Peter's argument was that "most important to me is that they understand why this is relevant" and, sometimes, the "skills that we test, don't really fit" with what MyITLab Grader assesses.

Each instructor also stressed the importance of fostering a collaborative classroom, whereby students were "encouraged to help one another" during the demonstrations and lab assignments. Andrew explained his stance as, "if they can't figure something out, [they should] ask the person beside them, ask a bigger group of people, [ask] Google, look in the book, and then ask me." Scott adopted a similar position: "My policy was if they skipped right to MyITLab, I wouldn't help them with it. They had to show me first that they did the [textbook] exercises… I wanted them to get peer-reviewed from the friend sitting next to them first." Scott's justification was that the MyITLab Grader projects provided comprehensive "feedback that students could access after the class" or at home, but that the lab time provided an opportunity to learn from and assist one another.

Most of the instructors acknowledged that they needed to adjust their teaching in order to "focus on the Grader projects, as it was the one that counted" for term work. As Peter noted, "I'm here to help, but the end result is that [students] are going to be marked on what [they] do in the Grader." For "[students] who did one out of five" Grader projects, he continued, "their marks were low,…but if you were getting 90s and 100s [in Grader], you passed the class." In line with this comment, Susan admitted to "teaching to the Grader projects, absolutely!" for her students' benefit and Andrew described his need to make "minor adjustments based on what they were going to be assessed on." However, after a brief pause, Andrew followed up with "And I don't believe that's how we should be doing things!" Only Brenda did not feel the need to adjust her lesson coverage to meet the assessment requirements of MyITLab.

**Student Learning and Assessment**

When asked about their perceptions regarding student learning and performance, instructors generally divided the student body into two types: the “keeners” and the “kids.” The keeners were described by both Andrew and Peter as “more mature students” who “tended to come prepared” for class. This group completed their assigned work and used the feedback provided by MyITLab Grader to improve upon their scores. The “high-school kids,” on the other hand, were described by Peter as the “younger generation, that while they may type better,…they don’t realize that the skills they’re learning here aren’t things that they’ve learnt previously.” Andrew reported that, out of his 93 students, only eight or nine had completed the optional simulation tutorials in MyITLab, while Peter found that only three of his students had engaged the tutorials. Peter further explained that “with first year students,…it’s just about getting the grade,” so they would call a friend over to “click, click, click, and that’s it. They haven’t really learned how to do it, they just want to get the Grader project done.” Scott confirmed this assessment, stating that “Some students view it more in the sense that they want to learn the material,” while other students focus on “getting the highest grade, regardless of whether or not their friend told them exactly what to do.” Scott followed up with, “they think they’ll be able to figure it out later,” but that was rarely the case. All of the instructors agreed that the majority of students had not read the chapters prior to class or completed the hands-on practice exercises available in the textbook.

One of the more interesting discussions revolved around the transfer of learning that occurred from MyITLab Grader formative assessments to the summative exams. According to all instructors, students who successfully completed the assigned work in

MyITLab Grader seemed to do better on the exams, but that did not necessarily mean that they earned high scores. Peter recalled students approaching him after class with “I got 90% on the MyITLab Grader stuff, so why did I do so poorly on the test?” While this may have had something to do with the “kids” discussion in the previous paragraph, Andrew believed that there existed a “big disconnect between MyITLab” and the exams (also referred to as quizzes). He explained that “MyITLab gives you 24 steps and, at the end, you have a result that is then graded. In our quizzes, we generally present problems that you have to solve” through the application of the software to a scenario. Peter also supported the differences between the “prescriptive, step-by-step Grader” approach versus the problem-based module exams. However, Susan defended the task-based similarities between the two assessments, feeling that neither was truly “problem-based.” Susan also disagreed with her students who told her “the quiz was nothing like the Grader projects or the work they’d been doing on their own.” While she did grant that the Grader projects may have been “too simplistic,” Susan believed the disconnect may have been related to how the topics were taught and whether the content and structure was properly aligned with the learning outcomes.

Scott returned the spotlight onto the students and how they approached the material, stating that it depended on “how much they allowed a friend to guide them [through Grader] without understanding what they were doing.” Peter also argued for accountability from the individual students, but at the same time lauded the collaborative peer environment. Both Scott and Brenda believed that the content, supplementary material, and instructor support were made available for students to learn the software successfully, but that it was up to the students to put in the effort. Brenda later clarified, however, that the difficulty-level of the content was also a significant factor: “Word and PowerPoint [are] relatively simple. I don’t think there was a major issue that we didn’t prepare them for. Excel’s always the problem.” Susan confirmed this sentiment stating that her class quite enjoyed MyITLab until Excel; after which, “they hated it and they were really mad at me.” Andrew expressed that his class had fun with PowerPoint with “most of them [getting] 100 on each of the assignments.” Unfortunately, Peter’s and Scott’s classes did not get to use MyITLab Grader for PowerPoint, which may or may not have impacted their final attitudes toward the software.

**Information Quality and Satisfaction**

Focusing the inquiry on the MyITLab software itself, the quality of information was discussed in terms of two key attributes: completeness of the feedback information and accuracy of the student grading reports. For the most part, the instructors believed that the software provided timely and quality feedback to students. Andrew appreciated that the feedback was “tied specifically to what they did and [that] they got it immediately” after completing the project, but felt that a larger “acceptable solution bank” would have helped in terms of grading accuracy. Scott also expressed his satisfaction with the student grading and feedback reports, commenting that many students seemed to be using the reports successfully in-class and that he had “not heard any complaints.” On the other hand, Susan seemed concerned that students were “not given enough detail to figure out what they had done wrong” and, therefore, were not able to self-correct their work without her assistance. Like Andrew, she felt that a wider and more comprehensive solution bank would be helpful, so that students could “answer something in more than one way” to get the points.

MyITLab Grader's grading accuracy provided far more controversy and frustration among both instructors and students. While a couple of instructors were delighted with how far the software had come since they had previously used it, others expressed their frustration in dealing with student complaints. Scott spoke expressively about how "the previous version was absolutely brutal" in comparison, and that he was now quite satisfied with the grading accuracy. Andrew rationalized to students that, "you have to understand there are always eight different ways to do things, especially in Excel. And, it's looking for you to follow an instruction in a very particular way." Brenda found the grading accuracy to be "pretty good," only having to adjust "four grades through the whole semester." "When it works, it's very good," noted Peter, although he ended up instituting a blanket policy of adding 5% to each student's score halfway into the semester in order to cover potential grading errors and ward off student complaints. Andrew also began "fixing students' grades" at first, but then stopped after he found the time spent doing this in MyITLab had negatively impacted his availability to work with students during lab time. In fact, a few instructors commented on how lab time had become more about troubleshooting MyITLab's grading reports than helping students learn the software, which required them to change their approach.

**System Quality and Satisfaction**

With respect to system quality, the inquiry process focused on the software's reliability and accessibility in the computer labs. The instructors again perceived the software to be high quality and were generally satisfied with its performance. There were no issues of instability or reported crashes during the semester, other than a few slow network days experienced by Andrew and Susan (which could not be attributed to

MyITLab). “When we started using MyITLab three years ago,” recalled Peter, “stability was the key issue. It was very unstable!” Continuing, he described how some students had to wait 20 to 40 minutes for exercises and projects to load in their Web browsers. Now, the system has “worked flawlessly 90 to 95% of the time. So, when you consider that compared to what we were doing before, I’m quite happy.” The instructor perceptions related to accessibility were also positive. The system was always online and ready according to Andrew, but Brenda and Peter mentioned some issues students experienced in getting the software to work correctly on Apple computers. Related to this point, a few instructors expressed their disappointment with the technical support services provided by Pearson Education, when asked questions about system compatibility and access to MyITLab from home computers.

**Perceived Ease of Use and Usefulness**

From the instructors’ standpoint, MyITLab did not present any insurmountable challenges in terms of ease-of-use. While there were comments from Brenda and Scott on the time-consuming nature of exporting student grades, the majority of instructors found no issues in learning to use the administrative panel or gradebook. Susan was the least experienced with MyITLab, as exemplified by her comment “I didn’t know how to edit their grades when the Grader messed up… That’s something I didn’t teach myself in August (laughs).” She also had difficulty moving “stuff in and out of the course, that I shouldn’t have been doing… I don’t think I really understood how that all worked.” She had later discovered that the course captain had done all the “moving [of content] that was required.” The instructors believed that MyITLab was also relatively easy for students to navigate. Except for some difficulties finding and interpreting the detailed grading feedback, as noted previously by Andrew and Susan, students seemed comfortable opening and completing the assignments.

With respect to usefulness, the instructors were unanimous in their belief that the MyITLab Grader software was a worthwhile tool for both teaching and learning Microsoft Office. For Scott, one of the key benefits was that the feedback and reporting system "lessened the amount of time he needed to spend with students" getting caught up. Students could go home and review the grading reports and figure out for themselves where they had gone wrong. Not surprisingly perhaps, Susan believed that she "could have done it better" in regards to providing students with useful feedback, but admitted that "the workload would be a problem." Brenda also focused on the workload advantages, explaining that with MyITLab students "get graded on a regular basis, not just every one or two weeks or so, but actually every chapter that we cover [has] an opportunity to practice that gets evaluated… I couldn't possibly grade those by myself." Peter described these benefits further, "If you have two sections, you're going to end up with 80 students, twice a week, so there's 160 things to mark each week and it just couldn't be done… That's why we went to the Grader system." And, the result concluded Peter was that the weekly grading workload was "almost eliminated this term" by MyITLab and had "better accuracy than me trying to grade all of them in a week." Peter also believed that the software provided evidence of students' efforts in the course, stating "when students complain, I can look and say 'you only did four of the 11 chapters in MyITLab,' and that's a huge justification to be able to tell students that's why you struggled on this [exam]."

When asked about the perceived benefits or usefulness to students, Andrew explained that “it’s a great tool to have them sit there in lab with their hands on the keyboard, interacting with Excel… And the fact that they get an evaluation of what they did immediately after it is a positive… They don’t have to wait a week” to learn if they did it correctly, since the “feedback and assessment are tied directly to the activity in an immediate way.” Brenda also felt that benefit was “just being able to practice, but still get feedback.” Similarly, Peter liked the fact that students “had something to do every class” with a grade attached. “I think from the students’ perspective,” explained Scott, “you can finish it at midnight on Sunday or whatever, and you’ll still get some feedback.” Students can “learn at their own pace.” Susan also felt that MyITLab provided a “cool” alternative for students to a textbook exercise, but felt that her implementation of MyITLab did not elicit the same benefits that students in other classes may have experienced.

**Social Influences, Attitudes, and Intentions**

With respect to social peer pressure, the instructors did not communicate that they felt pressured to use MyITLab and, in fact, Peter and Scott removed it from their PowerPoint modules entirely. However, the course captain did exert some compliance pressure halfway through the term, via an email directive, regarding the adjustment of MyITLab grades. It seemed that one or two instructors were “gifting” assignment points only to those students who “whined” loudly enough. Concerned with the fairness of this practice, the course captain directed professors to formalize a classroom policy that was equitable to all students and not only to those who complained.

Susan’s classroom had the most distinct culture in comparison to other instructors’, whereby “10 high achievers were pretty vocal… and when they got frustrated, they communicated that, and they felt that they weren't learning anything" using MyITLab. Statements from this group, according to Susan, greatly impacted other students' attitudes in the class. As noted previously, Susan's class "did not like [MyITLab] as a whole, but not until they got to that failing exam." However, she felt obliged to continue using the software, since the students had paid "money for the textbook and [MyITLab] code, so you have to use it or else they're angry." Unsurprisingly, Susan would not recommend using MyITLab Grader as an assessment tool, even though she did value the "extra practice that it provided" as a tutorial.

While Andrew's overall assessment of MyITLab was relatively positive and he recommended its continued use, he also felt that it may be necessary to "change the way we use it." He also believed that some of his students thought "MyITLab sucked and hated it, and on a scale of one to five would give it a zero." However, "other students didn't have a low opinion of it" and it seemed to work fine for them. Meanwhile, Brenda was decidedly for the continued use of MyITLab in future semesters, and both Peter's and Scott's overall impression was "favorable." Peter projected his students' acceptance of MyITLab as being "very positive" with "90% of the students being as happy as could be." Scott also recommended the continued use of MyITLab but was somewhat more tentative, explaining that "when it's right, there are no issues. But as soon as something goes wrong,… [students] lose confidence in the system. It really freaks them out." However, Scott admitted that "overall, the complaints were never that they didn't like MyITLab. The complaints were that 'I didn't get the grade'." Evidently, four of the five instructors' opinions and attitudes were favorable toward the MyITLab Grader software, with each of them recommending its continued use for BuAd 128.

**Summary of the Instructor Interviews**

Implementing a new, innovative technology into a performance-based classroom environment is rarely an easy and straight-forward undertaking. However, the consensus among these instructors was that MyITLab Grader proved to be a valuable educational technology. The software was believed to be successful in enhancing student learning with frequent and continual feedback, while reducing the instructors' grading workload. While there were some software quality issues in terms of student grading accuracy, instructors were able to adjust their practices to deal with these challenges and focus instead on the greater benefits. As noted in the analysis of observations, Susan's difficult classroom environment, lack of training in MyITLab, and lack of familiarity with teaching Office seemed to contribute to her (and her students') negative attitude and experiences with MyITLab Grader. Given this qualitative picture of instructor experiences, it's now time to investigate and add to our understanding of students' perceptions and attitudes towards MyITLab, through the quantitative analysis of the student survey results.

## Analysis of Student Surveys

As in the analysis of observations and interviews, the case study methodology uses quantitative data analysis to inform analytic generalizations through description, pattern matching, explanation building, and cross-case synthesis (Yin, 2003). The quantitative survey results and analyses provide evidence of the perceived educational experiences of students with respect to MyITLab Grader. The following sections reveal not only a summary of the survey results, but serve to enlighten the previous qualitative descriptions from the student perspective.

**Overview of the Student Survey Results**

As of December 9th, 2011, there were 322 students enrolled in the Fall, 2011 section of BuAd 128. Of these students, 149 (or 46%) responded to the online survey between November 29th and December 8th, 2011. As shown in Table 4.4, respondents were divided almost equally between males and females, with 84% reporting to be under the age of 26 years. Perhaps more illuminating to the study, the student respondents self-reported on their Microsoft Office skill level prior to taking the course: 72% specified either Beginner or Novice, and 28% specified Intermediate or Advanced. No comparative scores were collected at the start of the semester to assess how students' self-perceptions of skill level may have changed throughout the semester.

Table 4.4

*Student Demographic Profile*

| Characteristic | Item | Frequency | Percent (%) |
|---|---|---|---|
| Gender | Male | 75 | 50.3 |
| | Female | 74 | 49.7 |
| Age Group | < 20 years | 66 | 44.3 |
| | 20 to 25 years | 60 | 40.3 |
| | > 25 years | 23 | 15.4 |
| Skill Level (Self-Rated) | Beginner | 35 | 23.5 |
| | Novice | 72 | 48.3 |
| | Intermediate | 39 | 26.2 |
| | Advanced | 3 | 2.0 |
| Total | | 149 | 100.0 |

In order to describe variations between the embedded units of analysis, the student responses were separated and analyzed according to their respective instructor groupings. Table 4.5 summarizes student numbers by instructor, the survey response rate, and the end-of-semester Grade Point Average (GPA) and Median Grade scores from the Okanagan College Office of Institutional Research (Kevin Trotzuk, personal communication, 2012). The overall GPA for Fall, 2011 was 70.1% and the Median score was 74.9%; no measures of dispersion or variability were provided in the institutional report.

Table 4.5

*Student Distribution by Instructor with Grade Results*

| Instructors | Total Students | Total Responses | Response Rate (%) | Grade Point Average (%) | Median Grade (%) |
|---|---|---|---|---|---|
| Andrew | 92 | 15 | 16.3 | 69.0 | 72.2 |
| Brenda | 63 | 41 | 65.1 | 70.7 | 75.0 |
| Peter | 71 | 18 | 25.4 | 73.3 | 79.5 |
| Scott | 61 | 49 | 80.3 | 68.9 | 74.8 |
| Susan | 35 | 26 | 74.3 | 67.5 | 73.0 |

With respect to the constructs from the adjusted Wixom and Todd model, the following analysis is separated into two sections according to variable type. All 25 Likert-type items are scored using a balanced 7 point scale, asking students to provide a value from Strongly Disagree (1) to Strongly Agree (7). The middle point of the scale, scored as 4, is labeled “Neither Agree or Disagree.” Questions using a negatively-keyed response have been reverse-scored to facilitate the interpretation of scores from negative (1) to positive (7) responses. As an ordinal variable, the appropriate measures of center are either the mode or median, while measures of variability may use either the range or interquartile range (IRQ) (Moore & McCabe, 2005). When a single Likert-type item, however, is combined with three or more additional questions measuring the same construct, the result is a composite Likert-scale variable that may be evaluated using an interval scale (Boone & Boone, 2012). As such, Likert-scale items may use the mean as a measure of center and the standard deviation as a measure of variability. The student survey instrument employs both Likert-type items (median and IQR) and Likert-scale items (mean and standard deviation). Each of these variable types are discussed in the following sections.

Before proceeding with the detailed analysis, a summary of these calculations across all instructor sections appears superimposed over the adjusted Wixom and Todd model in Figure 4.1.

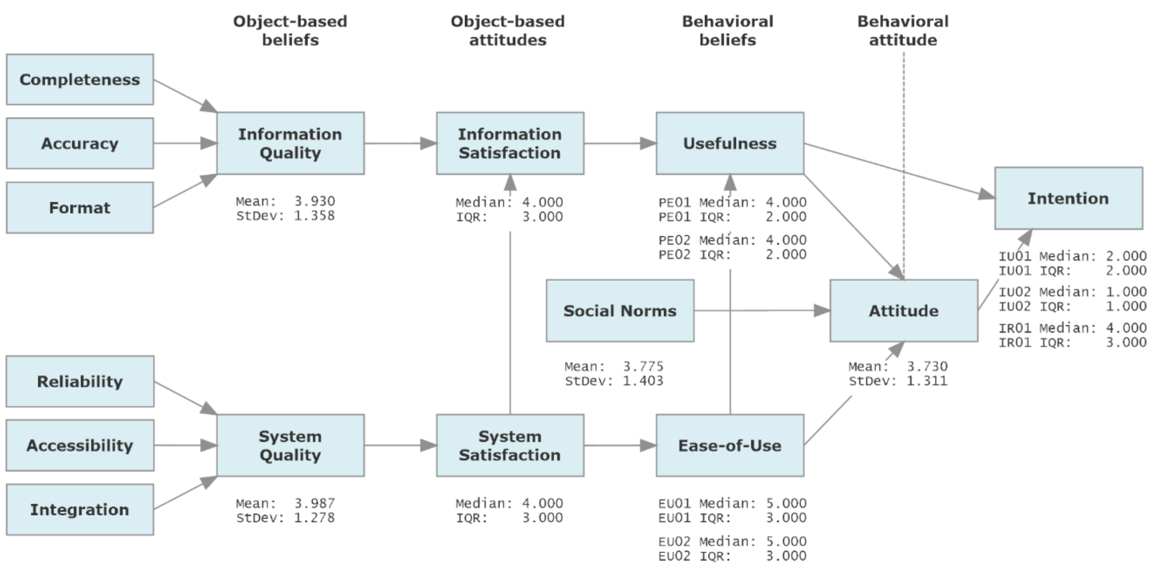


*Figure 4.1.* The Adjusted Model with Measures of Center and Dispersion

As shown in Figure 4.1, the general survey results indicate that students were not overwhelmingly pleased with the implementation and use of the MyITLab Grader software. In fact, only the Ease-of-Use construct scored positively with medians surpassing the scale's midpoint. Besides the two low median values attributed to the Intention-to-Use construct (IU01 and IU02), which measures whether students will continue using the software beyond the course completion date, the remaining means and medians seem to hover around the midpoint with some significant variability. On the other hand, the least variability once again appears for Intention-to-Use, which emphasizes the presumptive behavioral choice to let the MyITLab Grader subscription lapse upon completion of the course.

**Analysis of Variable Distributions**

For the ordinal and interval quantitative variables, the characteristics of interest include each distribution's center, spread, modality, shape, and outliers (Moore & McCabe, 2005). Especially true in exploratory data analysis, histograms provide an excellent starting point for reviewing these characteristics. Appendix H provides histograms for each Likert-type item and Likert-scale composite construct. While the composite variable histograms for Information (IQ) and System Quality (SQ) present mostly bell-shaped distributions around the midpoint of the Likert scale, the Information (IS) and System Satisfaction (SS) constructs are flattened across all data points except for a few Strongly Agree (7) responses. As Likert-type items from a non-probability sample, these two satisfaction constructs could not be reliably tested for significant categorical differences between the medians.

Similar to the satisfaction constructs, the Perceived Usefulness (PE01) of feedback for learning Microsoft Office is relatively flat, other than a handful of Strongly Agree (7) data points. In fact, 35 respondents chose the purely negative stance (1 and 2 on the scale) that MyITLab Grader did not help them to learn Microsoft Office, while 30 respondents chose the positive stance (6 or 7 on the scale) that the software did help their learning. Unfortunately, such varied responses along the x-axis hinder any reliable interpretation (Weinberg & Abramowitz, 2008). The Perceived Usefulness (PE02) for skill improvement, on the other hand, is arguably bell-shaped with a slight tendency to skew left. With a mode of 5.0 and a median of 4.0, 64% of respondents reported values between 4 and 6, a somewhat more concrete response than the previous Likert-type items. Although not a glowing report on the usefulness of MyITLab Grader in terms of improving students' Microsoft Office skills, the distribution's shape more clearly illustrates students' perceptual beliefs.

For the Ease-of-Use construct, the usability (EU01) histogram presents a slightly skewed left distribution, with a mode of 6.0 and a median of 5.0. Similar in shape to the PE02 distribution, the learnability (EU02) histogram provides a mode of 5.0, but with a more pronounced left skew. Regardless of what students may think about MyITLab Grader's feedback and system quality, these results provide evidence that the majority of students perceive MyITLab Grader to be a relatively easy program to learn and use. However, the question remains on whether students actually used the full complement of MyITLab's features (e.g., audio PowerPoints, simulation tutorials, and hands-on videos), or were they only accessing the assignments and gradebook. As in Microsoft Office, students may be able to perform the 20% of features and functions that they know exist, but they may not be aware of the other 80% of available functionality.

Both the Social Norms (SN) and Attitude (AT) constructs present bell-shaped distributions, as one might expect with composite variables, but the AT construct tends to skew slightly left. When collapsing the bin intervals, the normal shapes become more prominent. However, the constructs contain several lower data points that serve to pull the distributions' means left of their medians of 4.0. From these measures, students' behavioral attitudes toward MyITLab Grader seem to be in line with their behavioral beliefs regarding the influence of peers. In other words, students seem to possess a non-committal attitude toward MyITLab Grader (mode=4.5, median=4.0, and mean=3.7), and believe that their peers and instructor have similar non-committal attitudes (mode=4.0, median=4.0, and mean=3.8).

Some of the more predictable results are illustrated by the Intention-to-Use histograms (Figures H.11 and H.12). For the Intention-to-Continue (IU01) using MyITLab Grader beyond the course completion date, the distribution's shape is clearly right-skewed with a mode of 1.0 and a median of 2.0. For the Intention-to-Renew (IU02) the software's subscription, the distribution's shape is once again right-skewed with both a mode and median of 1.0. Obviously students do not perceive the benefits of continuing to use MyITLab Grader outweighing the costs of time (IU01) or renewal fees (IU02). The Intention-to-Recommend (IR01) histogram proves more challenging to describe. With a mode of 1.0 and a median of 4.0, there are obviously a range of student opinions with respect to recommending the use of MyITLab for future courses. Of the 149 respondents, 48 students chose the purely negative stance (1 and 2 on the scale) – in essence that

MyITLab Grader should no longer be used in BuAd 128 – and only 27 respondents chose the purely positive stance (6 or 7 on the scale). The majority of respondents (71) had no definitive position on the matter.

To summarize, the analysis of frequency histograms can provide some interesting insight into the shapes of the distributions for a particular data set. However, Gliem & Gliem (2003) remind us that single Likert-type items may have considerable measurement error and are, therefore, unreliable for use in making inferences about complex theoretical constructs. While the Likert-type item scores provide a descriptive snapshot of students' perceptions of MyITLab Grader in the context of the BuAd 128 case, their use in drawing inferences about other freshman computer literacy courses is severely restricted. Composite Likert-scaled items are undoubtedly more valid (given the reduced error), but these results are also limited to case-based analytic generalizations given the use of nonprobability, voluntary survey methods.

**Analysis of Likert-Type Items**

Nine of the 25 survey questions are classified as Likert-type items. Although progressively-increasing numbers are assigned to the response items, representing an ordinal relationship, the extent of that relationship cannot be implied (Boone & Boone, 2012). For the student survey, Likert-type items are used to focus the spotlight upon five constructs – Information Satisfaction (IS01), System Satisfaction (SS01), Ease-of-Use (EU01 and EU02), Usefulness or Performance Expectancy (PE01 and PE02), and Intention (IU01, IU02, and IR01). Notice that the Intention construct provides separate question items for measuring Intention-to-Use (IU) and Intention-to-Recommend (IR). Table 4.6 displays a summary of descriptive measures for these Likert-type items. Notice that the wide range for responses is nearly identical for each question item, emphasizing once again the variety of extreme responses received in the survey.

Table 4.6

*Summary of Descriptive Statistics for Likert-Type Items*

| Construct | Median | IQR | Range |
|---|---|---|---|
| Information Satisfaction (IS01) | 4.000 | 3.000 | 6.000 |
| System Satisfaction (SS01) | 4.000 | 3.000 | 6.000 |
| Ease-of-Use (EU01) | 5.000 | 3.000 | 6.000 |
| Ease-of-Use (EU02) | 5.000 | 3.000 | 6.000 |
| Usefulness (PE01) | 4.000 | 2.000 | 6.000 |
| Usefulness (PE02) | 4.000 | 2.000 | 6.000 |
| Intention-to-Use (IU01) | 2.000 | 2.000 | 6.000 |
| Intention-to-Use (IU02) | 1.000 | 1.000 | 5.000 |
| Intention-to-Recommend (IR01) | 4.000 | 3.000 | 6.000 |

Focusing on the perceived differences between instructors and their implementations of MyITLab Grader, this section presents paired-boxplot graphics to illustrate variations among the aforementioned constructs. While the histograms in Appendix H display the overall shape of the variables' distributions, a boxplot better describes the center and spread of the individual items based on values from the standard five-number summary (Moore & McCabe, 2005). For instance, the two object-based attitudinal measures for Satisfaction (shown in Figure 4.2) reveal medians between 3.0 and 5.0 for most instructors, except for Susan's results (median=2.0) for informational feedback. The variability within Andrew's section on the same variable also seems significant, with an elongated interquartile range (IQR). However, these student responses tighten up somewhat around the same median-level when asked about their satisfaction with the MyITLab Grader software itself.

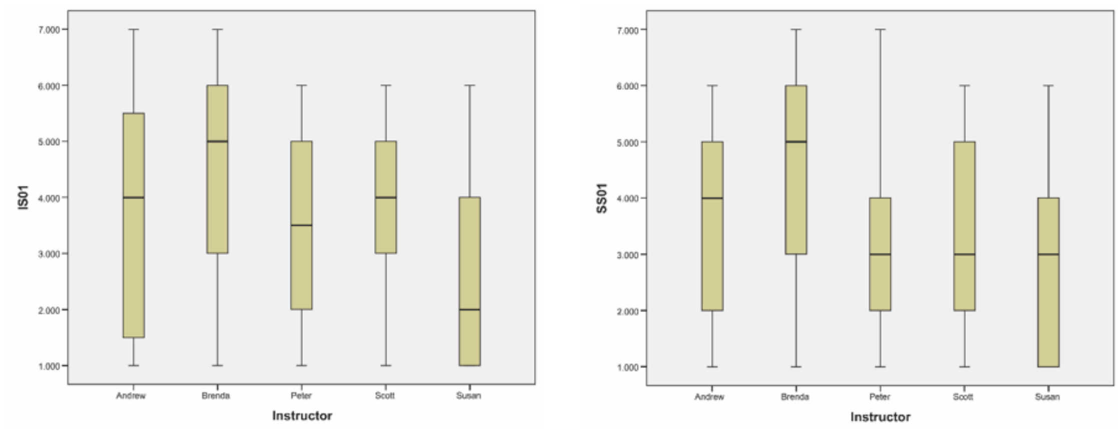


*Figure 4.2.* Satisfaction Boxplots: Information (IS01) and System (SS01)

The Ease-of-Use response items earn the highest median scores of any construct, and seem to possess reasonable IQR variability levels. However, the interesting point of the boxplots shown in Figure 4.3 is the wide range of student responses, using the entire scale from 1 through 7 across multiple instructors. In essence, students of the same instructor have polar opposite perceptions regarding the difficulty level in learning and using the MyITLab Grader software.

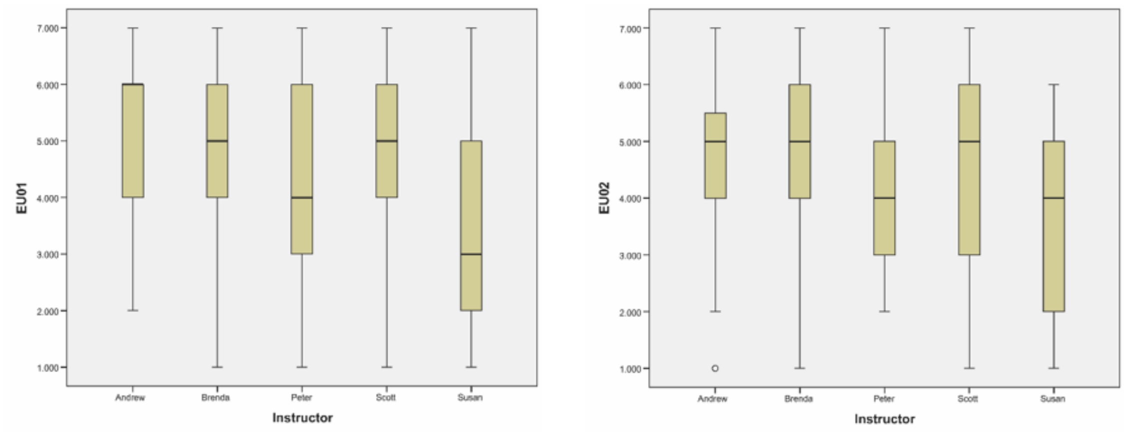


*Figure 4.3.* Ease-of-Use Boxplots: Usability (EU01) and Learnability (EU02)

The Usefulness response items measure students' perceptions of how well the MyITLab software provided corrective feedback and helped them to learn Microsoft Office. From the boxplots in Figure 4.4, the results once again illustrate the perceived shortcomings or challenges faced by Susan's students in terms of informational feedback. More surprisingly, however, is the range of results for measuring whether the MyITLab Grader software has helped students learn the required skills. In fact, all five instructors have students scoring MyITLab between 1 and 7 within the same classroom, with Andrew's classroom experiencing the greatest variability. Given these results, the outliers identified in Susan's boxplot were not deemed extraordinary items and a review of the individual case scores confirmed the consistency of inter-item rankings.

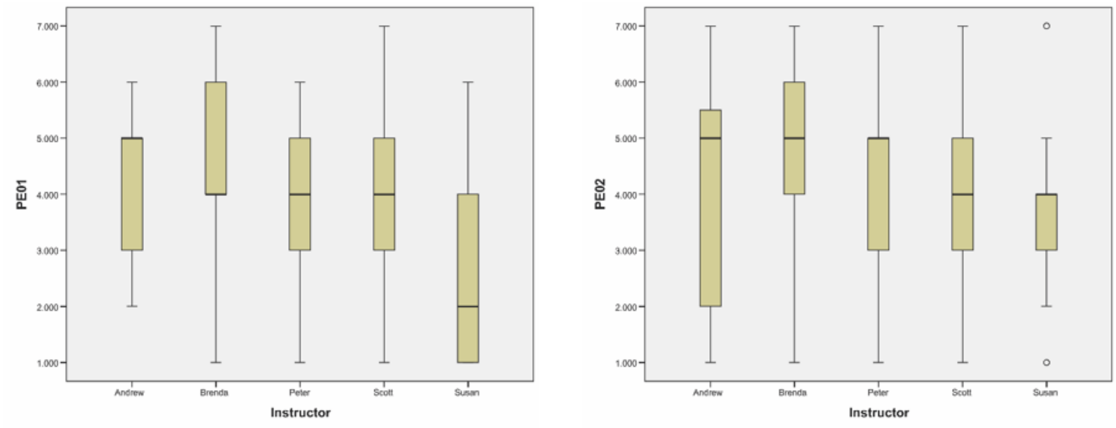


*Figure 4.4.* Usefulness Boxplots: Feedback (PE01) and Performance (PE02)

The lowest median scores were reported for the two Intention constructs shown in Figure 4.5, as might be expected in a college freshman computer class. With relatively similar medians and IQR results, the noteworthy data points are actually found in the higher ranges. Appreciating the small number of responses, there are students in the upper quartile (including those labeled as outliers) who would consider using or renewing the MyITLab Grader software after the course completion date.

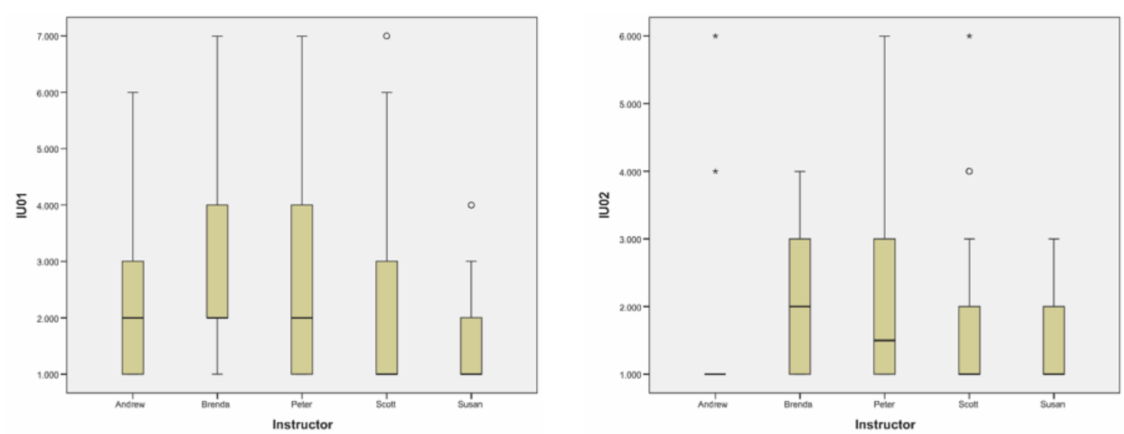


*Figure 4.5.* Intention Boxplots: Continued Use (IU01) and Renewal (IU02)

Figure 4.6 illustrates the results from one of the most important questions asked of students – would you recommend that MyITLab Grader be used in this course? The results mirror the first item, satisfaction with informational feedback (IS01), in terms of center, shape, and dispersion. Susan's class was the least impressed with the feedback provided, and the majority would not recommend the continued use of MyITLab. Similar to previous items, however, four out of five instructors have students who responded between 1 and 7 within the same class; thus highlighting the significant "within unit" variability.

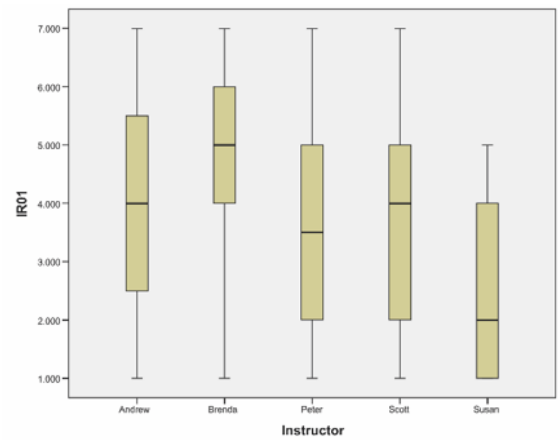


*Figure 4.6.* Intention Boxplot: Recommendation (IR01)

### Analysis of Likert-Scale Items

Complex latent constructs, such as attitude, are difficult (if not impossible) to measure with one or two Likert-type items (Boone & Boone, 2012). Instead, composite scores that combine four or more individual responses can be used to provide an interval measurement scale for statistical data analysis (2012). In the student survey, four constructs – Information Quality, System Quality, Social Norms, and Attitude – are measured using Likert-scale items, comprising 16 survey questions or four items each. The Likert-scale composite variables are calculated by averaging the Likert-type item results from each construct. Given the use of a nonprobability, voluntary survey method, there was no reliable basis for calculating factorial weightings on the items; therefore, equal weightings (i.e., averages) were applied in computing the values for comparative purposes.

Descriptive measures for the Likert-scale items appear in Table 4.7, along with Cronbach's coefficient alpha for testing reliability, accuracy, and internal consistency. The closer that Cronbach's alpha is to 1.0 the greater the internal consistency (i.e., the degree of interrelatedness) of the individual items that make up the composite scale (Gliem & Gliem, 2003). All measures fulfilled the suggested levels with composite reliability scores exceeding the .70 threshold (Lund Research, 2016; Nunnally & Bernstein, 1994). Similar to the median scores for the Likert-type items, the mean scores tend to group around the midpoint of the scale. Referencing the central limit theorem for sufficiently large sample sizes (Moore & McCabe, 2005), the Likert-scale histograms largely present as bell-shaped and symmetrical distributions (although once again, a voluntary census was conducted so inferences are both troublesome and unnecessary.) With reasonable justification, these distributions seem to be congruent with Pukelsheim's (1994) Three-Sigma Rule for descriptive purposes. In other words, 68% of the values should appear within one standard deviation from the mean, 95% of values should fall within two standard deviations, and 99.7% of values should fall within three standard deviations. The face validity of these measures seems to be in-line with the values appearing in Table 4.7.

Table 4.7

*Summary of Descriptive Statistics for Likert-Scale Items*

| Construct | Likert-Type Items | Mean | Standard Deviation | Cronbach's Alpha (α) |
|---|---|---|---|---|
| Information Quality (IQ) | 4 | 3.930 | 1.358 | .802 |
| System Quality (SQ) | 4 | 3.987 | 1.278 | .703 |
| Social Norms (SN) | 4 | 3.775 | 1.403 | .897 |
| Attitude (AT) | 4 | 3.730 | 1.311 | .778 |

For the purposes of analytic generalization, as opposed to inferential generalization, the Likert-scale items provide meaningful, and arguably conservative, measures for comparison to other Likert-type items. Because the mean is more sensitive to extreme observations (or outliers) than the median, boxplots are once again selected to best describe the center-points and levels of variability within the composite distributions (Moore & McCabe, 2005). Beginning with an analysis of the object-based beliefs for Information and System Quality in Figure 4.7, there appears to be some significant variability in Brenda's and Scott's sections, while Susan's students consistently rate the quality somewhat lower than the students of other instructors. Only Peter's section seems to be tightly grouped around the median, perhaps articulating a more common and consistent set of object-based beliefs.

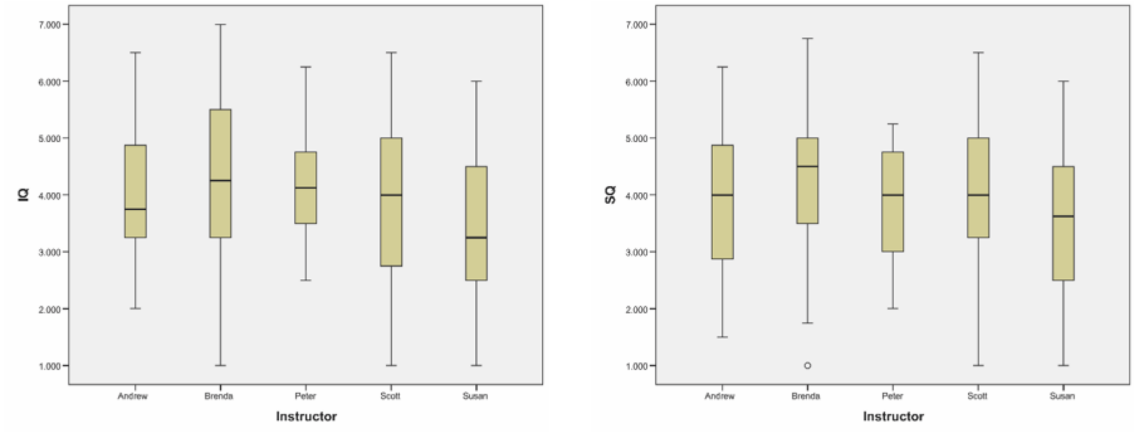


*Figure 4.7.* Quality Boxplots: Information (IQ) and System (SQ)

The Social Norms composite scores in Figure 4.8 illustrate some apparent differences between the instructors. Remembering that this construct measures students' perceptions of other people's beliefs about using MyITLab Grader, Susan's students are clearly sending a message with their tightly grouped responses around the lower extremes on the scale. The dispersion of results for other instructors seems similar in shape to most constructs; but, the large range of opinions remains a consistent theme. Investigating the histograms of individual Likert-type items that make up the Social Norms construct shows that students believe that their instructors, in general, feel more positive about the software than do their immediate peers.

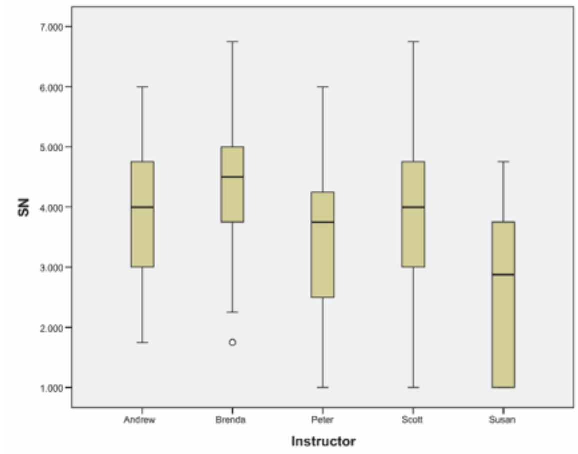


*Figure 4.8.* Social Norms (SN) Boxplot

The final, and arguably most important, construct measures the influence that object- and behavioral-based beliefs and social norms have had on respondents' attitudinal scores toward MyITLab Grader. The first noteworthy point in the Figure 4.9 boxplot is that respondent scores vary greatly from 1 through 6 across the instructor groupings, with most mean and median values showing below the midpoint. In Susan's section, students' attitudes do not seem to be swayed as much by their Social Norms beliefs, as one might have expected. While still far from being wholeheartedly enthused with MyITLab, the significantly negative trend from Susan's section in Figure 4.8 does not seem to carry forward to impact the formation of their individual attitudes. Lastly, the medians, interquartile ranges, and minimum and maximum values appear to be largely consistent across all instructor sections.

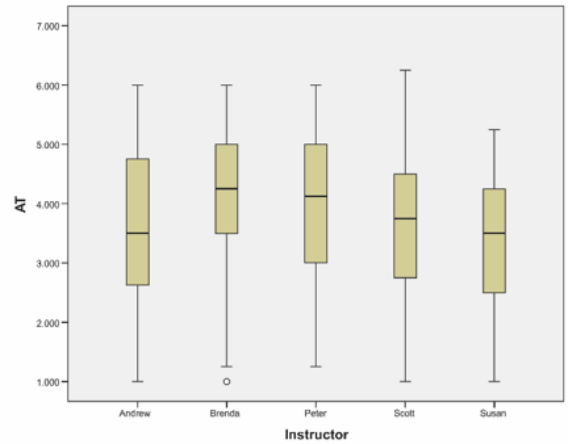


*Figure 4.9.* Attitude (AT) Boxplot

**Summary of the Student Survey Results**

An adjusted Wixom and Todd instrument was used to survey students in BuAd 128 – Computer Applications. The purpose of the survey was not to provide evidence as to the instrument’s inferential or predictive capabilities, but to provide triangulating and confirmatory evidence for use in describing students’ classroom experiences with the MyITLab Grader software. For this reason, a voluntary census was conducted and descriptive graphics and tables were analyzed to better appreciate students’ perceived beliefs, attitudes, and intentions.

The online survey was conducted near the end of the semester and produced 149 valid submissions for a 46% response rate. Reviewing the individual embedded units, the response rates varied from 16.3% for Andrew’s sections to 80.3% for Scott’s sections. While the reasons for the disparity are largely unknown, the assumption is that three of the instructors provided class time for students to complete the survey (65.1% to 80.3%), while two instructors asked students to complete it at home or on their own time (16.3%

and 25.4%). The low response rate may also indicate some voluntary response bias, whereby the data is collected from self-selected respondents who hold extreme opinions, either positive or negative, which may further explain the variability in histograms and boxplots.

As for the survey data itself, nearly three quarters of the respondents self-reported as being either a beginner or novice in using Microsoft Office at the beginning of the course. Overall, the measures for technology acceptance and user satisfaction reveal students at either end of the spectrum. While some students possess a positive attitude towards the MyITLab Grader, the majority are either non-committal or possess negative beliefs and attitudes. The highest scores were returned on the ease-of-use constructs, while the lowest scores were for respondents' intention to continue using MyITLab Grader beyond the course completion date. One embedded unit, Susan's section, had consistently lower scores with respect to their beliefs and opinions of the software, while other units hovered around the scale's midpoint. Further summations and interpretations of the data are provided in the following chapter.

# CHAPTER 5. DISCUSSION AND CONCLUSIONS

When it comes to computer literacy and software proficiency, today's university and college students are not that different from students of the past two decades. Their assumed levels of technological sophistication, having grown up as millennials with smartphones, tablets, and Facebook, are overstated and arguably superficial (Dednam, 2009; Eichelberger & Imler, 2015; Jones et al., 2010). Even though students are competent users of email, messaging, and the Internet, their computing and technology skills, required for both academic and workplace success, have been described as both rudimentary and basic (Gharawi & Khoja, 2015; Hanson et al., 2011; Kennedy et al., 2008; Rondeau & Li, 2009). In order to provide students with the skills necessary to perform at a satisfactory level, computer literacy courses in higher education need to continuously evolve and improve in order to meet the needs of a diverse population with disparate technical competencies. One example of an evolutionary step forward involves the development and implementation of Web-based, automated tutorial and grading software for Microsoft Office training and assessment. Unfortunately, the effectiveness and efficiency of this type of software has not been rigorously examined, nor well-documented (Varank, 2006). To close this gap in research, this study describes the use and implementation of MyITLab, an innovative software technology developed by Pearson Education, and its impact on a freshman-level computer literacy course.

## Application of the Case Study Methodology

This research study applied the case study methodology to frame the inquiry process within an empirical, scientific approach. Merriam (1998) emphasizes that the case study methodology is appropriate when needing to “gain an in-depth understanding of the situation” and when the “interest is in process rather than outcomes, in context rather than a specific variable, in discovery rather than confirmation” (p. 19). Through descriptive analyses and generalization, the case study strategy presents a concrete and contextual summarization that allows for the reader’s (and not just researcher’s) interpretation (1998). In order to foster a well-rounded and informed perspective for the context of the computer literacy classroom, data in this study were collected and analyzed from multiple sources, including course documents, classroom observations, instructor interviews, and student survey results. According to Yin (2003), every “good case study… uses as many sources as possible,” even when such sources may not provide any new, confirmatory, or contradictory information (p. 85). In this study, the course documents, including syllabi and examination files, provided a stable, exact, and precise source of evidence. Classroom observations provided the contextual reality checks and balances necessary for interpretation and generalization. As the embedded units within the case analysis, instructors provided targeted and insightful interview sources. And, lastly, a survey instrument integrated the research areas of user satisfaction and technology acceptance in order to provide quantitative results from students in an unobtrusive, albeit voluntary, manner.

Yin (2003) strongly encourages the use of multiple sources of evidence for triangulating on the same set of research questions. With converging lines of inquiry, potential problems of construct validity are addressed, in that “multiple sources of evidence essentially provide multiple measures of the same phenomenon” or experience (2003, p. 99). Yin also advocates that this “chain of evidence” explicitly link the research questions to the data collected and, ultimately, the conclusions drawn (2003). In essence, Yin’s case study approach, on which this study is modeled, assists both the reader and researcher in following the derivation of evidence, addressing the “methodological problem of determining construct validity, [and] thereby increasing the overall quality of the case study” (2003, p. 105) Consistent with Yin’s (2003) recommendations for reporting high-quality research, this study provides sufficient citations and quotes from the qualitative field data, an appropriate database for storing and querying the evidence, comprehensive research-based protocols driven by the theoretical framework and research questions, and analytical processes suitable for the methodologies selected (p. 105). The study’s resultant trustworthiness and credibility involves an interweaving among the methodological procedures followed, the theoretical frameworks selected, the analytical lens applied, and the researcher’s own experience and expertise.

With respect to the mixed-methods case study approach, the researcher's role and personal biases have been fully documented and the procedures for data collection and analysis described in detail for reliability purposes. Attention was focused on the experiential similarities and differences among the embedded case units (i.e., the instructors). And, to further ensure high-quality data analysis, Yin’s (2003) principles were followed by (a) attending to all the collected evidence, (b) addressing the most significant themes, and (c) applying the researcher’s own prior, expert knowledge to demonstrate awareness and thoughtfulness of the contextual issues. The analytical and interpretive results have been presented in a descriptive narrative, supported by instructors' quotations and the researcher's personal insights. Results from the student survey have been tabulated, and descriptive statistics generated, using categories abstracted from the literature. Internal validity was addressed through the use of published protocols derived from the research questions and survey questions adapted from previously-vetted instruments, in line with the theoretical framework. External validity for any case study, however, must be addressed in terms of reader generalizability, which involves "leaving the extent to which the study's findings apply to other situations up to the people in those situations" (Merriam, 1998, p. 211.) Having presented an overview of the research and the selected methodology, the following section discusses and summarizes the results of the study.

## Discussion of Results

The purpose of this study is to describe the experiences and impact on teaching and learning that resulted from the use of MyITLab Grader in BuAd 128, a computing applications course in the School of Business at Okanagan College. This study builds upon decades of end-user computing satisfaction and technology acceptance research. The primary focus of the research is descriptive, as opposed to evaluative, with the following goals: (a) to describe instructors' experiences with using MyITLab Grader in the classroom, (b) to identify patterns of technology usage, implementation, and delivery, and (c) to elucidate levels of user satisfaction, attitudes, and intentions regarding MyITLab Grader. The aspirant outcome of the research is to inform future decision-making regarding the use and implementation of similar educational technology products, within alike contexts, and the design and development of course curricula that utilize automated grading and tutorial software.

## Research Objectives

Before putting forward analytic generalizations, this section presents direct responses to the research question and objectives. These summations also serve to extend the prior analysis with specific insights related to the overall research purpose. The following section then encapsulates these insights into generalized assertions, or "statements of truth", which are based on and derived from the data.

**Research Objective 1: To describe the ways in which instructors are incorporating automated grading and tutorial software into their computer literacy classrooms.** BuAd 128 follows a traditional approach to teaching computer applications to freshman-level business students. Within a typical computer lab classroom, instructors separate their two-hour class time, more or less equally, into demonstration ("Show Me/Guide Me") and open lab time. The lecture demonstrations introduce the topics, features, or skills required for Microsoft Word, Excel, and PowerPoint, while the lab time provides opportunities for students to practice, engage the instructor for individual help, and complete the assigned term work. Students are assessed using weekly assignments (30%), module exams (60%) for each of the Microsoft Office applications, and a Microsoft PowerPoint group presentation (10%) during the final week. There is no final exam in the course. MyITLab, a Web-based automated grading and tutorial software from Pearson Education, is used to deliver and grade the weekly assignments but, more importantly, provides corrective feedback for each assignment with links to simulation-based tutorials for adaptive, mastery learning. The majority of students work on the

MyITLab assignments during open lab time, but may also complete the online exercises outside of class time or at home. For the MyITLab assignments, students are allowed to submit their work for grading two times, with only the highest score being recorded by the software. The module exams and other coursework are graded manually by the instructors.

From the instructors' standpoint, the implementation of MyITLab in the classroom simply replaced the use of textbook exercises and required no additional preparatory effort, other than familiarizing themselves with the exercises online. Furthermore, the administrative time and effort required to select and assign term work was reported to be minimal, as the "course captain" (or coordinating instructor) had already prepared the assignments and learning modules in MyITLab prior to the semester. While a few instructors mentioned the need to "play around" within specific areas of the software (e.g., the grade book), the implementation of MyITLab was largely viewed as seamless and easy. By midpoint of the semester, the course content became more challenging (i.e., Microsoft Excel, as opposed to Word) and instructors experienced some "backlash" from students who began feeling frustrated with MyITLab's grading accuracy. During this period, instructors felt they were spending an inordinate amount of time troubleshooting technical support and grading issues, rather than helping students learn the material. In response, some instructors introduced blanket, compensatory marks for "potential" MyITLab grading inconsistencies, while others held their ground or continued to adjust grades individually. Another common response was for instructors to modify their lecture demonstrations to "teach to the MyITLab Grader assignments," in order to ensure student success. The blowback from such a policy was lower student grades on the module exams, which focused more on the applications of Microsoft Office for creating solutions (e.g., newsletters, budgets, and sales presentations). On the positive side, instructors enthusiastically reported that their weekly grading workload was all but eliminated using MyITLab.

From students' standpoint, the MyITLab software provided weekly focus and grade-based motivation to complete the assigned term work. Instructors encouraged a collaborative, peer support environment during the open labs, and many students took advantage of this time to work as partners or groups on their MyITLab assignments. Students would submit their work for grading, open the gradebook to see their score (which MyITLab returned immediately), and, if necessary, review the Grader feedback report to see where marks were lost. While students could launch an adaptive simulation tutorial directly from the Grader feedback report, most students chose to seek assistance from peers or call over the instructor to help fix their assignment in order to earn back the missed points for a second submission attempt. Soon after the assignments were completed and submitted in the open lab, students would pack up and depart the classroom (again as a group) regardless of the class time remaining.

To summarize, the MyITLab software was implemented into BuAd 128 as a substitute for the weekly textbook exercises. As explained by the course captain, the goal was to provide both a grade and corrective feedback to students on their term work, which had not been possible before due to the sizeable workload. Overall, instructors were pleased with the seamless integration of the software into their classrooms, but found that their role changed from teaching to troubleshooting when faced with MyITLab's grading inaccuracies. During open lab time, students worked through the weekly assignments collaboratively, which may or may not have been different from how they would have approached working on the textbook exercises, and were able to correct and resubmit their work to recapture lost points. In essence, the use of MyITLab motivated students to review their work, correct their misunderstandings with peer assistance, and improve upon their original outcomes, which instructors noted would not have happened in previous semesters.

**Research Objective 2: To identify the perceptual gaps between instructors' expectations and in-class experiences using automated grading and tutorial software.** All but one instructor had used the MyITLab automated grading and tutorial software a few years previous to the study. The experience was “absolutely brutal” recounted one instructor, which explained the return to a manual “peer-reviewed, completion check” the following year. In the manual system, students had one of their neighbors confirm that the assigned textbook exercise had been completed during lab time and this point counted towards a nominal participation grade on the assessment rubric. Unfortunately, there was no instructor review for correctness and no feedback provided on any weekly assignments, due to the magnitude of the grading requirements. As a result, students in the previous semesters had no way of knowing whether they had achieved the requisite level of understanding prior to entering the module exams. Given these experiences, instructors were cautiously optimistic that the MyITLab software would be “useable” and “helpful” to students, while not creating unnecessary “busy-work” (and “headaches”) for themselves.

The one remaining instructor who had no prior experience with MyITLab was initially thankful for the increased time-on-task benefits that it promised her students. Her "clean-slate" approach to the software may have been moderately tainted by the other professors' war stories; however, she was a veteran professor with no qualms about having to modify the course as it progressed. Although the least experienced and technically-adept (self-admittedly) instructor in this particular area, she was confident in her abilities to meet student learning outcomes even if it meant dropping the MyITLab software and returning to the textbook. As described by another instructor, MyITLab was a "low-risk" proposition for the instructors, with the worst-case scenario being that they would have to assign textbook exercises and institute the manual, peer review grading system once again.

***Andrew's experience.*** Andrew had been teaching BuAd 128 for the past few years, remembering the long hours required for hand-grading assignments, the failed trial of MyITLab, and the benign peer-review grading system. He was especially hopeful that MyITLab would "be a good project to try this term," and excited to see how far MyITLab had come since their last effort. However, he also knew that there might be "some challenges with students' perceptions of how things got marked" from his previous experience with the software. While he agreed that there were time-on-task benefits during the semester, Andrew believed that the MyITLab Grader assignments were too prescriptive and, as such, they did not adequately prepare students for the difficulty-level of the module exams. In fact, he felt that the step-by-step assignments misrepresented how Microsoft Office was being used in the real world. So, while hopeful in the beginning, Andrew's in-class experiences with MyITLab left him wanting more out of the software, especially in terms of real-world, outcome-focused assessments and instruction.

***Brenda's experience.*** Brenda was happy to see a return to MyITLab Grader because it would potentially "take some of the grading away." Her expectations were relatively pragmatic, having had some past trouble with the software, but hopeful (like Andrew) that these issues were resolved and that the software would work this time. "I know it's not going to be perfect," exclaimed Brenda, "but it's way better than doing [the grading] manually or not giving them any opportunities to practice." She summarized her thoughts with "those were my expectations and they were pretty much met, because [MyITLab] does grade correctly most of the time… It was way better than in the past for sure." She believed the software achieved its goals for the semester and that her students' grades were more reflective of their motivation and effort than the strengths or weaknesses of MyITLab.

***Peter's experience.*** As one of the primary proponents for MyITLab, Peter initially hoped it would ease the weekly grading workload, which he believed it did successfully and with "no more preparation time required." He had witnessed the less than successful peer-review grading of the previous years, and believed that receiving automated feedback for weekly assignments would better students' chances at improving their grades. While he believed the overall student performance to be lower this semester than in previous years, Peter found that the "people who worked on MyITLab certainly got better grades" than other students; thus, confirming his expectations for the software. However, his early experiences with MyITLab were that it consumed too much of his in-class time in reviewing grading inaccuracies. As a result, he adjusted his assignment grading policy by adding 5% to each students' score, in order to reduce the "whining" and "complaining." Like Andrew, Peter perceived MyITLab to be somewhat misleading for students, in that they could earn 100% on the assignments and yet still do poorly on the exams. Coming to his own defense, Peter postulated that "this was not a hardworking cohort" and questioned whether students made sufficient use of the resources and tutorials available to them in MyITLab.

***Scott's experience.*** Scott had also used MyITLab in the past and was especially wary of the software's reliability at the beginning of the semester. Like the others, he was hopeful that the past problems had been corrected and that "all the assignments were going to work" this time. He was one of two instructors, along with Andrew, who voiced their readiness to "jump ship" or "opt out of MyITLab should [problems] occur." Fortunately, Scott found his in-class experiences to be generally positive and that MyITLab had significantly decreased the time previously set aside for reviewing material. Rather than creating frustration among students, Scott believed that MyITLab "helped carry them through" the content, especially when working outside of the classroom. He noted some minor grading errors throughout the semester, but summarized his experiences with "Overall, I liked it… It's a good tool."

***Susan's experience.*** Susan's expectations were the least informed by personal experience, in that she had not used the software before and was largely unfamiliar with its features: "I figured it out enough to make it work, but I don't think I ever actually understood the fastest way to do things." Susan also expected more direct linkages between her interpretation of the learning outcomes, module exams, and MyITLab Grader assignments. "I was getting a little frustrated because I didn't find that the book was teaching them what I wanted them to know." Her experience with MyITLab was further impacted by classroom culture, technical problems, and negative student attitudes.

"Most of my students had Macs and couldn't get it to work properly" at home and then "there were the network problems," she reported. As for the software, Susan "had no problem with MyITLab, other than the grading was off on some [assignments]." However, Susan's experience with MyITLab (and the course itself) was that it failed to prepare students to perform successfully on the module exams or to achieve her interpretation of the learning outcomes.

For the most part, instructors' pre-course expectations were that MyITLab would reduce their grading workload, increase students' time-on-task practice time, supply quantitative results for students' term work, and provide grading feedback that students could use to enhance their learning. Four of the five instructors' confirmed that their expectations for MyITLab were satisfactorily met. However, Susan's experiences were that the software contributed to the failure of preparing students to succeed in the course and, furthermore, negatively impacted students' attitudes and the overall classroom culture.

**Research Objective 3: To identify the opportunities and barriers perceived by instructors with respect to the continued use of automated grading and tutorial software.** The primary advantages afforded by MyITLab seem to align with instructors' expectations for reduced grading workloads, increased time on task, and the provision of student feedback where none previously existed. Andrew's overall attitude toward the software was positive, realizing the opportunities that MyITLab provided for touching and "spending time with the program(s)." However, he questioned if students were in fact using MyITLab as a "reflective tool on what they did and how they would get better." He doubted that "they really went that far with it." On the other hand, Brenda commented

"If you don't grade it, they don't care," and believed that MyITLab's grading and feedback motivated students to delve into the software and work harder. Brenda's primary concern was that "students have to understand that it's not perfect; it's just a tool" and that they must take responsibility for their own learning, rather than blaming the software.

The greatest barrier to the acceptance of MyITLab as an ongoing curriculum resource seems to be the perceived grading inaccuracies (and the resulting student frustrations) that occurred across the classes. Peter confirmed that the "grading ability and consistency" in MyITLab could pose a barrier for implementing the software in future semesters, but was pleased overall with the 90-95% accuracy experienced in his sections. Other instructors voiced their satisfaction with the grading accuracy, appreciating that MyITLab could never account for every possible method used to achieve a particular outcome. Having said that, a few of the instructors recommended that additional methods be added to the "solution bank" in order to make the software more flexible and forgiving. A related barrier to the acceptance of MyITLab transcends the grading issues to focus on the diagnostic reports provided to students. One of the key value propositions for MyITLab is its ability to guide students to mastery learning through the use of corrective feedback, simulation tutorials, exercise videos, and other resources. Andrew and Susan both mentioned that their students had difficulty finding the detailed feedback required to correct their misunderstandings or improve upon their assignment scores. Regardless of whether this failure was caused by usability issues or a lack of training, the usefulness of the software is blocked when detailed assignment feedback and relevant learning resources cannot be accessed easily and in a timely manner by students.

Similar to when computer training simulations for Microsoft Office were first introduced, many of the instructors also questioned the value of the prescriptive, step-by-step MyITLab Grader assignments. Although technically and programmatically necessary, the relatively inflexible and linear approach to exercise construction and skills assessment provides another barrier to the adoption of MyITLab. A common theme arose during the instructor interviews, "Are we teaching and assessing students on how to apply software to solve problems, or are we simply supporting their ability to follow directions mindlessly?" When asked about the transference of learning from MyITLab to the module exams, instructors perceived a disconnect between the task-based assignments and the outcome-based exams. "Wait just a minute, this [MyITLab] isn't teaching us anything," complained one student after receiving her exam results. In another class, students argued with the instructor about how they could earn such high marks in MyITLab and then nearly fail the exam. The presumed disconnect between learning individual features of a software program (e.g., how to change print margins in Microsoft Word) and applying that software to problem-solving scenarios, became apparent in the module exams. This disconnect between procedural learning versus real-world applications presents a potential barrier for MyITLab, not to mention automating grading and tutorial software in general.

Although a significant barrier in the previous failed trial of MyITLab, the technology infrastructure and, specifically, Internet-speed were no longer perceived to be a problem. The instructors did not experience issues accessing the software, launching assignments, or downloading feedback from the gradebook. While Susan's classroom did have network connectivity issues, these problems were campus-based and unrelated to MyITLab. Along with everything else, however, the network issues may have negatively impacted students' attitudes toward MyITLab in Susan's classroom. Overall, given adequate Internet bandwidth and sufficiently powerful lab computers, MyITLab was perceived to "work as advertised." While some students did experience intermittent problems with their personal Apple computers, these issues do not seem to pose an insurmountable barrier to the classroom adoption of MyITLab.

**Research Objective 4: To describe students' perceptions of system quality, feedback information quality, and overall satisfaction level with the automated grading and tutorial software.** The results from the adjusted Wixom & Todd student survey instrument may be divided into end-user computing satisfaction measures and technology acceptance measures. With respect to the computing satisfaction constructs, the survey data were literally positioned all over the map, often equally distributed between lower and upper values on the 7-point Likert scale. With measures of center closely grouped near the midpoint, the real story presents itself in the dispersion and variability of data points. Taken as a group, students' perceptions regarding their satisfaction with the MyITLab software are distributed across the entire spectrum.

When analyzed comparatively between instructors, many of the negative responses seemed to originate from Susan's students and, to a lesser extent, Andrew's and Peter's classrooms. Even though they initially liked MyITLab, Susan's students obviously did not feel that they had "enough detail to figure out what they did wrong" on assignments and, therefore, rated the information quality lower than other groups. As described by Susan, students lost confidence in the ability of MyITLab to "teach" them the skills necessary to be successful on the module exams. Furthermore, the classroom's technical problems and students' Mac-based issues would explain the lower satisfaction scores for MyITLab's reliability and accessibility measures, respectively. While students in Brenda's classroom reported the highest levels of overall satisfaction for both information and system quality, the values were still mediocre at best.

As explained by Weinberg & Abramowitz (2008), interpretations are challenging when students' responses are distributed so widely across the spectrum, with some students emphatically dissatisfied with MyITLab and others quite pleased with its quality.

**Research Objective 5: To describe students' perceptions of usability, usefulness, and overall attitude toward the automated grading and tutorial software.** For the technology acceptance measures, the data paint a similar picture to the end-user computing satisfaction results. Some students demonstrated a positive attitude towards MyITLab and, most likely, recommended its continued use in BuAd 128. Other students trashed the software with low behavior-based ratings and suggested that it never be used again. Mostly, however, students seemed rather non-committal in their attitudes and opinions, opting for the impuissant midpoint on the Likert scale.

While it is not possible to link student responses to instructor labels used during the interviews, one might conjecture that the "good" or "keener" students learned how to use MyITLab for their benefit, while the "bad" students or "kids" failed to complete the term work or draw from the software as a learning resource. On the other hand, negative attitudes may have also resulted when "good" students earned top scores in MyITLab, but then failed to perform acceptably on the module exams. Likewise, positive attitudes may have resulted when “bad” students worked through assignments at home and successfully practiced the skills necessary to succeed on exams. Again, it is impossible to determine which truths are hidden in the data, which is why triangulating the methods and data analysis are so important. For example, Peter perceived that 90% of his class was happy with the performance and usefulness of the software, which was unsupported by his students’ survey responses. His reasoning was that the “most common mark [was] 100%” and that “a majority of students who used [MyITLab] never questioned the grade they got.” Similarly, Scott “never heard any complaints saying it wasn’t useful” or that students “couldn’t understand the feedback,” yet his students rated MyITLab as being neither useful or useless and varied greatly on their assessment of the quality of feedback information.

Upon further review of the survey data, Susan’s and Andrew’s sections once again provided many of the negative responses regarding perceived usefulness, attitudes, and intentions. When asked about peer influences, Susan’s students clearly sent a message with their tightly grouped responses at the lower end of the scale. Students’ perceptions, seemingly, were that both Susan and their peers had low opinions of MyITLab. But, generally speaking across classrooms, students reported that their instructors thought more positively about the software than did their peers.

While far from being enthused with MyITLab, the attitudinal distributions seemed to group around the midpoint for all instructors. The Ease-of-Use construct was the only one to score positively, indicating that students perceived the software to be relatively easy to navigate, learn, and use. The two measures with the least variability were the Intention-to-Use constructs, which measures whether students will continue to use the software after the end of the course. The results for these constructs were overwhelmingly negative, which may be attributable to the financial obligation of maintaining the subscription. Having said that, several students responded affirmatively, that they would continue using the software, highlighting once again the significant “within-unit” variability.

As with computing satisfaction, measures for technology acceptance seemed to be distributed across the spectrum, with half the students leaning positively and half the students leaning negatively when asked about the usefulness and their overall attitude toward MyITLab.

## Analytic Generalizations

Synthesizing the results of the data analysis with the researcher’s own experience, several assertions are now presented for the purpose of informing the research purpose, and specifically the design and development of future curricula for computer literacy education.

**Assertion 1: MyITLab can effectively eliminate or, at least, reduce instructor grading workloads for weekly assignments.** Automated grading and feedback systems, such as MyITLab, can provide more consistent, helpful, constructive, and frequent feedback than is possible manually (Debuse et al., 2007). These systems have also been proven to have a positive impact on instructors’ workloads and time commitments, along with reporting high levels of instructor satisfaction (Debuse et al., 2008). The instructors in this study experienced similar workload benefits when implementing MyITLab for weekly term assignments, and the majority recommended its continued use, based largely on this premise.

**Assertion 2: MyITLab provides the opportunity for students to get frequent corrective feedback on their assignment submissions.** Jenkins (2004) reported on several advantages of computer-based automated grading systems, which include: repeatability, immediacy of feedback, trackability by faculty, reliability and equitability, timeliness, and flexibility of access. These characteristics align with the benefits espoused by the instructors in this study. Not only were students provided with continuous assignment feedback throughout the term, but also provided with adaptive links to simulation tutorials and video resources to enhance their learning. Whether students made optimal use of the resources is another matter entirely. Furthermore, instructors were able to track students' workflow and produce progress reports as evidence of student progress and engagement.

**Assertion 3: The prescriptive, step-by-step presentation of instructions in MyITLab assignments may not solely meet the needs of solution-focused learning outcomes.** Learning transfer has been studied for many years, and is especially important in the design of effective e-learning software (Clark & Mayer, 2002). Although admirable for meeting time-on-task practice requirements, this study illustrates how student learning from step-by-step assignments in MyITLab Grader is not easily transferred to solution-based exams. Clark and Mayer (2002) describe the use of varied and realistic worked examples for learning the "near-transfer skills" necessary for procedural tasks, such as those present in application software (p. 186). In BuAd 128, the instructors' lecture demonstrations must be used to present worked examples that bring together the learning that takes place in MyITLab assignments with real world applications of the software.

**Assertion 4: Instructors should be trained on MyITLab, in order to maximize the software's utility and usefulness.** Especially critical for technology acceptance, a person's self-efficacy impacts their ability to learn and perform tasks using computer software (Compeau & Higgins, 1995; Karsten & Schmidt, 2008; Stewart, 2016). MyITLab is not merely an educational website: it is a complex, Web-based technology that encapsulates simulation tutorials, online exercises and assessments, an automated grading engine, student grade book, diagnostic feedback and reporting tools, eBook resources, audio PowerPoint lectures, and hands-on videos. As witnessed during Susan's classroom observation and discussed later in her interview, MyITLab can be overwhelmingly feature-rich with many teaching, learning, and administrative capabilities. In comparison to the more technically-savvy instructors, Susan struggled with basic tasks in MyITLab, such as how to adjust students' grades, how to remove exercise steps that were not grading correctly, and how to set assignment due dates. In order to implement and utilize these features and tools in the curriculum, instructors require sufficient training and mentoring. The successes and shortcomings in this study were largely a factor of instructors' prior knowledge and experience using the software, confirming the importance of formalizing a pre-semester training and mentorship program.

**Assertion 5: The MyITLab solution bank of acceptable responses should be expanded by Pearson Education, in order to reduce the potential for grading inaccuracies.** The most frequent complaint expressed by both instructors and students, with respect to using MyITLab, was that the software would at times grade correct work as being incorrect. Not only are there multiple ways to perform a particular software task, there are often multiple steps that must be completed. The existing number of potential correct solutions, given the variety of performed behaviors and progressive ordering of steps, appears to be inadequate. By increasing the number of correct responses available, the assumption is that grading concerns would be minimized and the need for instructor troubleshooting reduced.

## Application of the Theoretical Framework

The Wixom and Todd (2005) integrated research model integrates two parallel streams in software and information systems research, specifically end-user computing satisfaction (EUCS) and technology acceptance (TAM). Combining these two streams provides a "conceptual bridge from design and implementation decisions to system characteristics to the prediction of usage" (p. 86). Most end-user computing satisfaction research focuses on informational content and system attributes, such as accuracy, completeness, flexibility, and reliability, to illuminate development decisions (Davis et al., 1989). Unfortunately, these object-based attributes have proven to be weak predictors of system usage. Technology acceptance literature, on the other hand, has established proven predictive linkages between system usage and users' attitudes and beliefs regarding a system's ease of use and perceived usefulness (Venkatesh et al., 2003). The Wixom and Todd (2005) model successfully illustrates how users' object-based beliefs and attitudes about a system can act as influencers on their behavioral beliefs and attitudes about using a system.

While several applications of the Wixom and Todd (2005) model appear in the field of information systems research, its application for the study of innovative educational technologies is sparse. Some possible explanations for its limited use may be revealed by the differences that exist within the workplace and classroom environments. In a typical workplace, standardized technologies and systems are provided to employees to help them achieve specific goals efficiently and effectively, measured by deadlines, productivity, and return on investment. Issues including data compatibility and employee training are forefront in the decision to implement such workplace systems. In a college or university classroom, instructors typically act unilaterally in choosing the educational technologies they wish to adopt and then either recommend or require those resources to be used by students. Students must make their own decisions on whether the resources are necessary or worth it for earning the desired grade. These purchase decisions are often influenced by the instructor, their in-class peers, their prior-learning and self-efficacy, and various external sources (e.g., social media reviews). A limitation of the Wixom and Todd (2005) model is that it does not differentiate between voluntary and mandatory system usage, nor does it account for the impact of social influences on usage behavior.

To make up for these shortcomings in studying the classroom environment, an adjusted Wixom and Todd (2005) model was developed in this study to incorporate elements from the Unified Theory of Acceptance and Use of Technology (UTAUT) model (Venkatesh et al., 2003). The Social Norms construct was added as an influencer of users' behavioral attitudes (Legris et al., 2003; Mathieson, 1991; Park, 2009; Punnoose, 2012; Taylor & Todd, 1995; Venkatesh & Davis, 2000; Venkatesh et al., 2003). This construct measured both instructor and peer influence, to determine how students' attitudes might have been impacted by other's opinions. Secondly, several moderating factors including gender, age, and past experience were added as mediators, which may enhance or diminish the impact of the direct determinants (Venkatesh et al., 2003). While the statistical significance of these factors was not assessed, their inclusion provided confirmatory descriptive evidence for use in analyzing and interpreting student experiences and in forming data-based assertions.

While the brevity of the Wixom and Todd (2005) model is one of its more appealing factors, other constructs were identified during the study for future consideration, including: Autonomy, Instructor Quality, and Service Quality. Autonomy refers to the degree to which students perceive the ability to take responsibility for and control of their own learning (Lakhal, Khechine, & Pascott, 2013). Technology acceptance researchers have successfully incorporated the autonomy construct into the UTAUT model to better reflect the importance and convenience of online access as an influencer of Perceived Usefulness and Behavioral Intentions (Chauhan & Jaiswal, 2016; Lakhal et al., 2016). In addition, the Instructor Quality construct has been studied by Lwoga (2014) as an influencer of Perceived Usefulness and User Satisfaction regarding learning management systems. Together with the Social Norms construct, the quality of the instructor, and their ability to integrate a complex educational technology into the classroom, undoubtedly impacts students' quality perceptions and acceptance of e-learning software. The Instructor Quality construct includes metrics for response timeliness, teaching style, and helpfulness towards learners (Cheng, 2012). Lastly, Service Quality, or technical support, has proven to be a significant contributing factor in end-user computing satisfaction research (Cheng, 2012; Ong et al., 2009; Xu et al., 2013). Delone and McLean's (2003) Updated IS Success model portrays the Service Quality construct alongside Information Quality and System Quality, although "each of these quality dimensions [would] have different weights depending upon the level of analysis," context, and research purpose (p. 18). Xu et al. (2013) developed their 3Q Model for e-service usability as an extension of the Wixom and Todd (2005) model by incorporating Perceived Service Quality as another object-based belief. The researchers provided evidence that Service Quality beliefs shaped users' attitudes about service satisfaction (an object-based attitude), which in turn positively influenced behavioral beliefs regarding enjoyment, ease of use, and usefulness of a Web-based application (2013). Figure 5.1 provides a second iteration of the adjusted Wixom and Todd model for use in future survey research, with the proposed additional constructs highlighted.

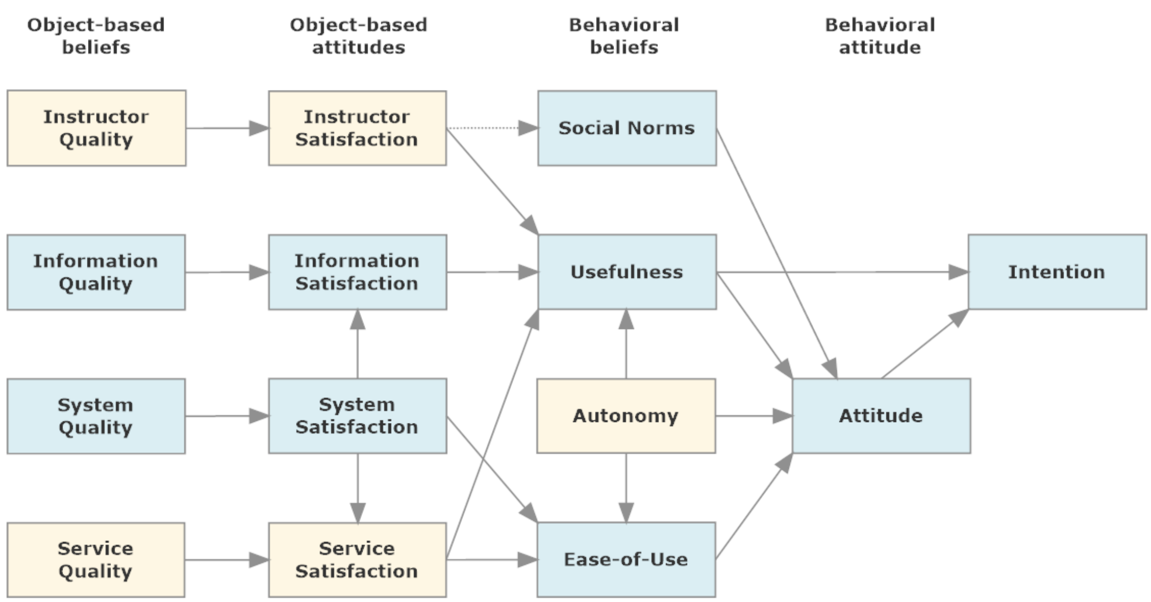


*Figure 5.1.* Proposed Modifications to the Adjusted Wixom and Todd Model

Comments gleaned from the instructor interviews further support the addition of these constructs, especially Service Quality, to the adjusted Wixom and Todd model. For example, Brenda recited instances whereby students “never got a response back” from MyITLab’s Online Student Support and that they had to access “the live chat, and actually say, [the instructor] is here right now, why is this not working? Anything else, like writing an e-mail, would just take forever.” Scott concurred that a number of students “either called or wrote in and nobody got feedback or acknowledgment” from Pearson regarding their problems. Andrew noted that “on the front page it says if you’ve got issues with grading, contact MyITLab rather than your professor.” However, he found that “students did not receive great support from MyITLab in terms of getting [their] questions answered.” Some descriptive terms, such as “a black hole” and an “empty box” where “there’s nobody home” were used by the instructors to chide the support services. These negative experiences would undoubtedly impact one’s attitude towards an educational technology solution, and should be included in future iterations of the adjusted Wixom & Todd research model and survey instrument.

## Limitations

The limitations of this study relate primarily to role of the researcher, context, and methodology. To begin, the researcher, as the primary instrument for gathering and analyzing data, is “limited by being human - that is, mistakes are made, opportunities are missed, and personal biases interfere” (Merriam, 1998, p. 20). Especially given that the research was conducted by a single person, these potential biases may have gone unchecked possibly during data collection and analysis (Yin, 2003). As Merriam (1998) writes, “all observations and analyses are filtered through that human being’s worldview, values, and perspective,” which may or may not align with the readers’ (p.22). Patton (2002) also emphasizes that qualitative analysis often benefits by the triangulation of competencies and viewpoints of different investigators. To mitigate this limitation, the role of the researcher has been fully documented in the methodology, in order to provide the reader with an informed perspective for making their own judgements.

The context of this case study is a single computer literacy course in a large community college in Western Canada. As a descriptive case study, the resulting analysis and assertions should not be generalized outside of this context. Instead, the purpose of the case study is to fully appreciate and understand this particular phenomenon (i.e., the implementation of MyITLab) within this particular context (i.e., BuAd 128) at this particular time (i.e., Fall, 2011). Regarding contextual validity, the course syllabus and MyITLab software from Fall 2011 have been proven to be similar, if not identical, to current offerings. So, while the data is four years old and limited in its generalizability to other contexts, the study's results may be used to inform on and generalize to theoretical propositions and model construction for future research.

Methodological limitations refer to the data collection methods and analytical techniques performed in the study. Assessing the validity and reliability of a case study involves "examining its component parts — the validity and reliability of the instrumentation, the appropriateness of the data analysis techniques, and the degree of relationship between the conclusions drawn and the data upon which they presumably rest." (Merriam, 1998, p. 199). The purposeful selection of instructors and students from a convenient population, together with the voluntariness of the online survey, limited the data analysis to certain techniques. With respect to instrumentation, the student survey incorporated previously-vetted questions; however, it had not been (and could not be due to the sampling methodology) statistically tested as a complete instrument to confirm its validity. This limitation was not deemed significant, given that the application of the survey was for descriptive and not inferential purposes, and that the face validity of the survey aligned directly with the two proven instruments from past empirical research.

With respect to the appropriateness of the data analysis techniques, the data collection methods informed the analytical procedures directly. One analytical limitation related to the use of Likert-type items for several model constructs, instead of creating composite measures. Due to the voluntary nature of the student survey, along with the late-semester timing, it was necessary to reduce the length of time required to complete the survey in order to ensure an acceptable response rate. Therefore, questions were removed that would have otherwise been combined to form more desirable summated Likert scales; thus limiting the ability to standardize on means and variances for comparative purposes. As it was, the survey response rate was only 46%, suggesting a potential for voluntary response bias. Understanding these limitations, it is important to note that the conclusions drawn in this study were based directly in the data, as shown by the ample use of interview quotes, observations, and descriptive statistics.

## Implications

Besides the future research opportunities already described for the adjusted Wixom and Todd model, the practical implications of this case study are not surprisingly rooted in both the technical and human elements. From a technical standpoint, any educational technology that is adopted by instructors must work properly and seamlessly in the classroom environment – advice which seems "Cubanesque" from Teachers and Machines. For another example of "the more things change, the more they stay the same," Jenkins (2004) reported over a decade ago that the strengths of automated grading systems included the following aspects: repeatability, reliability, accessibility, and the immediacy of feedback. MyITLab certainly displays these student-centered characteristics, and without question positively impacts instructors' grading workloads. However, students' problems with the repeatability or accuracy of grading measures negates all of these other positives. Even though the grading accuracy in MyITLab is probably higher, stated one instructor, than what it would have been if he had done it manually, students are not satisfied (nor should they be) with less than 100% accuracy. Without this level of confidence and trustworthiness, the technology should be adopted sparingly for assessment purposes. And, that is the critical point. MyITLab effectively delivers time-on-task practice exercises, along with immediate feedback and access to remedial learning resources, but instructors should not base students' final grades on a technology that is suspect. As witnessed with automated grading systems for essay writing, the human grader cannot yet be replaced entirely, although the technology is developing rapidly with recent advances in artificial intelligence. To summarize, MyITLab should be implemented for the advantages the software provides in teaching and learning, but used cautiously in computing students' final grades.

Moving on to the human element, this research illustrates the need for instructors and students to be fully trained on the use of an educational technology, such as MyITLab. Additionally, instructors must feel knowledgeable, comfortable, and confident in their understanding of how the technology will impact students, before being asked to communicate and demonstrate its value in the classroom. As any software developer or instructional designer will attest, the client (or instructor, in this case) should be involved throughout the planning, design, development or acquisition, and implementation of an educational technology in order to ensure “buy-in” and acceptance. Furthermore, to maximize the potential benefit of the technology in the classroom, instructors must set aside time to teach students how to navigate and access the features of the software and to set realistic expectations for its implementation. These steps were largely bypassed in this particular case, which may have impacted the instructors’ and students’ attitudes toward and experiences with MyITLab in BuAd 128.

## Conclusion

Computer literacy necessitates an understanding and appreciation of personal computer technologies, along with specific skill proficiency in Microsoft Office applications. Past research has demonstrated that computer literacy is an important curricular component in higher education and that the majority of students do not possess the level of software proficiency required for academic or workplace success. This particular case study described and analyzed the impact and user experience of implementing the MyITLab automated tutorial and grading software in a college-level computer literacy course. Using a Web-based delivery system, this curriculum resource promises to alleviate professor grading workloads and enhance student learning for Microsoft Office training.

Using the case study methodology, data were collected from course documents, classroom observations, instructor interviews, and student surveys. Using qualitative and quantitative techniques, the data were analyzed and summarized to inform the research purpose of providing insight into both instructor and student experiences with the software, describing how instructors implement the software in a traditional classroom environment, identifying opportunities or barriers for implementing the software, and determining the levels of satisfaction and acceptance for students, with respect to learning Microsoft Office. In addition to responding directly to the research objectives, several analytic generalizations were formulated from the data to inform future curriculum design and development decisions, including how:

1. MyITLab can effectively eliminate or, at least, reduce instructor grading workloads for weekly assignments.
2. MyITLab provides the opportunity for students to get frequent corrective feedback on their assignment submissions.
3. The prescriptive, step-by-step presentation of instructions in MyITLab assignments may not solely meet the needs of solution-focused learning outcomes.
4. Instructors should be trained on MyITLab, in order to maximize the software's utility throughout the term.
5. The MyITLab solution bank of acceptable responses should be expanded by Pearson Education, in order to reduce the potential for grading inaccuracies.

These assertions are grounded in the data and the researcher's personal expertise in Microsoft Office training. As a descriptive case study, these results are just one person's encounter with an innovative educational technology in a complex setting. The reader is, therefore, encouraged to reconsider the information presented and generalize it for their own purposes.

# LIST OF REFERENCES

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Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*, 179–211.

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Boston: Pearson Education.

Akilli, G. K. (2007). Games and simulations: A new approach in education? In D. Gibson, C. Aldrich, & M. Prensky (Eds.), *Games and simulations in online learning. Research and development frameworks* (pp. 1–20). Hershey: Information Science Publishing.

Aldrich, C. (2005). *Learning by doing: A comprehensive guide to simulations, computer games, and pedagogy in e-learning and other educational experiences*. San Francisco: Pfeiffer.

ATLAS.ti Scientific Software Development GmbH. (2016). ATLAS.ti. Berlin, Germany. Retrieved from http://atlasti.com/

Azevedo, R., & Bernard, R. M. (1995). A meta-analysis of the effects of feedback in computer-based instruction. *Journal of Educational Computing Research*, *13*(2), 111–127. doi:10.2190/9LMD-3U28-3A0G-FTQT

Balasubramanian, N., & Wilson, B. G. (2005). *Games and simulations*. ForSITE. Retrieved from http://site.aace.org/pubs/foresite/GamesAndSimulations1.pdf

Baltzan, P., & Welsh, C. (2015). *Business driven information systems* (Fourth Canadian edition). Whitby, Ontario: McGraw-Hill Ryerson.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, *84*(2), 191–215. doi:10.1037/0033-295X.84.2.191

Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. *Educational Psychologist*, *28*(2), 117–148. doi:10.1207/s15326985ep2802_3

Banerjee, S., & Kawash, J. (2009). Re-thinking computer literacy in post-secondary education. In R. Brouwer, D. Cukierman, & G. Tsiknis (Eds.), *Proceedings of the 14th Western Canadian Conference on Computing Education (WCCE 2009)* (pp. 17–21). New York, N.Y: ACM Press.

Bangert-Drowns, R. L., Kulik, C.-L. C., Kulik, J. A., & Morgan, M. (1991). The instructional effect of feedback in test-like events. *Review of Educational Research*, *61*(2), 213–238. doi:10.3102/00346543061002213

Barrera, J. C. (2013). Computer literacy in undergraduate business education: The case for the adult fast track programs. *American Journal of Business Education*, *6*(4), 471–482. Retrieved from http://www.cluteinstitute.com/ojs/index.php/AJBE/article/viewFile/7946/8001

Bartholomew, K. W. (2004). Computer literacy: Is the emperor still exposed after all these years? *Journal of Computing Sciences in Colleges*, *20*(1), 323–331.

Benbasat, I., & Barki, H. (2007). Quo vadis, TAM? *Journal of the Association for Information Systems*, *8*(4), 211–218.

Bennett, S., Maton, K., & Kervin, L. (2008). The ‘digital natives’ debate: A critical review of the evidence. *British Journal of Educational Technology*, *39*(5), 775–786. doi:10.1111/j.1467-8535.2007.00793.x

Bloom, B. S., Engelhart, M. D., Furst, E. J., Hill, W. H., & Krathwohl, D. R. (1956). *Taxonomy of educational objectives: The classification of educational goals*. London, WI: Longmans, Green and Company.

Boettcher, J. V. (2007). Ten core principles for designing effective learning environments: Insights from brain research and pedagogical theory. *Innovate*, *3*(3). Retrieved from http://www.innovateonline.info/index.php?view=article&id=54

Bonk, C. J., & Graham, C. R. (Eds.). (2006). *The handbook of blended learning: Global perspectives, local designs*. San Francisco: Jossey-Bass.

Boone, H. N., & Boone, D. A. (2012). Analyzing Likert data. *Journal of Extension, 50*(2), Art. 2TOT2. Retrieved from http://www.joe.org/joe/2012april/tt2.php

Bretz, R., & Johnson, L. (2000). An innovative pedagogy for teaching and evaluating computer literacy. *Information Technology and Management*, *1*(4), 283–292.

Bullen, M., Morgan, T., & Qayyum, A. (2011). Digital learners in higher education: Generation is not the issue. *Canadian Journal of Learning and Technology*, *37*(1), 1–24. Retrieved from http://www.cjlt.ca/index.php/cjlt/article/view/550

Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, & Social Sciences and Humanities Research Council of Canada. (2010). *Tri-Council Policy Statement: Ethical conduct for research involving humans*. Retrieved from http://www.pre.ethics.gc.ca/pdf/eng/tcps2/TCPS_2_FINAL_Web.pdf

Certiport Inc. (2012). *Microsoft Office specialist 2010: Certify to succeed*. Retrieved from http://www.certiport.com/Portal/desktopdefault.aspx

Charmaz, K. (2003). Grounded theory: Objectivist and constructivist methods. In N. K. Denzin & Y. S. Lincoln (Eds.), *Strategies of qualitative inquiry* (2nd ed., pp. 249–291). Thousand Oaks, CA: SAGE Publications.

Chauhan, S., & Jaiswal, M. (2016). Determinants of acceptance of ERP software training in business schools: Empirical investigation using UTAUT model. *The International Journal of Management Education, 14*(3), 248–262. doi:10.1016/j.ijme.2016.05.005

Cheng, Y.-M. (2012). Effects of quality antecedents on e-learning acceptance. *Internet Research, 22*(3), 361–390.

Chickering, A. W., & Gamson, Z. F. (1987). Seven principles for good practice in undergraduate education. *AAHE Bulletin*, *39*(7), 3–7.

Ciampa, M. (2013, May). Student perceived importance and correlations of selected computer literacy course topics. *Journal of Instructional Pedagogies, 11*. Retrieved from http://www.aabri.com/manuscripts/131490.pdf

Clark, R. C., & Mayer, R. E. (2002). *e-Learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning.* San Francisco: Jossey-Bass Publishers.

Compeau, D. R., & Higgins, C. A. (1995). Computer self-efficacy: Development of a measure and initial test. *MIS Quarterly*, *19*(2), 189–211.

Cornell University. (2015). *The Cornell note-taking system*. Retrieved from http://lsc.cornell.edu/wp-content/uploads/2015/10/Cornell-Note_Taking-System.pdf

Corti, L., Day, A., & Backhouse, G. (2000). Confidentiality and informed consent: Issues for consideration in the preservation of and provision of access to qualitative data archives. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research, 1*(3), Art. 7. Retrieved from http://nbn-resolving.de/urn:nbn:de:0114-fqs000372

Couch A., & Keniston, K. (1960). Yeasayers and naysayers: Agreeing response set as a personality variable. *Journal of Abnormal and Social Psychology, 60*, 151–174.

Courier, M., & Papp, R. (2005). Software applications in higher education: Necessary evil? In *Proceedings of the 2005 Southern Association of Information Systems Conference* (pp. 54–61).

Creighton, W., Kilcoyne, M., Tarver, R., & Wright, S. (2006). Computer literacy levels of students enrolling in a post-secondary computer applications/information technology course. *Information Technology, Learning, and Performance Journal*, *24*(1), 15–23.

Creswell, J. W. (2003). *Research design: Qualitative, quantitative, and mixed method approaches* (2nd ed.). Thousand Oaks, CA: SAGE Publications.

Creswell, J. W., & Miller, D. L. (2000). Determining validity in qualitative inquiry. *Theory into Practice*, *39*(3), 124–130. Retrieved from https://people.ucsc.edu/~ktellez/Creswell_validity2000.pdf

Crookall, D., Oxford, R., & Saunders, D. (1987). Towards a reconceptualization of simulation: From representation to reality. *Simulation/Games for Learning*, *17*(4), 147–171.

Dahlstrom, E., Brooks, D. C., Grajek, S., & Reeves, J. (2015, December). The ECAR study of undergraduate students and information technology, 2015. Louisville, CO: EDUCAUSE Center for Applied Research (ECAR). Retrieved from http://net.educause.edu/ir/library/pdf/ss15/ers1510ss.pdf

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*(3), 319–340.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, *35*(8), 982–1003. doi:10.1287/mnsc.35.8.982

de Jong, T. (1991). Learning and instruction with computer simulations. *Education and Computing*, *6*(3-4), 217–229. doi:10.1016/0167-9287(91)80002-F

de Jong, T., & van Joolingen, W. R. (1998). Scientific discovery learning with computer simulations of conceptual domains. *Review of Educational Research*, *68*(2), 179–201. doi:10.3102/00346543068002179

Debuse, J. C. W., Lawley, M., & Shibl, R. (2007). The implementation of an automated assessment feedback and quality assurance system for ICT courses. *Journal of Information Systems Education*, *18*(4), 491–502.

Debuse, J. C. W., Lawley, M., & Shibl, R. (2008). Educators' perceptions of automated feedback systems. *Australasian Journal of Educational Technology*, *24*(4), 374–386.

Dednam, E. (2009). Away with computer literacy modules at universities, or not? In *Proceedings of SACLA '09* (pp. 23–32). New York: ACM Press.

DeLone, W. H., & McLean, E. R. (2003). The DeLone and McLean model of information systems success: A ten-year update. *Journal of Management Information Systems, 19*(4), 9–30.

Dipietro, M., Ferdig, R. E., Boyer, J., & Black, E. W. (2007). Towards a framework for understanding electronic educational gaming. *Journal of Educational Multimedia and Hypermedia, 16*(3), 225–248.

Doll, W. J., & Torkzadeh, G. (1988). The measurement of end-user computing satisfaction. *MIS Quarterly*, *12*(2), 259–274.

Driscoll, M. P. (2005). *Psychology of learning for instruction* (3rd ed.). Boston, MA: Pearson Education.

Eichelberger, M., & Imler, B. B. (2015). "How do I send email?": Technology challenges for first-year students in the college library. *Library Hi Tech, 33*(3), 329–339. doi:10.1108/LHT-03-2015-0027

Edmiston, E., & McClelland, M. (2001). A conversation about ensuring computer literacy of first-year students. *Journal of Computing Sciences in Colleges*, *16*(2), 306–316.

Epperson, A. (2010). Computer literacy revisited: A comprehensive investigation of computer literacy. *ACM Inroads*, *1*(2), 30–33. doi:10.1145/1805724.1805736

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research*. Reading, MA: Addison-Wesley. Retrieved from http://people.umass.edu/aizen/f&a1975.html

Friese, S. (2012). *Qualitative data analysis with ATLAS.ti*. Thousand Oaks, CA: SAGE Publications.

Gall, M. D., Gall, J. P., & Borg, W. R. (2007). *Educational research: An introduction* (8th ed.). Boston: Pearson Education.

Gatto, D. (1993). The use of interactive computer simulations in training. *Australasian Journal of Educational Technology*, *9*(2), 144–156.

Gharawi, M. A., & Khoja, M. M. (2015). Assessing basic computer applications' skills of college-level students in Saudi Arabia. *International Journal of Social, Behavioral, Educational, Economic, Business, and Industrial Engineering*, *9*(4), 1240–1245. Retrieved from http://scholar.waset.org/1999.10/10001078

Gliem, J. A., & Gliem, R. R. (2003). *Calculating, interpreting, and reporting Cronbach's alpha reliability coefficient for Likert-type scales*. 2003 Midwest Research to Practice Conference in Adult, Continuing, and Community Education.

Goodfellow, M., & Wade, B. (2007). The digital divide and first-year students. *Journal of College Student Retention*, *8*(4), 425–438.

Grant, D. M., Malloy, A. D., & Murphy, M. C. (2009). A comparison of student perceptions of their computer skills to their actual abilities. *Journal of Information Technology Education*, *8*, 141–160.

Grenci, R. T. (2013). Positioning computer literacy as a value-added business core course. *Business Education and Accreditation*, *5*(1), 67–80. Retrieved from ftp://ftp.repec.org/opt/ReDIF/RePEc/ibf/beaccr/bea-v5n1-2013/BEA-V5N1-2013-6.pdf

Gupta, G. K. (2006). Computer literacy: Essential in today's computer-centric world. *ACM Inroads*, *38*(2), 115–120.

Hanson, B., Kilcoyne, M., Perez-Mira, B., Hanson, T., & Champion, S. (2011). Digital knowledge and application skills: A comparison study of entering freshman. *Journal of Research in Business Information Systems, 4*(4), 60–68.

Hardy, C., Heeler, P., & Brooks, D. W. (2006). Are high school graduates technologically ready for post-secondary education? *Journal of Computing Sciences in Colleges*, *21*(4), 52–60.

Hasan, B., & Ali, J. M. H. (2004). An empirical examination of a model of computer learning performance. *Journal of Computer Information Systems*, *44*(4), 27–33.

Herrington, J., & Oliver, R. G. (1999). Using situated learning and multimedia to investigate higher-order thinking. *Journal of Interactive Learning Research*, *10*(1), 3–24.

Higgins, R., Hartley, P., & Skelton, A. (2002). The conscientious consumer: Reconsidering the role of assessment feedback in student learning. *Studies in Higher Education, 27*(1), 53–64. doi:10.1080/03075070120099368

Hoffman, M. E., & Blake, J. (2003). Computer literacy: Today and tomorrow. *Journal of Computing Sciences in Colleges*, *18*(5), 221–233.

Hoffman, M. E., & Vance, D. R. (2005). Computer literacy: What students know and from whom they learned it. In *SIGCSE '05 Proceedings of the 36th Technical Symposium on Computer Science Education* (pp. 356–360). New York: ACM Press.

Hoffman, M. E., & Vance, D. R. (2008). Computer literacy: A student-oriented perspective. *Journal of Computing Sciences in Colleges*, *23*(5), 90–100.

IBM Corporation. (2016). IBM SPSS Statistics. Retrieved from http://www.ibm.com/analytics/us/en/technology/spss/

Jenkins, M. (2004). Unfulfilled promise: Formative assessment using computer-aided assessment. *Learning and Teaching in Higher Education*, *2004-05*(1), 67–80.

Johnson, D. W., Bartholomew, K. W., & Miller, D. (2006). Improving computer literacy of business management majors: A case study. *Journal of Information Technology Education*, *5*, 77–94.

Jones, C., Ramanau, R., Cross, S., & Healing, G. (2010). Net generation or digital natives: Is there a distinct new generation entering university? *Computers & Education*, *54*(3), 722–732. doi:10.1016/j.compedu.2009.09.022

Kalman, H. K., & Ellis, M. L. (2007). Improving undergraduate computer instruction: Experiments and strategies. *AACE Journal*, *15*(1), 23–38.

Kaminski, K., Switzer, J., & Gloeckner, G. (2009). Workforce readiness: A study of university students' fluency with information technology. *Computers & Education*, *53*(2), 228–233. doi:10.1016/j.compedu.2009.01.017

Karsten, R., & Schmidt, D. (2008). Business student computer self-efficacy: Ten years later. *Journal of Information Systems Education*, *19*(4), 445–453.

Kennedy, G. E., Judd, T. S., Churchward, A., Gray, K., & Krause, K.-L. (2008). First year students' experiences with technology: Are they really digital natives? *Australasian Journal of Educational Technology*, *24*(1), 108–122.

Kirriemuir, J., & McFarlane, A. (2004). *Report 8: Literature review in games and learning*. FutureLab Series. Retrieved from http://www.futurelab.org.uk/resources/documents/lit_reviews/Games_Review.pdf

Koh, C. E., Prybutok, V. R., Ryan, S. D., & Wu, Y. (2010). A model for mandatory use of software technologies: An integrative approach by applying multiple levels of abstraction of informing science. *Informing Science: The International Journal of an Emerging Transdiscipline*, *13,* 177–203. Retrieved from http://www.inform.nu/Articles/Vol13/ISJv13p177-203Koh561.pdf

Kulhavy, R. W., & Stock, W. A. (1989). Feedback in written instruction. *Educational Psychology Review*, *1*(4), 279–308.

Kvavik, R. B., & Caruso, J. B. (2005). Study of students and information technology, 2005: Convenience, connection, control, and learning. Boulder, CO: EDUCAUSE Center for Applied Research (ECAR). Retrieved from http://www.educause.edu/ers0506

Lakhal, S., & Khechine, H. (2016). Student intention to use desktop web-conferencing according to course delivery modes in higher education. *International Journal of Management Education, 14*(2), 146–160. doi:10.1016/j.ijme.2016.04.001

Lakhal, S., Khechine, H., & Pascott, D. (2013). Student behavioural intentions to use desktop video conferencing in a distance course: Integration of autonomy to the UTAUT model. *Journal of Computing in Higher Education, 25*(2), 93–121. doi:10.1007/s12528-013-9069-3

LeCompte, M. D., Preissle, J., & Tesch, R. (1993). *Ethnography and qualitative design in educational research* (2nd ed.). San Diego: Academic Press.

Lee, T.-H., Shen, P.-D., & Tsai, C.-W. (2010). Enhance students' computing skills via web-mediated self-regulated learning with feedback in blended environment. *International Journal of Technology and Human Interaction*, *6*(1), 15–32. doi:10.4018/jthi.2010091702

Lee, Y.-C. (2008). The role of perceived resources in online learning adoption. *Computers & Education, 50*(4), 1423–1438. doi:10.1016/j.compedu.2007.01.001

Legris, P., Ingham, J., & Collerette, P. (2003). Why do people use information technology? A critical review of the technology acceptance model. *Information & Management, 40*(3), 191–204. doi:10.1016/S0378-7206(01)00143-4

Lund Research. (2016). *Laerd Statistics.* Retrieved from http://statistics.laerd.com

Lwoga, E. T. (2014). Critical success factors for adoption of web-based learning management systems in Tanzania. *International Journal of Education and Development using Information and Communication Technology*, *10*(1), 4–21.

Mahmood, M. A., Burn, J. M., Gemoets, L. A., & Jacquez, C. (2000). Variables affecting information technology end-user satisfaction: A meta-analysis of the empirical literature. *International Journal of Human-Computer Studies*, *52*(4), 751–771. doi:10.1006/ijhc.1999.0353

Marangunić, N., & Granić, A. (2015). Technology acceptance model: A literature review from 1986 to 2013. *Universal Access in the Information Society*, *14*(1), 81–95. doi:10.1007/s10209-014-0348-1

Martin, F., & Dunsworth, Q. (2007). A methodical formative evaluation of computer literacy course: What and how to teach. *Journal of Information Technology Education*, *6*.

Martin, F., Klein, J. D., & Sullivan, H. (2007). The impact of instructional elements in computer-based instruction. *British Journal of Educational Technology*, *38*(4), 623–636. doi:10.1111/j.1467-8535.2006.00670.x

Mason, B. J., & Bruning, R. (2001). *Providing feedback in computer-based instruction: What the research tells us*. Retrieved from http://dwb.unl.edu/Edit/MB/MasonBruning.html

Mathieson, K. (1991). Predicting user intentions: Comparing the technology acceptance model with the theory of planned behavior. *Information Systems Research, 2*(3), 173–191.

Merriam, S. B. (1998). *Qualitative research and case study applications in education* (2nd ed.). San Francisco: Jossey-Bass Publishers.

Moore, D. S., & McCabe, G. P. (2005). *Introduction to the practice of statistics* (5th ed.). New York: W.H. Freeman & Co.

Moore, G. C., & Benbasat, I. (1991). Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information Systems Research, 2*(3), 192–222.

Morrison, G. R., Ross, S. M., Gopalakrishnan, M., & Casey, J. (1995). The Effects of feedback and incentives on achievement in computer-based instruction. *Contemporary Educational Psychology*, *20*(1), 32–50. doi:10.1006/ceps.1995.1002

Mory, E. H. (2004). Feedback research revisited. In D. H. Jonassen (Ed.), *Handbook of research on educational communications and technology* (2nd ed., pp. 745–783). Mahwah, NJ: Lawrence Erlbaum Associates.

Murray, M., Hooper, J., & Perez, J. (2007). A project-based approach to assessing student competency with productivity software. In *Proceedings of SIG-ED IAIM 2007 Conference* .

Narciss, S., & Huth, K. (2004). How to design informative tutoring feedback for multimedia learning. In H. M. Niegemann, D. Leutner, & R. Brünken (Eds.), *Instructional design for multimedia learning* (pp. 181–195). Münster: Waxmann.

Nistor, N., Gögüs, A., & Lerche, T. (2013). Educational technology acceptance across national and professional cultures: A European study. *Educational Technology Research and Development, 61*(4), 733–749. doi:10.1007/s11423-013-9292-7

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). McGraw-Hill series in psychology. New York, NY: McGraw-Hill.

Oblinger, D. G., & Oblinger, J. L. (2005). Is it age or IT: First steps toward understanding the net generation. In D. G. Oblinger, J. L. Oblinger, & C. Windham (Eds.), *Educating the net generation* (pp. 2.1-2.20). Boulder, CO: EDUCAUSE.

Ong, C.-S., Day, M.-Y., & Hsu, W.-L. (2009). The measurement of user satisfaction with question answering systems. *Information & Management, 46*(7), 397–403. doi:10.1016/j.im.2009.07.004

Palvia, S. C. J., & Palvia, P. C. (2007). The effectiveness of using computers for software training: An exploratory study. *Journal of Information Systems Education*, *18*(4), 479–489.

Park, S. Y. (2009). An analysis of the technology acceptance model in understanding university students' behavioral intention to use e-learning. *Educational Technology & Society, 12*(3), 150–162.

Patton, M. Q. (2002). *Qualitative research & evaluation methods* (3rd ed.). Thousand Oaks, CA: SAGE Publications.

Peat, M., & Franklin, S. (2002). Supporting student learning: The use of computer-based formative assessment modules. *British Journal of Educational Technology*, *33*(5), 515–523.

Perez, J., Murray, M., & Myers, M. (2007). An information technology literacy self-assessment instrument: Development and pilot results. In *Proceedings of 13th Americas Conference on Information Systems (AMCIS)* .

Poelmans, S., Truyen, F., & Desle, R. (2009). Perceived computer literacy among different types of (under)grad students: Findings of a survey. *ICERI2009 Proceedings,* 4910–4921.

Prensky, M. (2001a). Digital natives, digital immigrants. *On the Horizon*, *9*(5).

Prensky, M. (2001b). Do they really think differently? *On the Horizon*, *9*(6).

Pukelsheim, F. (1994). The Three Sigma Rule. *The American Statistician, 48*(2), 88. doi:10.2307/2684253

Punnoose, A. C. (2012). Determinants of intention to use eLearning based on the technology acceptance model. *Journal of Information Technology Education: Research*, *11*, 301–337.

Quora website. (2011). *Do people know how to use Microsoft Office?* Quora.com. Retrieved from http://www.quora.com/Microsoft-Word/Do-people-know-how-to-use-Microsoft-Office

Reeves, T. C., & Oh, E. (2008). Generational differences. In J. M. Spector, M. D. Merrill, J. J. G. van Merrienboer, & M. P. Driscoll (Eds.), *Handbook of research on educational communications and technology* (3rd ed., pp. 295–303). New York: Lawrence Erlbaum Associates.

Rondeau, P. J., & Li, X. (2009). The impact of a computer proficiency exam on business students' admission to and performance in a higher-level IT course. *Journal of Information Systems Education, 20*(4), 477–485.

Ruben, B. D. (1999). Simulations, games, and experience-based learning: The quest for a new paradigm for teaching and learning. *Simulation & Gaming, 30*(4), 498–505. doi:10.1177/104687819903000409

Saldaña, J. (2009). *The coding manual for qualitative researchers.* Thousand Oaks, CA: SAGE Publications.

Shute, V. J. (2008). Focus on formative feedback. *Review of Educational Research, 78*(1), 153–189. doi:10.3102/0034654307313795

Smith, P. L., & Ragan, T. J. (2005). *Instructional design* (3rd ed.). Hoboken, N.J: J. Wiley & Sons.

Stewart, A. N. (2016). *An assessment comparing community college students' computer self-efficacy and task-based computer knowledge* (Doctoral Dissertation). University of Southern Mississippi. Retrieved from http://aquila.usm.edu/dissertations/354/

Tapscott, D. (1998). *Growing up digital: The rise of the net generation*. New York: McGraw-Hill.

Tapscott, D. (2009). *Grown up digital: How the net generation is changing your world*. New York: McGraw-Hill.

Taylor, S., & Todd, P. A. (1995). Understanding information technology usage: A test of competing models. *Information Systems Research*, *6*(2), 144–176. doi:10.1287/isre.6.2.144

Tesch, D. B., Murphy, M. C., & Crable, E. (2006). Implementation of a basic computer skills assessment mechanism for incoming freshmen. *Information Systems Education Journal*, *4*(13).

Varank, I. (2006). A comparison of a computer-based and a lecture-based computer literacy course. *Eurasia Journal of Mathematics, Science and Technology Education*, *2*(3), 112–123.

Venables, A., & Tan, G. (2009). Realizing learning in the workplace in an undergraduate IT program. *Journal of Information Technology Education*, *8*, 17–26. Retrieved from http://www.jite.informingscience.org/documents/Vol8/JITEV8IIP017-026Venables706.pdf

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, *46*(2), 186–204. doi:10.1287/mnsc.46.2.186.11926

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, *27*(3), 425–478.

VERBI GmbH. (2016). MAXQDA. Berlin, Germany. Retrieved from http://www.maxqda.com/

Wallace, P., & Clariana, R. B. (2005). Perception versus reality - Determining business students' computer literacy skills and need for instruction in information concepts and technology. *Journal of Information Technology Education*, *4*, 141–151.

Weinberg, S. L., & Abramowitz, S. K. (2008). *Statistics using SPSS: An integrative approach* (2nd ed.). Cambridge, New York: Cambridge University Press.

Wixom, B. H., & Todd, P. A. (2005). A theoretical integration of user satisfaction and technology acceptance. *Information Systems Research*, *16*(1), 85–102. doi:10.1287/isre.1050.0042

Xu, J., Benbasat, I., & Cenfetelli, R. T. (2013). Integrating service quality with system and information quality: An empirical test in the e-service context. *MIS Quarterly, 37*(3), 777–794.

Yin, R. K. (2003). *Case study research: Design and methods* (3rd). *Applied social research methods series, Volume 5*. Thousand Oaks, CA: SAGE Publications.

Zandvliet, D., & Farragher, P. (1997). A comparison of computer-administered and written tests. *Journal of Research on Computing in Education*, *29*(2), 423–438.

Zimmerman, B. J. (1990). Self-regulated learning and academic achievement: An overview. *Educational Psychologist*, *25*(1), 3–17. doi:10.1207/s15326985ep2501_2

# APPENDICES

# Appendix A. BuAd 128 Course Syllabus (Fall 2011)

okanagan college

**Business Administration**

## Course Outline

| | |
|---|---|
| **COURSE NUMBER:** | BUAD 128 |
| **COURSE TITLE:** | COMPUTER APPLICATIONS I |
| **CREDITS:** | 3 |
| **CALENDAR DESCRIPTION:** | This course includes the use of computers in the business environment, including word processing, presentation graphics and spreadsheets. Computer concepts including hardware, software and data communications are covered at the intermediate level. Students will be expected to use their computer skills in other business courses. |
| **SEMESTER & YEAR:** | Fall 2011<br>(Also offered by Distance Education) |
| **PREREQUISITE:** | None |
| **CO-REQUISITE:** | None |
| **PREREQUISITE TO:** | BUAD 129, 236, 272, 282, 283, 293, 298, 333, 335, 340, and 360 |
| **FINAL EXAM:** | No |
| **HOURS PER WEEK:** | 4 |
| **GRADUATION REQUIREMENT:** | Required – BBA & Diploma, all options |
| **SUBSTITUTABLE COURSES:** | None |
| **TRANSFER CREDIT:** | CA, CIB, CMA, PMAC |
| **SPECIAL NOTES:** | Credit may be received by passing a Challenge Exam |
| **DEVELOPMENT DATE:** | June 1994 |
| **REVISION DATE:** | 2011 |

**DEPARTMENT CHAIR'S SIGNATURE:** *(Approval on file)*

*Figure A.1.* BuAd 128 Course Syllabus (page 1 of 4)

Appendix A continued.

**BUAD 128** **COMPUTER APPLICATIONS I** **Fall 2011**

**PROFESSORS:**

[redacted]

**COURSE DESCRIPTION:**

The business technology courses are designed to provide students with an introduction to the use of microcomputers in business, with a particular emphasis on the use of Microsoft Office in smaller organizations. The applications covered in this course include: Microsoft Word, Excel, and PowerPoint.

**COURSE OBJECTIVES**:

**Microsoft Word**
*The student will be able to perform the following:*
- Format a document using styles, templates, footnotes, and endnotes
- Create a table of contents
- Create and use outlining
- Insert objects using linking and embedding
- Perform a mail-merge operation - form letters, mailing labels, and envelopes

**Microsoft Excel**
*The student will be able to perform the following:*
- Convert data to information - list and data management
- Use AutoFilter and Advanced Filter commands to display subsets of lists
- Create pivot tables and pivot charts
- Consolidate data using 3D workbooks and file links
- Construct external reference formulas
- Automate repetitive tasks using VBA macros
- Use functions - financial, logical, text, date & time, and statistical

**Microsoft PowerPoint**
*The student will be able to perform the following:*
- Create a presentation design template
- Apply graphics, sounds, videos, and special effects
- Prepare presentation materials for delivery - notes pages and handouts
- Publish a presentation to the Web

The student will be expected to use these computer skills in other business courses.

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*Figure A.2.* BuAd 128 Course Syllabus (page 2 of 4)

Appendix A continued.

**BUAD 128** **COMPUTER APPLICATIONS I** **Fall 2011**

**REQUIRED TEXTS AND MATERIALS:**

*Title*: Exploring Office - Word, Excel, & PowerPoint 2010 by Grauer/Hulett/Poatsy.
*MyITLab Package ISBN*: 978-0-13-287684-1 (Pearson Education)
*Individual ISBNs*: Word – 978-0-13-510440-8, Excel – 978-0-13-509859-2,
PowerPoint – 978-0-13-509100-5
*Storage*: 512 MB (or larger) USB Memory Stick

**EVALUATION PROCEDURE:**

Assignments ........................................ 30%
Application Quizzes ............................. 60%
Term Project/Presentation .................... 10%
Total .................................................... 100%

**COURSE SCHEDULE:** ***Note**: This schedule is a guide and is subject to change.*

| Week of: | | Class Topics | Major Evaluations |
|---|---|---|---|
| Sep. | 4 | Tues. Sept 6 College-wide Orientation Day<br>Wed. Sept 7 Classes Begin<br>Mon. Oct 10 Thanksgiving Day (no classes)<br>Fri. Nov 11 Remembrance Day (no classes) | |
| | 11 | Introduction, StrengthsQuest, & Word: Chapter 1 | Class assignments |
| | 18 | Word: Chapter 2 & 3 | Class assignments |
| | 25 | Word: Chapters 4 & 5 | Class assignments |
| Oct. | 2 | Review and Word - Quiz | **Word Quiz** |
| | 9 | Excel: Chapter 1 & 2 | Class assignments |
| | 16 | Excel: Chapters 3 & 4 | Class assignments |
| | 23 | Excel: Chapters 5 & 7 | Class assignments |
| | 30 | Excel: Chapters 8 & 11 | Class assignments |
| Nov. | 6 | Excel: Review & Quiz | **Excel Quiz** |
| | 13 | PowerPoint: Chapters 1-2, & 3 | Class assignments |
| | 20 | PowerPoint: Chapter 4 & Review | Class assignments |
| | 27 | PowerPoint: Quiz & Class Presentations | **Presentations** |
| Dec. | 4 | Class Presentations | **PowerPoint Quiz** |
| | | | |
| Dec | 7 - 17 | FINAL EXAM PERIOD (No Final Exam) | |

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*Figure A.3.* BuAd 128 Course Syllabus (page 3 of 4)

Appendix A continued.

## SKILLS ACROSS THE BUSINESS CURRICULUM

The Okanagan School of Business promotes core skills across the curriculum. These skills include reading, written and oral communications, computers, small business, and academic standards of ethics, honesty and integrity.

## STUDENT CONDUCT AND ACADEMIC HONESTY

**What is the Disruption of Instructional Activities?**
At Okanagan College (OC), disruption of instructional activities includes student "conduct which interferes with examinations, lectures, seminars, tutorials, group meetings, other related activities, and with students using the study facilities of OC", as well as conduct that leads to property damage, assault, discrimination, harassment and fraud. Penalties for disruption of instructional activities include a range of sanctions from a warning and/or a failing grade on an assignment, examination or course to suspension from OC.

**What is Cheating?**
"Cheating includes but is not limited to dishonest or attempted dishonest conduct during tests or examinations in which the use is made of books, notes, diagrams or other aids excluding those authorized by the examiner. It includes communicating with others for the purpose of obtaining information, copying from the work of others and purposely exposing or conveying information to other students who are taking the test or examination."

Students must submit independently written work. Students may not write joint or collaborative assignments with other students unless the instructor approves it in advance as a group/team project. Students who share their work with other students are equally involved in cheating.

**What is Plagiarism?**
Plagiarism is defined as "the presentation of another person's work or ideas without proper or complete acknowledgement." It is the serious academic offence of reproducing someone else's work, including words, ideas and media, without permission for course credit towards a certificate, diploma, degree and/or professional designation. The defining characteristic is that the work is not yours.

"Intentional plagiarism is the deliberate presentation of another's work or ideas as one's own." Intentional plagiarism can be a copy of material from a journal article, a book chapter, data from the Internet, another student, work submitted for credit in another course or from other sources.

"Unintentional plagiarism is the inadvertent presentation of another's work or ideas without proper acknowledgement because of poor or inadequate practices. Unintentional plagiarism is a failure of scholarship; intentional plagiarism is an act of deceit."

**What are the Students' Responsibilities to Avoid Plagiarism?**
Students have a responsibility to read the OC Plagiarism Policy and Procedures outlined in the OC calendar, which is available in online format www.okanagan.bc.ca. Students must acknowledge the sources of information used on all their assignments. This usually involves putting the authors' name and the year of publication in parentheses after the sentence in which you used the material, then at the end of your paper, writing out the complete references in a Reference section.

"Students are responsible for learning and applying the proper scholarly practices for acknowledging the work and ideas of others. Students who are unsure of what constitutes plagiarism should refer to the UBC publication "*Plagiarism Avoided; Taking Responsibility for your Work*". This guide is available in OC bookstores and libraries.

Students are expected to understand research and writing techniques and documentation styles. The Okanagan School of Business requires the use of the APA or MLA style, but suggests that students cite references using the APA guidelines (see Publication Manual of the American Psychological Association, 5th edition (2001). A copy of the APA manual is available in the reference section and also available for circulation from OC libraries. The library website has access to these two major citing styles.

**What are the Penalties for Plagiarism and Cheating?**
The Okanagan School of Business does not tolerate plagiarism or cheating. All professors actively check for plagiarism and cheating and the Okanagan School of Business subscribes to an electronic plagiarism detection service. All incidents of plagiarism or cheating are reported and result in a formal letter of reprimand outlining the nature of the infraction, the evidence and the penalty. The Dean of the Okanagan School of Business and the Registrar record and monitor all instances of plagiarism and cheating. Penalties for plagiarism and cheating reflect the seriousness and circumstances of the offence and the range of penalties includes suspension or expulsion from OC.

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*Figure A.4.* BuAd 128 Course Syllabus (page 4 of 4)

# Appendix B. Purdue Institutional Research Board Approval

PURDUE UNIVERSITY

HUMAN RESEARCH PROTECTION PROGRAM
INSTITUTIONAL REVIEW BOARDS

| | |
|---|---|
| **To:** | TIMOTHY NEWBY<br>BRNG 3138 |
| **From:** | JEANNIE DICLEMENTI, Chair<br>Social Science IRB |
| **Date:** | 05/10/2016 |
| **Committee Action:** | **Determined Exempt, Category (4)** |
| **IRB Action Date:** | 05/10/2016 |
| **IRB Protocol #:** | 1602017217 |
| **Study Title:** | A DESCRIPTIVE CASE STUDY: INVESTIGATING THE IMPLEMENTATION OF WEB-BASED, AUTOMATED GRADING AND TUTORIAL SOFTWARE IN A FRESHMAN COMPUTER LITERACY COURSE |

The Institutional Review Board (IRB) has reviewed the above-referenced study application and has determined that it meets the criteria for exemption under 45 CFR 46.101(b).

Before making changes to the study procedures, please submit an Amendment to ensure that the regulatory status of the study has not changed. Changes in key research personnel should also be submitted to the IRB.

Please retain a copy of this letter for your regulatory records. We appreciate your commitment towards ensuring the ethical conduct of human subject research and wish you well with this study.

# Appendix C. Consent Form for Observation and Personal Interview

Okanagan College, Vernon Campus
School of Business
7000 College Way,
Vernon, BC V1B 2N5

**Informed Consent Form for Classroom Observation & Personal Interview**

**Investigating the Impact of Implementing Automated Grading and Tutorial Software into a Freshman Computer Literacy Course**

Thank you for agreeing to participate in the aforementioned study. Under the direction of principal investigator, Glen Coulthard of the School of Business at Okanagan College, this research study is being conducted as part of a doctoral dissertation in Learning Design and Technology at Purdue University. The data gathered may also be used subsequently for journal articles submitted to academic research publications. For more information about this study or for details regarding the use of research results, please contact Glen Coulthard at (250) 545-7291 local 2226 or via email at gcoulthard@okanagan.bc.ca. Copies of the study may be obtained after July 1st, 2012 by sending an email request to Glen Coulthard.

**Introduction**

Okanagan College subscribes to the ethical conduct of research and to the protection of the interests, comfort, and safety of study participants. The information in this form is being provided so that you may understand the procedures, risks and benefits associated with this research. As an important part in the process of informed consent, this form describes the research and tells you what your participation will involve. Please take the time to read the contents carefully.

**Purpose of the Study**

The purpose of this descriptive study is to investigate the impact on teaching and learning that results from the implementation and use of automated grading and tutorial software. Using phenomenography (the study of experiences) as the theoretical lens, you will be asked to reflect upon your positive and negative experiences in using the MyITLab Grader software in BUAD 128 – Computer Applications at Okanagan College. The results from this study will inform curriculum design decisions for computer literacy programs, supply insights into the benefits and challenges of integrating innovative learning technologies into the classroom, and guide the implementation and evaluation of automated grading solutions in other institutions.

**Study Procedures**

If you agree to participate, Glen Coulthard will observe one session of your BUAD 128 section(s) before the end of the Fall, 2011 semester—the date, time, and class to be mutually agreed upon. There will be no preparation or debriefing time required from you for this observation. You will then be asked to participate in a one-on-one interview with Glen, lasting no more than one (1) hour and taking place before the end of the final exam period. While the observation will take place within the classroom, during regular class hours, the interview will be scheduled for a time and location that is convenient for both parties. Please note that the observation will not be videotaped or recorded in any way, other than through handwritten notes. The interview, however, will be audiotaped and the recording later transcribed. You will be asked to review the interview transcript to ensure accuracy and completeness, which may take one additional hour.

*Figure C.1.* Consent Form (page 1 of 2)

Appendix C continued.

There are no potential risks or known inconveniences associated with your participation in this study. On the other hand, you may benefit from potential curricular improvements and a better understanding of your students' needs and learning preferences. At the request of the course planning committee for BUAD 128, a debriefing session will be made available after July 1st, 2012. Unfortunately, there will be no compensation for your participation in this study.

**Confidentiality**

As a privacy measure, your name and identity will be kept strictly confidential through the use of a pseudonym for reporting purposes. Only the graduate student researcher, Glen Coulthard, will have access to the coding of pseudonyms, observation notes, and interview transcripts. If you would prefer attribution for comments made during the interview, please let the researcher know after reviewing your transcript. Lastly, all data gathered by the researcher will be digitized and stored on a password-protected computer in encrypted form. The data will be kept until December, 2014, when it will be destroyed permanently.

**Contact Information for Concerns about the Rights of Research Participants**

This project has been reviewed and granted a certificate of approval by the Okanagan College Research Ethics Board.

If you have any concerns about your treatment or rights as a research participant, you may contact the Chair, Research Ethics Board through the Office of Research Services at (250) 762-5445 local 4491.

**Consent**

Your participation in this study is entirely voluntary and you may refuse to participate or withdraw your participation at any time without consequence. Your signature on this form indicates that you understand the information provided regarding this research project, including all procedures and the personal risks involved. Your participation in this project is in no way related to your employment contract. You understand that your identity and any identifying information obtained will be kept confidential, unless otherwise indicated.

Your signature below indicates that you consent to participate in this study. You will receive a copy of this consent form for your own records.

Participant's name (Please print): ______________________________

Participant's signature ______________________ Date ____________

Investigator's signature ______________________ Date ____________

*Figure C.2.* Consent Form (page 2 of 2)

# Appendix D. Instructor Pre-Interview Survey

okanagan college

Okanagan College, Vernon Campus
School of Business
7000 College Way,
Vernon, BC V1B 2N5

**Pre-Interview Survey for Professors**

Please type your responses to the following questions and then return as an attachment to Glen Coulthard via email at gcoulthard@okanagan.bc.ca by December 13th, 2011. The purpose of this pre-interview survey is twofold: 1) to introduce you to the types of questions that will be asked during the face-to-face interview, and 2) to help you focus and reflect on your experiences with MyITLab Grader. I look forward to reviewing your responses prior to our interview. Thank you for your participation and assistance!

1. **Describe how MyITLAB Grader was used in your specific section(s) of BUAD 128?**

2. **Describe one (or more) positive experiences you had in using MyITLab Grader this past semester. In other words, what "positive" impacts did you personally experience as a professor?**

3. **Describe one (or more) negative experiences you had in using MyITLab Grader this past semester. In other words, what "negative" impacts did you personally experience as a professor?**

4. **In what ways did MyITLAB Grader succeed or fail in impacting student learning outcomes?**

# Appendix E. Instructor Interview Protocol

## Professor Interview Protocol

Interviewee: ____________________________

❒ Signed consent form

Location & Date: ___________________________

Start & End Times: ____________________________

The purpose of this interview is to examine your experiences with using Pearson's MyITLab Grader software this past semester. Specifically, I am interested in hearing some examples about how Grader impacted your class preparation, in-class teaching, and students' learning.

To begin, let's reconstruct how you implemented or used Grader in a typical week of teaching Word or Excel.

**CLASS PREPARATION**

❒ First, lead me through your method of preparation for the coming week's classes?

- How did this prep compare to previous years? To other courses (in terms of time and effort)?

❒ Describe a positive experience or benefit that you received with respect to the use of Grader on class preparation.

❒ Describe a negative experience, frustration, or cost that you incurred with to respect the use of Grader on class preparation.

**TEACHING AND ADMINISTRATION**

❒ Lead me through a typical class session for Word or Excel.

❒ Can you recall any specific examples of when you may have strayed from this typical approach? What happened and why did you stray?

❒ Sometimes professors tweak or modify their approach in order to react to students' needs, technical issues, and/or administrative pressures. With respect to Grader, did you make any changes as the semester progressed? If so, what changes were made and why?

❒ Describe a positive impact or benefit that Grader had on your overall workload.

❒ Describe a negative impact that Grader had on your overall workload.

*Figure E.1.* Interview Protocol (page 1 of 2)

Appendix E continued.

**STUDENT LEARNING**

❒ Describe how students interacted with Grader and each other in-class. How did this impact your role in the classroom?

❒ Most professors "check in" with or "take the pulse" of their class to determine if they need to adjust their teaching style or speed, review previous topics, or change their use of technology. Can you describe a situation where you took the pulse of the class with respect to Grader?

- From this interaction, what were some of the "take-aways" for you?

❒ Describe a positive experience or benefit that you feel students received with respect to the use of Grader in-class.

❒ Describe a negative experience, frustration, or cost that you feel students incurred with to respect the use of Grader in-class.

**PERCEPTIONS AND EXPECTATIONS**

❒ Compare your method of preparation and in-class teaching to the other professors of Buad 128. What did you do differently/similarly?

- How did the use of Grader encourage homogeneity (ensure consistency across sections)? Individuality (allow for flexibility)?

❒ Thinking back to the beginning of term, describe your initial expectations for using Grader.

- What was your mindset toward Grader during those initial "breaking-in" weeks. How did it change over time?

❒ In what ways did Grader meet, fail to meet, or exceed your expectations.

❒ In what ways did Grader succeed or fail in impacting student learning outcomes? How did students fair in comparison to previous years?

❒ Describe your overall satisfaction level with Grader, in terms of usefulness (impact on student learning and instructor workload), trustworthiness (grading accuracy), and stability (dependability).

❒ What is your recommendation re: the continued use of Grader?

*Figure E.2.* Interview Protocol (page 2 of 2)

# Appendix F. Student Questionnaire Welcome Screen

Okanagan College, Vernon Campus
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7000 College Way,
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## STUDENT ONLINE QUESTIONNAIRE – WELCOME SCREEN

**MyITLab Grader Survey**

Thank you for agreeing to participate in this brief questionnaire. This research study is being conducted by Glen Coulthard as a doctoral dissertation in Learning Design and Technology at Purdue University. The purpose of the study is to investigate the impact of a new instructional technology on teaching and learning in an introductory computer literacy course. In addition to being used in writing journal articles for academic research publications, the results of this study will inform curriculum design decisions and supply insights into the benefits and challenges of integrating automated grading and tutorial software into the classroom.

Your participation in this study is anonymous, voluntary, and uncompensated. There are no potential risks or inconveniences associated with your participation. All of the study data will be kept confidential and secure using encryption technology and password protection. Furthermore, you may withdraw your participation at any time by closing your browser window. Incomplete responses will not be included in the analysis.

If you have any questions about this research study, please contact the principal investigator, Glen Coulthard (gcoulthard@okanagan.bc.ca) from Okanagan College at (250) 545-7291 local 2226. Concerns about your treatment or rights as a research participant should be directed to the Chair of the Research Ethics Board, through the Office of Research Services at (250) 762-5445 local 4491.

The following questionnaire consists of 25 items, grouped onto four screens plus one initial information screen, and should take less than 10 minutes to complete. By clicking on the Next button below, the questionnaire will appear and you must complete it in a single session. When you reach the final screen, click the Submit button to submit your results. By clicking Submit, it will also be assumed that you have given consent for the results to be used.

As a current student in BUAD 128, your familiarity and experience using the MyITLAB automated grading and tutorial software is crucial to this research study! Thanks once again for your participation.

## Appendix G. Student Survey Items

Table G.1

*Survey Constructs and Measurement Items*

| Construct Codes | Question Item | References |
|---|---|---|
| **System Quality** (4 items) | | |
| SQ01 – Reliability | MyITLab Grader performs reliably. | (Wixom & Todd, 2005) |
| SQ02 – Accessibility | MyITLab Grader is difficult to access from different locations (i.e., home and school). (RC) | (Wixom & Todd, 2005) |
| SQ03 – Integration | MyITLab Grader makes it easy to jump from questions that I get incorrect to the appropriate MyITLab tutorial that I need to review | (Wixom & Todd, 2005) |
| SQ04 – Quality | MyITLab Grader is a high quality software product. | (Wixom & Todd, 2005) |
| **Information Quality** (4 items) | | |
| IQ01 – Completeness | MyITLab Grader provides me with comprehensive feedback on my assignments. | (Wixom & Todd, 2005) |
| IQ02 – Accuracy | The feedback I receive from MyITLab Grader is accurate the majority of the time. | (Wixom & Todd, 2005) |
| IQ03 – Format | The feedback I receive from MyITLab Grader is presented in a confusing way. (RC) | (Wixom & Todd, 2005) |
| IQ04 – Quality | MyITLab Grader provides me with high quality feedback on my assignments. | (Wixom & Todd, 2005) |
| **System Satisfaction** (1 item) | | |
| SS | All things considered, I am very satisfied with MyITLab Grader. | (Wixom & Todd, 2005) |
| **Information Satisfaction** (1 item) | | |
| IS | All things considered, I am very satisfied with the quality of feedback that I get from MyITLab Grader. | (Wixom & Todd, 2005) |

Table G.1 continued.

| Construct Codes | Question Item | References |
|---|---|---|
| **Ease-of-Use** (2 items) | | |
| EU01 | I found MyITLab Grader difficult to use. (RC) | (Wixom & Todd, 2005) |
| EU02 | I found MyITLab Grader easy to learn. | (Venkatesh et al., 2003) |
| **Social Norms** (4 items) | | |
| SN01 | My instructor thinks that MyITLab Grader is a high-quality software product. | (Venkatesh et al., 2003) |
| SN02 | My instructor believes that the feedback from MyITLab Grader helps me to learn Microsoft Office. | (Venkatesh et al., 2003) |
| SN03 | My peers think that MyITLab Grader is a high-quality software product. | (Venkatesh et al., 2003) |
| SN04 | My peers think that the feedback from MyITLab Grader helps them to learn Microsoft Office. | (Venkatesh et al., 2003) |
| **Usefulness** (2 items) | | |
| PE01 | MyITLab Grader provides feedback that helps me to learn Microsoft Office. | (Lee, 2008) |
| PE02 | The feedback from MyITLab Grader did not improve my skills in working with Microsoft Office. (RC) | (Lee, 2008) |
| **Attitude** (4 items) | | |
| AT01 | I dislike the idea of using an automated grading system like MyITLab Grader. (RC) | (Wixom & Todd, 2005) |
| AT02 | My attitude toward using MyITLab Grader is very favorable. | (Wixom & Todd, 2005) |
| AT03 | MyITLab Grader has made me better aware of my skill level in using Microsoft Office. | (Venkatesh et al., 2003) |
| AT04 | Overall, my use of MyITLab Grader has improved my skills in working with Microsoft Office. | (Koh et al., 2008) |

Table G.1 continued.

| Construct Codes | Question Item | References |
|---|---|---|
| **Intention-to-Use** (3 items) | | |
| IU01 | After this course, I plan to continue using MyITLab Grader until my subscription expires. | (Lee, 2008) |
| IU02 | After this course, I intend on renewing my subscription to MyITLab Grader. | (Lee, 2008) |
| IR01 | All things considered, I recommend that MyITLab Grader continue to be used in BuAd 128 classes. | (Koh et al., 2008) |

*Note:* RC = reverse coded.

**Appendix H. Student Survey Histograms**

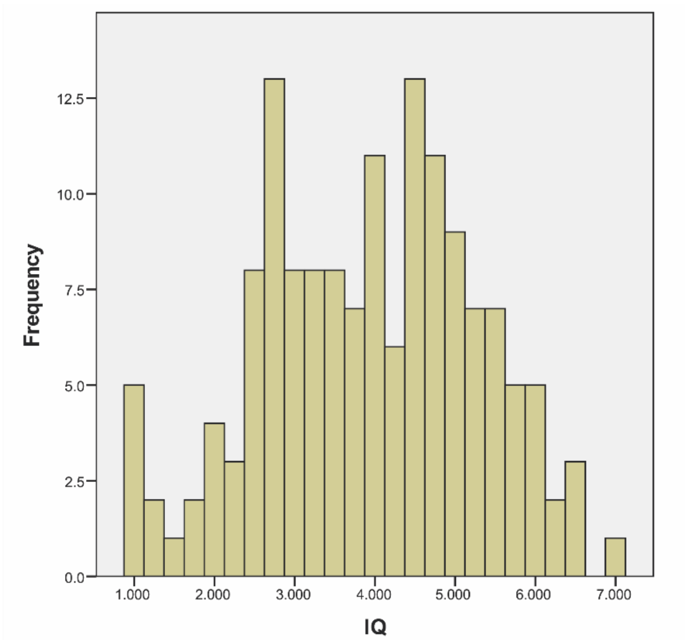


*Figure H.1.* Information Quality (IQ) Histogram

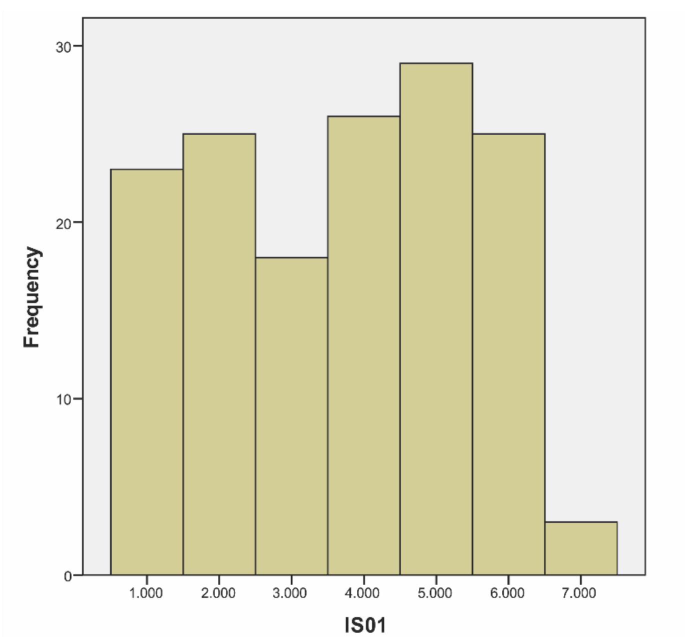


*Figure H.2.* Information Satisfaction (IS01) Histogram

Appendix H continued.

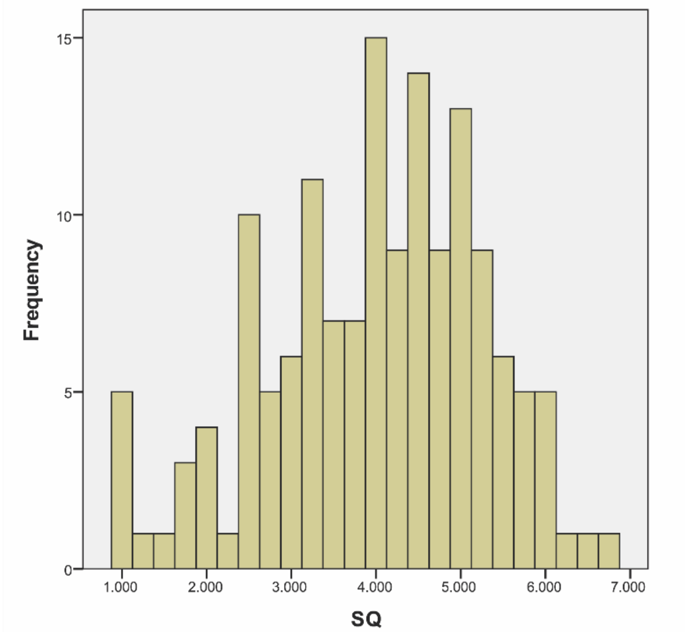


*Figure H.3.* System Quality (SQ) Histogram

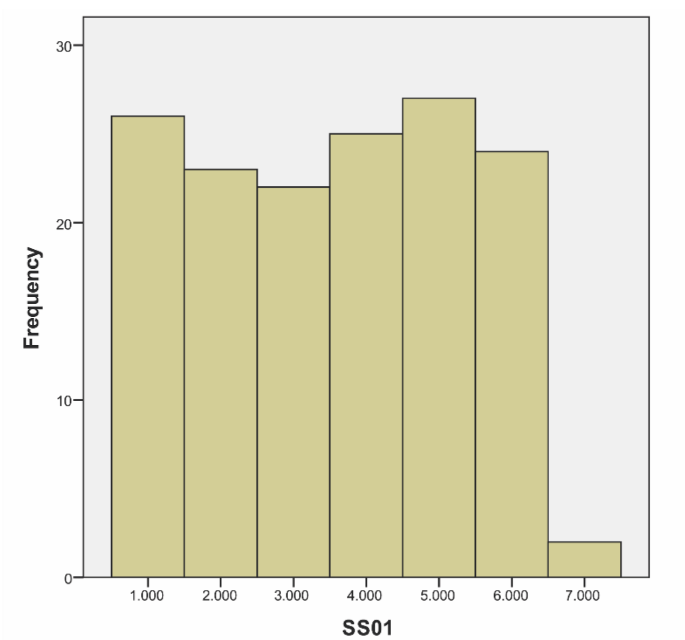


*Figure H.4.* System Satisfaction (SS01) Histogram

Appendix H continued.

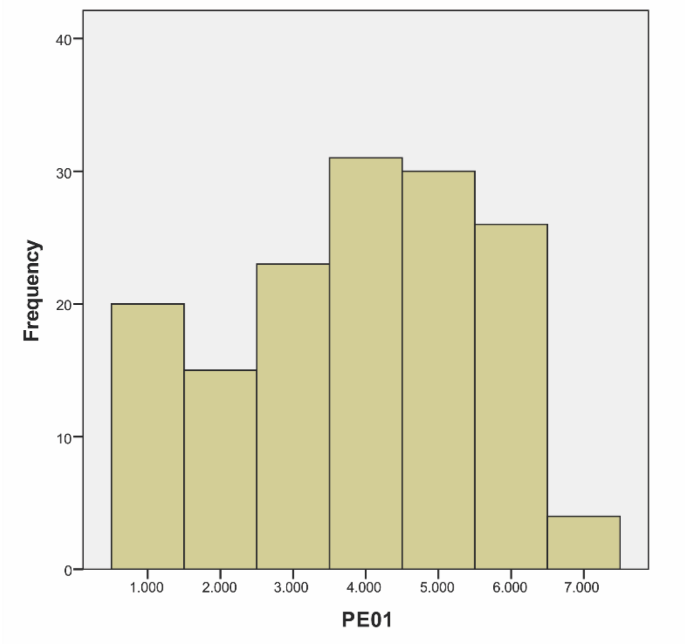


*Figure H.5.* Usefulness of Feedback (PE01) Histogram

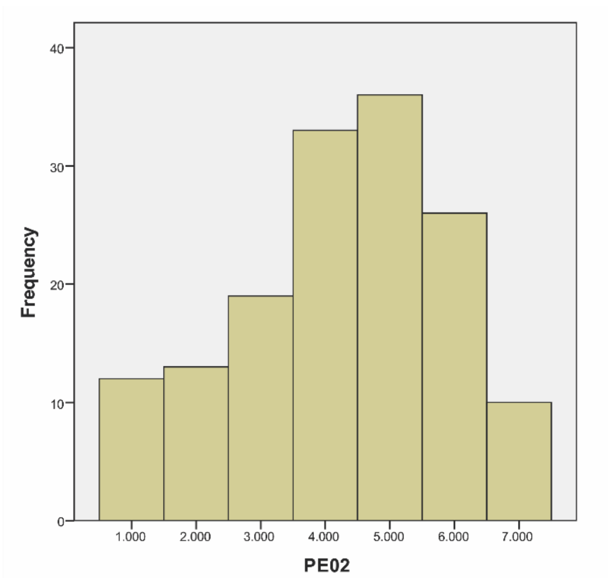


*Figure H.6.* Usefulness of Feedback (PE02) Histogram

Appendix H continued.

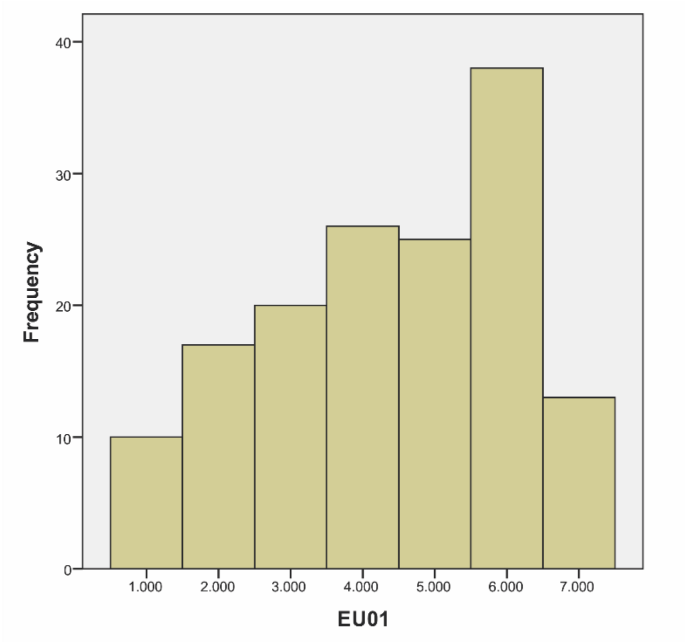


*Figure H.7.* Ease-of-Use for Usability (EU01) Histogram

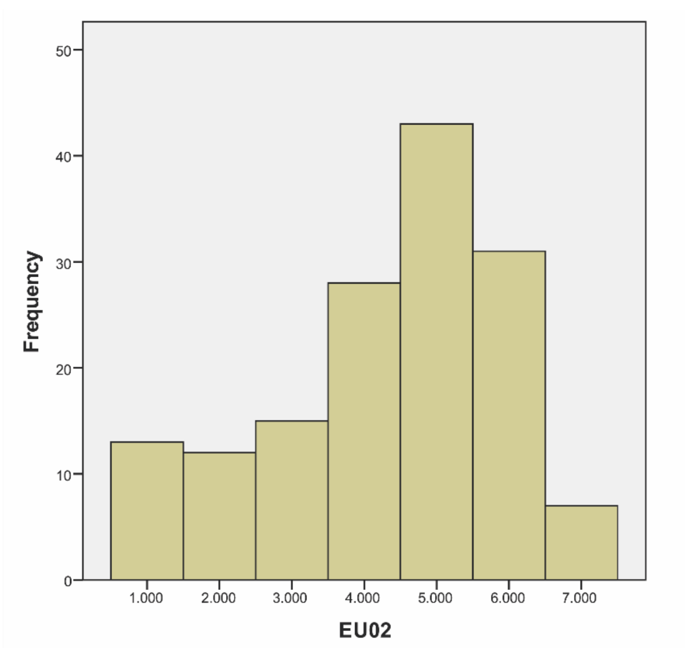


*Figure H.8.* Ease-of-Use for Learnability (EU02) Histogram

Appendix H continued.

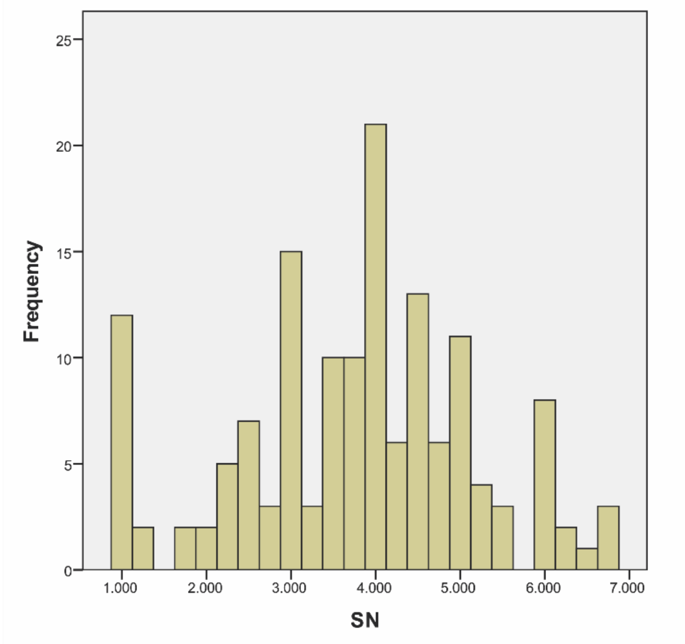


*Figure H.9.* Social Norms (SN) Histogram

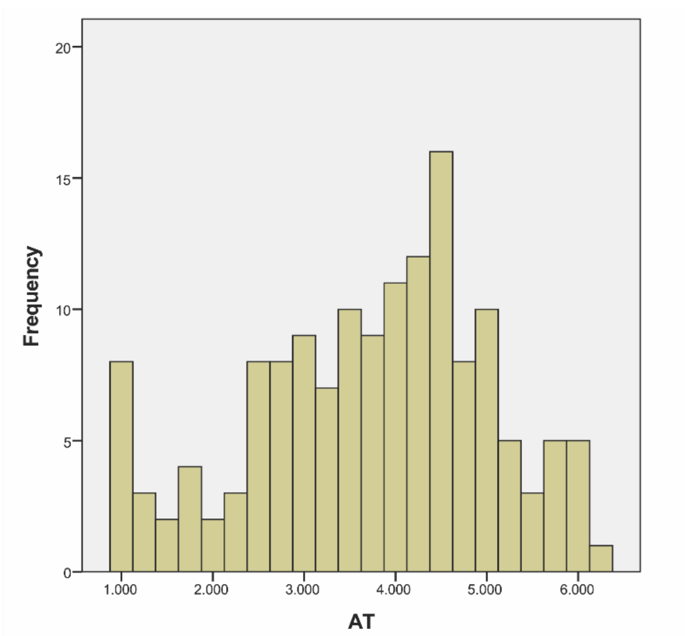


*Figure H.10.* Attitude (AT) Histogram

Appendix H continued.

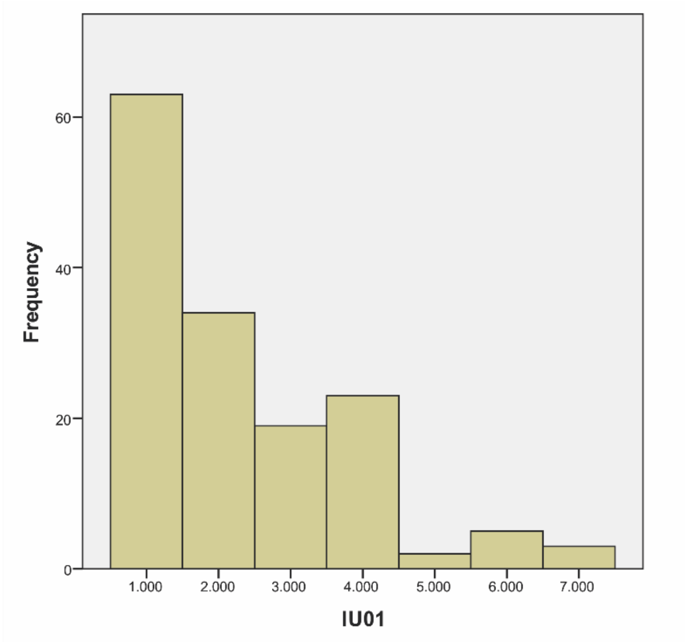


*Figure H.11.* Intention to Use (IU01) Histogram

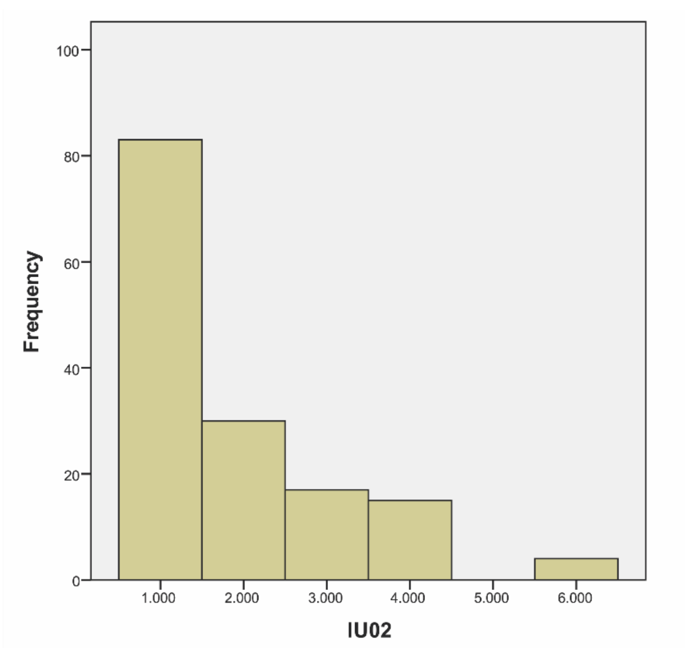


*Figure H.12.* Intention to Renew (IU02) Histogram

Appendix H continued.

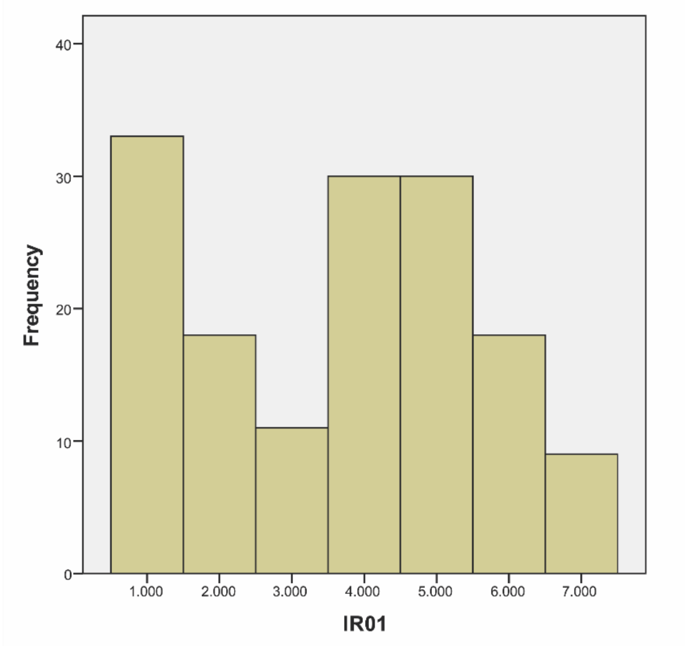


*Figure H.13.* Intention to Recommend (IR01) Histogram

VITA

# VITA

## Glen J. Coulthard

## EDUCATION

**Ph.D.** December, 2016
*Learning Design & Technology, Department of Curriculum and Instruction*
Purdue University, West Lafayette, Indiana
Dissertation: A Descriptive Case Study: Investigating the Implementation of Web-based, Automated Grading and Tutorial Software in a Freshman Computer Literacy Course
Major Professor: Dr. Timothy J. Newby

**M.A.** May, 2001
*Educational Technology Leadership, School of Education and Human Development*
George Washington University, Washington, DC

**B.Com.** May, 1988
*Marketing, Faculty of Commerce and Business Administration*
University of British Columbia, Vancouver, British Columbia, Canada

## ACADEMIC APPOINTMENTS

**College Professor** 2002 – present
*Okanagan College, School of Business, Vernon, British Columbia, Canada*
Lecture/Lab Instructor: BuAd 128 – Computer Applications, BuAd 200 – Digital Marketing, BuAd 210 – Marketing Research, BuAd 247 – Training and Development, BuAd 283 – Management Information Systems, BuAd 333 – Internet Marketing, and BuAd 335 – Electronic Commerce.

**Graduate Assistant** 2005 – 2007
*Educational Technology Program, Department of Curriculum and Instruction*
Purdue University, West Lafayette, Indiana
Lab Instructor: EDCI 270 – Introduction to Educational Technology and Computing

**Program Administrator** 1994 – 1998
*Technology Program, Faculty of Adult and Continuing Education*
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**SELECTED ARTICLES AND PRESENTATIONS**

Ertmer, P. A., Richardson, J. C., Belland, B., Camin, D., Connolly, P., Coulthard, G. J., et al. (2007). Using peer feedback to enhance the quality of student online postings: An exploratory study. *Journal of Computer-Mediated Communication*, *12*(2), article 4. Retrieved from http://jcmc.indiana.edu/vol12/issue2/ertmer.html

Simons, K., Oakes, W., Coulthard, G., Stickman, E., & Goktas, Y. (2006). *A framework for supporting cross-disciplinary education-engineering collaboration.* Presented at the 2006 National Service Learning Conference, Washington, DC.

Ertmer, P., Richardson, J., Belland, B., Camin, D., Coulthard, G., & Mong, C. (2006). *Efficacy of peer feedback in online learning environments.* Presented at the 2006 Annual Meeting of the American Educational Research Association, San Francisco, CA.

Ertmer, P., Belland, B., Camin, D., Coulthard, G., & Mong, C. (2006). *Perceptions of the challenges/benefits of a methods course.* Presented at the 2006 Annual Meeting of the American Educational Research Association, San Francisco, CA.

Newby, T. & Coulthard, G. (2006). *Creating Presentations with Articulate - Beyond PowerPoint.* Presented at a Teaching & Technology Brown Bag Seminar for the Center of Instructional Excellence at Purdue University, West Lafayette, IN.

Coulthard, G. (2005). *Evaluating the SimNet software tutorial and assessment solution in a computing literacy course.* Presented at the League for Innovation in the Community College: 2005 Conference on Information Technology, Dallas , TX.

Coulthard, G. (2005). *A review of software tools for managing your personal knowledgebase.* Presented for the Purdue Association of Educational Technology (PAET) at Purdue University, West Lafayette, IN.

Coulthard, G. (2002). *Integrating Microsoft Office into the curriculum.* Presented at San Diego State University's Professional Development Conference, San Diego, CA.

Coulthard, G. (2002). *Teaching and learning Microsoft Office.* Presented at the Texas Community College Teachers Association's 2002 Annual Conference, Houston, TX.

Coulthard, G. (2002). *Innovative teaching practices for Microsoft Office.* Presented at the West Valley College's Professional Development Day, Saratoga, CA.

Coulthard, G. (1998). *Integrating technology into your curriculum.* Presented at the League for Innovation in the Community College: 1998 Annual Conference, San Francisco, CA.

## PROFESSIONAL AND CORPORATE EXPERIENCE

**President/Director** 1995 – present
Current Communications Inc., Coldstream, British Columbia, Canada

**Executive Director** 1991 – 1994
Computer Consultants International, Maple Ridge, British Columbia Canada

**Management Consultant** 1998 – 1991
Laventhol and Horwath, Vancouver, British Columbia, Canada

## BOOK PUBLICATIONS

Coulthard, G. J. & Orwick, M. (2013). *Project Learn for Microsoft Office 2013*. Burr Ridge, IL: McGraw-Hill Higher Education.

Coulthard, G. J. (2012). *Computing Now!* New York, NY: McGraw-Hill Higher Education.

Coulthard, G. J. & Triad Interactive, Inc. (2009). *SimNet for Office: A workbook tutorial guide.* New York, NY: McGraw-Hill Higher Education.

Coulthard, G. & Clifford, S. (2004). *Advantage series for computer education: Microsoft Office 2003.* New York, NY: McGraw-Hill Technology Education.

Hutchinson, S. & Coulthard, G. (2002). *Advantage series for computer education: Microsoft Office XP*. Burr Ridge, IL: McGraw-Hill Higher Education.

Hutchinson, S. & Coulthard, G. (2000). *Advantage series for computer education: Microsoft Office 2000.* Burr Ridge, IL: McGraw-Hill Higher Education.

Hutchinson, S. & Coulthard, G. (1997-1998). *Advantage series for computer education: Microsoft Office 97.* Burr Ridge, IL: McGraw-Hill Higher Education.

## ACADEMIC SERVICE

- Grant-in-Aid (GIA) Committee, Okanagan College (2012-present)
- Extended Study Leave (ESL) Committee, Okanagan College (2012-2015)
- Research Ethics Board (REB), Okanagan College (2008-2012)
- Fellow, Institute for Learning & Teaching (ILT), Okanagan College (2010-2013)
- Queen’s University Inter-Collegiate Business Competition (ICBC) Team Coach (MIS national finalist in 2011, 2013, 2015, 2016)
- Vice President, Purdue Association of Educational Technology (2006-2007)