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Developing an instrument to assess student readiness for online learning: a validation study

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Given the continued growth in online learning as well as reports of high attrition rates in it, understanding student readiness for online learning is necessary. Over the years several surveys have been developed to assess student readiness as a predictor of success in online programs; however, a review of the literature yielded limited results of their translation and criterion-referenced validity. The researchers of this article sought to develop a more rigorous survey instrument for students to self-assess readiness for online learning. The authors report on findings from a three-phase study during which the instrument was developed, evaluated, and validated. Through the process of validation, the researchers systematically engaged in an iterative process to refine the instrument, which resulted in not only a more rigorous instrument but one that more clearly defines ready and situates it within the literature on learner characteristics, digital divide, and information and communications technology (ICT) engagement.

Keywords: online readiness; learner characteristics; ICT engagement

Introduction

Enrollments in formal online education programs continue to increase each year (Allen & Seaman, 2010; Dawley, 2007). Although online learning is far from an agreed-upon term for this mode of learning (see Lowenthal, Wilson, & Parrish, 2009),[1] an estimated 3.2 million students took at least one online course at the post-secondary level in the fall of 2005 (Allen & Seaman, 2006); that number grew to 3.5 million in 2006 (Allen & Seaman, 2007) and to 3.9 million in 2007 (Allen & Seaman, 2008). Further, while the overall growth has slowed compared to previous years, the growth in formal post-secondary online learning enrollments still outpaces the growth of traditional face-to-face enrollments (Jaschik, 2009). In 2008, online learning enrollments in post-secondary education are estimated to have grown between 11.3% (Lokken, 2009) and 12.9% (Allen & Seaman, 2008). Online learning is also growing rapidly at the K-12 level (Picciano & Seaman, 2007). This continued growth, coupled with research that suggests that formal online learning is not inferior

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to face-to-face learning (Bernard, Abrami, et al., 2004; Means, Toyama, Murphy, Bakia, & Jones, 2009), suggests that online learning is here to stay.

Although enrollments are increasing in formal online learning, overall graduation rates are not. The USA still ranks among the leaders in overall college participation; however, it ranks in the bottom half of overall college completion (Callan, 2006). Even more troubling is that attrition in online learning is higher than traditional face-to-face programs (Carr, 2000; Moody, 2004; Phipps & Merisotis, 1999; Willging & Johnson, 2004). Retention, attrition, and student persistence are complex issues that are difficult to study (see Hagedorn, 2005). To complicate matters further, research on attrition in online learning is relatively new and in its early stages (Shea & Bidjerano, 2008, p. 346). Therefore, there is a great deal we do not know about why some students persist and others do not when learning online.

Given the continued growth in online learning, reports of high attrition, and an overall interest in seeing students succeed, the authors set forth to better understand students' readiness for online learning at the post-secondary level by investigating traits and characteristics of students who are prepared to learn online. In this article, the authors describe the process used to develop, evaluate, and validate a survey designed to assess readiness to learn and participate in formal online learning environments at the post-secondary level.

Literature review

Previous readiness surveys

Many online programs (e.g., UCLA, SUNY Learning Network, and DuPage) publish learner readiness surveys to help prospective students assess their own preparedness for online learning (e.g., McVay, 2000, 2001; Parnell & Carraher, 2003; Smith, 2005; Smith, Murphy, & Mahoney, 2003; Watkins, Leigh, & Triner, 2004) or to predict the extent to which a student will be successful learning online (e.g., Bernard, Brauer, Abrami, & Surkes, 2004; Kerr, Rynearson, & Kerr, 2006; Pillay, Irving, & McCrindle, 2006). Although characteristics of successful online learners have been well documented (Dabbagh, 2007; Tallent-Runnels et al., 2006), the question remains about the extent to which colleges and universities can use their knowledge of these characteristics to help students be successful learning online.

Existing surveys of online student readiness (see Bernard, Brauer, et al., 2004; Mattice & Dixon, 1999; McVay, 2001) focus on general learner characteristics (e.g., self-directed learning, interpersonal communication skills, and academic locus of control) and basic technology skills (e.g., email, word processing, and basic software). In the following paragraphs, we briefly summarize a few of the more popular ones.

Mattice and Dixon (1999) developed a survey in the late 1990s to assess their students' interest in learning online as well as their students' readiness for distance education. The survey asked students not only about their previous experience with distance education (e.g., lifestyle choices such as time management, need for structured guidance, interest in online classes, length of commute, and work schedules) and their access to technology, but also about their plans (or not) to later enroll in an online course.

Their survey comprised three indices: student readiness (readiness index) based of an earlier survey used at DeAnza College, student access to/use of technology (technology index), and student interest in distance education (interest index). The readiness index consisted of questions about students' self-direction, orientation to time, and preferences for feedback. It did not, however, delve into student self-concept or self-efficacy (Bruner, 1977). The technology index focused almost entirely around student access to the Internet and email, and level of experience with these instruments. The interest index queried students about their interest in distance education.

Not long after the work of Mattice and Dixon (1999), McVay (2000, 2001) developed a 13-item survey to measure readiness for online learning. McVay's survey focused on students' comfort with the basic skills and components of online learning (e.g., computer skills and discussion boards) and their independence as learners (Smith, 2005). Smith et al. (2003) later investigated the reliability and validity of McVay's survey. They determined that the instrument was reliable and resulted in a two-factor structure – comfort with e-learning and self-management of learning – but that more work was needed to establish predictive validity (Smith et al., 2003, p. 57). As a result, Smith (2005) later repeated the study and provided further explanation of each construct based on existing literature. As in past research, Smith illustrated that McVay's survey was a reliable and valid instrument for measuring two factors: self-management of learning and comfort with e-learning.

Recognizing the strengths as well as the limitations of McVay's readiness for online learning questionnaire (2000, 2001), Bernard, Brauer, et al. (2004) developed a new survey expanding the original 13 items to 38 items in order to predict student online learning achievement. A factor analysis revealed that 25 of the questions clustered around the following constructs: beliefs about distance education, confidence in prerequisite skills, self-direction and initiative, and desire for interaction. The survey asks about students' beliefs in the efficacy of the Internet to provide learning as well as students' beliefs in their own ability to succeed in an online course. Although Bernard's team unquestionably improved McVay's original survey by probing student self-efficacy with technology, the authors of this article posit that there is still room to query individuals more fully about their engagement with information and communications technology (ICT) including their attitudes about engaging with ICT.

Shortly after, Kerr et al. (2006) developed their own instrument to assess students' readiness for online learning by using the following existing instruments: Rosenberg's self-esteem scale (1965); Felder and Soloman's index of learning styles (1991); Taraban, Kerr, and Rynearson's metacognitive reading strategies questionnaire (2000, 2004); Shia's academic intrinsic motivation questionnaire (1998); and Trice's academic locus of control scale (1985). Their initial survey consisted of the following subscales: computer skills, independent learning, need for online learning, academic skills, and dependent learning.

Development of a new readiness survey

These previous surveys ask participants to reflect on their attitudes and beliefs about online learning as well as their own personal learner preferences. They tend to ask questions about individual equipment access. Readiness, as expressed by these instruments, encompasses self-concept/self-efficacy with academics, information, technology, and locus of control and equipment owned (e.g., computers). Although the above-mentioned surveys yielded modest results methodologically, there seems to be an overall recognition of the limitations and need to expand on the items. Our initial work, described here, was an attempt to develop a more current instrument that combined learner characteristics and technology capabilities and to employ a methodologically rigorous approach to the development of the instrument.

Building on previous conceptualizations of student readiness for online learning and aspects of the digital divide, we developed a survey that consisted of two subscales: learner characteristics and technology capabilities. The first subscale, measuring learner characteristics, builds on existing surveys noted earlier (e.g., Bernard, Brauer, et al., 2004; Mattice & Dixon, 1999; McVay, 2001). For instance, the learner characteristics subscale asks about individual beliefs in their ability to complete a college degree, beliefs about responsibility in problem solving (academic and technical), self-efficacy in writing and expression, orientation to time and time management, and behavior regulation for goal attainment. Many of the characteristics that make one successful in traditional learning environments will translate to success for online learners; for instance, self-direction, academic self-concept, and locus of control (Dabbagh, 2007). Questions regarding these characteristics make up the first subscale: learner characteristics.

The second subscale expanded on existing surveys to measure technology capabilities, including basic technology skills such as the ability to use email and the Internet, as well as material access to technology, such as devices and bandwidth, and the nature and frequency of technology use. Whereas previous surveys tended to focus on one area or only have one or two items per area, this subscale initially consisted of 18 items.

In addition to expanding on existing surveys, we wanted to develop a more rigorous instrument by being systematic and comprehensive about its validation. Typically during survey development, a team of experts develops and reviews questions for clarity and completeness and then the survey is ready to go (McDowell, 2006). However, with the rise in popularity of online learning it has become increasingly important to follow a more rigorous approach to ensure such instruments are both reliable and valid.

Validity is a quality achieved when an instrument moves through a rigorous process to examine the face, content, and criterion-referenced validity (Trochim, 2006). Yet many instruments that claim to measure readiness for online learning have not undergone such a rigorous process. Trochim (2006) suggests that construct validity be divided into two distinct types: translation validity and criterion-referenced validity. Translation validity involves the extent to which the instrument translated the construct you are attempting to measure and thus the questions represent the construct being measured. Translation validity includes face and content validity, which are non-statistical interpretations of the items and instrument as a whole. Criterion-referenced validity is a statistical analysis whereby the performance of the items (how individuals answered the questions) are analyzed both within the instrument and across items, as well as in comparison to other similar items from other instruments (Trochim, 2006).

Reliability ensures that an instrument provides consistent results across comparable situations (Fowler, 2009). The research reported in this study outlines the validation process followed by the researchers.

Method

This study involved a three-phase approach to validate a survey measuring students' readiness for online learning. The first two phases address translation validity, while the third phase addresses criterion-referenced validity. During phase 1 the survey was developed and reviewed by a team of experts; in phase 2 an item analysis was conducted; and then in phase 3 a statistical analysis of reliability and validity of the survey instrument was conducted. Throughout each phase, findings informed the researchers in a systematic refinement of the instrument. Our goal is two-fold: to contribute a rigorously validated instrument to the field of online learning and to share our methods for future survey development.

Phase 1: survey development

The initial survey was developed based on concepts about readiness from the literature (Bernard, Brauer, et al., 2004; Dabbagh, 2007; Mattice & Dixon, 1999; McVay, 2001), goals of the research team, and several discussions to refine the item pool. Included in the development of the instrument were faculty from Education, Health Sciences, and Academic Computing. The approach used in this phase represents the most common approach to ensuring content and face validity, whereby a team of experts reviews the items for clarity and completeness (Trochim, 2006).

However, once the original instrument (see Table 1) was developed the team sought to intensify its rigor by conducting an item analysis of the learner characteristics subscale. We purposefully chose not to evaluate the technology capabilities subscale as these items appeared to be straightforward in asking about basic skills, ownership, and frequency of use.

Phase 2: item analysis

A more rigorous and ideal approach to addressing content and face validity is to conduct focus groups and interviews to explore participant perceptions and the underlying meaning of each item (McDowell, 2006) through a critical systematic review often referred to as cognitive testing (Fowler, 2009). Cognitive testing is a process to evaluate the extent to which questions are consistently understood and answered by individuals. The interview questions attempt to capture how well the participants understood the question and 'about issues related to their answers' (Fowler, 2009, p. 119). Common tasks of cognitive testing are 'to ask respondents to say in their own words what they think the question is asking' (p. 119) and 'to ask respondents to explain how they chose a particular answer over others' (p. 119). As we were working within an online environment and not face-to-face, we developed an online questionnaire whereby participants were asked to analyze each item of the learner characteristics subscale by responding to three open-ended questions about each item.

Participants

We invited 26 graduate students studying toward a degree in educational computing and enrolled in an online course, 'Computer Applications in Educational Administration,' which aims to provide 'education administrators a general understanding of technology issues in K-12 administration and a big-picture view of planning for technology' (Miszkiewicz, 2006, p. 1), to participate in the item analysis as part of a course assignment. The class consisted of 11 males and 15 females; of these, 25 completed the item analysis. Participants did receive credit for completing the item analysis as a course assignment; however, the data was de-identified so that survey item responses could not be linked to individual course participants.

Table 1. Survey items.

Phases 1 & 2: Original instrument (2006) 36 items	Phase 3: OLRS instrument (2008) 32 items
Learner characteristics	*Learner characteristics subscale*
1. I am confident in my ability to excel in a college program. 2. I do not give up easily when confronted with obstacles. 3. I believe I am responsible for my own education; what I learn is ultimately my responsibility. 4. I am comfortable working in alternative learning environments. 5. I am comfortable expressing my opinion in writing to others. 6. I am effective in communicating my opinion in writing to others. 7. I work well in a group. 8. I work well independently. 9. I am good at completing tasks independently. 10. I am comfortable responding to other people's ideas. 11. I am good at giving constructive and proactive feedback to others. 12. I am a good 'time manager.' 13. I am capable of self-discipline. 14. I can read for comprehension without guided questions from the instructor. 15. I am goal directed; if I set my sights on an end result, I usually achieve it. 16. I am interested in an online program because I have commuting problems. 17. I am interested in an online program because I have conflicts with work. 18. I am interested in an online program because I have conflicts with childcare and/or family obligations. 19. I am interested in an online program because I have scheduling conflicts. 20. I have daily access to a computer with an Internet connection.	Please answer the following questions in the context of your experience as a college student in an online program. 1. I am confident in my ability to excel in a college program. 2. I do not give up easily when confronted with technology-related obstacles (e.g., Internet connection issues, difficulty with downloads, difficulty locating information, unable to contact instructor immediately, etc.). 3. I believe I am responsible for my own education; what I learn is ultimately my responsibility. For example, I am responsible for communicating with my professor when I have difficulty understanding, obtaining answers to questions I might have about assignments, material, and content, etc. 4. I am comfortable working in alternative learning environments. For this question, alternative learning environments are defined as spaces outside of the traditional classroom such as library, online, home, etc. 5. I am comfortable expressing my opinion in writing to others. 6. I am able to express my opinion in writing so that others understand what I mean. 7. I work well in a group. (For example, I am an active communicator in a group, I contribute my fair share in a group, etc.) 8. I am good at completing tasks independently. 9. I am comfortable responding to other people's ideas. 10. I give constructive and proactive feedback to others even when I disagree. 11. I organize my time to complete course requirements in a timely manner. 12. I regulate and adjust my behavior to complete course requirements. 13. I understand the main ideas and important issues of readings without guidance from the instructor. (For example, I can read for comprehension without guided questions from the instructor.) 14. I achieve goals I set for myself.

Table 1. (*Continued*).

Phases 1 & 2: Original instrument (2006) 36 items	Phase 3: OLRS instrument (2008) 32 items
Technology capabilities	*Technology capabilities subscale*
1. Do you own your own computer? (yes/no) 2. What type of computer do you own at home? 3. What operating system does your home computer use? (check one) 4. How does your home computer connect to the Internet? (check one) 5. Which do you most often use to complete class work? 6. If you use your office computer, what operating system does your computer use? (check one) 7. If you use your work computer, what type of Internet connection does it have? 8. Do you know how to open and use the following software? Check all that apply. 9. Do you know how to install software on your computer for class purposes? 10. How often do you use email? 11. How often do you use the Internet? 12. What is your primary purpose for using the Internet? 13. Which course management systems have you used? 14. Please check any of the following tasks that you are competent to execute: (check all that apply) 15. How often do you use Instant Messaging? 16. Which Instant Messaging software do you use?	15. I am interested in an online program because of (check all that apply): 16. I have daily access to the Internet in order to complete assignments. Tell us about the computers you use to access and complete coursework by completing the following matrices. 17. Your computer type(s): 18. How often do you use computer(s): 19. Your operating system(s): 20. Your connection type(s): 21. Indicate which of the following software you know how to use by checking all that apply. 22. Do you know how to install software on your computer for course purposes? 23. How often do you use email? 24. Suppose the following files were emailed to you as attachments. Please indicate which of them you would know how to open, view, and/or print (check all that apply): 25. How often do you use the Internet? 26. For what purpose do you use the Internet (e.g., Instant Messaging and email, web searching)? 27. If you were viewing a website, indicate which of the following files you know how to open, view, and/or print (check all that apply): 28. Which course management systems have you used? (select all that apply) 29. Please check any of the following tasks that you are competent to execute (select all that apply): 30. Which of the following research tools have you used in your coursework? 31. How often do you use Instant Messaging? 32. Which Instant Messaging software do you use? (select all that apply)

Procedure

We invited students to evaluate the survey as part of an assignment for their course. Participants first completed the original 20-item subscale (see Table 1). Upon completion of the survey subscale, participants were asked to go through each item again and answer three open-ended questions about each of the survey items. Based on Converse and Presser's recommendations for examining the construct of items (1986), participants answered each of the following questions for each survey question:

(1) What did the whole question mean to you?
(2) Would you reword the question? How?
(3) When you created your response, what was it that you had in mind? (I want to know what you thought you were answering and what you were thinking when you answered it.)

The lead researchers analyzed and coded the responses to each question of the item analysis questionnaire using an open coding system (Strauss & Corbin, 1990). Items were coded based on the extent to which the response matched our intended construct of the item as follows: matched, borderline, and did not match at all. The lead researchers then tallied the number for each code and more closely examined those questions in which responses had a higher number of borderline or not matching. As the analysis continued, it was found that the responses to question 3 ('When you created your response, what was it that you had in mind?') were most revealing as to whether the questions asked what we intended. As a result, responses to question 3 were analyzed first, leading the researchers back to question 2 (the recommendations for rewording) for assistance with revisions.

For example, when responding to original item 2, 'I do not give up easily when confronted with obstacles,' most of the responses to 'What did the whole question mean to you?' matched our intended construct, but an analysis of responses to the final question, 'When you created your response, what was it you had in mind?,' revealed multiple interpretations from examples of real life, to college life, to technology-specific obstacles. One participant responded: 'I pursue challenges,' which implies that this person seeks out challenges to overcome. Another response ('This asks me if I can be defeated or scared off easily. I definitely do not.') assisted us in clarifying and refining what we wanted to know. Our intention was to ask, if or when faced with challenges in an online environment would the individual give up? Further analysis of the recommendations for rewording enabled us to step back and rethink, what the question was asking. Thus, the rewrite became 'I do not give up easily when confronted with technology-related obstacles (e.g., Internet connection issues, difficulty with downloads, difficulty locating information, unable to contact instructor immediately, etc.).' It was the combination of responses to each question about the item that informed the extent to which revisions were made to each question.

Findings

Analysis of student responses to the item analysis overall revealed that students were responding to questions on the basis of their personal life experiences in general rather than within the educational context of online learning. As a result an overall prompt to each item was added, 'Please answer the following questions in the context of your experiences as a college student in an online program,' to clarify the context in which questions should be answered. Additionally, as illustrated in Table 2 most items were revised to include examples, while only one item was deleted due to participants' perception that items 8 and 9 were asking the same thing.

The outcome of phases 1 and 2 was the development of a 32-question survey designed to measure learner characteristics (14 items) and technology capabilities (18 items) of students. Although the initial goal was for students to self-assess online readiness, we expanded the construct of readiness to include aspects of access (e.g., mental access, material access, skills access, and usage access) framed by van Dijk's

Table 2. Comparison of original item with revised item for learner characteristics subscale.

Original item	Revised item
1. I am confident in my ability to excel in a graduate program.	I am confident in my ability to excel in a *college* program.
2. I do not give up easily, even when confronted with obstacles.	I do not give up easily when confronted with *technology-related* obstacles (*e.g., Internet connection issues, difficulty with downloads, difficulty with locating information, unable to contact instructor immediately, etc.*).
3. I believe I am responsible for my own education; what I learn is ultimately my responsibility.	I believe I am responsible for my own education; what I learn is ultimately my responsibility. *For example, I am responsible for communicating with my professor when I have difficulty understanding, obtaining answers to questions I might have about assignments, material, and content, etc.*
4. I am comfortable working in alternative learning environments.	I am comfortable working in alternative learning environments. *For this question alternative learning environments are defined as spaces outside of the traditional classroom such as library, online, home, etc.*
5. I am comfortable expressing my opinion in writing to others.	I am comfortable expressing my opinion in writing to others.
6. I am effective in communicating my opinion in writing to others.	I am able to express my opinion in writing *so that others understand what I mean*.
7. I work well in a group.	I work well in a group. *For example, I am an active communicator in a group, I contribute my fair share in a group, etc.*
8. I work well independently.	Deleted – responses indicated same meaning as item 9.
9. I am good at completing tasks independently.	I am good at completing tasks independently (*i.e., I don't need others to encourage or remind me to complete assignments*).
10. I am comfortable responding to other people's ideas.	I am comfortable responding to other people's ideas.
11. I am good at giving constructive and proactive feedback to others.	I give constructive and proactive feedback to others *even when I disagree*.
12. I am a good 'time manager.'	*I organize my time to complete course requirements in a timely manner*.
13. I am capable of self-discipline.	*I regulate and adjust my behavior to complete course requirements.*
14. I can read for comprehension without guided questions from instructor.	I understand the main ideas and important issues of readings without guidance from the instructor. For example, I can read for comprehension without guided questions from the instructor.
15. I am goal oriented; if I set my sights on an end result, I usually achieve it.	I achieve goals I set for myself.

Table 3. van Dijk's definitions of access related to digital divide (2002).

Term	Definition
Mental access	Lack of elementary digital experience caused by lack of interest, computer anxiety, and unattractiveness of the new technology
Material access	No possession of computers and network connections
Skills access	Lack of digital skills caused by insufficient user-friendliness and inadequate education or social support
Usage access	Lack of significant usage opportunities or unequal distribution of them

digital divide research (2002) (see Table 3) as well as the more traditional questions asked by educators regarding learner characteristics, values, and preferences (see Dabbagh, 2007). Additionally, with the development of more collaborative technology it is essential that students have collaborative social skills such as conflict management, decision-making, trust building, and open communication to manage their relationships and the extent to which peers are learning from each other (Dabbagh, 2007).

Phase 3: survey validation and reliability

During phase 3, we combined the survey with questions from three existing surveys (Bernard, Brauer, et al., 2004; Mattice & Dixon, 1999; McVay, 2001) to conduct the criterion-referenced validity whereby similar items from existing instruments are compared with items from our instrument. We also conducted statistical analysis of items within our instrument to examine their validity (how well the instrument performed across and within items) and reliability (consistency of the instrument's performance). The total survey comprised 96 items. The first eight items were demographic questions, items 9–23 comprised the learner characteristics subscale, and items 24–40 comprised the technology capabilities subscale of our original survey instrument, the online learning readiness survey (OLRS) (Dray & Miszkiewicz, 2007). Items 41–96 were added at the end of the survey as a point of comparison, to test the criterion validity of our instrument with other existing measures. Items 41–71 came from the Mattice and Dixon survey, and items 72–96 from the Bernard, Brauer, et al. survey, which included items from McVay's survey (see Table 4).

Participants

Faculty from a mid-sized comprehensive urban teacher college asked their students to participate in the validation of the survey. The invitation yielded 501 participants from

Table 4. Survey items for validation study.

Items	Source
1–8	Demographic questions
9–23	OLRS subscale 1: learner characteristics (Dray & Miszkiewicz, 2007)
24–40	OLRS subscale 2: technology capabilities (Dray & Miszkiewicz, 2007)
41–71	Mattice and Dixon (1999) survey items
72–96	Bernard, Brauer, et al. (2004) survey items; McVay (2000, 2001) items embedded

undergraduate and graduate courses: of these, 32% were male and 67% were female, with 1% not responding to the question. With regard to age, 41% of respondents were under 21, 37% were 21–25, 16% were 26–40, and the remaining 5% were 41 and over, with 1% not answering the question. Respondents were primarily from the School of Education (40%) with the remainder spread across Arts and Humanities (12%), Natural and Social Sciences (19%), and Professions (18%), with 11% not responding. Of the participants, 79% were undergraduates, 19% graduates, and 2% non-matriculated. Caucasian/White made up 73% of respondents, African American/Black were 13%, Hispanic 7%, Asian/Pacific Islander 3%, American Indian 0.2%, mixed 2.4%, and other 1.2%. Of the 501 participants in our data set, one was deleted due to incomplete data.

Procedure

To evaluate the technical quality of the instrument, we conducted reliability analysis, confirmatory factor analysis, and convergent validity. Overall the survey had two distinctive subscales – learner characteristics and technology capabilities. The technology capability subscale variables were further classified based on the digital divide themes (see Table 5) suggested by van Dijk (2002).

Table 5. Descriptive statistics by variable.

Factor 1: Learner characteristics				Factor 2: Technology capabilities				
Question/ variable transformed	Max	Mean	SD	Question/variable transformed	Max	Mean	SD	Subscales within factor 2
Q9	4	3.328	0.786	Q23tot	7	1.854	1.017	Mental access
Q10	4	3.258	0.654	Q34tot	7	4.062	1.016	Mental access
Q11	4	3.502	0.589	Q24	1	0.960	0.196	Mental access
Q12	4	3.304	0.645	Q25/27/28 hometot	15	5.252	1.652	Mental access
Q13	4	3.220	0.655	Q25/27/28 worktot	15	2.442	2.267	Mental access
Q14	4	3.262	0.602	Q25/27/28 labtot	15	2.566	2.389	Mental access
Q15	4	3.272	0.666	Q25/27/28 othertot	15	1.768	2.178	Mental access
Q16	4	3.476	0.560	Q29tot	5	3.774	1.144	Skill access
Q17	4	3.250	0.540	Q30	1	0.850	0.357	Skill access
Q18	4	3.114	0.581	Q32tot	6	4.946	1.486	Skill access
Q19	4	3.034	0.725	Q35tot	6	4.956	1.519	Skill access
Q20	4	3.250	0.613	Q36tot	5	1.466	0.581	Skill access
Q21	4	3.094	0.634	Q37tot	12	9.530	2.583	Skill access
Q22	4	3.360	0.568	Q38tot	5	2.566	0.717	Skill access
				Q26home	4	2.790	0.656	Usage
				Q26work	4	1.262	1.338	Usage
				Q26lab	4	1.360	1.270	Usage
				Q26other	4	0.794	1.143	Usage
				Q31	5	3.394	0.851	Usage
				Q33	5	3.802	0.497	Usage
				Q39	4	1.976	1.650	Usage

Reliability analysis. The overall internal consistency of the survey is .778 (Cronbach's alpha).

Validity. We validated the underlying structure of the survey by performing confirmatory factor analysis (CFA) (with EQS software); we did this to evaluate whether the survey scores reflected our initial theoretical constructs. Three models were conducted: (1) a one-factor model (all the questions in the survey) to determine if the survey questions measure a general construct; (2) a two-factor model (learner characteristics and technology capabilities); and (3) a five-factor model (learner characteristics and the four subscales such as mental access or material access). Table 6 shows the fit indices by model.

Based on the results of the CFA, the five-factor model is the model that better fitted the data observed. The comparative fit index (CFI), root mean square error of approximation (RMSEA), and chi-square/df gradually improved compared to the one- and two-factor models. The statistics of the five-factor model (chi-square = 1333.2, df = 551, p = .000) and RMSEA (.053) indicate that this model adequately fitted the item scores. Collectively, we conclude that the five-factor model better reflects the underlying pattern among scores than any of the alternative models.

Most factor loadings were statistically significant and generally high (see Table 7). Questions with the highest loadings are Q13 (students are comfortable to express own opinion in writing to others, .637) under learner characteristics, Q34tot (the purposes students use the Internet for, .552) under mental access, hometot (the accessibility of different types of technology at home, .466) under material access, Q32tot (the types of email attachment students know how to open/view/print, .859) under skill access, and Q33 (how often students use the Internet, .755) under usage – these are strong indicators of key elements of students' learner and technology capabilities for an online program. Most of the correlation coefficients were in the right directions with statistical significance. For example, hometot (the accessibility of computer/Internet at home) was positively correlated with Q26home (the usage of computer/Internet at home), as students who had more access to computers or Internet at home would be more likely to use them frequently.

As mentioned earlier, we administered two other surveys (Bernard, Brauer, et al., 2004; Mattice & Dixon, 1999) as part of the reliability and validity study and included questions from these surveys at the end of our instrument. It is important to note that the Bernard, Brauer, et al. survey included items from the McVay survey (2000, 2001). We mapped questions in survey 2 (Mattice & Dixon, 1999) onto the five

Table 6. Model fit indices of three models of confirmatory factor analysis.

	Model 1 One factor	Model 2 Two factors	Model 3 Five factors
Comparative fit index (CFI)	0.563	0.792	0.845
Root mean square error of approximation (RMSEA)	0.089	0.062	0.053
Chi-square	2767.2	1609.3	1333.2
Degrees of freedom (df)	557	556	551
Chi-square/df	4.97	2.89	2.42

Table 7. CFA factor loadings for five-factor model.

Learner characteristics			Technology capabilities			
Question/variable transformed	Factor loading	*R*-squared	Question/variable transformed	Subscale	Factor loading	*R*-squared
Q9	0.360	.130	Q23tot	Mental	0.195	.038
Q10	0.440	.193	Q34tot	Mental	0.552	.305
Q11	0.518	.268	Q24	Material	0.289	.084
Q12	0.595	.354	hometot	Material	0.466	.218
Q13	0.609	.371	worktot	Material	0.440	.193
Q14	0.637	.406	labtot	Material	0.260	.068
Q15	0.503	.253	othertot	Material	0.389	.152
Q16	0.560	.314	Q29tot	Skill	0.668	.446
Q17	0.601	.361	Q30	Skill	0.391	.152
Q18	0.534	.285	Q32tot	Skill	0.859	.737
Q19	0.536	.288	Q35tot	Skill	0.838	.703
Q20	0.512	.263	Q36tot	Skill	0.203	.041
Q21	0.512	.262	Q37tot	Skill	0.707	.499
Q22	0.527	.278	Q38tot	Skill	0.422	.178
			Q26home	Usage	0.447	.199
			Q26work	Usage	0.270	.073
			Q26lab	Usage	0.165	.027
			Q26other	Usage	0.223	.050
			Q31	Usage	0.584	.341
			Q33	Usage	0.755	.570
			Q39	Usage	0.278	.078

factors as we did for the online survey. Survey 3 (Bernard, Brauer, et al., 2004) involved items measuring learner characteristics only. The internal consistency of these surveys is survey 2 = .662 and survey 3 = .802. The convergent validity coefficients are presented in Table 8, the former with a lower reliability and the latter with a higher reliability, than the survey proposed.

Table 8. Convergent validity coefficients with survey 2 (Mattice & Dixon, 1999) and survey 3 (Bernard, Brauer, et al., 2004).

	Survey 2					
	LC	Mental	Material	Skills	Usage	Survey 3
LC	0.349**	0.151	0.068	0.217	0.091	0.391**
Mental	0.112	0.325**	0.244	0.157	0.240	0.277
Material	0.004	0.104	0.307**	0.101	0.193	0.170
Skills	0.234	0.158	0.274	0.422**	0.246	0.292
Usage	0.122	0.142	0.330	0.276	0.443**	0.285

**Correlations are significant at the 0.01 level (2-tailed).

The magnitude of the correlations shows appropriate evidence for convergent validity. The magnitude is positive, which means they are focusing on similar constructs, and of moderate magnitude; although they are not exactly the same.

Discussion

The results of the validation study yielded strong translation and criterion-referenced validity for items from the learner characteristics subscale. We believe this was in part due to the phase 2 item analysis, which assisted us in better articulating each item. However, items from the technology capabilities subscale yielded inconsistent results during the statistical analysis, with some items yielding stronger results than others, causing us to more closely examine the construct of the items and revisit the literature to more clearly define the notion of readiness with regard to engagement with ICT.

Reconceptualizing readiness with technology

Although we agree that existing surveys provide an important exploration of the characteristics of *prepared* and *successful* online students, we believe that the literature points to other important factors that must be considered, in particular, students' engagement with ICT, rather than simply access to technology. For instance, Chelus (2003) conducted a study examining the relationship of bandwidth connectivity (i.e., dialup compared to cable or T3) to student success rates in online learning as applied to knowledge gap theory, and found that students with higher bandwidth participated more in class and achieved a higher grade. While her sample was small, implications of her study point to a more nuanced and layered understanding of the digital divide that moves away from conceptualizing it as mere access to technology. Similarly, we posit that student success in online programs is a complex interplay of personal learner characteristics and level of engagement with ICT.

For some time, the term digital divide has been recognized with a focus on access to the Internet and/or equipment. Conversations have tended to focus on who could afford to buy personal computing equipment and high bandwidth. Selwyn (2004), however, suggested that expressing the digital divide in this manner is simplistic. Revealing the complexities of individual ICT use, including reasons for non-use (e.g., economic, social, and practical reasons to engage or not engage), Selwyn (2011) urges researchers to study relationships to ICT. He argues that individuals develop a relationship with ICT, a term under whose umbrella resides a diverse range of technologies.

van Dijk and Hacker (2003), like Selwyn (2011), considered former categorizations of the digital divide and ICT engagement as too simplistic. According to van Dijk (2006), the term digital divide is a metaphor that confuses people by suggesting that there are two complete groups divided by something that is well defined or as he describes it, a gap that is 'difficult to bridge … about absolute inequalities … [and is] a static condition' (p. 222). van Dijk views the digital divide as more fluid, ever changing, and perpetually in motion as variables such as advances in technology, changes in economy, society, and education affect individuals. The framework he provides includes four main gaps of access within the digital divide: material access, skills access, usage access, and motivational access (altered from mental access in his 2003 publication). Like Selwyn, van Dijk points out that measuring something like access in purely economic terms is misleading. Physical access to ICT is far more complex and distributed across one's exposure to social and cultural resources, educational resources, and time. van Dijk (2006) cited the ever evolving PEW Internet and American Life Project statistics to illustrate that the digital divide is dynamic, that individuals are not in or out; rather individuals move in and out and across the digital divide based on variables within those realms noted above. Lack of interest, lack of skill, attitudes of family and friends, and anxiety are variables that exist within Selwyn's breakdown of access and use (2004), as well as within van Dijk's framework of material, skills, usage, and motivation.

The influence of these variables is confirmed in research by Hsieh, Rai, and Keil (2008), who revealed that 'enjoyment and confidence in using information and communication technologies, availability, and perceived behavioral control are more powerful in shaping continued ICT use intention for the disadvantaged' (p. 97). Hsieh et al. defined digital inequality as inequality in the access and use of ICT and found that perceived ease of use, attitude of family and friends toward the resource, and personal attitudes were influential toward the use of ICT to both the socially advantaged and socially disadvantaged groups surveyed. Specifically, hedonic outcomes (enjoyment), self-efficacy, availability, and perceived behavioral control were more influential in the use of ICT among the socially disadvantaged.

Revised readiness survey

After a closer review of the literature on digital divide and level of engagement with ICT, we significantly revised the technology capability scale and re-named it ICT engagement subscale. This new subscale measures four areas of ICT engagement:

(a) basic technology skills, such as ability to use specific applications in specific ways (e.g., email, Internet, spreadsheet, and documents);
(b) access to technology including ownership of technology and connectivity to the Internet;
(c) usage of technology, such as nature and frequency of use;
(d) relationship with ICT, such as beliefs, values, confidence, and comfort with technology.

Given the impact of the item analysis on refining the learner characteristics subscale and the subsequent results from the statistical analysis of these items, we intend to conduct this method with the new ICT engagement subscale. We also plan to conduct another validation study with the new items.

Implications

Emerging literature suggests that ideal online learners have a balance of learner characteristics and technology skills (Dabbagh, 2007). Equally important is the extent to and the ways in which students engage with ICT (Selwyn, 2004; van Dijk, 2002). As such, instruments that measure readiness should consider not only learner characteristics and technology skills but also level of engagement with and self-efficacy about ICT (DeTure, 2004). Our purpose is to provide a validated and rigorous instrument for institutions to assess learner characteristics and ICT engagement and to provide a central database of responses to continue survey refinement and validation.

The significance of this instrument lies in enabling learners to self-assess their readiness/preparedness so that institutions of higher education can make informed decisions about how to improve outcomes for online learners. Areas of interest include helping:

(a) students identify what areas they might have problems on or might need to work harder on when they take online courses;
(b) faculty/programs understand what areas students struggle with and as a result build in orientations and other support services to help these students;
(c) faculty and instructional designers design better course content to engage students in learning;
(d) program directors and administrators better understand the needs of faculty and students.

The next step of this research will measure the impact and effectiveness of the instrument by tracking outcomes of student attrition/retention rates, changes in course and program development, and changes in support services in correlation with survey results.

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Note

1. Although the term online learning is far from an agreed-upon term for learning and teaching that takes place online, it is a commonly used term in the literature to describe the process of learning in formal learning environments in which a large part of the course is conducted online and therefore it is the term that we use for this mode of learning in this article. Although some researchers specify how much time must be spent online for it to be termed an online course – for example, the Sloan-C reports (Allen & Seaman, 2006, 2007, 2008) define online courses as courses in which more than 80% is delivered online – overall this type of specificity is lacking in most literature focused on online learning. Furthermore, even though our focus is on online learning that takes place in formal post-secondary online learning environments, much of the focus of this article is applicable to formal environments in other sectors (e.g., K-12, corporate, and government), hybrid types of courses, as well as informal online learning environments. See Lowenthal et al. (2009) for a discussion on the terms used to talk about online learning.

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References

Allen, I.E., & Seaman, J. (2006). *Making the grade: Online education in the United States, 2006.* Needham, MA: Sloan-C. Retrieved from http://www.sloan-c.org/publications/survey/survey06.asp

Allen, I.E., & Seaman, J. (2007). *Online nation: Five years of growth in online learning.* Needham, MA: Sloan-C. Retrieved from http://sloanconsortium.org/publications/survey/pdf/online_nation.pdf

Allen, I.E., & Seaman, J. (2008). *Staying the course: Online education in the United States, 2008.* Needham MA: Sloan-C. Retrieved from http://sloanconsortium.org/sites/default/files/staying_the_course-2.pdf

Allen, I.E., & Seaman, J. (2010). *Learning on demand: Online education in the United States, 2009.* Needham, MA: Sloan-C. Retrieved from http://sloanconsortium.org/publications/survey/pdf/learningondemand.pdf

Bernard, R.M., Abrami, P.C., Yiping, L., Borokhovski, E., Wade, A., Wozney, L., et al. (2004). How does distance education compare with classroom instruction? A meta-analysis of the empirical literature. *Review of Educational Research, 74*(3), 379–439. doi: 10.3102/00346543074003379

Bernard, R.M., Brauer, A., Abrami, P.C., & Surkes, M. (2004). The development of a questionnaire for predicting online learning achievement. *Distance Education, 25*(1), 31–47. doi: 10.1080/0158791042000212440

Bruner, J. (1977). *The process of education* (2nd ed.). Cambridge, MA: Harvard University Press.

Callan, P.M. (2006). *Measuring up 2006: The national report card on higher education.* San Jose, CA: National Center for Public Policy and Higher Education. Retrieved from http://measuringup.highereducation.org/_docs/2006/NationalReport_2006.pdf[

Carr, S. (2000, February 11). As distance education comes of age, the challenge is keeping the students. *The Chronicle of Higher Education, 46*(23), A39–A41. Retrieved from http://chronicle.com/free/v46/i23/23a00101.htm

Chelus, C. (2003). *Access, assessment, and bandwidth: High speed Internet and distance education.* Unpublished doctoral dissertation, University of Buffalo, Buffalo, New York.

Converse, J.M., & Presser, S. (1986). *Survey questions: Handcrafting the standardized questionnaire.* Thousand Oaks, CA: Sage.

Dabbagh, N. (2007). The online learner: Characteristics and pedagogical implications. *Contemporary Issues in Technology and Teacher Education, 7*(3), 217–226. Retrieved from http://www.citejournal.org/

Dawley, L. (2007). *The tools for successful online teaching*. Hershey, PA: Information Science.

DeTure, M. (2004). Cognitive style and self-efficacy: Predicting student success in online distance education. *The American Journal of Distance Education, 18*(1), 21–38. Retrieved from http://www.ajde.com/index.htm

Dray, B.J., & Miszkiewicz, M. (2007). *The intersection of learner characteristics and technology capabilities: Implications for online learning*. Paper presented at the 2007 AERA Annual Meeting, Chicago, IL.

Felder, F.M., & Soloman, B.A. (1991). *Index of learning styles.* Raleigh: North Carolina State University. Retrieved from http://sn.umdnj.edu/studentsonly/cas/IndexofLearningStyles.pdf

Fowler, F.J. (2009). *Survey research methods* (4th ed.). Thousand Oaks, CA: Sage.

Hagedorn, L.S. (2005). How to define retention: A new look at an old problem. In A. Seidman & V. Tinto (Eds.), *College student retention* (pp. 89–106). Westport, CT: Praeger.

Hsieh, J.J.P.-A., Rai, A., & Keil, M. (2008). Understanding digital inequality: Comparing continued use behavioral models of the socio-economically advantaged and disadvantaged. *MIS Quarterly, 32*(1), 97–126. Retrieved from http://www.misq.org/

Jaschik, S. (2009, April 6). Rise in distance enrollments. *Inside Higher Ed.* Retrieved from http://www.insidehighered.com/news/2009/04/06/distance

Kerr, M.S., Rynearson, K., & Kerr, M.C. (2006). Student characteristics for online learning success. *The Internet and Higher Education, 9*(2), 91–105. doi: 10.1016/j.iheduc.2006.03.002

Lokken, F. (2009, March). *Distance education survey results: Tracking the impact of eLearning at community colleges.* Washington, DC: Instructional Technology Council. Retrieved from http://www.itcnetwork.org/file.php?file=/1/ITCAnnualSurveyMarch2009Final.pdf

Lowenthal, P.R., Wilson, B., & Parrish, P. (2009). Context matters: A description and typology of the online learning landscape. In M. Simonson (Ed.), *32nd Annual proceedings: Selected research and development papers presented at the annual convention of the Association for Educational Communications and Technology* (pp. 161–172). Washington, DC: Association for Educational Communications and Technology.

Mattice, N.J., & Dixon, P.S. (1999). *Student preparedness for distance education* (Research Report). Santa Clarita, CA: College of the Canyons.

McDowell, I. (2006). *Measuring health: A guide to rating scales and questionnaires.* New York: Oxford University Press.

McVay, M. (2000). *Developing a Web-based distance student orientation to enhance student success in an online bachelor's degree completion program.* Dissertation, Nova Southeastern University, USA. Retrieved from http://web.pdx.edu/~mmlynch/McVay-dissertation.pdf

McVay, M. (2001). *How to be a successful distance education student: Learning on the Internet.* New York: Prentice Hall.

Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2009). *Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies.* Washington, DC: US Department of Education. Retrieved from http://www.ed.gov/rschstat/eval/tech/evidence-based-practices/finalreport.pdf

Miszkiewicz, M.J. (2006, Summer). *EDC707 Computer Applications in Education Administration Syllabus.* Buffalo, NY: Buffalo State College.

Moody, J. (2004). Distance education: Why are the attrition rates so high? *Quarterly Review of Distance Education, 5*(3), 205–210. Retrieved from http://www.infoagepub.com/Quarterly-Review-of-Distance-Education.html

Parnell, J.A., & Carraher, S. (2003). The Management Education by Internet Readiness (Mebir) Scale: Developing a scale to assess personal readiness for internet-mediated management education. *Journal of Management Education, 27*(4), 431–446. doi: 10.1177/1052562903252506

Phipps, R., & Merisotis, J. (1999, April). *What's the difference? A review of contemporary research on the effectiveness of distance learning in higher education.* Washington, DC: The Institute for Higher Education Policy. Retrieved from http://www2.nea.org/he/abouthe/images/diseddif.pdf

Picciano, A., & Seaman, J. (2007). *K-12 online learning: A survey of U.S. school district administrators.* Needham, MA: The Sloan Consortium.

Pillay, H., Irving, K., & McCrindle, A. (2006). Developing a diagnostic tool for assessing tertiary students' readiness for online learning. *International Journal of Learning Technology, 2*(1), 92–104. doi: 10.1504/IJLT.2006.008696

Rosenberg, M. (1965). *Society and the adolescent self-image.* Princeton, NJ: Princeton University Press.

Selwyn, N. (2004). Reconsidering political and popular understandings of the digital divide. *News Media & Society, 6*(3), 341–362. doi: 10.1177/1461444804042519

Selwyn, N. (2011). Digitally distanced learning: A study of international distance learners' (non)use of technology. *Distance Education, 32*(1), 85–99. doi: 10.1080/01587919.2011.565500

Shea, P., & Bidjerano, T. (2008). Measures of quality in online education: An investigation of the Community of Inquiry Model and the net generation. *Journal of Educational Computing Research, 39*(4), 339–361. doi: 10.1007/s12528-009-9024-5

Shia, R.M. (1998). *Assessing academic intrinsic motivation: A look at student goals and personal strategy.* Unpublished senior thesis, Wheeling Jesuit University, West Virginia.

Smith, P.J. (2005). Learning preferences and readiness for online learning. *Educational Psychology, 25*(1), 3–12. doi: 10.1080/0144341042000294868

Smith, P.J., Murphy, K.L., & Mahoney, S.E. (2003). Towards identifying factors underlying readiness for online learning: An exploratory study. *Distance Education, 24*(1), 57–67. doi: 10.1080/01587910303043

Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques.* Newbury Park, CA: Sage.

Tallent-Runnels, M.K., Thomas, J.A., Lan, W.Y., Cooper, S., Ahern, T.C., Shaw, S.M., et al. (2006). Teaching courses online: A review of the research. *Review of Educational Research, 76*(1), 93–135. doi: 10.3102/00346543076001093

Taraban, R., Kerr, M.S., & Rynearson, K. (2000). College students' knowledge and use of comprehension strategies. *Reading Psychology, 21*(4), 283–308. Retrieved from http://www.tandf.co.uk/journals/titles/02702711.asp

Taraban, R., Kerr, M.S., & Rynearson, K. (2004). Analytic and pragmatic factors in college students' metacognitive reading strategies. *Reading Psychology,* 25(2), 67–81. Retrieved from http://www.tandf.co.uk/journals/titles/02702711.asp

Trice, A.D. (1985). An academic locus of control scale for college students. *Perceptual and Motor Skills,* 61, 1043–1046. doi: 10.1177/0013164487472022

Trochim, W.M. (2006). *Research methods knowledge base* (2nd ed.). Retrieved from http://www.socialresearchmethods.net/kb/

van Dijk, J. (2002). A framework for digital divide research. *The Electronic Journal of Communication, 12*(1). Retrieved from http://www.gw.utwente.nl/vandijk/research/digital_divide/Digital_Divide_overigen/a_framework_for_digital_divide.doc/

van Dijk, J. (2006). Digital divide research, achievements, and shortcomings. *Poetics,* 34, 221–235. doi: 10.1016/j.poetic.2006.05.004

van Dijk, J., & Hacker, K. (2003). The digital divide as a complex and dynamic phenomenon. *The Information Society, 19*(4), 315–326. Retrieved from http://www.ingentaconnect.com/content/routledg/utis/2003/00000019/00000004/art00007

Watkins, R., Leigh, D., & Triner, D. (2004). Assessing readiness for e-learning. *Performance Improvement Quarterly, 17*(4), 66–79. doi: 10.1111/j.1937-8327.2004.tb00321.x

Willging, P.A., & Johnson, S.D. (2004). Factors that influence students' decision to dropout of online courses. *Journal of Asynchronous Learning Networks, 8*(4), 105–118. Retrieved from http://sloanconsortium.org/publications/jaln_main