

Authentic Learner Assessment in an Online Environment: Using Instructional Design
Techniques to Create an Assessment Model for an Introductory Computer Science Course

by

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Abstract

The Internet and the WWW have given birth to new learning environments such as electronic distributed education. Authentic assessment in online learning environments presents a multitude of challenges and no ideal model seems to have emerged. These challenges are reviewed along with online methodologies currently in use, their effectiveness, and why they are used. Findings were used to provide the basis for developing a model for authentic assessment in an online computer science course. Assessment methodologies that are effective in measuring learning, engage the learner, are integrated into the learning process, and promote further learning are recommended.

Authentic Learner Assessment in an Online Environment: Using Instructional Design Techniques to Create an Assessment Model for an Introductory Computer Science Course

Has education been revolutionized by the Internet? Hardin and Ziebarth (2000) respond, “Well, not exactly” (p. 2). In recent years, however, the Internet has played a role in establishing new learning environments, and some educators believe that a revolution is taking place that cannot be ignored by educators or administrators.

This study sought answers to two questions: What features, tools and methodologies are currently used in assessment paradigms in courses in post-secondary education? And which methodologies provide authentic assessment appropriate for an online learner assessment paradigm in an introductory computer science or information technology course? The results were used to develop an online assessment model for an introductory computer science course.

A multitude of challenges to the problem of authentic assessment in online learning environments exists. One might theorize that simply transferring face-to-face classroom assessment tools and methods to an online environment would be adequate. However, practice has shown that such methodologies do not constitute authentic assessment in the online instructional environment. The underlying theory is that many of the traditional learner assessment methodologies will not produce the desired results of authentic assessment in an online learning environment and that a close analysis of methodologies currently in use in online assessment can provide the basis for developing a model for authentic online assessment.

Suggesting that the challenges of assessment and testing in the twenty-first century can be met Baker (2001) states boldly,

Assessment and testing are bound to be more important at the beginning of this century than they have been, even in the near past. Politicians have embraced testing as a pillar of the educational edifice. However, we must bring interpretive intelligence to bear on the results of tests. (§ 32)

Baker recommends the use of technological advances that allow practitioners to adapt measurement of achievement to the learner.

Willis (1998) states, “Effective teachers use a variety of means, some formal and others informal, to determine how much and how well their students are learning” (§ 1). “When teaching at a distance, educators must address a different teaching challenge than [sic] when teaching in a traditional classroom” (§ 3). Absent from the distance teaching and learning environment are the traditional classroom, a relatively homogeneous group of learners and the feedback available through face-to-face interaction, and an instructor with total control of the course delivery system.

Technology provides new ways of designing and delivering learning systems and assessing learning. Learner assessments designed for traditional face-to-face instruction are inappropriate and often ineffective when transferred to an online environment. Anderson, Bauer, and Speck (2002) conclude that two major questions face instructors in higher education who choose to move their courses to an online environment: “What do we need to know about grading student work in the online environment? And what are ways we can do it” (p. 1)? The challenge is to devise online assessment methodologies that are authentic, reliable, ethical, engage the learner and promote learning. Instructional design techniques will integrate assessment practices with other learning strategies and activities to accomplish the real task of instruction – optimization of learning.

The complexions of institutions of higher learning are changing. Green (2002) reports, “As in the past five years, survey respondents across all sectors of higher education identify ‘assisting faculty integrate technology into instruction’ as the single most important IT issue confronting their campuses ‘over the next two or three years’” (p. 5). Designing authentic assessment methodologies and activities for online learning environments is a challenge for instructional designers. The current movement from a teaching infrastructure to a learning infrastructure produces particular challenges for online courses in higher education. Byers (2001) states, “Instruction gains value when measurement shows that objectives have been achieved and learning has occurred. Making the measurement an integral part of class activity allows the identification of problems and consequent improvements even while the course is ongoing” (p. 359).

The Web-based Commission (2000) report strongly favors the use of technology for instruction and assessment of learning. “Technology can support what we now know to be more effective learning environments. Interactive applications linked to the Internet can provide environments better matched to support learner-centered, knowledge-centered, community-centered, and assessment-center conditions for learning” (p. 75). The report suggests, however, that existing barriers in current methods of teaching and assessment need to be overcome.

Perhaps the greatest barrier to innovative teaching is assessment that measures yesterday’s learning goals. It is a classic dilemma: tests do a good job of measuring basic skills, which, in turn, influence the teaching of these skills so students can score well on the tests. Testing works well so long as we are testing the right things. (p. 75)

New opportunities abound and research has shown that embedding learner assessment into the instructional process promotes continuous learning, but new assessment methodologies are required. The report states, “... the current forms of testing are not designed to measure how educational reforms, including those based on technology, can improve student understanding” (p. 76). Important in this assessment methodology is how assessment activities are designed and delivered. “Fortunately, development of sophisticated test construction, delivery, and scoring through new technologies will make it possible to do a better job of evaluating the skills we seek to build” (p. 76).

Colleges and universities are experimenting with various methodologies to assess their programs as well as to assess learners to prove that their online teaching is effective. Carnevale (2001) states, “Indeed, assessment is taking center stage as online educators experiment with new ways of teaching and proving that they’re teaching effectively” (p. A 46). Most studies of assessment in online learning environments deal with assessing the appropriateness, effectiveness, or acceptability of the program itself rather than assessing learner achievement. There is mounting evidence that instruction and assessment must be integrated, particularly in an online environment, to engage learners and maximize learning. Speck (2002) takes the position, “If it is to be effective, assessment must be part and parcel of the entire learning enterprise and therefore is not a distant stage of pedagogical theory. Assessment must be integrated into a holistic view of pedagogy. This [*sic*] means that any theory of assessment presumes and informs a theory of learning” (p. 5). “We need to find new ways and new tools that will provide as many windows as possible into the subtle complexities of the mind,” says Bridges (1995, p. 49). “Our goal as evaluators and teachers is to document, as richly as possible our students’ learning and to accomplish this in a deeply thoughtful manner. To that end, we need to use an array of assessment tools from a variety of perspectives” (Bridges, p. 49).

Instructors use assessment for several purposes: to diagnose student needs, to grade student progress, to motivate students, and to evaluate the impact of their instruction. According to Stiggins (1999), student achievement should be assessed accurately, and the results of assessment should be used to the student's advantage. Integration of assessment and instruction is derived from the use of performance criteria as an instructional tool, and in order for integration to succeed, the instructor must first understand the use of performance criteria as instructional tools and then create performance criteria that lend themselves to the necessary instructional uses. Stiggins identifies five standards for sound, quality learner assessment.

Quality assessments arise from and accurately reflect clearly specified achievement expectations for students Sound assessments are specifically designed to serve instructional purposes Quality assessments rely on appropriate assessment methods. ...Quality assessments representatively sample student performance with enough exercises to permit confident conclusions about achievement. Sound assessments are designed, developed, and used in such a manner as to eliminate sources of bias that can distort the accuracy of results. (pp. 21-23)

It is important that we know how these standards apply to assessment. "Knowing precisely what we are asking students to master is important because different achievement targets require the application of different assessment methods" (p. 21). It is important to begin the assessment development process with a clear vision of what academic success means in that context.

Traditional forms of learner assessment may not meet the challenges of teaching and learning in an electronic environment. Wiggins (1998) states, "Because each major test is a one-shot effort, and because much secrecy surrounds these questions and test scoring, conventional approaches to testing cannot provide what we most need in our schools: a way to help students systematically to *self-correct* their performance" (p. xi). Traditional testing adversely affects learning and performance. Wiggins argues, "A steady dose of simplistic tests in school then unwittingly teaches the student an incorrect view of intellectual performance in the adult world while undercutting the student's need for and right to user-friendly feedback from ongoing assessment on clear and worthy achievement targets" (p. 10). "But as long as assessment is conceived of as what we do after teaching and learning are over, and as long as it yields a hard-to-fathom score too late to be useful, assessment will never serve its primary client, the student, or its primary purpose, improvement leading to excellence" (p. 10). Wiggins concludes, "Our excessive reliance on short-answer and multiple-choice testing has landed us in a world I describe as 'teach, test, and hope for the best' (p. 10). "By contrast," Wiggins assures us, "if an assessment system were actually *working* to teach students, what would we see? We would see strong performance gain over time for *all* students" (p. 11). Wiggins characterizes authentic assessment as assessment that:

Is realistic, ... requires judgment and innovation, ... asks the student to "do" the subject, replicates or simulates the context in which adults are "tested" in the workplace in civic life and in personal life, ... assesses the student's ability to efficiently and effectively use a repertoire of knowledge and skill to negotiate a complex task, ...and allows appropriate opportunities to rehearse, practice, consult resources, and get feedback on and refine performances and products. (p. 23)

Authentic assessment differs from traditional assessment in that it measures what learners can do with the knowledge they have gained. Bridges (1995) identifies several principles of authentic assessment:

Authentic assessment is continuous, informing every aspect of instruction and curriculum building. As they engage in authentic assessment, teachers discover and learn what to teach as well as how and when to teach it. Authentic assessment is an integral part of the curriculum. Children are assessed while they are involved with classroom learning experiences, not just before, or after a unit through pre- or post-tests. Authentic assessment is developmentally and culturally appropriate. Authentic assessment focuses on students' strengths. Teachers assess what students can do, what they know, and how they can use what they know to learn. Authentic assessment recognizes that the most important evaluation is self-evaluation. Students and teachers need to understand why they are doing so that they may have some sense of their own success and growth Authentic assessment invites active collaboration; teachers, students, and parents work together to reflect and assess learning. (p. 8)

Assessing higher order learning in an electronic environment is a new challenge for some college and university professors. Educators are asking whether the traditional methods of assessing student achievement are adequate, fair, or even valid in today's educational environment of high technology, rapidly changing skill sets, and varied learning styles. "We need to find new ways and new tools that will provide as many windows as possible into the subtle complexities of the mind," says Bridges (1995, p. 49). "Our goal as evaluators and teachers is to document, as richly as possible our students' learning and to accomplish this in a deeply thoughtful manner. To that end, we need to use an array of assessment tools from a variety of perspectives" (p. 49).

Several assessment methodologies used in post-secondary education emerged from the study. Assessment methodologies from the literature are shown in Table 1.

Table 1. Assessment methodologies from literature

- Open-book and open-notes assessment
- Repeated testing
- Assessment based on course objectives
- Outcome- or performance-based assessment
- Interactive assessment
- Continuous assessment
- Assessment of student journals
- Assessment by collaborative testing
- Portfolio assessment
- Self assessment
- Resource-based learning assessment
- Project-based assessment

Through use of an online survey instrument, respondents reported use, effectiveness, and reasons for use of the following assessment methodologies in introductory computer science, information technology, or similar computer applications courses in an online environment: (a) objective questions such as multiple-choice, fill-in blank, matching, and lists; (b) subjective questions which include short answer, and short paragraphs; (c) projects or assignments submitted electronically which include spreadsheets, documents, databases, presentations, program coding and other projects; (d) collaborative testing which incorporates individual responses to questions after teaching and group deliberation; (e) outcome- or performance-based assessment of learner skills or abilities; (f) interactive assessment of electronic correspondence

between learner and instructor such as e-mail and chat sessions; (g) self-assessment, which requires learners to reflect upon their own work and knowing that they know the appropriate material; and (h) online threaded discussions through which learners respond to questions or statements posted by the instructor or other learners. Assessment methodologies found in the literature were used as a basis for the methodologies included in the online survey.

Findings from the online survey are presented in Tables 2 and 3. Table 2 shows findings for instructors who teach online courses and includes both online and offline learner assessments.

Table 2. Assessments used in online courses and effectiveness ratings

<u>Courses Taught Totally Online (n=13)</u>								
<u>Assess learners online (n=4)</u>								
<u>Question Type</u>	<u>Used</u>		<u>Neutral</u>		<u>Effective</u>		<u>Extremely Effective</u>	
	<u>#</u>	<u>%</u>	<u>#</u>	<u>%</u>	<u>#</u>	<u>%</u>	<u>#</u>	<u>%</u>
Objective	4	100	1	25	3	75		
Subjective	2	50	2	100				
Projects	4	100			2	50	2	50
Collaborative	0	0						
Outcome	2	50			2	100		
Interactive	3	75	1	33	1	33	1	33
Self-Asses	2	50		100	2	100		
Discussions	2	50	1	50	1	50		
<u>Do not assess learners online (n=9)</u>								
<u>Question Type</u>	<u>Used</u>		<u>Neutral</u>		<u>Effective</u>		<u>Extremely Effective</u>	
	<u>#</u>	<u>%</u>	<u>#</u>	<u>%</u>	<u>#</u>	<u>%</u>	<u>#</u>	<u>%</u>
Objective	1	11	1	33	1	33	1	33
Subjective	1	11	1	33			1	33
Projects	2	22	1	33			2	67
Collaborative	1	11			1	100		
Outcome	1	11			1	50	1	50
Interactive	1	11			2	100		
Self-Asses	2	22			2	100		

Names of the assessment types were abbreviated for space considerations. Participant responses are assigned to sub-groups which correspond to the categories of assessments in online courses and courses with only some online components. Because no methodologies were rated as extremely ineffective and only three were rated ineffective, these two effectiveness ratings were omitted from Tables 2 and 3

Sixty-two percent of survey respondents teach some online courses. Thirty-one percent of these respondents assess learners online. Objective questions, projects or assignments submitted electronically, and interactive assessments are used more frequently than other assessment types. These assessment types also receive high effectiveness ratings. Although outcome- or performance-based and self-assessment methodologies are not used as frequently, they also receive high effectiveness ratings. Sixty-nine percent of survey respondents who teach courses online do not assess learners online. They reported most frequently using electronically submitted projects or activities and self-assessment methodologies. These respondents also rated both assessment types as effective.

Findings from the survey show that instructors who teach courses with only some online content do not use online assessment as often as those who teach online courses. These instructors rely more heavily on more traditional offline assessment methodologies. Whether this practice is determined by the level of online content or the level of the instructors' desire to deviate from traditional assessment methods is not known. Online and offline assessment types used and effectiveness ratings for courses with only some online content are shown in Table 3.

Table 3. Assessments used and effectiveness ratings in courses with some online components

<u>Courses Taught With Some Online Components (n=16)</u>									
<u>Assess learners online (n= 8)</u>									
<u>Question Type</u>	<u>Used</u>		<u>Neutral</u>		<u>Effective</u>		<u>Extremely Effective</u>		
	<u>#</u>	<u>%</u>	<u>#</u>	<u>%</u>	<u>#</u>	<u>%</u>	<u>#</u>	<u>%</u>	
Objective	8	100			6	75	2		25
Subjective	3	38	2	40	1	20	2		40
Projects	8	100			4	50	4		50
Collaborative	2	25			2	100			
Outcome	7	88			3	50	3		50
Interactive	5	63	2	50	2	50			
Self-Asses	2	25			2	100			
Discussions	4	50			2	50	1		25
<u>Do not assess learners online (n=11)</u>									
<u>Question Type</u>	<u>Used</u>		<u>Neutral</u>		<u>Effective</u>		<u>Extremely Effective</u>		
	<u>#</u>	<u>%</u>	<u>#</u>	<u>%</u>	<u>#</u>	<u>%</u>	<u>#</u>	<u>%</u>	
Objective	6	50	2	29	5	71			
Subjective	6	54	1	13	6	75	1		13
Projects	10	91	1	10	6	60	2		20
Collaborative	0	0			1	100			
Outcome	3	27	2	50			2		50
Interactive	3	27	2	50	1	20	1		25
Self-Asses	4	36	2	50	2	50			

Seventy-six percent of survey respondents teach courses with some online components. Only forty-four percent of this sub-group reported they assess learners online, yet fifty percent of this sub-group reported using the assessment types listed. Data reveal that three instructors failed to mark the Assess Learners Online box in the survey although they reported using the assessment types listed. The online survey software permits respondents to select items independently, and if an item is selected in error and not deselected, response errors occur which might taint results. This sub-group of instructors reported using objective questions, projects or assignments submitted electronically, and outcome- or performance-based online assessments most frequently. These three assessment types also are rated as either effective or extremely effective by this sub-group.

Sixty-one percent of respondents who teach courses with only some online components do not assess learners online. Some instructors may fall into both sub-groups because they assess learners both online and not online depending on the nature of their courses. Projects or activities submitted electronically is the assessment method reported by more instructors in this sub-group than any other assessment type. This assessment methodology is also rated effective or extremely effective.

Analysis of the survey data identified four reasons for using and judging the effectiveness of specific assessment types that were reported more often than others. Table 4 shows the four reasons and frequency with which they were reported.

Table 4. Most frequently reported reasons for using a specific methodology

<u>Reason</u>	<u>Frequency Reported</u>
This methodology measures performance, application of skills, and use of previously gained knowledge	33 %
This methodology measures both construction and comprehension skills	28 %
This type of assessment is easy to use with large numbers of students	23 %
These assessments are easy to grade	19 %

It is clear from the findings that only two of the reasons frequently given relate to the definition or characteristics of authentic assessment stated earlier in this chapter. The other two reasons relate to logistics of course management rather than how assessment is integrated into the learning process.

Methodologies that Provide Authentic Assessment

Based on findings from the literature review (Alley & Jansak, 2001; Byers, 2001; Carnevale, 2001; Dewalt, et al., 2000; Fodor, 2001; Jacobs & Chase, 1992) and survey data, several assessment methodologies were identified that provide authentic assessment appropriate for use in building an online assessment paradigm for an introductory computer science course. This section evaluates the use and effectiveness of those methodologies. By integrating the methodologies most often used with the reasons for use and judgment of effectiveness, it should be possible to develop the desired model for assessing learners online in an introductory computer science or information technology course. Those assessment methodologies that have been used but instructors reported as ineffective or neutrally effective will not be considered appropriate for the model. Authentic assessment criteria require that methods are effective in measuring learner achievement (Wiggins, 1998).

Some assessment methodologies used in face-to-face learning environments are inadequate for use in an online learning environment as well as others that are currently in use in online learning environments. Findings from the literature on assessment methodologies which might provide authentic learner assessment in an online environment are shown in Table 5.

Table 5. Authentic methodologies for online assessment from the literature

- Open-book and open-notes assessment
- Assessment based on course objectives
- Outcome- or performance-based assessment
- Interactive assessment
- Continuous assessment
- Assessment by collaborative testing
- Project-based assessment

Courses taught online and courses with only some online components were evaluated as a single unit in order to analyze methodologies used for online assessment in both categories. The purpose for identifying and evaluating assessment methodologies that were used for online assessment rather than offline assessment is two-fold: first to add to the body of research in online learning, and second to attempt to identify authentic assessment methodologies for the proposed model.

Themes of authentic assessment methodologies that may be appropriate for use in an online environment emerge from a review of the literature and focus on the concepts of alternative and authentic assessment (Carnevale, 2001; Fodor, 2001; Alley & Jansak, 2001; Byers, 2001; Thorpe, 1998; Morgan, 1995). Although not all researchers use these specific terms, the characteristics of the assessment practices they describe and recommend are those of alternative assessment practices, many of which also meet the criteria for authentic assessment as previously defined. Emphasis is on assessing higher order learning, skill development, use of prior knowledge, and the ability to perform tasks correctly coupled with timely and appropriate feedback from the instructor to allow learners to alter patterns of behavior during the course. Outcome- or performance-based assessment in which learner skills at using knowledge are assessed is suggested by Carnevale (2001), Fodor (2001) and others and seems quite appropriate as an assessment type for these courses because learners are required to perform specific tasks in addition to gaining amounts of knowledge about the subject. Interactive assessment, the use of collecting performance data through the use of technology as Byers (2001), Alley & Jansak (2001), Fodor (2001) and others describe is a natural component of a computer science, information technology, or similar computer applications course. Not only is the use of interactive resources taught, their use is an integral component of the learner's communications with the instructor. Continuous assessment, the practice of integrating assessment activities into learning activities of the curriculum and providing timely feedback to learners, makes sense as a viable assessment type for use in almost any curriculum. Continuous assessment requires integration of assessment into all course activities. Thorpe (1998) and others highly recommend the use of continuous assessment. Project-based assessment, which incorporates assessment into curriculum design, is quite popular in higher education and particularly in courses which use or teach information technology as Morgan (1995) reports. Many activities such as creation of electronic documents, spreadsheets, databases, presentations, and Web pages require the completion of project assignments in both a timely and accurate manner.

Patterns of use and judgment of effectiveness of assessment types also emerge from the findings in the data. Among instructors in both major groups who assess learners online, objective questions, projects or activities submitted electronically and outcome- or performance-based assessment types received the highest overall rating of use and effectiveness combined.

Relationship of Online Assessment Types Used to Effectiveness Ratings

An important relationship should exist between the types of online assessments instructors use and the judgment of the effectiveness of these assessments. The findings indicate however, that this relationship does not always exist. Figure 1 shows the relationships between assessment types and effectiveness ratings for courses taught online.

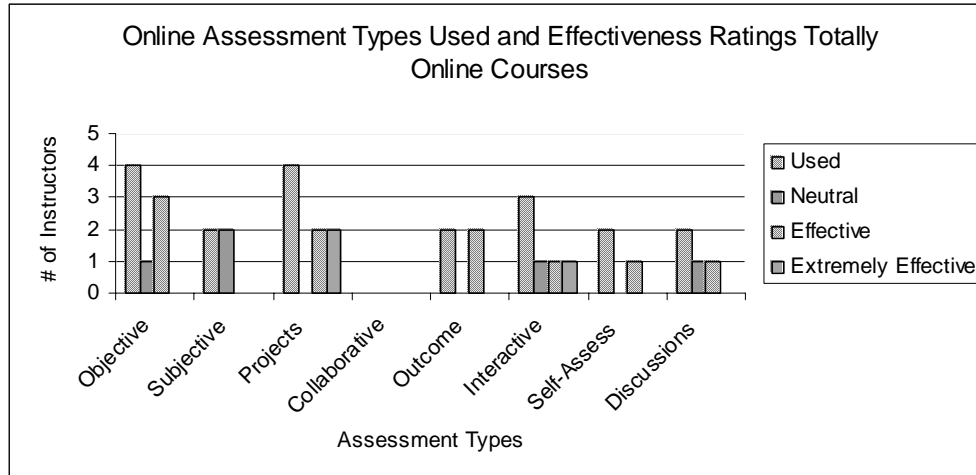


Figure 1. Relationship of online assessment types used to effectiveness ratings in online courses

Figure 2 shows the relationships between assessment types and effectiveness ratings for courses with only some online components.

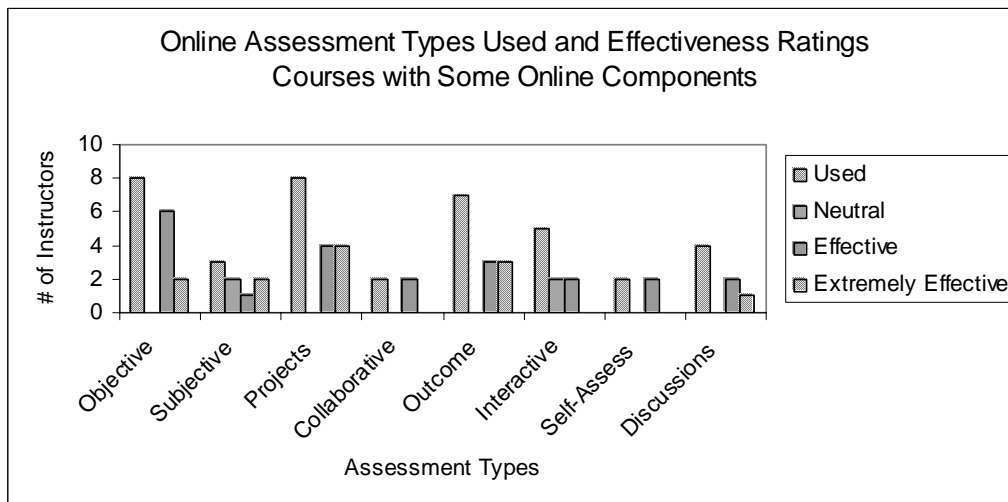


Figure 2. Relationship of online assessment types used to effectiveness ratings in courses with only some online components

Results and Conclusions

Attributes of authentic assessment were found in fifty-eight percent of the assessment methodologies described in the literature. Fifty percent of the assessment types presented in the survey were found to present attributes of authentic assessment. Attributes of authentic assessment were found in only thirty-one percent of the reasons for using specific online assessment types. Eighty-eight percent of the assessment types used for online assessment were found to be effective.

Use of objective questions for learner assessment was found to be popular in an online environment. An online Course Management Systems (CMS) allows easy distribution of objective type questions in quizzes, practice tests, and exams. However, this methodology is not

seen in the literature as a good alternative or authentic assessment type. Projects or assignments submitted electronically as an assessment methodology was strongly favored by instructors who assess learners online and is also seen in the literature as an effective alternative online assessment type. This assessment type was also strongly favored by instructors who teach courses with only some online components and do not use online assessment. Collaborative testing as a methodology is recommended in the literature and was deemed effective in the survey data although few instructors reported using it in an online environment. These data seem to indicate that in introductory computer science, information technology, or similar computer applications courses, instructors either do not often assign group activities to their students or do not use these activities for assessment purposes. Outcome- or performance-based assessment is strongly recommended in the literature as an effective alternative and authentic assessment methodology and was also highly favored by the survey group for online assessment. Interactive assessment ranked high as an effective online assessment type among instructors in the survey group and is also strongly recommended in the literature.

The literature base clearly identifies and describes assessment methodologies used in higher education which exhibit attributes and characteristics of authentic assessment described earlier. The literature further describes methodologies used in traditional classroom settings which may be portable to online teaching and learning environments and explains why some assessment methodologies used in traditional face-to-face instructional systems are not appropriate for and cannot be easily ported to online learning environments. Assessment methodologies to be considered for inclusion in the proposed online assessment paradigm met the following criteria: (a) the methodologies exhibit attributes or characteristics of authentic assessment; (b) they are found in both the literature and the survey data; (c) they are rated as effective or extremely effective in measuring learning, engaging the learner, integrating into the learning process, and promoting further learning by the group of instructors participating in the study; (d) they are appropriate for use in online introductory computer science, information technology, or similar computer applications courses; and (e) the reasons instructors reported for using these assessment types also exhibit characteristics of authentic assessment.

The study found the following assessment methodologies that meet these criteria: (a) projects or assignments submitted electronically, such as spreadsheets, documents, databases presentations, program coding, and other objects; (b) collaborative testing, in which learners respond individually to questions after group deliberations and teaching one another; (c) outcome- or performance-based assessment, in which learners are assessed on demonstration of skills or abilities; and (d) interactive assessment, in which instructors and learners correspond through e-mail or chat sessions.

Clearly objective questions, projects or activities submitted online, and outcome- or performance-based assessments were most favored among this group of instructors who teach introductory computer science, information technology or similar computer applications courses. Objective questions do not fully meet the criteria for authentic assessment, but projects or activities submitted online and outcome- or performance-based assessments are strong authentic assessment methodologies. Interactive assessments also ranked high in use as an online assessment methodology; however, only about half of those instructors who have used this type of assessment felt it was effective.

The finding that collaborative testing is seldom used in these online courses is surprising in light of the extensive literature on collaborative learning and learner-centered education at the post-secondary level. According to the literature, collaborative learning is taking a foothold in

post-secondary curricula as the current trend in learner-centered education. Team work in the market place is so prevalent that this assessment methodology appears to be a logical stepping stone to learner career development. In the field of computers and technology, the team approach is used extensively in developing new products and services. It was not surprising to find that outcome- or performance-based assessment is widely used and strongly recommended for an introductory computer science or information technology course which requires extensive student interaction, project development, and online assignments. Neither was this finding surprising in light of the knowledge and skills students must acquire for performing numerous interactive tasks in the field of computer technology.

It is recommended that these four assessment types be considered as the most likely candidates for the proposed model: (a) projects or assignments submitted electronically, (b) collaborative testing, (c) outcome- or performance-based assessment, and (d) interactive assessment. Other assessment types that received high effectiveness ratings may also be included to provide a balanced authentic assessment paradigm that measures learning, engages the learner, is integrated into the learning process, and promotes further learning.

Why do instructors use assessment methodologies that apparently do not meet the criteria for authentic assessment? Why do instructors not make better use of assessment methodologies that are authentic in nature? Authentic assessment seems to be the key. Perhaps instructors do not understand the meaning of authentic assessment? How would instructors have to modify their instruction and assessment methods in order to incorporate into their courses authentic assessment that is effective in measuring learning, engages the learner, is integrated into the learning process, and promotes further learning? Must instructors be more diligent with assessment in an online environment than in face-to-face classroom instruction? Does the online environment mitigate the use of different paradigms of assessment, and if so, how will instructors begin to learn of these paradigms and integrate them into their teaching and learning systems?

Colleges and universities must accept the challenge to adopt current effective teaching methodologies, including authentic assessment as an integral part of teaching and learning, in order to meet the educational demands of learners. Faculty must learn to use the four authentic assessment methodologies identified in the study to assess both what learners know and what they can do with their knowledge. It is imperative that colleges and universities institute extensive ongoing programs for faculty and staff development that include current effective teaching and learning strategies.

My description of future educational institutions and systems consists of a holistic view of the instructional and learning processes, and as I stated in 2000:

Successful educational institutions in the future will of necessity integrate the worlds of education, work, and leisure with leading edge electronic technologies as they become available. The new model for educational activity will be that which is delivered by the institutions and acquired by the students in an anytime, anyplace, on-demand fashion. The educational institution of the future, at the post-secondary level at least, will not be a campus we drive through and view the ivy covered halls of wisdom, but it will be a learning experience we participate in while we drive along the highway, relax at home, work at our desks, fly to distant locations, collaborate with fellow learners, and accomplish all the other tasks required of us to be productive, useful, and educated citizens of the world. It will always be at our fingertips, or at least no more than a click away. (p. 34)

One of the major challenges of this new “at-our-fingertips” learning environment is how to assess learner achievement in an online course in which learner and instructor seldom or never see each other in face-to-face contact. The assessment must be authentic as defined by Wiggins (1998), Bridges (1995) and others and must be effective in that it measures learning, engages the learner, is integrated into the learning process, and promotes further learning. The assessment paradigm developed as a result of this study will be a step forward.

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