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Multimedia Competencies for an Educational Technologist: A Survey of Professionals and Job Announcement Analysis

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This paper examines the multimedia competencies of an educational technologist via a job announcement analysis and survey of professionals within the field. A conceptual framework is provided involving the new definition of the field of educational technology and associated knowledge, skill, and ability statements. Two-hundred five unique job postings were examined using an emergent themes analysis. Additionally, 231 professionals within the field completed a survey of multimedia competencies. Results indicate key multimedia competencies for professionals practicing within the field, including knowledge of critical software tools such as presentation software and screen recording software; oral and written communication skills; and the ability to create effective instructional products. Recommendations to employers, educational technology programs, and professionals are provided.

INTRODUCTION

An important aspect of the development of any field of endeavor is the competencies the professionals practicing within the field develop from their educational preparation and work experiences. A competency is "a knowledge, skill or [ability] that enables one to effectively perform the activities of a given occupation or function to the standards expected in employment" (Richey, Fields & Foxon, 2001, p. 26). Most fields have professional associations that guide the development of a body of knowledge within a field by establishing professional conduct standards, facilitating knowledge creation and dissemination, and by creating a curriculum (e.g., set of competencies) to prepare individuals to enter the profession (Jacobs, 2007). Some will even establish professional certifications and licensures (e.g., Certified Performance Technologist) to certify professionals' competencies. In general, these professional associations promote the interest, welfare and common good of a field of endeavor and advocate for its professionals by defining the field of endeavor and highlighting the contributions the professionals make to society at large.

The broad field of *educational technology*, which has been historically referred to as instructional technology, instructional systems design, and many other names, is a particularly interesting example because of its multidisciplinary nature (drawing from several disciplines) and far reach into several different contexts (e.g., higher education, K-12, military, etc.). The field of educational technology has a host of professional associations including the *Association of Educational and Communication Technology* (AECT), *Association for the Advancement of Computing in Education* (AACE), *International Society for Performance Improvement* (ISPI), *American Society for Training and Development* (ASTD), and *International Society for Technology in Education* (ISTE) to name a few. Each professional association makes its unique contribution to the field and to the competencies of the professionals within the field.

AECT provides the definition of the field, which is important for several reasons. First, it defines the body of knowledge in the field to include advances in theory, technology, and practice. Second, the definition is used to develop the professional standards and competencies of the professionals within the field. For instance, the National Council for Accreditation of Teacher Education (NCATE), the gold standard accrediting agency for professional colleges and schools of education, uses the guidelines provided by AECT to certify that professional schools are preparing professionals to meet the expectations of the field. Currently, NCATE is still using the guidelines based on the 1994 definition of the field (Earle & Persichitte, 2005); however, AECT is currently revising these curriculum standards to match

the new definition released in 2007.

ISPI has developed standards for Certified Performance Technologist (CPT) designation. ISTE develops the National Educational Technology Standards (NETS) for administrators, teachers, and students. ASTD has developed competency-based standards for the Certified Professional in Learning and Performance (CPLP) (ASTD, 2009). ASTD has also developed a Competency Model for Learning and Performance, which identifies the roles, areas of expertise, and foundational competencies for professionals in the learning and performance field. Another organization, the *International Board of Standards for Training, Performance and Instruction* (IBSTPI), has been developing and validating the standards for professionals in the fields of training and performance for more than two decades. Currently, over 400 organizations worldwide in a wide variety of sectors, including private industry, academia, military, and government, use these standards to improve both individual performance and organizational results (IBSTPI, 2010).

Apart from the various professional associations that have published competencies for educational technologists, few studies have been conducted by reliable sources to identify competencies for educational technologists. Kenny, Zhang, Schwier and Campbell (2007) listed the competencies: communication skills, knowledge of instructional design models, problem-solving/decision-making skills, and technology skills, as a result of their research. Liu, Gibby, Quiros, and Demps (2002) listed problem-solving and decision-making skills as one of the competencies required for instructional designers. Tennyson (2001) identified three competency areas, including educational foundations, instructional systems design methodology, and instructional design process experience.

Very little work has been conducted to identify multimedia competencies for professionals in the field of educational technology. Brown, Sugar and Daniels (2007) identified entry-level multimedia production competencies and skills of educational technology professionals. Results reported the authoring applications media producers regularly use and attributes that are most important to the choice of an authoring application. Martin and Winzeler (2008) identified competencies for multimedia knowledge, skills and tools. This study reported on the importance of web design as a multimedia skill needed for educational technologists.

Job Announcement Analysis

One approach to identifying key competencies has been job analysis. Wilson (1974) defines job analysis as “any process of collecting, ordering, or evaluating work or worker-related information” (p.8). Dessler (2004)

defines it as the procedure for determining the duties and skill requirements of a job and the kind of person who should be hired for it. In particular, this research used job announcements as the data source. Job analysis data can be used in a number of different ways – recruitment and selection, compensation, performance appraisal, discovering unassigned duties, compliance, job restructuring, training program development, qualifications standard development, test development, performance evaluation, preparation of accurate job descriptions, and/or employee counseling (Dessler, 2004; Wilson, 1974).

Moallem (1995) analyzed 150 jobs and found that knowledge/experience of advanced media/technology was rated the highest requirement (50%) for master's level positions in universities/colleges and school districts. Knowledge and experience in the design, development, and implementation of training programs was the most required skill/knowledge (47.4%) for business and industry positions. Shank (2006) analyzed job advertisements from periodicals, a job discussion list, and an employment web site over a period of five years to investigate position announcements of the newly emerging position of Instructional Design Librarian. Ten unique position announcements were identified and examined to determine the positions' qualifications and job responsibilities. Osorio (1999) examined 201 positions advertised by colleges and universities during the years 1976, 1986 and 1998 to determine how the positions' qualifications and job responsibilities have changed over the years. Results showed that job announcements published in three chosen years reflect how technology has changed the role of librarians in the last decades.

Multimedia in Educational Technology

A core component of the field of educational technology has been multimedia and its use to influence learning. Historically, the field has referred to multimedia as "audio/visual", but has largely accepted the term multimedia in lieu of its predecessor. As noted by Heller, Martin, Haneef and Gievska-Krliu (2001), the term multimedia is polysemous in that it holds different meanings to different disciplines and people. To many, the traditional definition of multimedia might be the seamless integration of two or more forms of media (Heller, Martin, Haneef & Gievska-Krliu, 2001). This definition implies that two or more forms of media (e.g., music and animation) are used to stimulate two or more human senses (e.g., eye and ears, respectively) simultaneously. This is a purest definition of multimedia. Following this definition, we often speak of multimedia technology which can be used to create, integrate, and present different media forms.

An alternative interpretation of multimedia can be found in the research and theory of cognitive psychology. Research on multimedia learning has evolved from simple media comparison studies (Clark, 1983) to the basis of explaining human learning. This fundamental shift gave rise to cognitive theories in multimedia learning (Hede, 2002; Mayer, 2001; Schnotz, 2005). Perhaps the most recognized is the cognitive theory of multimedia learning developed by Richard Mayer and his colleagues. From this perspective, multimedia can be defined as the presentation of information using both words and pictures (Mayer, 2001). This definition includes only those things that simultaneously stimulate a visual and auditory channel (e.g., narration with animation). The cognitive approaches to multimedia share a few related theoretical underpinnings, including sensory, working and long-term memory, limited-capacity processing, and dual channels (Hede, 2002; Mayer, 2001; Schnotz, 2005). These theories, in turn, have been used to develop and empirically test what we now refer to as the principles of multimedia learning (e.g., multimedia, redundancy, modality principles). Within the field of educational technology, both perspectives of multimedia are important. The traditional perspective relates to the various technologies used within the field to develop and deliver multimedia learning resources. The cognitive perspective informs the professionals within the field on how to create multimedia learning resources to best influence learning.

Purpose

The AECT curriculum standards (based on 1994 definition) emphasize the design, development, utilization, management, and evaluation of multimedia learning resources as well as the delivery of these resources to learners in a plethora of formats (Earle & Persichitte, 2005). Since 1994, we have observed rapid changes in the information and communication technology used to design and deliver multimedia learning resources. Further, the research over the 15 years has fundamentally changed our understanding of the theory and practice of multimedia learning (e.g., Richard Mayer's 2001 book titled *Multimedia Learning*). In many ways, the new definition of the field is an attempt to capture the status quo in the theory, technology, and practice.

While there is ample literature on the theory and practice of multimedia in educational technology, there is a dearth of research literature that espouses the core competencies of those practicing within the field (Daniels, 2008). That is, we have little knowledge about what the expectations are for professionals in the field pertaining to multimedia. A query of the *Curricula Data of Degree Programs in Educational Communications and Technology* database shows that 47% of educational technology programs offer one or

more courses in media management, 68% in instructional development, and 58% in materials production (AECT Curriculum, 2010). However, the depth and breadth of the materials covered in these courses is rarely shared outside the classroom.

Thus, the purpose of this research is to fill this void in the research literature. First, we provide a conceptual framework to connect multimedia to the new definition of the field and appropriate knowledge, skill, and ability statements. Second, we use this framework to analyze job postings in the field of educational technology with the goal of identifying core competencies. Third, using the conceptual framework and results from the job posting analysis, we created a survey to query professionals within the field to determine the core competencies of multimedia. Finally, we provide recommendations to professionals, educational technology programs, and employers based on our findings.

CONCEPTUAL FRAMEWORK

Our conceptual framework incorporates the new definition of educational technology (Januszewski & Molenda, 2007) and connects the definition to knowledge, skill, and ability statements (Wang, Schnipke, & Witt, 2005). AECT's new definition of the field is (Januszewski & Molenda, 2007):

> Educational technology is the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources. (p. 1)

There are several elements to this definition which are thoughtfully articulated in Januszewski and Molenda's (2007) text. In particular, there are three actionable terms that attempt to summarize the work of professionals in the field: create, use, and manage. These terms were used in the survey created in this research. These terms are qualified with the phrase "ethical practice of facilitating learning and improving performance." Two other key elements to the definition are the resources and processes employed within the field. The processes and resources speak to the knowledge, skills, and abilities professionals within the field employ for their practice; and the tools, programs, and media used by these professionals.

Knowledge, skill and ability statements were adopted because they are used to generate lists of competencies for licensure and certification exams (Wang, Schnipke, & Witt, 2005). An extant literature review was conducted to examine the types of knowledge, skills, and abilities recommended by the experts in the field (Alessi & Trollip, 2001; Mayer, 2001; Moallem,

1995; Tennyson, 2001; Kenny, Zhang, Schwier & Campbell, 2005; Sumuer, Kursun & Cagiltay, 2006; Sugar, Angel, Brown, & Daniels, 2007). Additionally, 205 job announcements were analyzed using an emergent themes analysis (Tashakkori & Teddlie, 1998). The analysis revealed over 87 key multimedia competency areas (see Appendix A and Appendix B) including programming and scripting, authoring tools, audio and video editing, course management systems, and several other multimedia competencies. These competencies represent the processes and resources educational technologists employ for practice illustrated in Figure 1.

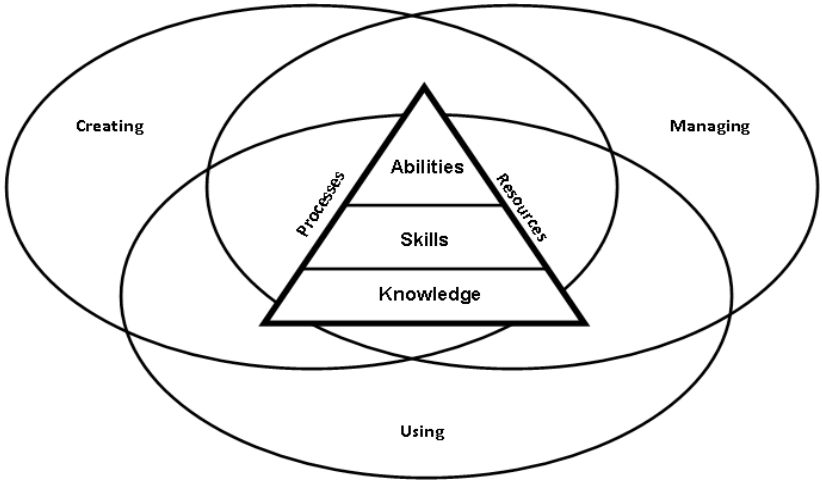

Figure 1. Knowledge, skill, and ability statements as core competencies in educational technology.

There is purposeful overlap among the various knowledge, skill, and ability statements. Knowledge statements refer to an organized body of information usually of a factual or procedural nature. Skill statements refer to the adept manual, verbal or mental manipulation of things. Finally, ability statements refer to the capacity to perform an observable activity. These statements can be thought of as overlapping in which skills rest upon knowledge, and abilities rest upon skills as illustrated in Figure 1. For example, the "Ability to create a web-site" might require knowledge of several areas, such as the Hyper-text Markup Language, web authoring tools, and Cascading Style Sheets, and also require skills in web design. They are not mutually exclusive categories.

METHOD

The research was executed in two phases to address the research problem: 1) Job announcements analysis, and 2) Survey of professionals. This section outlines the methodology employed in each phase of the study.

Phase I: Job announcements analysis

A job analysis was conducted to identify multimedia job requirements for educational technologists. Job announcements were collected from June 2009 to August 2009 using the keyword "multimedia." All job announcements must have been for educational technology-related positions. Two-hundred five unique job postings from several online databases (eLearning guild, AECT jobs, Monster.com, highereducationjobs.com, Career Builder, ASTD database, Chronicle,com, Higheredjobs.com, and ISPI Database.) were compiled and analyzed using an emergent theme content analysis in which the themes (or competencies) emerged from the job postings themselves (Tashakkori & Teddlie, 1998). These competencies were grouped into knowledge, skill, and ability domains. Table 1 shows the distribution of job announcements compiled from each online database. As can be gleaned, the majority of the jobs were compiled from Monster, CareerBuilder, and Higher Education Jobs.

Table 1
Job announcements by online job database.

Job Database	n	%
AECT Database	1	0.49
ASTD Database	3	1.46
Career Builder	50	24.39
Chronicles of Higher Education	11	5.37
eLearning Guild	6	2.93
Higher Education Jobs	39	19.02
ISPI Database	4	1.95
Monster	91	44.39

The job announcement coding process was executed in three iterations. To facilitate the job coding analysis, the codes were implemented as dichotomous fields using a Microsoft Access database and its form features. A screen shot of the *coding form* is shown in Figure 1. The coding form served as a tool to improve the coding process in terms of efficiency and accuracy.

In iteration one, three members of the research team met to discuss the various categories and to code a random sample of the job announcements as a group. During the process, research team members would sit at a computer to independently code job announcements using the coding form and discuss coding differences as a group to engender consistency in the coding process. The members of the research team compiled a set of rules during this phase that could be used to guide the coding when ambiguities would arise and agreed to add to these rules when necessary (using a GoogleDocs). For instance, if the job announcement used the term "Microsoft Office Suite", the members of the research team would automatically code knowledge of "word processing", "spreadsheet", "presentation", and "database" software.

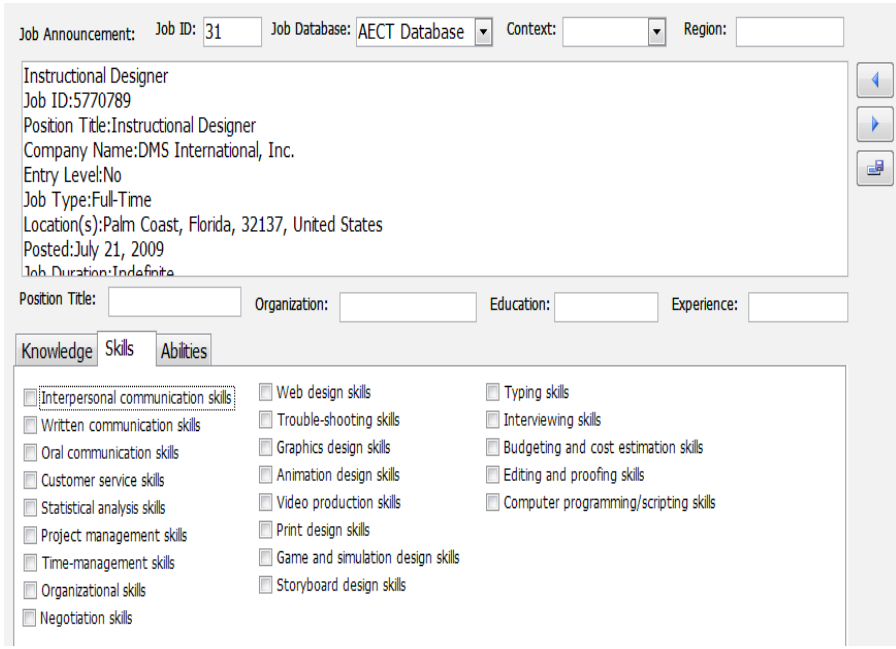

Figure 2. Screen caption of Access Database form used for coding.

During iteration two, the three members of the research team were provided a random sample of 10 job announcements to code independently using the coding form and the set of rules. Upon completion, the data were combined and the average inter-rater reliability was calculated at 84%. Any categories that had less than 80% of agreement across the three raters was carefully re-examined by the group during a discussion, and a new set of rules was generated. Given the high number of categories (87), scoring dif-

ferences were discussed and it was determined that cumulative inter-rater reliability of 84% was acceptable to continue the coding independently. During the final iteration, the job announcements split into three random samples and were coded by the members of the research team independently. They were then compiled into a final data set.

The job announcements included several job titles including instructional designers, curriculum developers, e-learning developers, courseware developers, and directors of instructional technology to name a few. Sixty-one percent of the job announcements were in the context of business/industry, 31.7% were higher education, 3.9% were government, and 3.4% were K-12 education. The job announcements required varying educational requirements (most requiring at least a bachelors degree), and required experience ranging from zero to 10 years. The job announcements were for regions all across the United States and some regions outside the United States (e.g., Afghanistan). The internal consistency reliability across the job announcements, as measured by the Kruder-Richardson 20, was acceptable at K-R 20 = .80 for knowledge, K-R 20 = .69 for skill, and K-R 20 = .73 for ability. The results are tabulated descriptively and shown in Appendix A.

Phase II: Survey of professionals

A survey was created on three specific domains: knowledge, skills, and abilities. The survey included a background section and 87 items in one of the three domains. The response scale for the items was: Not important at all (1); Important to a small extent (2); Important to some extent (3); Important to a moderate extent (4); and Important to a great extent (5). This response scale was adopted to gauge the relative importance of a competency from a professional's perspective. The instructions for participants to respond read "Please indicate the importance of the following (knowledge/skill/ability) statements in creating, using, and managing multimedia learning resources and processes." The instructions were derived from the conceptual framework, using a consistent and purposeful terminology. The internal consistency reliability, as measured by Cronbach's alpha, for the scale was very high in each domain at $\alpha = .96$ for knowledge, $\alpha = .93$ for skill, and $\alpha = .95$ for ability.

Two-hundred thirty-one respondents completed at least a portion of the survey. The survey was released to a wide audience via the ITFORUM listserv, INSTTECH listserv (Educause), AECT listserv, the Florida State University Alumni listserv, Arizona State University Alumni listserv, and the University of South Florida Alumni listserv. The survey was accessible for a three-week period, and during this time, two reminder emails were sent out. Since so many different listservs were used to recruit respondents, response rates cannot be determined.

Table 2 shows the demographic characteristics of the respondents. Fifty-eight percent of the respondents were female and the remaining male. The respondents represented a wide range of income levels with more than 75% of the respondents earning between $30,001 to $100,000 per year. On ethnicity, 79% of the respondents were White/Caucasian. More than 75% of the respondents had been in the field for zero to 12 years. Nearly 70% of the respondents represented the higher education context, followed by approximately 15% representing business/industry. More than 75% of the respondents had earned at least a master's degree.

Table 2
Demographic characteristics of respondents.

	n	%
Gender		
Female	135	58.44
Male	96	41.56
Income level		
$0-$30,000	33	14.29
$30,001 - $50,000	53	22.94
$50,001 - $75,000	80	34.63
$75,001 - $100,000	48	20.78
$100,001 - $150,000	11	4.76
> $150,000	6	2.60
Ethnicity		
American Indian/Alaska Native	1	0.43
Asian	17	7.36
Black/African American	7	3.03
Hispanic/Latino	8	3.46
Other	15	6.49
White/Caucasian	183	79.22
Years in Field		
0 - 4 years	69	29.87
5 - 8 years	54	23.38
9 - 12 years	52	22.51
13 - 16 years	23	9.96
17 - 20 years	6	2.60
Context		
Business/Industry	35	15.15
Currently Unemployed	9	3.90

	n	%
Government	6	2.60
Higher Education	161	69.70
K-12	19	8.23
Military	1	0.43
Highest Degree Earned		
High School	2	0.87
Associates	2	0.87
Bachelors	31	13.42
Masters	128	55.41
Specialist	5	2.16
Doctorate	63	27.27

The respondents were members of a wide range of professional associations, including 32% having membership in AECT, 20% having membership in ISTE, 12% in ASTD, 10% in ISPI, and 8.7% in AACE. Eighty-five percent of the respondents reside within the United States, and the remaining represent diverse international countries including South Africa, the Netherlands, the United Kingdom, and the United Arab Emirates. The average and standard deviation for each of the items is shown in Appendix B.

RESULTS

Interpretation of the results must be viewed within the limitations of this study. The job announcement analysis was based on job announcements posted for only one period of time and primarily in the United States. Since technology and practice changes at such a rapid pace, there is no guarantee these findings would be available in future job announcements. Further, there was great variability in the length of the job announcements, as some announcements were very specific in terms of the desired knowledge, skills, and abilities while others were not. The survey of professionals is limited to the honesty and expertise of those that responded. Additionally, the survey of professionals was biased to professionals in a higher education context in that professionals in higher education responded to the survey with greater frequency.

Job announcements analysis

The complete job announcements can be found in Appendix A. This section summarizes the results that most frequently occurred during the job announcements analysis.

Knowledge domain: Table 3 shows the top ten most frequently coded items in the job analysis for the knowledge domain. The results indicate that more than 80% of the job postings required knowledge of bitmap image software and vector image software such as Photoshop and Illustrator, respectively. More than 70% of the job postings also required knowledge of video software, audio software, and screen recording software such as Camtasia. Web authoring tools such as Dreamweaver and desktop publishing software such as PageMaker were coded in more than 50% of the job announcements. Mention of instructional design models was found in approximately 46% of the job announcements. Finally, presentation software and word processing software were coded in more than 40% of the job announcements.

Table 3

Knowledge domain top ten items from job announcement analysis.

Knowledge Domain	n	%	Rank
Knowledge of bitmap image software (e.g., Photoshop)	166	80.98%	1
Knowledge of vector image software (e.g., Illustrator)	164	80.00%	2
Knowledge of video software (e.g., Premiere)	163	79.51%	3
Knowledge of audio software (e.g., Audacity)	160	78.05%	4
Knowledge of screen recording software (e.g., Captivate or Camtasia)	149	72.68%	5
Knowledge of web authoring tools (e.g., Dreamweaver)	130	63.41%	6
Knowledge of desktop publishing software (e.g., PageMaker)	117	57.07%	7
Knowledge of instructional design models/principles (e.g., Dick & Carey)	96	46.83%	8
Knowledge of presentation software (e.g., PowerPoint)	93	45.37%	9
Knowledge of word processing software (e.g., Word)	83	40.49%	10

Skill domain: Table 4 shows the top ten skills from the job announcement analysis. As can be gleaned, graphics design, oral communication, and written communication skills were found in more than 60% of the job announcements. More than half of the job announcements included mention of web design, print design, and interpersonal communication skills. Video production and project management skills were found in more than 30% of the job announcements. Finally, computer programming /scripting and organizational skills were coded in more than 20% of the job announcements.

Table 4
Skill domain top ten items from job announcement analysis.

Skill Domain	n	%	Rank
Graphics design skills	141	68.78%	1
Oral communication skills	129	62.93%	2
Written communication skills	124	60.49%	3
Web design skills	121	59.02%	4
Print design skills	115	56.10%	5
Interpersonal communication skills	106	51.71%	6
Video production skills	67	32.68%	7
Project management skills	63	30.73%	8
Computer programming/scripting skills	52	25.37%	9
Organizational skills	49	23.90%	10

Ability domain: Table 5 shows the top ten ability items from the job announcement analysis. The most important is the ability to create effective instructional products, which was coded in more than 70% of the job announcements. A close second is the ability to work well with others in teams at 60%. The ability to work with diverse constituencies, apply sound instructional design principles, and the ability to conduct evaluation were coded in more than 30% of the job announcements. The ability to work under deadlines, teach face-to-face, work independently, and manage teams was coded in more than 20% of the job announcements.

Table 5
Ability domain top ten items from job announcement analysis.

Ability Domain	n	%	Rank
Ability to create effective instructional products	149	72.68%	1
Ability to work well with others (in teams)	124	60.49%	2
Ability to work with diverse constituencies (e.g., SMEs and clients)	80	39.02%	3
Ability to apply sound instructional design principles	71	34.63%	4
Ability to conduct a needs assessment	69	33.66%	5
Ability to conduct evaluation (formative/summative)	66	32.20%	6
Ability to work under deadlines	60	29.27%	7
Ability to teach face-to-face	60	29.27%	8
Ability to work independently	59	28.78%	9
Ability to manage teams	55	26.83%	10

Survey of professionals

The complete survey of professionals can be found in Appendix B. This section summarizes the results that were the highest scoring averages from the survey of professionals.

Knowledge domain: Table 6 shows the highest scoring items from the survey of professionals in the knowledge domain. The two most important areas according to the professional survey include knowledge of instructional design models and principles as well as knowledge of assessment methods. Knowledge of course management systems and web 2.0 technologies such as blogs and wikis also scored relatively high. Additionally, knowledge of copyright and cognitive theories of learning was important. In terms of tools, presentation software, screen recording software, web authoring tools, and word processing software were in the top ten highest scores.

Table 6

Knowledge domain top ten items from survey of professionals.

Knowledge Domain	M	SD	Rank
Knowledge of instructional design models/principles (e.g., Dick & Carey)	4.23	0.94	1
Knowledge of assessment methods	4.23	0.96	2
Knowledge of course/learning management systems (e.g., Blackboard or Moodle)	4.20	0.99	3
Knowledge of Web 2.0 technology (e.g., Wikis, Blogs, Podcasts, etc.)	4.12	1.07	4
Knowledge of copyright laws	4.08	1.03	5
Knowledge of cognitive theories of learning	4.07	1.03	6
Knowledge of presentation software (e.g., PowerPoint)	4.03	1.11	7
Knowledge of screen recording software (e.g., Captivate or Camtasia)	4.03	0.94	8
Knowledge of web authoring tools (e.g., Dreamweaver)	3.96	0.99	9
Knowledge of word processing software (e.g., Word)	3.92	1.04	10

Skill domain: Table 7 shows the highest scoring items from the survey of professionals in the skill domain. Written communication skills scored the highest from the survey of professionals, shortly followed by interpersonal communication skills. Computer programming/scripting skills ranked third. Also important were oral communication skills, time-management skills, organizational skills, customer service skills, editing and proofing skills, and project management skills.

Table 7
Skill domain top ten items from survey of professionals.

Skill Domain	M	SD	Rank
Written communication skills	4.66	0.72	1
Interpersonal communication skills	4.64	0.75	2
Computer programming/scripting skills	4.60	0.79	3
Oral communication skills	4.51	0.82	4
Time-management skills	4.44	0.89	5
Organizational skills	4.44	0.81	6
Trouble-shooting skills	4.36	0.93	7
Customer service skills	4.29	0.95	8
Editing and proofing skills	4.15	0.96	9
Project management skills	3.98	1.06	10

Ability domain: Table 8 shows the highest scoring items from the survey of professionals in the ability domain. The most important was the ability to apply multimedia design principles to design and development, followed by the ability to create effective instructional products. The third most important was the ability to work under deadlines, while the fourth was the ability to operate computer hardware. Also important was the ability to work with diverse constituencies, ability to work in team and manage teams, ability to adapt and learn new technology and processes, ability to work independently, and the ability to work with synchronous technology.

Table 8
Ability domain top ten items from survey of professionals.

Ability Domain	M	SD	Rank
Ability to apply multimedia design principles to design and development	4.76	0.64	1
Ability to create effective instructional products	4.64	0.80	2
Ability to work under deadlines	4.60	0.80	3
Ability to operate computer hardware	4.59	0.81	4
Ability to work with diverse constituencies (e.g., SMEs and clients)	4.58	0.80	5
Ability to work well with others (in teams)	4.56	0.77	6
Ability to manage teams	4.54	0.80	7
Ability to adapt and learn new technology and processes	4.49	0.89	8
Ability to work independently	4.48	0.87	9
Ability to work with synchronous technology	4.34	0.89	10

Lowest Rated Competencies

Table 9 lists the ten most lowly-rated competencies among the three categories combined (knowledge, skill, and ability) from the professional survey. The least important competency was knowledge of programming languages, followed by knowledge of game engines, and knowledge of server-side scripting languages. The fourth least important competency was the knowledge of 3D modeling tools, and the fifth being game and simulation design skills.

Table 9

Lowest ten items from survey of professionals.

All Domains	M	SD	Rank
Knowledge of programming languages (e.g., C++)	2.21	1.21	87
Knowledge of game engines (e.g., Torque)	2.51	1.08	86
Knowledge of server-side scripting languages (e.g., PHP)	2.56	1.22	85
Knowledge of 3D modeling tools (e.g., Maya)	2.61	1.13	84
Game and simulation design skills	2.81	1.16	83
Knowledge of virtual environments (e.g., SecondLife)	2.83	1.11	82
Knowledge of project management software (e.g, Microsoft Project)	2.86	1.09	81
Knowledge of accessibility software (e.g., JAWS)	2.9	1.28	80
Knowledge of client-side scripting languages (e.g., JavaScript)	2.93	1.19	79
Knowledge of database software (e.g., Access)	2.99	1.09	78

Table 10 lists the ten most lowly-rated competencies from the job posting analysis among the three categories combined (knowledge, skill and ability). Knowledge of Mayer's multimedia principles was the lowest, followed by knowledge of game engines, typing skills, and knowledge of accessibility software.

Table 10
Lowest ten items from job posting analysis.

All Domains	n	%	Rank
Knowledge of Mayer's multimedia principles (e.g., Modality principle)	1	0.49%	87
Knowledge of game engines (e.g., Torque)	1	0.49%	86
Typing skills	1	0.49%	85
Knowledge of accessibility software (e.g., JAWS)	2	0.98%	84
Negotiation skills	3	1.46%	83
Ability to sit at a computer for extended periods	4	1.95%	82
Knowledge of motivation theories (e.g., ARCS)	5	2.44%	81
Knowledge of virtual environments (e.g., SecondLife)	6	2.93%	80
Interviewing skills	8	3.90%	79
Knowledge of copyright laws	9	4.39%	78

DISCUSSION

This study has resulted in several interesting findings. To illustrate these findings, we must first explore the intersection between the job announcements analysis and survey of professionals. In the knowledge domain, knowledge of instructional design models and principles was important in both the job announcements analysis and survey of professionals. Further, in terms of software tools, presentation software, word processing software, web authoring tools, and screen recording software were important in both the job announcements analysis and survey of professionals. This is consistent with the current trends in the field and graduates are expected to not only have knowledge of the instructional design models and principles, but also the hands on tools required to create effective instructional products. This finding is also aligned with the instructional design model competency delineated by Kenny, Zhang, Schwier and Campbell (2007). Their instructional design model competency states that instructional designers should be well-versed in a number of instructional design models and strategies. Nine of the top ten knowledge competencies from job announcement analysis , and six of the top ten from the survey of professionals confirm that educational technologists should be competent in important and advanced software (bitmap image editing, vector image editing, audio software, video software, web authoring, screen recording etc) that is currently used in the field. This finding is once again aligned with the technology skill competency listed by Kenny, Zhang, Schwier and Campbell (2007).

In the skill domain, both written and oral communication skills were very important. Also important to this domain was interpersonal communication skills, organizational skills, project management skills, and computer programming/scripting skills as they scored in the top ten of both the job announcements analysis and survey of professionals. This finding aligns with the communication skills competencies that Kenny, Zhang, Schwier and Campbell (2007) stated: "Instructional designers should be able to communicate effectively with clients, subject matter experts, and other team members both verbally and in writing" (p.13). A number of studies have listed communication to be one of the essential skills for instructional designers (Allen , 1996; Cox, 2003; Liu et al. 2002; Rowley et al. 2002). IBSTPI has listed communication as one of the essential skills in the professional foundations category where instructional designers should be able to communicate effectively in visual, oral and written form. To be an efficient educational technologist, project management skills were also rated very high along with the communication skills. This finding reinforces that a number of educational technologists are managing instructional development projects and are expected to play the role of a project manager along with being an educational technologists; hence communication skills and project management skills have been rated high. A number of researchers have identified project management to be one of the essential skills (Allen 1996; Bichelmeyer et al. 2001; Cox, 2003; Cox & Osguthorpe, 2003; Rowley et al. 2002).

In the ability domain, the ability to create effective instructional products, work well with others, work with diverse constituencies, work under deadlines, and manage teams were significant to both the job announcements analysis and survey of professionals. Educational technology projects are usually team-based and the educational technologist is expected to be able to be a team member, manage a team, and also work independently. The educational technologist works with graphic designers, programmers, and developers in a typical situation. In higher education, the educational technologist works with the faculty member and other technology staff to develop technology-enhanced, online courses (Kenny et al, 2007). IBSTPI lists collaboration an advanced competency in the management and implementation category and states "Promote collaboration, partnerships and relationships among the participants in a design project" (p.1).

It was also interesting to note that the knowledge of game engines, virtual environments (e.g., Second Life), and accessibility software were rated among the lowest ten required competencies in both the survey and from the job posting analysis. Virtual environments like Second Life and game engines are growing popularity in the field. We now have educational gaming

conferences (e.g., Games + Learning + Society), educational gaming journals (e.g., International Journal of Gaming and Computer-Mediated Simulations), and several new educational game companies that use the powerful technology to harness the interest of learners (e.g., Muzzy Lane or Tabula Digita). It may be that the job postings and professionals that responded to the survey have not yet ventured into this new domain.

RECOMMENDATIONS

Based on our results, we provide recommendations to employers, educational technology programs, and professionals. These recommendations are intended to assist in using the results from this study to better inform practice.

Employers. To employers, we recommend providing more specificity within the job announcements themselves. Some of the job announcements were very specific about the knowledge, skills, and abilities potential applicants should have, while many provided unspecific accounts of the job requirements. Providing more in-depth descriptions will enable potential applicants to match their background and experience to the competencies required to function successfully on the job. Specifically, we recommend the use of knowledge, skill, and ability statements within the job announcements themselves. Some might come from the conceptual framework of multimedia competencies provided in this manuscript.

We also recommend providing employees the necessary tools and resources to successfully execute their job function. The field of educational technology draws from many human and capital resources, and consequently, the number and variety of tools professionals will need to carry out their work is vast. Employers need to carefully assess the types of instructional products their organization will strive to develop and assure their staff is well-equipped with the appropriate tools to create, use, and manage these products.

Educational technology programs. To educational technology programs, we recommend a continued focus on covering instructional design principles, group project-based learning opportunities with deadlines, and increased access and exposure to multimedia authoring tools. Our results show that knowledge of instructional design models is a key area in both the professional survey and job announcements analysis. Further, our results suggest that professionals in the field must be able to work well within teams, manage teams, and work with diverse constituencies. Forming the expectations of the program so that students work within groups on projects with deadlines will help prepare students for the expectations of the workforce. The focus of these projects should be on the creation of effec-

tive instructional products using a variety of authoring tools, including presentation software, screen recording software, web authoring tools, bitmap and vector image production software, video and audio production software, word processing software, and desktop publishing software.

Professionals. To professionals, we recommend continued professional development to inform practice and use of key technology. Professionals should join professional associations (e.g., AECT) and attend relevant conferences and workshops to acquire the necessary knowledge, skills, and abilities to function in the workforce. Further, we recommend that professionals match the results of this work to their current competencies to identify gaps. These perceived gaps will assist professionals in seeking their professional development opportunities and assure that professionals are up to date in current trends.

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Appendix A: Job Announcements Statistics.

Knowledge Domain	n	%
Knowledge of cognitive theories of learning	18	8.78%
Knowledge of motivation theories (e.g., ARCS)	5	2.44%
Knowledge of adult learning theory	43	20.98%
Knowledge of instructional design models/principles (e.g., Dick & Carey)	96	46.83%
Knowledge of Mayer's multimedia principles (e.g., Modality principle)	1	0.49%
Knowledge of project management body of knowledge (PMBOK)	37	18.05%
Knowledge of accessibility (e.g., Section 508)	14	6.83%
Knowledge of copyright laws	9	4.39%
Knowledge of computer networks	20	9.76%
Knowledge of assessment methods	52	25.37%
Knowledge of computer hardware	32	15.61%
Knowledge of word processing software (e.g., Word)	83	40.49%
Knowledge of spreadsheet software (e.g., Excel)	80	39.02%
Knowledge of presentation software (e.g., PowerPoint)	93	45.37%
Knowledge of database software (e.g., Access)	57	27.80%
Knowledge of web authoring tools (e.g., Dreamweaver)	130	63.41%
Knowledge of desktop publishing software (e.g., PageMaker)	117	57.07%
Knowledge of bitmap image software (e.g., Photoshop)	166	80.98%
Knowledge of vector image software (e.g., Illustrator)	164	80.00%
Knowledge of audio software (e.g., Audacity)	160	78.05%
Knowledge of video software (e.g., Premiere)	163	79.51%
Knowledge of screen recording software (e.g., Captivate or Camtasia)	149	72.68%
Knowledge of educational authoring software (e.g., Toolbook or Authorware)	46	22.44%
Knowledge of course/learning management systems (e.g., Blackboard or Moodle)	78	38.05%
Knowledge of content management systems (e.g., Joomla)	28	13.66%
Knowledge of 3D modeling tools (e.g., Maya)	9	4.39%
Knowledge of game engines (e.g., Torque)	1	0.49%
Knowledge of client-side scripting languages (e.g., JavaScript)	65	31.71%
Knowledge of Flash (and ActionScript)	60	29.27%
Knowledge of Cascading Style Sheets (CSS)	30	14.63%
Knowledge of markup languages (e.g., HTML/XHTML/XML)	59	28.78%

Knowledge of project management software (e.g, Microsoft Project)	16	7.80%
Knowledge of virtual environments (e.g., SecondLife)	6	2.93%
Knowledge of server-side scripting languages (e.g., PHP)	12	5.85%
Knowledge of programming languages (e.g., C++)	47	22.93%
Knowledge of learning object standards (e.g., SCORM)	31	15.12%
Knowledge of accessibility software (e.g., JAWS)	2	0.98%
Knowledge of Web 2.0 technology (e.g., Wikis, Blogs, Podcasts, etc.)	17	8.29%
Knowledge of assessment software (e.g., Respondus)	22	10.73%
Knowledge of virtual classrooms (e.g.,Wimba or Elluminate! Live)	12	5.85%
Knowledge of streaming video technology (e.g., Windows Media Server)	9	4.39%
Skill Domain	**n**	**%**
Interpersonal communication skills	106	51.71%
Written communication skills	124	60.49%
Oral communication skills	129	62.93%
Customer service skills	40	19.51%
Negotiation skills	3	1.46%
Statistical analysis skills	11	5.37%
Project management skills	63	30.73%
Time-management skills	40	19.51%
Organizational skills	49	23.90%
Web design skills	121	59.02%
Trouble-shooting skills	37	18.05%
Graphics design skills	141	68.78%
Animation design skills	38	18.54%
Video production skills	67	32.68%
Print design skills	115	56.10%
Game and simulation design skills	9	4.39%
Storyboard design skills	26	12.68%
Typing skills	1	0.49%
Interviewing skills	8	3.90%
Budgeting and cost estimation skills	30	14.63%
Editing and proofing skills	17	8.29%
Computer programming/scripting skills	52	25.37%
Ability Domain	**n**	**%**
Ability to apply multimedia design principles to design and development	41	20.00%

Ability to create effective instructional products	149	72.68%
Ability to apply sound instructional design principles	71	34.63%
Ability to develop accessible instructional products	23	11.22%
Ability to conduct a needs assessment	69	33.66%
Ability to conduct a task analysis	30	14.63%
Ability to work with synchronous technology	24	11.71%
Ability to work with asynchronous technology	21	10.24%
Ability to sit at a computer for extended periods	4	1.95%
Ability to manage teams	55	26.83%
Ability to work well with others (in teams)	124	60.49%
Ability to work independently	59	28.78%
Ability to work on multiple projects (multi-task)	54	26.34%
Ability to work in multiple operating systems (e.g., Mac/PC/Linux)	19	9.27%
Ability to conduct evaluation (formative/summative)	66	32.20%
Ability to develop and administer sound assessments	40	19.51%
Ability to operate computer hardware	27	13.17%
Ability to adapt and learn new technology and processes	39	19.02%
Ability to work with diverse constituencies (e.g., SMEs and clients)	80	39.02%
Ability to work under deadlines	60	29.27%
Ability to prioritize work	42	20.49%
Ability to teach online	23	11.22%
Ability to teach face-to-face	60	29.27%

Appendix B; Descriptive Statistics of Survey.

Knowledge Domain	M	SD
Knowledge of cognitive theories of learning	4.07	1.03
Knowledge of motivation theories (e.g., ARCS)	3.75	1.07
Knowledge of adult learning theory	3.91	1.08
Knowledge of instructional design models/principles (e.g., Dick & Carey)	4.23	0.94
Knowledge of Mayer's multimedia principles (e.g., Modality principle)	3.70	1.15
Knowledge of project management body of knowledge (PMBOK)	3.36	1.06
Knowledge of accessibility (e.g., Section 508)	3.67	1.19
Knowledge of copyright laws	4.08	1.03
Knowledge of computer networks	3.18	1.13
Knowledge of assessment methods	4.23	0.96
Knowledge of computer hardware	3.28	1.06
Knowledge of word processing software (e.g., Word)	3.92	1.04
Knowledge of spreadsheet software (e.g., Excel)	3.46	1.08
Knowledge of presentation software (e.g., PowerPoint)	4.03	1.11
Knowledge of database software (e.g., Access)	2.99	1.09
Knowledge of web authoring tools (e.g., Dreamweaver)	3.96	0.99
Knowledge of desktop publishing software (e.g., PageMaker)	3.08	1.17
Knowledge of bitmap image software (e.g., Photoshop)	3.80	1.03
Knowledge of vector image software (e.g., Illustrator)	3.26	1.13
Knowledge of audio software (e.g., Audacity)	3.77	1.08
Knowledge of video software (e.g., Premiere)	3.65	1.15
Knowledge of screen recording software (e.g., Captivate or Camtasia)	4.03	0.94
Knowledge of educational authoring software (e.g., Toolbook or Authorware)	3.15	1.21
Knowledge of course/learning management systems (e.g., Blackboard or Moodle)	4.20	0.99
Knowledge of content management systems (e.g., Joomla)	3.29	1.11
Knowledge of 3D modeling tools (e.g., Maya)	2.61	1.13
Knowledge of game engines (e.g., Torque)	2.51	1.08
Knowledge of client-side scripting languages (e.g., JavaScript)	2.93	1.19
Knowledge of Flash (and ActionScript)	3.28	1.11
Knowledge of Cascading Style Sheets (CSS)	3.42	1.16
Knowledge of markup languages (e.g., HTML/XHTML/XML)	3.67	1.05
Knowledge of project management software (e.g, Microsoft Project)	2.86	1.09
Knowledge of virtual environments (e.g., SecondLife)	2.83	1.11

Knowledge of server-side scripting languages (e.g., PHP)	2.56	1.22
Knowledge of programming languages (e.g., C++)	2.21	1.21
Knowledge of learning object standards (e.g., SCORM)	3.06	1.26
Knowledge of accessibility software (e.g., JAWS)	2.90	1.28
Knowledge of Web 2.0 technology (e.g., Wikis, Blogs, Podcasts, etc.)	4.12	1.07
Knowledge of assessment software (e.g., Respondus)	3.40	1.22
Knowledge of virtual classrooms (e.g.,Wimba or Elluminate! Live)	3.68	1.15
Knowledge of streaming video technology (e.g., Windows Media Server)	3.53	1.16
Skill Domain	**M**	**SD**
Interpersonal communication skills	4.64	0.75
Written communication skills	4.66	0.72
Oral communication skills	4.51	0.82
Customer service skills	4.29	0.95
Negotiation skills	3.96	1.01
Statistical analysis skills	3.10	1.07
Project management skills	3.98	1.06
Time-management skills	4.44	0.89
Organizational skills	4.44	0.81
Web design skills	3.76	0.98
Trouble-shooting skills	4.36	0.93
Graphics design skills	3.56	1.08
Animation design skills	3.07	1.13
Video production skills	3.28	1.13
Print design skills	3.24	1.06
Game and simulation design skills	2.81	1.16
Storyboard design skills	3.72	1.18
Typing skills	3.75	1.20
Interviewing skills	3.62	1.09
Budgeting and cost estimation skills	3.47	1.11
Editing and proofing skills	4.15	0.96
Computer programming/scripting skills	4.60	0.79
Ability Domain	**M**	**SD**
Ability to apply multimedia design principles to design and development	4.76	0.64
Ability to create effective instructional products	4.64	0.80
Ability to apply sound instructional design principles	4.23	0.94
Ability to develop accessible instructional products	4.19	1.01

Ability to conduct a needs assessment	4.06	1.02
Ability to conduct a task analysis	4.00	1.10
Ability to work with synchronous technology	4.34	0.89
Ability to work with asynchronous technology	4.01	1.14
Ability to sit at a computer for extended periods	3.89	1.00
Ability to manage teams	4.54	0.80
Ability to work well with others (in teams)	4.56	0.77
Ability to work independently	4.48	0.87
Ability to work on multiple projects (multi-task)	3.44	1.26
Ability to work in multiple operating systems (e.g., Mac/PC/Linux)	4.06	1.02
Ability to conduct evaluation (formative/summative)	4.02	1.03
Ability to develop and administer sound assessments	4.09	1.04
Ability to operate computer hardware	4.59	0.81
Ability to adapt and learn new technology and processes	4.49	0.89
Ability to work with diverse constituencies (e.g., SMEs and clients)	4.58	0.80
Ability to work under deadlines	4.60	0.80
Ability to prioritize work	3.74	1.15
Ability to teach online	3.66	1.20
Ability to teach face-to-face	4.16	1.05