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RESEARCH ARTICLE

Examining competencies for the instructional design professional: An exploratory job announcement analysis

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Abstract

The purpose of this study is to examine core professional competencies for instructional designers through a job announcement analysis involving both qualitative and quantitative produces used on a qualitative data source. Using a conceptual framework as a guide, we extracted and examined a total of $N = 1030$ unique job announcements obtained from September to October 2019 from three popular job search databases: Glassdoor.com, Indeed.com and Monster.com. Using a systematic content analysis coding procedure, we coded the absence or presence of $N = 185$ competencies organized into knowledge, skill and ability statements (80 knowledge statements, 43 skill statements and 62 ability statements). These data were analysed using exploratory factor analysis models for dichotomously scored data, resulting in meaningful factors that are representative of these data. Our results highlight critical competencies for professional instructional designers in each domain, including *soft skills*, *the ability to work with diverse stakeholders* and more technical competencies like *knowledge* of *video and audio authoring*. The study provides a current snapshot of the knowledge, skills and abilities of instructional designers across settings. We provide a comprehensive discussion of our limitations, findings related to similar works, implications and suggestions for future research.

INTRODUCTION

Instructional design as a profession is a dynamic and complex field with rapid technological developments and diverse learning environments. Instructional design professionals, graduates and professors often wonder about the needed qualifications and competencies in the current job market to be proficient in the instructional design field; however, 'no one person can be expected to be fully competent in all related skills and knowledge' (IBSTPI, 2012, p. 2). To overcome these challenges, instructional design organizations and academic programmes in higher education institutions have been making great efforts to identify professional standards for instructional designers. Researchers also have examined the evolution of instructional designer competencies and standards via multiple approaches over the decades to inform academic programmes to improve graduate students' preparedness before entering into the instructional design workplace. Drawing on previous research foundations, there is an ongoing need to examine competencies for instructional design professionals based on the expectations in the job setting.

REVIEW OF RELEVANT LITERATURE

Instructional design competencies and standards

Fundamental competencies are desired for instructional design practitioners to be qualified in workplaces, particularly knowledge of educational philosophy, learning theory and instructional theory; skills of applying principles and methodologies of instructional system design; and capabilities or experiences in creating effective instructional learning environments (Tennyson, 2001). Richey et al. (2001) defined these competencies as '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' (p. 26). Similarly, Ritzhaupt and Martin (2014) viewed competencies as 'generally measurable or observable knowledge, skills, abilities, attitudes and behaviors critical to successful job performance' (p. 15). El Asame and Wakrim (2018) defined competency as 'a set of personal characteristics (skills, knowledge, attitudes, etc.) that a person requires or needs to acquire, in order to perform an activity inside a certain context with a specific performance level' (p. 228). From these definitions, it is evident that in order to establish professional norms and measurable outcomes, instructional design professionals have developed and continued to refine the competencies.

Several professional organizations, such as the International Board of Standards for Training, Performance and Instruction (IBSTPI), International Society for Performance Improvement (ISPI), Association for Talent Development (ATD), Association for Educational Communications and Technology (AECT), International Society for Technology in Education (ISTE), Online Learning Consortium and University Professional and Continuing Education Association (UPCEA) have also proposed standards. The IBSTPI provides 22 Instructional Design Competencies (2012) each corresponding to one of the three levels of expertise for all instructional designers, advanced instructional designers and managers of instructional design. These competencies are categorized into five domains: professional foundations, planning and analysis, design and development, evaluation and implementation and management, with a total of 105 specific performance statements. The ISPI provided training to certify performance technologists drawing on ten professional standards, including four standards focusing on the fundamental training principles, such as focusing on results or outcomes, taking a systematic view, adding value and working in partnership with clients and stakeholders; and six standards focusing on the systematic process to develop a competent performance with an advanced level of proficiency, such as determining need or opportunity, design solutions including implementation and evaluation, ensuring solutions' conformity and feasibility, and evaluating results and impacts (ISPI) (ISPI, 2020). The ATD released its Talent Development Capability Model™ (2019) with three fundamental domain practices: developing professional capability, impacting organizational capability and building personal capabilities, with a total of 23 capabilities that learning and development professional should have, including instructional design, learning sciences, organization development and culture, change management, embodied intelligence and decision making, compliance and ethical behaviour, etc. (ATD, 2020).

Professional organizations have also established standards for educational leaders, educators, coaches and students in the instructional design learning community and provide foundations for an academic degree or certificate programmes specializing in learning, design and technology to prepare the graduates for the evolving needs of the job market. For example, AECT (2012) provides standards for educational technologies in five areas including *content knowledge, content pedagogy*, *learning environments*, *professional knowledge and skills*, and *research*. Each area of this standard is categorized through five indicators of theoretical foundation, method, assessment/evaluation and ethics. Another professional organization primarily supporting K-12 educators, ISTE has five primary standards including the standard for educators specifying the role of educator as a designer to be able to 'design authentic, learner-driven activities and environments that recognize and accommodate learner variability' (ISTE, 2020). The standard for coaches emphasizes that learning designers should be able to 'model and support educators to design learning experiences and environments to meet the needs and interests of all students' (ISTE, 2020).

Instructional design competencies in different professional sectors

Instructional designers have been employed across varied settings, such as corporate, government, non-profit and educational sectors (Klein & Jun, 2014; Ritzhaupt & Kumar, 2015). From the employers' perspective, Klein and Kelly (2018) noted that business and industry are the most common work settings for instructional designers, followed by higher education, consulting and health care. Klein and Kelly also identified that the five foremost skills that instructional designers should have are: *instructional design*, *instructional technology*, *communication* and *interpersonal skills*, *management* and *personal skills*. Furthermore, instructional designers play distinct roles, such as 'performance analyst, project manager, strategic and learning consultant, researcher, instructor, writer, project manager, media and web developer, trainer, evaluator and asset manager' (IBSTPI, 2012). As such, multiple alternatives to the title of instructional designer have become common in the job market, such as educational designer, instructional technologist, learning designer, curriculum developer, e-learning developer, online training consultant, training manager and performance-improvement consultant (Klein & Jun, 2014; Klein & Kelly, 2018; Ritzhaupt et al., 2010). These titles indicate nuanced variations in their job roles.

Instructional design professionals in non-education settings, such as corporate, government and non-profit sectors, require different competencies. For example, using a multimethod approach, Klein and Kelly (2018) first conducted a job announcement analysis with a set of 393 job announcements collected from www.simplyhired.com and www. Indeed.com and followed the analysis with individual interviews with 20 project managers. Findings demonstrated that half of the employers in the industry sector desired four competencies: using e-learning authoring software, effective collaboration, needs analysis skills and the foundation of learning theory and principles. Half of the employers in the consulting sector mentioned two competencies: creating learning solutions using the ADDIE model and collaborating effectively with multiple stakeholders. Half of the employers in the health care sector emphasized three competencies: expertise in ADDIE procedures, e-learning authoring software proficiency and effective communication. Focusing on the profession of the instructional design project manager, Van Rooij (2013) adopted the Delphi method and examined the perspective of chief learning officers from professional service sectors, such as finance and insurance, information technology, management and training/coaching. Van Rooij found that the most highly rated 12 instructional design competencies for project managers include abilities of, such as *listening to clients and team members*, *communicating effectively with various teams and key stakeholders*, demonstrating *keen understanding of how people learn*, *thinking critically for complex issues* and showing *business acumen* and *insight into the value of training*. In addition, researchers argued that different working experiences influence instructional designers' competencies (Hoard et al., 2019).

Instructional designers in the education sector, including higher education, are expected to have five competencies: effective collaboration skills, a foundation in learning theory and principles, effective communication through multimodal approaches, experience in e-learning authoring software and skills in using learning management systems and the ADDIE procedures (Klein & Kelly, 2018). In addition, researchers found that instructional designers in the educational sector do not require any formal coursework or academic credentials (Campbell et al., 2009; Cox & Osguthorpe, 2003). As such, instructional designers in the educational sector, with or without professional training, vary in their competencies due to their roles. For example, Ritzhaupt and Kumar (2015) conducted in-depth interviews with eight instructional designers who work in higher education settings (e.g. university, community college, career college, or for-profit college) and explored core knowledge and skills related to their jobs. These instructional designers had received professional training from their education and worked closely with faculty members on improving and developing existing or new coursework, promoting faculty professional development and communication, implementing and supporting the integration of learning management systems, maintaining websites, or providing technical support. Ritzhaupt and Kumar identified that the competencies that are most important for instructional design professionals in higher education include *instructional design and learning theory*, *soft skills and technical skills, willingness to learn on the job* and ability to *adapt to evolving products and technology*.

Job announcement analysis as a method to identify instructional design competencies

Researchers have utilized multiple approaches to identify competencies for instructional designers. These multiple methods include the Delphi method, job announcement analysis, survey-based research, in-depth interviews and a multimethod approach (Irby & Strong, 2015; Kang & Ritzhaupt, 2015; Klein & Kelly, 2018; Ritzhaupt et al., 2010, 2018; Ritzhaupt & Kumar, 2015; Rozitis, 2017; Sugar et al., 2007; Van Rooij, 2013). These approaches and methodologies provide different toolkits for researchers to examine instructional design professional competencies from different perspectives.

Amongst these techniques, the job announcement analysis has been considered as a common and powerful approach to identify key professional competencies in varied academic disciplines. This approach has advantages. First, on the level of data characteristics, the qualitative nature of a job announcement requires the employers to provide the most highly desired skills in a limited space. Information contained in the job advertisements represents a realistic and direct communication venue between the employers and their potential employees (Rios et al., 2020; Shetterly & Krishnamoorthy, 2008). The characteristics of a job announcement both indicate the relationship between the data itself and the characteristics' pertinence to a specific job position and enable the researchers to 'capture the datum's primary content and essence' for theory building (Saldaña, 2015, p. 4). Second, on the level of data collection, the job announcement analysis enables researchers to extract a large amount of data within a short amount of time (oftentimes 2–5 months) through web-based databases (e.g. Chronicle of Higher Education, Monster, Indeed, LinkedIn, Career Builder and Glassdoor) or through job databases provided by professional organizations, such as AECT, ASTD and ISPI (Kang & Ritzhaupt, 2015; Rios et al., 2020; Ritzhaupt et al., 2010, 2018; Ritzhaupt & Kumar, 2015; Ritzhaupt & Martin, 2014). Third, on the level of data application, information obtained from job advertisements were exploratory; as such it complements the limitations of a purely theory-driven framework (Burrus et al., 2013). Although the data collected could be temporary and periodical, findings from these analyses provide trends that will generate future discourse on professional competence.

CONCEPTUAL FRAMEWORK: KNOWLEDGE, SKILLS AND ABILITIES AS CORE PROFESSIONAL COMPETENCIES FOR INSTRUCTIONAL DESIGNERS

To guide the present job announcement analysis of instructional design professional competencies, we employed a conceptual framework that was developed and validated by Ritzhaupt et al. (2010), Ritzhaupt and Kumar (2015), Ritzhaupt and Martin (2014) (see Figure 1). This conceptual framework comprises three core competencies of general educational technologists: *creating*, *using*, and *managing* and connects these competencies to *knowledge*, *skill* and *ability* statements. The framework is inspired by the 2007 AECT definition of the field:

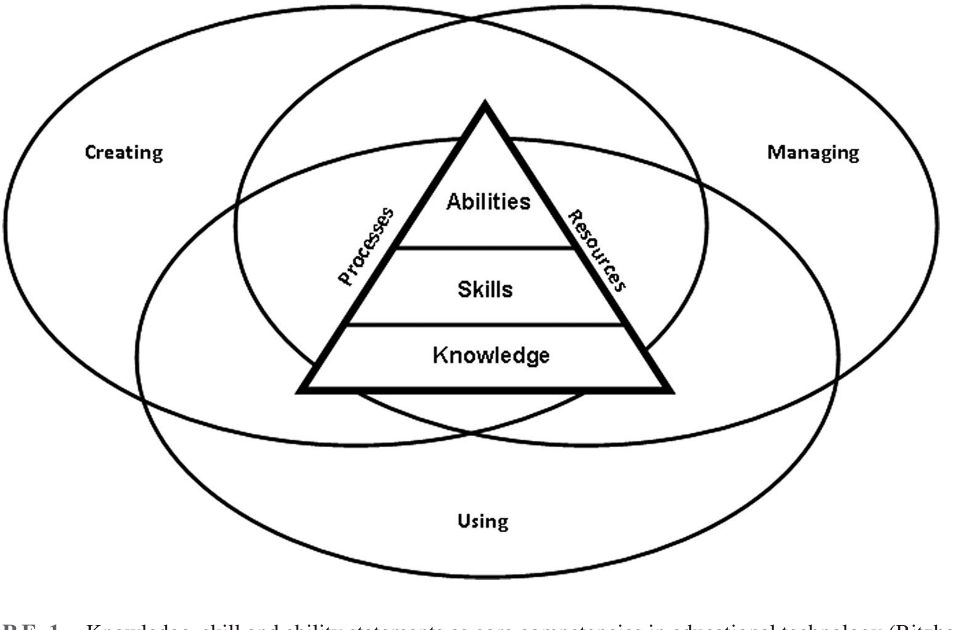

FIGURE 1 Knowledge, skill and ability statements as core competencies in educational technology (Ritzhaupt & Martin, 2014)

> Educational technology is the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources. (Januszewski & Molenda, 2007, p. 1)

In particular, each KSA statement addresses the three actionable terms of *create*, *use* and *manage* in this AECT definition. The *knowledge* statement emphasizes the information ‘of a factual or procedural nature’. For example, this could be an individual's knowledge of instructional design models and principles, of authoring tools, or of e-learning. The *skill* statement focuses on the ‘manual, verbal or mental manipulation of things’. For example, this could be an individual's skills in collaboration, research and oral and written communication. The *ability* statement refers to ‘the capacity to perform an observable activity’. For example, this could be an individual's ability to develop course materials, prioritize tasks, or develop an assessment (Ritzhaupt et al., 2010, p. 427). This conceptual framework intentionally places knowledge and skills below the abilities domain as the use of knowledge and skills are necessary to accomplish many of the observable activities. Previous researchers have also applied and adapted this conceptual framework, due to its generalizability, as a lens to contextualize educational technologists' competencies in different professional sectors, such as higher education institutions and corporate settings (Giacumo et al., 2018; Iqdami & Branch, 2016).

PURPOSE STATEMENT AND RESEARCH QUESTION

From reviewing the literature, it is evident that the expectations and job roles of instructional designers have changed over the years. This results in a need to identify competency required in different sectors in order to tailor their programme to train instructional designers who aspire to work in various settings (Van Rooij, 2013). Faculty in higher education need to provide flexibility and contextualized instruction for students in programmes to address different career sectors (Larson & Lockee, 2009). The university-industry relationship also plays a critical role in preparing graduates to be competitive in the changing job market. In this study, through a job announcement analysis of postings on three job boards from September to October 2019, we examined knowledge, skills and abilities required for instructional design professionals across professional settings.

Our overarching research question was: What are the professional instructional design competencies (knowledge, skills and abilities) evident from the job announcements for instructional design professionals?

METHOD

To understand the up-to-date competencies for instructional design professionals, we analysed job announcements in September and October 2019 from three popular job search databases. The final selection was coded according to a set of KSA statements that we implemented from previous research (Kang & Ritzhaupt, 2015; Ritzhaupt et al., 2018). While several taxonomies for mixed-method research exist, this research employs a mixed-methods research design involving the application of both qualitative and quantitative procedures on qualitative data sources, often referenced as a mixed model design (Tashakkori, & Teddlie, 1998). The methodology used in the job announcement analysis is described in detail in the following sections.

Data collection procedures

Selection of keywords

We selected eight relevant keywords to capture the various titles used by instructional designers: (a) instructional designer, (b) instructional developer, (c) educational designer, (d) educational developer, (e) learning designer, (f) learning developer, (g) curriculum designer and (h) curriculum developer.

Inclusion of job announcements

The information we are interested in includes both the basic information of each job posting and the detailed job description. The basic information in the job postings consists of job title, company name and location. All the information was collected simultaneously for the same period, from September 17th, 2019 to October 16th, 2019.

Selection of job search databases

Popular job search databases attract a good amount of both employers and job seekers for instructional design positions as shown in Table 1. To identify the most popular databases, we examined six different rankings of 2019 best job searching databases available online and developed a small ranking system. We looked for databases that were the most widely used and with the highest rankings. Meanwhile, the number of postings of the selected keywords for this research was also considered. We analysed the frequencies of all the databases listed on the six rankings websites and found that the top four databases were: Glassdoor.com, Indeed.com, LinkedIn.com and Monster.com. The four databases were the most widely used according to the rankings we referenced. Besides how widely the databases were used, the average rankings were analysed as well. Three of the most widely used databases—Glassdoor.com, Indeed.com and LinkedIn.com—also had the highest average rankings. Based on the analysis, we narrowed down the choices to the four most widely used databases and ran a trial search to see how many results each database would provide. Although Monster.com did not have a high average ranking, it provided a good number of search results for the keywords. Thus, we decided to include Monster.com as one of the databases we would use.

Extraction of job announcements

To extract the job announcement information we needed from each website, we selected two popular web scraping tools, Octoparse and ParseHub. After running a trial extraction for each database,

TABLE 1 Databases for the job announcement analysis and example keyword searches

Databases	Results # searching 'instructional designer'	Results # searching 'instructional developer'	Results # searching 'curriculum designer'
Indeed.com	2434	1447	1698
Glassdoor.com	7534	1441	1820
Monster.com	3078	977	202
LinkedIn	2000	402	377

we found that three of the four databases were available for extracting: Glassdoor, Indeed.com and Monster.com. Hence, the final selection of databases included these three and excluded LinkedIn. After establishing our data collection procedures, we scraped all of the job announcements from each database during the same time period and stored these data in spreadsheets for subsequent analyses.

Data coding procedures

From the three databases, 1870 job announcements were originally collected, but 840 announcements were removed due to incomplete information and duplicates. A total of 1030 job announcements were finally selected for coding and analysing. We followed a systematic procedure for coding the job announcements. Each job announcement was assigned a unique number for identification purposes. We extracted basic information from each job announcement, including the job title, company name and work location. Additionally, we extracted education requirements, context information and coded based on the KSA statements. We attempted to secure the salary information, but this detail was rarely reported in the job announcements. Kang and Ritzhaupt (2015) defined a set of most significant KSA statements for educational technology professionals. We employed these KSA statements and modified them according to the current job announcements. The KSA statements used in this research were finalized as 80 Knowledge statements, 43 Skills statements and 62 Abilities statements.

Two team members were involved in the systematic coding process. Following the guidelines for content analysis (Bengtsson, 2016), the data were carefully examined for the presence or absence of competency by careful examination of each job announcement. First, both team members studied the KSA statements together and created the initial codebook. Second, they coded a random sample of job announcements ($n = 50$) individually and periodically compared the consistency of their coding results until they had at least 80 per cent inter-rater agreement in their coding procedures. Coding differences were resolved by discussion between the two team members until consensus was achieved. A standardized spreadsheet was used to code each job announcement to ensure consistency and transparency in the process. Both team members stayed in constant communication during the coding process to resolve coding differences. The full coding process took approximately three months to complete between the two team members.

Characteristics of job announcements

The 1030 job announcements were coded and analysed, of which 53 per cent of the postings were from Glassdoor, 27 per cent from Indeed.com and 20 per cent from Monster.com. Nine hundred eighty-four positions (95.5 per cent of the total) indicated the working location, which spread over 49 states, Washington D.C. and Puerto Rico. Almost one-quarter of the positions were in California and Texas (see Table 2).

Over 99 per cent of the job announcement indicated the working context of the positions. To categorize the contexts of the job descriptions, we adopted the *North American Industry Classification System* (NAICS). NAICS is a system of classification of economic activities and the system was developed by *The Instituto Nacional de Estadística y Geografía* (INEGI) of Mexico, Statistics Canada and the United States Office of Management and Budget. (United States Census, 2017) According to the context described in the job descriptions and the definitions of each industry mentioned in NAICS, we concluded that there are 11 contexts mentioned within announcements. We listed the contexts with over 5 per cent proportion of the job descriptions shown in Table 3. The majority of the instructional

TABLE 2 Top 10 work locations of job positions

Locations	*n*	%
California	128	13.01
Texas	104	10.57
Florida	66	6.71
Georgia	56	5.69
New York	54	5.49
Virginia	54	5.49
Illinois	42	4.27
Washington	40	4.07
North Carolina	34	3.46
New Jersey	33	3.35

TABLE 3 Context of job announcements

Context	*n*	%
Professional, scientific and technical services	385	37.38
Educational services	196	19.03
Health care and social assistance	103	10.00
Information	87	8.45
Finance and insurance	84	8.16

design jobs were in Professional, Scientific and Technical Services (37.38 per cent), Educational Services (19.03 per cent) and Health Care and Social Assistance (10 per cent).

Only about 27 per cent of the job announcements did not mention the minimum educational requirements for the position, while the vast majority of announcements required a Bachelor's degree (62.5 per cent) and 7.4 per cent required a master's degree. As can be gleaned in Table 4, only two of the announcements required doctoral degrees, and 11 only required a high school diploma.

Data analysis procedures

Data were first analysed descriptively using SPSS version 25 by computing the frequencies and percentages for each item within a domain. We did this to detect if any of the items were not observed in the job announcements, which is problematic for an exploratory factor analysis model as the approach is based on variability. We chose exploratory factor analysis to examine these data since it is a robust data reduction method and since we have 185 variables in the present study (80 knowledge statements, 43 skill statements and 62 ability statements). Two variables from the knowledge domain were not observed (*Knowledge of business intelligence* and *Knowledge of SWOT analysis*) across the job announcements, and thus, these items were removed from the subsequent analyses. Next, data were analysed using Mplus since it is capable of handling exploratory factor analysis with dichotomously scored data in a robust and consistent manner (Muthén, 1978; Muthén & Muthén, 2007). Data were entered into exploratory factor analysis models for each of the individual domains: knowledge, skills

TABLE 4 Education requirements for job announcements

Education requirement (minimum)	*n*	%
Bachelor's degree	644	62.52
Master's degree	76	7.38
Associate degree	16	1.55
High school diploma	11	1.07
Doctoral degree	2	0.19
Not mentioned	281	27.28

and abilities. We used an oblique rotation (geomin) using maximum likelihood estimation as the factors were anticipated to be correlated in the models. Numerous models were executed to arrive at the best solution for each domain. Models were evaluated using systematic criteria and the parsimony of the model in explaining these data.

The number of factors to retain in each model was based on a careful review of the Screen plots, the Kaiser criterion (eigenvalue > 1) used to estimate the maximum number of factors we explored and the overall parsimony of the final model in attempting to identify a simple structure in the pattern matrices (e.g. simple structures with minimal cross-loadings) that meaningfully explained the factor loadings. After identifying the best model for each domain based on the stated criteria, we carefully named each factor using the content of each item identified in the factor and created composite variables based on the summation of observed items divided by the total number of items to represent a percentage for each latent construct. Pearson correlation coefficients were calculated amongst the latest constructs in each respective domain to explore the relationships amongst the factors derived from the job announcements.

RESULTS

In aligning with the employed KSA conceptual framework (Ritzhaupt & Martin, 2014), our study contextualizes the instructional design professional in each competency domain: knowledge, skills and abilities. The item-level descriptive statistics are available in the Appendices organized by each domain. Additionally, we also provide the pattern matrices used to assign items to each factor in the Appendices for review. The subsequent sections provide the details associated with each domain and the associated factors and correlation matrices for the latent construct in each domain.

Knowledge competencies domain

The knowledge domain required us to examine a wide range of models with the Kaiser criterion, suggesting 22 factors as our upper limit. We carefully examined the Scree plot, which showed the greatest changes at both five- and seven-factors. Thus, we explored a range of models from five to 22 factors to determine the optimal solution with the goal of parsimony in mind. After careful consideration, we arrived at the six-factor solution based on the Scree plot and the overall parsimony in explaining the factors within the model using simple structures. The factor loadings ranged from −0.809 to 1.223 with an average loading of 0.554. The lowest absolute value factor loading was 0.313, which is above the desired 0.30 threshold. Table 5 provides the factor labels with the number of items, mean

TABLE 5 Factors, eigenvalues, # of items and descriptive statistics for the knowledge domain

#	Factor	Eigenvalue	# of items	Mean %	Minimum %	Maximum %
1	Knowledge of video and audio authoring	19.48	7	26.41	0.00	100.00
2	Knowledge of productivity software	8.27	4	30.17	0.00	100.00
3	Knowledge of production, development and methodologies	7.41	17	11.03	0.00	100.00
4	Knowledge of digital literacy and principles	6.57	25	4.23	0.00	20.00
5	Knowledge of learning theory and web development	4.11	10	9.50	0.00	80.00
6	Knowledge of online, blended and traditional learning	3.81	14	20.47	0.00	78.57

TABLE 6 Correlation matrix of factors in the knowledge domain

#	Factors	1	2	3	4	5	6
1	Knowledge of video and audio authoring	1					
2	Knowledge of productivity software	0.154**	1				
3	Knowledge of production, development and methodologies	0.494**	0.124**	1			
4	Knowledge of digital literacy and principles	0.138**	0.070*	0.105**	1		
5	Knowledge of learning theory and web development	0.233**	0.097**	0.304**	0.154**	1	
6	Knowledge of online, blended and traditional learning	0.202**	0.138**	0.117**	0.074*	0.093**	1

*$p < 0.05$; **$p < 0.01$.

percentage and the maximum and minimum percentages. The highest percentage observed in the job announcements was the *Knowledge of productivity software*, while the least observed construct was *Knowledge of digital literacy and principles*.

Table 6 provides the correlation matrix for the latent constructs derived from the job announcement analysis data. Notably, all correlation coefficients were statistically significant and positive in the matrix with the strong relationship between *knowledge of production, development and methodologies* and knowledge of video and audio authoring at $r = 0.494$, which is a moderate strength effect size. The weakest observed correlation coefficient was between knowledge of digital literacy and principles and knowledge of productivity software at $r = 0.070$, which is trivial to small relationship at best.

Skills competencies domain

Upon the execution of multiple models for consideration, our final solution is a five-factor exploratory factor analysis model. The Kaiser criterion for these data suggested a 15-factor model, while the

Scree plot showed a distinct elbow at five factors. While the five-factor model did not result in a completely simple structure (e.g. there were some cross-loadings), the factor loadings ranged from 0.973 to −1.112 with the smallest factor loading based on an absolute value at 0.176. The average factor loading was approximately 0.502, showing that most items loaded on their respective factors with a reasonable amount of strength in the relationship. Table 7 provides the labels for each factor and the associated eigenvalue, number of items within the factor, mean percentage, minimum percentage and maximum percentage. Notably, *Soft skills* were the most frequently observed construct across the job announcements, while *Technical skills* were the least observed.

The correlation matrix amongst the five factors is illustrated in Table 8. As can be gleaned, no negative correlations were detected in the relationships amongst the five latent constructs. The strongest statistically significant correlation was between the observation of *Management skills* and *Soft skills* at $r = 0.366$ (a moderate relationship) across the job announcements, while the relationship between *Technical skills* and *Supporting skills* had the weakest statistically insignificant relationship at $r = 0.046$.

Abilities competencies domain

Within the abilities domain, the Kaiser criterion suggested a 22-factor solution, which we set as our upper limit in our analyses and models. By carefully examining the Scree plot, we identified an elbow in the eigenvalue at four and eight-factor models. Thus, again, we explored a wide range of models to determine the optimal solution for these data and finally, arrived at a six-factor model for the abilities domain derived from job announcements. Two of the items (*Ability to develop computer applications and databases* and *Ability to differentiate colour*) in this analysis were problematic in that they did not occur frequently in the analyses and did not meaningfully load on relevant factors in the models. Thus, we removed both

TABLE 7 Factors, eigenvalues, # of items and descriptive statistics for the skills domain

#	Factor	Eigenvalue	# of items	Mean %	Minimum %	Maximum %
1	Technical skills	8.20	8	3.52	0.00	37.50
2	Soft skills	4.34	13	27.15	0.00	92.31
3	Multimedia production skills	3.69	8	17.78	0.00	87.50
4	Management skills	2.96	8	17.01	0.00	75.00
5	Supporting skills	2.28	4	4.95	0.00	75.00

TABLE 8 Correlation matrix of factors in the skills domain

#	Factors	1	2	3	4	5
1	Technical skills	1				
2	Soft skills	0.165**	1			
3	Multimedia production skills	0.068*	0.156**	1		
4	Management skills	0.261**	0.366**	0.118**	1	
5	Supporting skills	0.046	0.071*	0.059	0.104**	1

*$p < 0.05$; **$p < 0.01$.

TABLE 9 Factors, eigenvalues, # of items and descriptive statistics for the abilities domain

#	Factor	Eigenvalue	# of items	Mean %	Minimum %	Maximum %
1	Ability to work on multiple projects	14.20	9	21.82	0.00	88.89
2	Ability to use feedback in design	4.89	3	12.30	0.00	100.00
3	Ability to apply ethical instructional design procedures to meet goals	3.98	29	16.98	0.00	58.62
4	Ability to design and deliver learning experiences	3.37	6	13.45	0.00	100.00
5	Ability to serve multiple roles and adapt	3.04	8	7.94	0.00	75.00
6	Ability to collaborate with diverse stakeholders	2.78	4	50.12	0.00	100.00

of these items from the subsequent analyses. The factor loadings ranged from 0.177 to 1.096. The average factor loading was approximately 0.597, showing that most items loaded on their respective factors with a reasonable amount of strength in the relationship. As shown in Table 9, the most obvious highly rated factor is the *Ability to collaborate with diverse stakeholders* at 50.12 per cent, followed by the *Ability to work on multiple projects* at 21.82 per cent with a notable difference of more than 25.00 per cent. The least observed construct was the *Ability to serve multiple roles and adapt* at only 7.94 per cent.

As can be seen in the correlation matrix of the six factors, all the correlations amongst the factors are positive, analogous to the knowledge and skills domains. The strongest correlation is between Ability to serve multiple roles and adapt and Ability to apply ethical instructional design procedures to meet goals ($r = 0.375$). The factor of Ability to design and deliver learning experiences and the factor of Ability to work on multiple projects has the weakest statistically insignificant correlation ($r = 0.041$). Notably, this was the only statistically insignificant correlation detected in these data (Table 10).

DISCUSSION

The findings from this study reinforce the important knowledge, skill and ability competencies for instructional design professionals aligned with the educational technology KSA framework (Ritzhaupt & Martin, 2014). The most frequently observed job announcements were classified into the professional, scientific and technical services; educational services; healthcare; information; and finance and insurance contexts. While the classification schemes are not the same, this is similar to the findings of Klein and Kelly (2018) who found that when they analysed 339 job announcements found that the top sectors for instructional design employment opportunities were business and industry, higher education, consulting and health care. In screening the announcements classified into the professional, scientific and technical services category, we note that several of the firms are consulting agencies offering instructional design services to other firms outsourcing this workload in their organizations. When organizations do not have the resources to have in-house instructional designers, the consultant model of hiring instructional design consultants is being used. This is reflected in several of the teaching cases in the most recently published version of the Instructional Design Casebook (Ertmer, Quinn & Glazewski, 2019) popularly used in many of instructional design and technology academic programmes.

TABLE 10 Correlation matrix of factors in the abilities domain

#	Factor	1	2	3	4	5	6
1	Ability to work in on multiple projects	1					
2	Ability to use feedback in design	0.144**	1				
3	Ability to apply ethical instructional design procedures to meet goals	0.307**	0.231**	1			
4	Ability to design and deliver learning experiences	0.041	0.087**	0.255**	1		
5	Ability to serve multiple roles and adapt	0.282**	0.211**	0.375**	0.119**	1	
6	Ability to collaborate with diverse stakeholders	0.331**	0.186**	0.295**	0.070*	0.230**	1

*$p < 0.05$; **$p < 0.01$.

About 27 per cent of postings in this analysis did not mention an educational requirement, more than sixty percent of the postings only required a bachelor's degree for the job postings advertised and less than eight percent required a master's degree. In Klein and Kelly (2018) study, 75 per cent of job postings required the candidate to have a bachelor's degree in any field, 15 per cent required a master's degree. This finding is also consistent with the findings of Kang and Ritzhaupt (2015) who observed in $N = 400$ job announcements in educational technology that more than 70 per cent of the job announcement only require a bachelor's degree. This presents both a challenge and opportunity for the field of instructional design as only a handful of programmes in the United States offer instructional design degrees at the bachelor level with most programmes offering both master and doctoral degrees (Kang & Ritzhaupt, 2015). Notably, only two of the N = 1030 job announcements analysed required a doctoral degree. The question of whether academic programmes are meeting the needs of the instructional design job market are raised by this gap.

Knowledge competencies domain

Instructional design models and principles, *e-learning development* and *online teaching and learning* were the top three knowledge competencies observed across the job announcements in the knowledge domain. Instructional design models and principles emerged as a required competency in 60 per cent of the job postings and e-learning software in 64 per cent of the postings in the Klein and Kelly (2018) study. Kang and Ritzhaupt (2015) also observed higher frequencies of instructional design models and principles, e-learning software and platforms, and online teaching and learning. This finding reiterates the importance of these two knowledge requirements for instructional designers. The online teaching and learning competency requirement amongst 49.7 per cent of the posting is unique to this job announcement analysis. This could be due to an increase in online training design and delivery by instructional designers, particularly in institutions of higher education.

The factor analysis model showed six latent constructs that were all positively and significantly correlated, which is an indication that we are measuring the higher-order construct of instructional design knowledge. In the factor models, the three most commonly observed factors (all greater than 20 per cent) were *Knowledge of productivity software*, *Knowledge of video and audio authoring*, and *Knowledge of online, blended and traditional learning*. The least frequently observed factor was *Knowledge of digital literacy and principles*. These larger constructs are indicative of several areas across our academic programmes. For instance, it is quite common in instructional design programmes to offer online and blended learning coursework, or multimedia learning and authoring courses.

Skills competencies domain

Collaboration skills, *content development skills*, *oral and written communication skills* rated the top three amongst the skills competencies for instructional designers. Along with content development skills, soft skills such as collaboration skills and communication skills have continued to reflect as necessary skills for instructional designers across contexts. This is consistent with the Klein and Kelly (2018) study who found collaboration skills as a required competency amongst 75 per cent of job postings and communication skills as required amongst 57 per cent of the postings. Oral and written communication skills emerged as a key competency in a job announcement analysis conducted by Ritzhaupt et al. (2010) a decade ago and more recently by Kang and Ritzhaupt (2015). This shows the continued importance of communication skills for instructional designers and also the critical skill of teamwork and collaboration with the diverse stakeholders involved in the instructional design process. Content development was also rated as a required skill and this was consistent in Klein and Kelly (2018) study though the emphasis was on using analysis for content development.

The final factor model had five skills observed and analogous to the knowledge domain, all of these constructs were positively related (notably, only three of the correlations were not significant), which shows the cohesion of the larger construct of instructional designers' skills. While our findings from the knowledge domain emphasized *Knowledge of video and audio authoring*, and *Knowledge of productivity software*, the skills domain indicates that the skills are also often observed in the job announcements with the Multimedia production skills as the second highest observed factor. Notably, the lowest observed factor was Technical skills, which is representative of items like *Database programming skills* or *Statistical analysis skills*. The highest rated factor was *Soft skills*, which is inclusive of items like *collaboration skills*, *oral and written communication skills* and *leadership skills*. These findings are consistent with several other competency studies conducted in the past ten years (Kang & Ritzhaupt, 2015; Klein & Kelly, 2018; Ritzhaupt et al., 2010).

Abilities competencies domain

The *ability to develop course materials*, *ability to create effective instructional products* and *ability to advise and consult with Subject Matter Expert (SMEs)* were the top three required ability competencies. Developing course materials and creating effective instructional products are the core ability competencies of instructional designers across contexts and this builds on the results from the knowledge domain emphasizing *Knowledge of video and audio authoring*, *Knowledge of productivity software* and from the skills domain of *Multimedia production skills*. However, while these competencies are clearly important and frequently observed, the evidence from the abilities domain model clearly re-iterates the importance of the *Soft skills* noted from the skills domain as the highest rated factor was the *Ability to collaborate with diverse stakeholders*, which was observed in 50.12 per cent of the job announcements. This is the most frequently observed factor across the three domains of knowledge, skills and abilities. Again, this finding is consistent with prior works, which emphasize the necessity of instructional designers working with multiple stakeholders in the roles, including individuals like subject-matter experts, graphic designers, software developers, project managers and more (Kang & Ritzhaupt, 2015; Klein & Kelly, 2018; Ritzhaupt et al., 2010). Our factor model from the abilities domain resulted in six representative constructs. The second highest observed factor in this domain was the *Ability to work on multiple projects*, which reinforces the importance of project management training and preparation in the instructional design profession (Ritzhaupt & Kumar, 2015; Van Rooij, 2010; Van Rooij, 2013).

Limitations and delimitations

As this is a complex mixed-methods study, there are some notable limitations that our readers should acknowledge in the interpretation of this work. First off, the job postings came from a few job boards and were collected only for a short time frame. While this is one of the largest job announcement analyses conducted in the field of instructional design, most of these postings were only for positions in the United States, and cannot be generalized to other nations, even in the western cultures since the roles and titles for instructional designers differ dramatically. Also, while some of these job postings had a lot of depth, some had minimal information for us to draw from. Job announcement analysis is as much an art as it is a science, and the method has other common drawbacks, such as variable information provided as we noted and can also be written by human resource professionals with limited subject-matter expertise, rather than those professionals working in the field. While these findings might be applicable for today, the competencies can change in a few years with the rapid changes in information and communication technologies, learning environments and professional environments. Finally, while we were able to arrive at meaningful factors using exploratory factor analysis, many of the items had cross-loadings, which can be a problem when using this approach for other research applications like instrument design and validation studies.

Implications and future research

These findings have implications for instructional design professionals, employers who hire instructional designers, educational technology programmes who prepare instructional designers for their future careers and our professional associations that provide ongoing support and professional development experiences for our nascent workforce. Students and other professionals who are seeking employment in instructional design positions can compare their competencies to analyze if they are prepared for the job market. Continued professional development on these competencies will also benefit individuals who wish to enter into instructional design positions. Employers could also use this as a guideline when hiring new professionals and even improving their own job announcements to solicit higher quality applicants. These competencies could also be used by managers to do performance reviews of instructional designers. This analysis also benefits instructional design programmes and faculty in designing courses and curriculum to prepare their students for instructional design positions and for professional associations like AECT, ISPI, ATD and IBSTPI who develop both certifications and standards for professionals in the field. They can support their students and professionals to document these competencies in projects and portfolios, which can facilitate the hiring process and validate competencies gained in professional programmes.

Future research on the instructional design professional competencies is both an ongoing and multifaceted area to study. While this study provides a snapshot of the current status of the profession, these competencies will evolve over time as information and communication technology, learning theory and professional environments changes. Thus, periodic checks on the profession is a necessary research endeavour and moving target for the research community. While this study presented a mixed-methods approach using job announcements as the data source, a wide array of techniques can be used to identify instructional designer competencies, including the use of surveys, the Delphi method, interviews and observations in the workplace to name a few. Additionally, the next natural step is to examine the possible differences across the professional contexts (e.g. higher education, business, healthcare, & military, etc.) in which instructional designers are procured. Future research can also seek to document the roles and practices in other nations in both the developed and developing worlds as we know the professional titles and roles differ dramatically from country to country. Future research on the instructional designer professional competencies serves several relevant purposes to both researchers and practitioners; hence, we encourage diverse and frequent studies in this domain.

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APPENDICES

TABLE A Frequencies and percentages of knowledge domain items

Knowledge of…	*N*	%
Instructional design models & principles (e.g. ADDIE, Dick and Carey)	607	58.93
e-Learning development	527	51.17
Online teaching and learning	512	49.71
Presentation software (e.g. PowerPoint)	391	37.96
Learning Management Systems (LMS) (e.g. Blackboard)	384	37.28
Word processing software (e.g. Word)	359	34.85
Spreadsheet software (e.g. Excel)	355	34.47
Video software (e.g. Premiere)	349	33.88
Educational authoring software (e.g. Articulate, Lectora)	344	33.40
Authoring tools (e.g. Captivate)	339	32.91
adult learning theory	326	31.65
Face-to-face teaching and learning	267	25.92
Bitmap image software (e.g. Photoshop)	243	23.59
Assessment methods (e.g. criterion-referenced)	240	23.30
Blended learning techniques	240	23.30
Formative and summative evaluation	232	22.52
Assessment software (e.g. Respondus)	224	21.75
Customer service	220	21.36
Vector image software (e.g. Illustrator)	215	20.87
Screen recording software (e.g. Camtasia)	212	20.58
Audio software (e.g. Audacity)	210	20.39
Streaming video technology (e.g. Windows Media Server)	194	18.83
Project management software (e.g. Microsoft Project)	161	15.63
Project management principles (e.g. PMBOK)	152	14.76
Online/blended programme management	142	13.79
Accessing and analysing DATA	131	12.72
Instructional simulation and game design	129	12.52
Markup languages (e.g. HTML/XHTML/XML)	102	9.90
Industry Standard	98	9.51
Virtual classrooms (e.g. Wimba or Elluminate! Live)	85	8.25
Virtual environments (e.g. SecondLife)	79	7.67
Classroom-based technology integration techniques	76	7.38
Client-side scripting languages (e.g. JavaScript)	71	6.89
Cognitive learning theory (e.g. Cognitive Load Theory)	67	6.50
Motivation theories (e.g. ARCS)	67	6.50
Constructivism	66	6.41
Professional development	65	6.31
Learning object standards (e.g. SCORM)	65	6.31

Knowledge of…	*N*	%
Mobile learning platforms (e.g. Android)	63	6.12
Synchronous distance learning methodologies (e.g. Blackboard Collaborate)	61	5.92
Programming languages (e.g. C++)	57	5.53
Cascading Style Sheets (CSS)	48	4.66
Human Performance Technology principles	45	4.37
Flipped classroom (blended)	44	4.27
Mobile application development	40	3.88
Flash (and ActionScript)	38	3.69
Server-side scripting languages (e.g. PHP)	32	3.11
Laws, policies and procedures in training programmes	32	3.11
Desktop publishing software (e.g. PageMaker)	30	2.91
Content management systems (e.g. Joomla)	28	2.72
Web authoring tools (e.g. Dreamweaver)	27	2.62
Social media technologies (e.g. Twitter)	26	2.52
Agile methodology (e.g. Scrum)	26	2.52
Global and local training planning	25	2.43
Organizational development	22	2.14
Cloud technologies	22	2.14
Web design principles	21	2.04
Operating system software (e.g. Windows 7)	15	1.46
Interface design	15	1.46
Database software (e.g. Access)	13	1.26
Game engines (e.g. Unity)	13	1.26
Copyright laws	10	0.97
Web 2.0 technology (e.g. Wikis, Blogs, Podcasts, etc.)	9	0.87
Web-based data collection tools (e.g. SurveyMonkey)	9	0.87
3D modelling tools (e.g. Maya)	5	0.49
Accessibility software (e.g. JAWS)	5	0.49
eCommerce application development	5	0.49
Six Sigma	5	0.49
STEM (i.e. Science, Technology, Engineering and Mathematics)	5	0.49
Statistical analysis tools (e.g. SPSS)	3	0.29
Common Core State Standards (CCSS)	3	0.29
College/university administration	3	0.29
Human resources management	2	0.19
Theories of leadership	2	0.19
Data communications (e.g. FTP File transfer protocol)	1	0.10
Twenty-first-century skills frameworks (e.g. P21)	1	0.10
Communications hardware	1	0.10
Computer hardware	1	0.10
Business intelligence (e.g. SAP BW)	0	0.00
SWOT analysis	0	0.00

TABLE B Frequencies and percentages of skills domain items

Skills	*N*	%
Collaboration skills	795	77.18
Content development skills	679	65.92
Oral and written communication skills	581	56.41
Video production skills	349	33.88
Project management skills	312	30.29
Interpersonal communication skills	304	29.51
Organizational skills	281	27.28
Graphic design skills	274	26.60
Presentation Skills	257	24.95
Research skills	251	24.37
Editing and proofing skills	226	21.94
Quality control skills	226	21.94
Audio production skills	210	20.39
Relationship building skills	204	19.81
Creative problem-solving skills	173	16.80
Logical problem-solving skills	173	16.80
Time management skills	169	16.41
Storyboard design skills	149	14.47
Customer service skills	126	12.23
Game and simulation skills	122	11.84
Analytical/technical documentation skills	109	10.58
Leadership skills	105	10.19
Animation design skills	64	6.21
Computer programming skills	63	6.12
Troubleshooting skills	57	5.5
Self-management skills	53	5.15
Finance/budgeting skills	49	4.76
Coaching skills	43	4.17
Mentoring skills	42	4.08
Interviewing skills	41	3.98
Team building skills	31	3.01
Web development skills	28	2.72
Computer software skills	27	2.62
Print design skills	25	2.43
Statistical analysis skills	19	1.84
Business analysis skills	12	1.17
Negotiation skills	11	1.07
Tactical and strategic planning skills	9	0.87
Talent management skills	5	0.49

Skills	*N*	%
Conflict-management skills	5	0.49
Coping skills	5	0.49
Typing skills	4	0.39
Database programming skills	2	0.19

TABLE C Frequencies and percentages of abilities domain items

Abilities	*N*	%
Develop course materials	839	81.46
Create effective instructional products	691	67.09
Advise and consult with subject matter expert (SMEs)	588	57.09
Collaborative different team members (e.g. working with designers, programmers, engineers, & project managers)	520	50.49
Work with diverse constituencies (e.g. SMEs and clients)	492	47.77
Work well with others (in teams)	465	45.15
Apply sound instructional design principles	430	41.75
Needs Analysis	427	41.46
Evaluate learning products and programmes	422	40.97
Articulate the basic concepts, terms and theory of instructional design	420	40.78
Develop assessments	351	34.08
Deliver training to learners	306	29.71
Manage multiple projects	269	26.12
Write learning objectives	261	25.34
Manage multiple tasks	252	24.47
Detail driven	251	24.37
Work under deadlines	226	21.94
Provide critical feedback	225	21.84
Be creative/ innovative	223	21.65
Work independently	220	21.36
Prioritize tasks	212	20.58
Use audio/visual equipment	210	20.39
Integrate theory and research into practice	208	20.19
Adapt to evolving products and technology	158	15.34
Communicate complex material	157	15.24
Develop in-person training	155	15.05
Meet Business Needs	151	14.66
working in a fast-paced environment	143	13.88
Share constructive feedback	139	13.50
Adapt and acquire new things quickly	116	11.26
Create workshops	113	10.97

Abilities	*N*	%
Demonstrate policies, procedures and new information	110	10.68
Web-Based collaborative platform (e.g. Google Docs, Share Point, Microsoft Teams)	108	10.49
Teach face-to-face	103	10.00
Use data to make educationally sound decisions	103	10.00
Learn quickly and independently	76	7.38
Act as a liaison with other departments	73	7.09
Analyse complex data	69	6.70
Be a self-starter	69	6.70
Evaluate complex issues	63	6.12
Build strong client relationships	61	5.92
Analyse industry trends in learning technologies	53	5.15
Manage vendors	49	4.76
Change management	49	4.76
Exercise ethical judgement	49	4.76
Teach in virtual learning environments	44	4.27
Oversee content delivery to online platform	44	4.27
Inspire and influence people	38	3.69
Think strategically	37	3.59
Be goal-oriented	33	3.20
Recognize opportunities and takes action	30	2.91
Work in international/global environment	29	2.82
Accommodate different learning styles	28	2.72
Translate strategic goals	28	2.72
Manage teams	26	2.52
Design thinking	16	1.55
Work in government settings	15	1.46
Advise or supervise employees	14	1.36
Troubleshoot technical problems (Hardware)	11	1.07
Breakdown a business process	6	0.58
Develop computer applications and databases	4	0.39
Differentiate colour	1	0.10

TABLE D Pattern matrix for the knowledge domain

Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Audio software (e.g. Audacity)	0.617	0.038	0.589	−0.024	0.096	0.146
Authoring tools (e.g. Captivate)	0.483	0.194	0.412	−0.073	−0.008	0.161
Educational authoring software (e.g. Articulate, Lectora)	0.668	0.259	0.009	0.12	−0.024	0.237
Streaming video technology (e.g. Windows Media Server)	0.755	−0.059	0.624	−0.028	0.107	0.168
Video software (e.g. Premiere)	0.808	−0.003	0.596	−0.174	0.02	0.28
Learning object standards (e.g. SCORM)	0.368	0	0.01	0.338	−0.135	0.125
Instructional simulation and game design	0.424	0.06	−0.012	0.302	0.002	0.131
Presentation software (e.g. PowerPoint)	−0.004	1.127	0.027	0.096	−0.06	−0.018
Spreadsheet software (e.g. Excel)	−0.189	0.917	0.524	−0.151	0.027	0.008
Word processing software (e.g. Word)	−0.009	0.878	−0.029	0.136	−0.015	0.067
College/university administration	−0.123	−0.682	−0.011	0.573	0.055	0.237
Bitmap image software (e.g. Photoshop)	0.489	0.166	0.561	−0.042	0.057	−0.003
Screen recording software (e.g. Camtasia)	0.465	0.147	0.55	−0.049	−0.037	0.153
Social media technologies (e.g. Twitter)	−0.103	−0.092	0.608	0.035	−0.139	0.366
3D modelling tools (e.g. Maya)	−0.09	−0.193	1.223	0.049	−0.023	−0.043
Accessibility software (e.g. JAWS)	−0.09	−0.193	1.223	0.049	−0.023	−0.043
Agile methodology (e.g. Scrum)	0.038	0	0.592	0.156	−0.006	−0.016
Desktop publishing software (e.g. PageMaker)	0.08	0.028	0.654	0.215	0.044	−0.089
eCommerce application development	−0.09	−0.193	1.223	0.049	−0.023	−0.043
Flash (and ActionScript)	0.201	0.044	0.618	0.106	−0.237	0.019
Programming languages (e.g. C ??)	0.287	−0.059	0.537	0.078	−0.434	−0.278
Six Sigma	−0.09	−0.193	1.223	0.049	−0.023	−0.043
Vector image software (e.g. Illustrator)	0.476	0.127	0.568	−0.012	0.1	−0.024
Professional development	−0.408	0.116	0.525	−0.068	−0.223	0.287
Learning Management Systems (LMS) (e.g. Blackboard)	0.178	−0.096	0.388	−0.14	0.204	0.293
Project management principles (e.g. PMBOK)	0.032	0.065	0.525	0.07	0.224	−0.015
Project management software (e.g. Microsoft Project)	0.014	0.102	0.524	0.056	0.209	0.005
Game engines (e.g. Unity)	0.044	−0.134	0.623	0.188	−0.17	0.087

Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Data communications (e.g. FTP File transfer protocol)	−0.016	−0.016	0.214	0.851	−0.037	0.084
Operating system software (e.g. Windows 7)	−0.375	0.17	0.032	0.517	−0.028	0.043
Web 2.0 technology (e.g. Wikis, Blogs, Podcasts, etc.)	−0.117	−0.285	0.025	0.433	−0.133	−0.008
Web authoring tools (e.g. Dreamweaver)	0.146	0.031	0.007	0.395	−0.368	0.04
Web-based data collection tools (e.g. SurveyMonkey)	0.049	−0.192	0.068	0.495	−0.057	0.21
Database software (e.g. Access)	0.006	−0.089	0.017	0.565	−0.097	−0.132
Statistical analysis tools (e.g. SPSS)	−0.268	−0.218	0.042	0.776	0.006	−0.192
Global and local training planning	0.003	0.019	−0.006	0.4	−0.206	0.245
Human resources management	−0.044	−0.283	0.057	0.695	−0.101	0.205
Organizational development	−0.155	−0.077	−0.032	0.418	0.017	0.286
Theories of leadership	−0.096	−0.469	0.11	0.661	0.014	0.24
Formative and summative evaluation	0.327	−0.127	−0.202	0.487	0.45	−0.006
Accessing and analysing DATA	−0.118	0.194	−0.118	0.409	0.006	−0.018
Assessment methods (e.g. criterion-referenced)	0.357	0.051	−0.133	0.47	0.433	−0.136
Twenty-first-century skills frameworks (e.g. P21)	−0.016	−0.015	0.214	0.851	−0.036	0.084
Common Core State Standards (CCSS)	−0.273	−0.379	0.025	0.514	−0.121	−0.007
STEM (i.e. Science, Technology, Engineering and Mathematics)	−0.391	−0.233	0.025	0.501	−0.158	−0.111
Assessment software (e.g. Respondus)	0.36	0.022	−0.133	0.492	0.436	−0.183
Communications hardware	−0.016	−0.016	0.214	0.851	−0.037	0.084
Computer hardware	−0.016	−0.016	0.214	0.851	−0.036	0.084
Interface design	0.305	−0.29	0.004	0.628	0.007	−0.128
Web design principles	0.245	−0.252	0.034	0.453	−0.043	0.194
Content management systems (e.g. Joomla)	0.047	0.077	−0.019	0.524	−0.004	−0.008
Copyright laws	−0.382	−0.042	0.013	0.516	0.015	0.077
Laws, policies and procedures in training programmes	−0.355	0.113	−0.034	0.399	0.023	0.232
Cascading style sheets (CSS)	0.443	−0.004	0.577	0.108	−0.608	−0.178
Client-side scripting languages (e.g. JavaScript)	0.528	0.123	0.009	0.258	−0.809	−0.036
Markup languages (e.g. HTML/XHTML/XML)	0.403	0.102	0.552	0.006	−0.576	−0.117

Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Server-side scripting languages (e.g. PHP)	0.147	0.068	0.577	0.043	−0.665	0.08
Human performance technology principles	−0.005	0.032	0.009	0.66	0.871	0.031
adult learning theory	0.055	0.101	0.446	0.013	0.603	0.218
Cognitive learning theory (e.g. cognitive load theory)	0.04	0.018	0.012	0.625	0.839	−0.061
Constructivism	0.067	0.02	0.016	0.629	0.832	−0.052
Motivation theories (e.g. ARCS)	0.073	0.021	0.011	0.629	0.822	−0.054
Cloud technologies	−0.024	−0.025	−0.019	0.389	−0.39	0.062
Virtual classrooms (e.g. Wimba or Elluminate! Live)	0.033	0.128	−0.039	0.283	0	0.508
Virtual environments (e.g. SecondLife)	0.02	0.084	−0.034	0.293	0.01	0.465
Mobile application development	−0.547	0.261	0.03	0.353	0.375	0.681
Customer service	−0.037	0.225	−0.145	0.109	−0.269	0.313
Blended learning techniques	−0.036	0.073	−0.18	0.065	−0.209	0.848
Face-to-face teaching and learning	0.009	0.179	−0.164	0.06	−0.109	0.732
Classroom-based technology integration techniques	−0.065	−0.015	0.567	−0.038	0.05	0.577
Synchronous distance learning methodologies (e.g. Blackboard Collaborate)	0.035	−0.006	−0.041	0.213	−0.23	0.489
e-Learning development	0.02	−0.16	0.274	−0.388	−0.025	0.972
Instructional design models and principles (e.g. ADDIE, Dick and Carey)	0.167	−0.015	−0.27	0.044	0.181	0.434
Online teaching and learning	0.214	−0.134	−0.245	−0.091	−0.082	0.961
Online/blended programme management	0.08	−0.031	−0.093	0.172	0.009	0.71
Mobile learning platforms (e.g. Android)	−0.362	0.243	0.025	0.309	0.299	0.646
Flipped classroom (blended)	0.093	−0.029	0.046	0.291	0.09	0.711

TABLE E Pattern matrix for the skills domain

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Editing and proofing skills	−1.112	0.03	0.009	0.501	0.069
Typing skills	0.713	−0.195	−0.018	0.163	0.21
Computer software skills	0.251	0.132	−0.012	0.111	0.044
Talent management skills	0.669	0.218	0.055	0.045	0.036
Business analysis skills	0.359	0.05	0.236	0.297	0.073
Statistical analysis skills	0.375	0.018	0.116	0.119	0.01
Conflict-management skills	0.771	0.391	−0.07	−0.02	−0.097
Database programming skills	0.867	−0.001	0.199	0.018	0.5
Collaboration skills	−0.101	0.376	0.135	0.198	−0.062
Creative problem-solving skills	0.024	0.749	0.023	−0.381	0.173
Interpersonal communication skills	−0.034	0.729	0.101	0.047	−0.306
Logical problem-solving skills	0.022	0.755	0.023	−0.37	0.176
Oral and written communication skills	0.001	0.844	0.066	−0.026	−0.201
Organizational skills	−0.039	0.438	−0.01	0.148	−0.2
Relationship building skills	−0.111	0.442	−0.059	0.257	0.05
Troubleshooting skills	0.127	0.457	−0.094	−0.008	−0.011
Leadership skills	0.068	0.41	−0.14	0.105	0.221
Negotiation skills	0.397	0.415	−0.167	−0.004	0.238
Research skills	−0.18	0.307	0.16	0.119	0.166
Customer service skills	−0.058	0.411	−0.001	0.094	0.153
Quality control skills	−0.07	0.321	−0.06	−0.055	0
Animation design skills	0.155	0.068	0.703	−0.04	−0.004
Audio production skills	−0.033	−0.008	0.909	−0.098	−0.036
Game and simulation skills	−0.039	0.094	0.508	−0.187	0.353
Graphic design skills	−0.088	0.112	0.664	0.011	−0.065
Print design skills	0.23	0.076	0.385	−0.049	0.27
Video production skills	0.019	−0.028	0.973	0.062	−0.021
Storyboard design skills	−0.075	−0.029	0.412	0.065	0.258
Computer programming skills	0.085	−0.065	0.176	−0.102	0.161
Analytical/technical documentation skills	−0.027	0.183	0.133	0.222	0.129
Content development skills	−0.281	−0.013	0.221	0.421	0.109
Self-management skills	0.133	0.336	0.084	0.47	−0.054
Time management skills	−0.017	0.332	−0.075	0.564	−0.13
Tactical and strategic planning skills	0.266	−0.06	0.432	0.914	−0.007
Team building skills	0.028	0.297	−0.111	0.508	0.252
Coping skills	0.37	0.169	−0.026	0.749	0.057
Project management skills	−0.173	0.297	0.05	0.409	−0.101
Web development skills	0.146	−0.032	0.266	0.064	0.342
Coaching skills	−0.09	−0.043	0.007	0.005	0.678
Mentoring skills	−0.098	0.035	−0.038	0.002	0.704
Interviewing skills	0.009	0.003	−0.001	0.16	0.307

TABLE F Pattern matrix for the abilities domain

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Manage multiple projects	0.973	0.12	0.336	0.128	0.26	0.173
Manage multiple tasks	0.946	0.063	0.278	0.123	0.154	0.211
Prioritize tasks	0.665	0.105	0.306	0.121	0.343	0.198
Work under deadlines	0.602	0.074	0.099	−0.047	0.175	0.289
Work independently	0.313	0.075	0.099	0.075	0.215	0.153
Accommodate different learning styles	0.306	0.02	0.299	0.06	−0.012	0.055
Detail driven	0.397	0.112	0.155	−0.086	0.317	0.228
working in a fast-paced environment	0.373	−0.11	0.133	0.059	0.189	0.203
Be creative/innovative	0.314	0.009	0.002	0.023	0.058	0.191
Use audio/visual equipment	0.172	0.072	0.07	0.126	−0.045	0.145
Be a self-starter	0.229	−0.064	−0.003	−0.024	0.201	0.047
Provide critical feedback	0.221	0.761	0.484	0.327	0.333	0.147
Share constructive feedback	0.187	1.096	0.001	0.169	0.136	0.094
Design thinking	0.354	0.559	0.095	−0.081	0.547	−0.207
Apply sound instructional design principles	0.26	−0.084	0.798	0.216	0.224	0.122
Articulate the basic concepts, terms and theory of instructional design	0.255	−0.082	0.792	0.227	0.196	0.117
Create effective instructional products	0.223	0.175	0.477	0.176	−0.005	0.141
Develop assessments	0.058	0.15	0.252	0.079	−0.137	0.246
Develop course materials	0.055	0.149	0.344	0.081	−0.182	0.195
Evaluate learning products and programmes	0.218	0.214	0.548	0.232	0.178	0.217
Use data to make educationally sound decisions	0.197	−0.029	0.825	0.181	0.285	0.107
Write learning objectives	0.048	0.188	0.309	0.1	−0.151	0.207
Advise or supervise employees	0.012	0.019	0.641	0.458	0.591	0.108
Analyse complex data	0.196	−0.068	0.897	0.154	0.337	0.052
Analyse industry trends in learning technologies	0.17	−0.011	0.516	0.24	0.514	0.08
Breakdown a business process	0.091	0.458	0.579	−0.025	0.412	−0.25
Manage vendors	0.073	0.026	0.177	0.123	0.023	0.105
Translate strategic goals	0.318	0.148	0.574	0.152	0.42	0.134
Build strong client relationships	0.269	−0.183	0.542	0.409	0.38	0.106
Troubleshoot technical problems (hardware)	−0.163	−0.1	0.726	0.377	0.204	−0.243
Evaluate complex issues	0.377	0.168	0.548	0.253	0.434	0.053
Exercise ethical judgement	0.39	−0.219	0.562	0.147	0.389	0.206

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Inspire and influence people	0.317	−0.079	0.539	0.189	0.507	0.178
Integrate theory and research into practice	0.246	−0.04	0.761	0.213	0.375	0.162
Recognize opportunities and takes action	0.209	−0.084	0.698	0.195	0.529	0.318
Think strategically	0.437	0.066	0.477	0.246	0.289	0.195
Industry standard	0.104	−0.051	0.481	0.179	0.206	0.189
Oversee content delivery to online platform	0.197	−0.13	0.389	0.144	0.151	0.027
Meet business needs	0.276	0.258	0.414	−0.102	0.335	0.213
Work in international/global environment	0.129	0.056	0.404	0.179	0.085	0.018
Change management	0.221	−0.074	0.422	0.165	0.378	0.098
Presentation skills	0.231	−0.119	0.325	0.26	0.163	0.092
Web-based collaborative platform	0.173	−0.167	0.412	0.087	0.264	0.092
Needs analysis	0.097	0.159	0.278	0.101	−0.026	0.205
Create workshops	0.056	−0.223	0.431	0.688	0.131	0.178
Deliver training to learners	−0.012	−0.154	0.215	0.753	0	0.072
Demonstrate policies, procedures and new information	0.167	−0.215	0.654	0.692	0.264	0.12
Develop in-person training	0.031	−0.004	0.04	0.852	−0.112	0.08
Teach face-to-face	0.032	−0.009	−0.005	0.857	−0.02	−0.053
Teach in virtual learning environments	−0.016	−0.018	0.289	0.766	0.115	−0.031
Act as a liaison with other departments	0.207	0.014	0.339	0.232	0.465	0.03
Manage teams	0.256	0.026	0.591	0.322	0.605	0.19
Adapt and acquire new things quickly	0.253	0.205	0.438	0.088	0.907	0.101
Adapt to evolving products and technology	0.2	0.131	0.283	0.174	0.55	0.08
Learn quickly and independently	0.2	0.207	0.355	−0.058	0.906	0.078
Communicate complex material	0.425	0.088	0.439	0.185	0.456	0.092
Be goal-oriented	0.302	0.381	0.105	−0.111	0.425	−0.127
Work in government settings	0.168	0.331	0.198	0.123	0.575	−0.204
Work well with others (in teams)	0.354	0.114	0.322	0.1	0.397	0.5
Advise and consult with Subject matter expert (SMEs)	0.305	0.25	0.164	0.049	0.114	0.66
Collaborate with different team members	0.307	0.119	0.288	0.132	0.407	0.86
Work with diverse constituencies (e.g. SMEs and clients)	0.271	0.045	0.304	0.116	0.246	1.006