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RESEARCH ARTICLE

The dimensions of e-learning quality: from the learner's perspective

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Abstract The present study was designed to identify the quality dimensions as perceived by adult learners who had taken one or more e-learning courses offered by higher education institutions in South Korea and to identify and confirm the structural features of these quality dimensions. The results of the exploratory factor analysis arising from a survey of 299 learners revealed that from their perspective, there were seven dimensions in evaluating the e-learning quality: *Interaction, Staff Support, Institutional Quality Assurance Mechanism, Institutional Credibility, Learner Support, Information and Publicity* and *Learning Tasks*. And the confirmatory factor analysis with responses obtained from another set of 496 adult learners confirmed a good fit of the seven-factor model to the observed data. While most of these seven dimensions are supported by previous studies, some dimensions, such as technology support, content and evaluation/assessment that e-learning providers had highlighted did not appear to be important for Korean adult learners. Possible explanations for these findings are discussed in relation to learner characteristics, e-learning design, and culture, and further research topics are suggested.

Keywords CFA · EFA · e-learning · e-learning quality · Learner's perspective · Quality

Introduction

There are a growing number of studies on quality and quality assurance (QA) in e-learning (e.g. Anderson and Elloumi 2004; Ehlers and Pawlowski 2006; Jara and Mellar 2007; Jung 2005; Meyer 2002; Middlehurst and Woodfield 2004), but only a few have examined the quality of e-learning from the learner's perspective. Most of these studies have defined the quality of e-learning from the perspective of e-learning providers, assessors, governments and professionals. This situation is somewhat surprising in that the quality of e-learning is not something that can be delivered to the learner but is something that is co-developed by

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the learner and the provider during the teaching and learning processes particularly in an interactive e-learning environment (Ehlers 2004). Certainly, then, the learner's thoughts and views on the quality of e-learning need to be clearly understood and incorporated with those of the provider's in defining the quality and QA. Unfortunately, this is rarely the case.

Quality is a relative and value-laden concept and may be viewed differently by various stakeholders (Dondi et al. 2006; Jung and Latchem 2007). For example, governments may see the quality of e-learning based on its socio-economic benefits, e-learning institutions may be more concerned about the quality of their management, cost-effectiveness, learner satisfaction, completion and graduation rates, and instructors may be more interested in the quality of teaching aspects of e-learning. While inputs from these stakeholders are valuable in studying and promoting the quality in e-learning, it is critical to understand learners' views as well, since the learner is the key stakeholder in any type of education, including e-learning. Especially in the context of e-learning for adult learners with jobs, it is vital to understand how these adult learners define the quality of e-learning since their needs and circumstances are diverse and quite different from conventional learners (Twigg 2001). Most of the existing studies show that quality concepts and QA guidelines developed in various settings reflect mainly the concerns of the e-learning institutions, instructors, assessors, employers, professional associations and funding bodies (Frydenberg 2002). The present study, by contrast, was designed to identify quality dimensions as perceived by adult learners who had taken one or more e-learning courses offered by South Korean higher education institutions and to identify and confirm the structural features of these quality dimensions. In this study, the terms dimensions and factors are used interchangeably.

Literature review

E-learning quality is a complex and multi-faceted issue. Some argue that the quality of e-learning should be judged by the same criteria and standards as face-to-face education. Others hold that conventional quality concepts are not appropriate because e-learning is so structurally different (E-Learning Advisory Group 2002; Stella and Gnanam 2004). Yet others argue that while certain general principles of quality should apply to both conventional and e-learning, there are certain features unique to e-learning that should also be addressed, such as asynchronous interactions, open access to vast resources and distributed learning (Jung 2008). And e-learning typically relies to a greater extent than conventional education on learners' motivation and commitment to interactivity and collaboration, which make it more difficult to gauge and assure the quality of e-learning.

Recent studies have identified quality dimensions, guidelines, best practices and benchmarks for e-learning in various settings. Phipps and Merisotis (2000), with support from Blackboard and National Education Association, initially developed a total of 45 benchmarks based on an extensive literature review, validated them with faculty, administrators and students in selected distance education institutions and finally suggested 24 common benchmarks for high quality online education in seven categories—institutional support, course development, teaching/learning, course structure, student support, faculty support, and evaluation and assessment. Similarly, McNaught (2001) identified the benchmarks in seven areas considered essential for ensuring quality in online education in the context of higher education: clear planning; robust and reliable infrastructure; good support systems for staff and students, including training and written information; good channels of communication between staff and students; regular feedback to students on

their learning; clear standards for courseware development; and ongoing evaluation with a strong student input. McNaught's benchmarks highlight the importance of interactive communication in e-learning, which those of Phipps and Merisotis do not.

After analyzing the literature on QA, Frydenberg (2002) summarized nine quality domains: institutional commitment; technology; student services; instructional design and course development; instruction and instructors; delivery; finances; regulatory and legal compliance; and evaluation. All these domains or dimensions identified in the studies above focus on the design and delivery aspects and emphasize management, finance and legal considerations from the provider's and assessor's perspective. As Frydenberg (2002) pointed out, current QA criteria are primarily influenced by the provider group including professional faculty associations, accrediting agencies that have the charge of guiding and evaluating e-learning institutions and faculty and administrators.

Similarly in the corporate training context, individual learners' needs and views on the quality of e-learning are often ignored. Gillis (2000) tested an e-learning evaluation model at 20 companies and identified several common quality guidelines including: checking a course's relevance to the organization's needs; analyzing content quality and usability; and applying instructional design methodology in course development. In another study, Strother (2002) emphasized the importance of analyzing business results and return on investment in the evaluation of e-learning quality in corporate training. To help educational and training institutions ensure the quality of e-learning development and provision, Lodzinski and Pawlowski (2006) developed a process- and product-oriented approach they termed the Quality Mark e-learning which also provides several quality marks from the business point of view. These quality dimensions drew attention to business results and cost benefits of e-learning.

Quality and QA guidelines for e-learning also have been developed by a number of national, regional and international agencies. Best Practices for Electronically Offered Degree and Certificate Programs,[1] developed by the Commission of Institutions of Higher Education in the USA, include 29 best practices in five quality components: institutional context and commitment, curriculum and instruction, faculty support, student support, and evaluation and assessment. Quality Criteria for Distance Education in South Africa[2] by the National Association of Distance Education Organizations of South Africa presents 212 individual quality elements in thirteen criteria: policy and planning, learners, program development, course design, course materials, assessment, learner support, human resource strategy, management and administration, collaborative relationships, quality assurance, information dissemination, and results. The E-xcellence[3] project by the European Association of Distance Teaching Universities offers a self-assessment tool which contains 33 benchmarks in six categories, including strategic management, curriculum design, course design, course delivery, staff support, and student support.

The Swedish National Agency for Higher Education (2008), basing this on an extensive review of existing models of e-learning quality, offers a model for quality assessment of e-learning (ELQ) which is made up of 10 quality dimensions: material/content; structure/virtual environment; communication, cooperation and interactivity; student assessment; flexibility and adaptability; support (for students and staff); staff qualifications and experience; vision and institutional leadership; resource allocation; and the holistic and process

[1] http://www.ncahlc.org/download/Best_Pract_DEd.pdf

[2] http://www.nadeosa.org.za/resources/reports/NADEOSA%20QC%20Section%201.pdf, http://www.nadeosa.org.za/Resources/Reports/NADEOSA%20QC%20Section%202.pdf.

[3] http://www.eadtu.nl/e-xcellenceqs/.

aspect. In South Korea (Korea hereafter), the Ministry of Education, Science and Technology (MEST) has developed 95 detailed quality criteria for cyber universities in six domains: educational planning (clear mission and its integration in institutional policies); instruction (instructional design, content development, delivery and evaluation); human resources (students, academic faculty and administrative staff); physical resources (facilities, hardware and software/network system); management and administration; and educational results (stakeholder satisfaction and social recognition) (MEST 2008). Canada's Open eQuality Learning Standards[4] reflect not only providers' perspectives but also learners' perceptions of e-learning quality. Among 22 areas for assessing quality across three dimensions (outcomes from, processes and practices in, and inputs and resources for e-learning products and services), the learning skills acquired, value of the credits gained, and return on investment are cited as being of special interest of learners. Similarly, Dondi et al. (2006) identify learners as the key players in defining quality and integrate learners' views in the framework they call Sustainable Environment for the Evaluation of Quality in E-Learning (SEEQUEL). The SEEQUEL framework allows each stakeholder, including the learner, to weight the importance of the QA criteria subjectively.

At the international level, the International Organization for Standardization (ISO) has developed 'a framework to describe, compare, analyze, and implement quality management and QA approaches' in the use of information technology in learning, education and training[5] which includes seven processes for quality development (Pawlowski 2006): establishment of requirements (i.e., defining objectives); general conditions (i.e., analyses of external context, personnel resources and target group); design (i.e., design of learning content, didactics and activities); production (i.e., development of content); introduction (i.e., testing, adaptation and release of learning resources); implementation (i.e., administration, activities and review of competence level); and evaluation/optimization.

While the studies and national, regional and international QA frameworks cited above appear to cover a broad range of dimensions, closer analysis reveals a great deal of common ground in assessing the quality of e-learning. Although different wording is used, there appears to be general agreement on several dimensions, all of which include the need for quality. These are, institutional support, which includes vision, planning and infrastructure; course development; teaching and learning (instruction); course structure; student support; faculty support; and evaluation, as found in Phipps and Merisotis (2000). As mentioned above, quality is viewed differently by various stakeholders. While inputs from the providers, assessors and governments are valuable in examining and promoting the quality in e-learning, it is also critical to understand learners' views since the success of e-learning typically relies to a greater extent on learners' motivation and engagement. However, the quality dimensions found in the literature lack empirical evidence of learners' perspectives of e-learning quality (Ehlers 2004; Yeung 2002).

Many claims are made for the advantages of e-learning, but ironically, in a field that emphasizes the importance of learner-centeredness, there have been very few studies looking into the learners' opinions of quality factors. Cashion and Palmieri (2002) did, however, conduct a study of Australian learners' views of vocational education and training provided online, and found that learners rated the following factors as important to quality: flexibility, responsive teachers, materials and course design, access to resources, and online assessment and feedback. For these learners, quality factors cited in earlier

[4] http://www.eife-l.org/publications/quality/oeqls/intro

[5] http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=33934

sections of this paper were rated as less important; specifically, institutional planning, infrastructure, administration and management, and faculty support.

Another study of online learners was conducted in the European context. After interviewing European learners with extensive experience of e-learning, Ehlers (2004) empirically identified seven key factors of e-learning: tutor support; collaboration; technology; costs-expectations-benefits; information transparency of provider and courses; course structure and presence; and didactics. He found that European learners regarded course process-related dimensions such as presence, didactics and collaboration as more important than institutional considerations such as vision, planning and finance in assessing the quality of e-learning. He also observed that learners perceived technology as a hygiene factor that is important only when it is lacking, not as a factor to increase the quality of e-learning while many institutions see this as a key factor to assure the quality in e-learning. In addition, these learners indicated that they judged e-courses by the extent to which individualized learning arrangements addressed their particular learning needs and their practical and cost benefits, aspects which are often neglected by the providers. These findings show that there can be important differences between learners and providers regarding the concept of quality and that there is need for further investigation into the learners' views of e-learning quality in various contexts to inform and improve QA frameworks in e-learning.

The present study aims to identify and confirm quality dimensions in e-learning as perceived by adult learners in Korea. The results of the study will provide empirical evidence of learners' perspectives of e-learning quality, which then can be integrated with those of providers, and allow for a more balanced and improved QA framework for e-learning.

Methodology

Participants

At the investigative stage, an exploratory factor analysis (EFA) was conducted with 299 learners who had taken one or more e-learning courses offered across 10 higher education institutions in Korea. A slight majority of these learners were females (56.7%), with almost 60% between the ages of 20–29. These figures were comparable to those reported for the average Korean adult e-learners (52.4% females and 59% aged 20–29 years, NIPA 2008). About 45% were studying at a local cyber university, over 38% were participating in an e-learning course/program offered by a local conventional university and 12% were taking an e-learning course/program offered by a for-profit e-learning company. Around 30% of the participants had taken more than 10 e-learning courses, 21% between 4 and 6 courses and 34% between 1 and 3 courses. 45% described their experience with the Internet as 'extensive' and less than 4% as 'very limited'. About 60% were majoring in education, 10% in humanities, 9% in natural sciences and 6% in social sciences. While education majors were over-represented and social science majors under-represented when compared with the overall population of Korean e-learners (25.8% are studying in humanities, 36.8% in social sciences, 17.3% in education, 14.0% in natural sciences and 6.1% in other areas), previous studies found no significant differences in pedagogical features of e-learning courses, nor experiences of e-learners across different major areas (Cho and Lim 2002; Jang et al. 2006). Therefore, it is assumed that the sample's distribution is unlikely to influence the results of this study.

504 learners attending the same 10 Korean higher education institutions were newly recruited for the confirmatory factor analysis (CFA). Fifty-three percent were female, over 42% of whom were between the ages of 20–29. About 46% were studying at a local cyber university, over 39% in an e-learning course/program offered by a local conventional university and 9% in an e-learning course/program offered by a for-profit e-learning company. Around 22% of the participants had taken more than 10 e-learning courses, 21% between 4 and 6 courses and 46% between 1 and 3 courses. 46% indicated their experience with the Internet as 'extensive' and less than 3% as 'very limited'. About 20% were majoring in education, 13% humanities, 19% natural sciences and 18% social sciences. These demographics show that more participants were in their 20 s and their majors were more evenly distributed compared with those at the investigative stage.

E-learning context

This study was carried out in Korea, a country in which the technology infrastructure is well established and e-learning is at the mass adoption stage (Bonk 2004). Korea ranks first in the International Telecommunication Union's Digital Opportunity Index (ITU 2007) which measures ICT opportunity, infrastructure and utilization and 5th out of the 60 nations surveyed in the Economist Intelligence Unit's earlier e-learning readiness study (EIU 2003). As Bonk (2004) observed, e-learning in Korea has been more strategically targeted by the government than has been the case in many other countries and is considered an integral part of a national strategy to realize a lifelong learning society. Since the early 2000s, 18 private, non-profit cyber universities and colleges have been established, 85% of the public and private universities have provided courses online, and over fifty online teacher training centers and hundreds of for-profit e-learning companies have been founded. And almost 60% of large corporations and 20% of small and medium-sized enterprises were using e-learning as early as 2004 (Latchem and Jung 2009). These developments have provided Korean adult learners with ample opportunities to take various e-learning courses and programs at low cost and have enabled learners to become familiar and confident with e-learning.

E-learning has been also considered an innovative tool to bring pedagogical changes to conventional education. About 70% of universities and all cyber universities have incorporated online discussion boards into their e-learning programs (Leem and Lim 2007), and some universities have established online learning communities for faculty and students. However, a survey of 6,257 students and 205 faculty members at 17 cyber universities (Jang et al. 2006) and several other evaluations conducted by external reviewers of these cyber universities (Jang et al. 2003; MEST 2007, 2008) revealed that online interaction is still relatively under-exploited, in large part due to heavy workloads that allowed little time for online tutoring. Most of the online courses surveyed were group-based, teacher-centered, centrally-organized, and focused on the provision of content. Moreover, much of the online learning consisted of video- and audio-on-demand.

The adult learners who participated in the present study came from three cyber universities, four conventional universities offering e-learning courses/programs, two for-profit e-learning companies, and a conventional distance teaching university offering online programs. The participating institutions were selected based on the criteria that they used the Internet in teaching and learning, targeted adult-learner groups and covered all provinces in the country. All of the participating institutions serve adult learners throughout the country and employ the Internet as the main instructional medium. A typical online course provides video-on-demand lectures for 16 weeks along with MP3

audio lecture files and reading and presentation materials for content delivery, and uses online discussion boards and emails as an interaction tool. Most e-learning courses of the participating institutions mixed content-oriented structure with collaborative group tasks. Learning is assessed by exams on learning content and performance in collaborative tasks. The one exception was an e-learning company that offered a content-based, independent learning environment with limited interactions between learner-tutor and learner-learner.

Instrument

An online survey was conducted to gather empirical evidence about an initial set of 64 items in the seven dimensions of QA in e-learning from a perspective of adult online learners. The purpose of the survey was to determine the level of importance of the items in the initial list for QA in e-learning so as to identify quality dimensions as perceived by learners in an e-learning environment and to investigate structural features of those quality dimensions through factor analyses. In order to develop a valid and reliable survey questionnaire, the following steps were undertaken.

In the literature review, sufficient common ground has been found to enable the author to develop an initial list of seven quality dimensions for use in the study. In particular, the seven categories suggested by Phipps and Merisotis (2000) served as a foundation for the seven dimensions of the present study, since they reflect common factors found across different QA studies, including: *institutional support, course development, course structure, teaching and learning, student support, faculty support*, and *evaluation and assessment*. The literature relating to QA frameworks helped the author operationally define each of these dimensions presented in Table 1.

Detailed items of each dimension were then created to gain information about the learners' perceptions of e-learning quality. In all, 80 items, based on the common criteria of the existing QA criteria and guidelines, were written across the seven dimensions: 21 items in *institutional support*, 34 items referring directly to course/pedagogy (14 for *teaching and learning*, 12 for *course development* and 8 for *course structure*), 17 items in supports (11 for *student support* and 6 for *faculty support*) and 8 items looking up *evaluation and assessment*. The largest number of items were generated in the course/pedagogy related dimensions since those dimensions were considered as the core part of e-learning. The second largest number of items were included in the *institutional support* dimension since that particular dimension covered multiple sub-areas. When a dimension addressed a single area as in the case of *evaluation and assessment*, smaller items were included. Definitions of the seven dimensions and key items are in Table 1.

- The *institutional support* dimension refers to activities and policy measures by an e-learning institution with regard to planning, QA policies, physical and human resources and leadership. 21 items were included in regard to this dimension.
- The *course development* dimension refers to activities and policy measures by an e-learning institution that help ensure and maintain the quality of course development processes, course materials and learning activities. 12 items were included in regard to this dimension.
- The *course structure* dimension refers to policies and procedures that support and relate to the teaching/learning process. 8 items were included in regard to this dimension. The *teaching and learning* dimension refers to activities related to pedagogy in e-learning. 14 items were included in regard to this dimension.

Table 1 Initial list of seven dimensions, definitions and items

Dimension	Definition	Total of items and examples
Institutional support	Activities and policy measures by an e-learning institution with regard to planning, QA policies, physical and human resources and leadership	21 items including: Reliable technology infrastructure Offline lecturing/seminar/tutoring facilities Strong leadership in the e-learning institution Clear vision and mission in an e-learning institution E-learning institution's development of quality standards
Course development	Activities and policy measures by an e-learning institution that help ensure and maintain the quality of course development processes, course materials and learning activities	12 items including: Policy and guidelines for e-learning course development Uses of various technologies to ensure maximum learning occurs Collaborative learning tasks Inclusion of video-recorded lectures of faculty Periodic review of courses/course materials
Course structure	Policies and procedures that support and relate to the teaching/learning process	8 items including: Access to online library resources Checking students' self-motivation and commitment to learn online before registration Access to physical library resources Clear indication of requirements for assignments
Teaching and learning	Activities related to pedagogy in e-learning	14 items including: Student interaction with faculty and tutors Student interaction with other students Required face-to-face meetings Flexibility in learning pace
Student support	The array of activities and policies for student services	11 items including: Technical support for students Psychological and social support for students Administrative support Student complaints procedure
Faculty support	The array of activities and policies that assist faculty/staff in performing their job	6 items including: Continuous training for faculty/staff Support tools for faculty/staff Policy and procedures for faculty/staff selection
Evaluation and assessment	Policies and procedures that address how an e-learning institution evaluates various aspects of its performance and learning achievement	8 items including: Periodic course/program evaluation by various means Periodic review of faculty/staff performances Evaluation of student satisfaction levels Regular review of student achievements

- The *student support* dimension refers to the array of activities and policies for student services. 11 items were included in regard to this dimension.
- The *faculty support* dimension refers to the array of activities and policies that assist faculty/staff in performing their job. 6 items were included in regard to this dimension.
- The *evaluation and assessment* dimension refers to policies and procedures that address how an e-learning institution evaluates various aspects of its performance and learning achievement. 8 items were included in regard to this dimension.

All of the items were developed in English. These 80 items were then reviewed by seven experts and ten adult online learners from several countries as well as Korea. Five experts specializing in e-learning development and delivery and two reviewers engaged in QA and evaluation of distance education were asked to judge the relevancy and validity of these items for measuring e-learning quality. Ten online learners including three Korean learners were asked to clarify the concepts and refine the language/terms used. By seeking comments from both inside and outside Korea, the author aimed to identify those QA items which were specific to Korean e-learning while avoiding any cultural or contextual bias or excluding universally accepted QA items, in order to develop an instrument that could be used in various national and cultural contexts. There were no significant disparities between the international and Korean experts with regards to the items presented. However, the Korean learners suggested a few items which stressed their preference for campus-based services and face-to-face sessions. As a result of this process, from the initial 80 items, 20 were deleted because they were redundant, 8 were revised for terminology clarification, 7 were adjusted to reflect global QA standards, and four new items were added to reflect the Korean e-learning context.

The revised 64 items were again sent to the same experts and learners for confirmation. After resolving some confusion over the wording in two of the items, all of these respondents agreed with the relevancy and validity of 64 items in this second round of testing. The survey questionnaire included 64 items in the seven dimensions mentioned to measure learners' perceptions of e-learning quality. In the survey questionnaire, respondents were asked to rate each item's importance in assessing and assuring the 'QUALITY' of e-learning (1 being lowest 7 being highest). An additional seven items were added to the questionnaire to obtain learner information regarding demographics and previous e-learning experiences. The final version of the questionnaire was translated into Korean by the author and the translated version was validated by two bilingual professionals in education.

To collect data for the CFA, a revised questionnaire consisting of the 26 items with at least .40 factor loadings and the seven items asking learners' demographic information and e-learning experience was created based on the results of the EFA.

Procedure

A survey questionnaire was developed and put on a commercial online survey site. Since the study sought responses from online learners via their instructors, an online survey was believed to be more effective and efficient and achieve large sample sizes (Reips 2002). Like other online survey sites, the commercial online survey site used in the study allowed the author to insert the open statements which explained the purpose of the study, benefits, possible dangers and voluntary nature of the study and gave the contact information, enter and format the questions, post a closing thank-you message and download the results as an excel file. Once the online survey site was ready, the author sent out an invitation email to

37 selected instructors teaching various subjects in the different institutions as specified in 'E-learning context' section and with at least 5 years of experience in e-learning delivery. In receipt of confirmation emails from the 20 instructors agreeing to participate in the survey and with the consent of their students, the link to the questionnaire was sent out to these instructors, 7 of whom specialized in education, 3 in language education, 2 in literature, 4 in biology, 2 in law, 1 in politics and 1 in computer science. The instructors emailed the link to their students and asked them to complete the online questionnaire. A total of 299 responses were received between March 1 and April 30, 2009. The EFA was then carried out with all of these responses to identify the dimensions or factors influencing online learners' assessment of e-learning quality.

To confirm the factor structure identified via the EFA, another invitation email attached with a revised survey questionnaire was sent out to 44 instructors who satisfied the same requirements as above. 28 instructors who obtained informed consents from their students posted a link to the revised online survey on their class bulletin board. A total of 504 responses were received between May 4 and May 18, 2010. 8 responses posted by the instructors were eliminated and 496 were used in the CFA.

Data analysis

The EFA were conducted to determine the number of common factors consisting of learner perception on the quality of e-learning. Then the CFA via Structural Equation Models (SEM) was carried out with AMOS 16.0 to examine the structure of those factors and intercorrelations among the factors.

Results

E-learning quality dimensions

First, the ceiling effect was evaluated with all 64 items to eliminate items which showed low discriminative power. As a result, six items with a mean + SD > 7 were eliminated from EFA, leaving 58 items for the next analysis.

EFA with unweighted least square extraction was conducted to obtain the initial eigenvalues of the 58 items. Scree plot and the Kaiser-Guttman criterion (eigenvalues greater than 1) were used. As a result, the models including five to seven factors were considered adequate. Parallel analysis produced the seven-factor structure as most appropriate.

With the seven-factor model, EFA was performed by means of the unweighted least squares method using an oblique rotation, promax. Promax was adopted for factor rotation since it was known to be better able to identify the presence of a simple structure (Finch 2006) and some factors such as *course development, course structure* and *teaching and learning* were assumed to be correlated with one another, since they were all course/pedagogy-related. *Student support* and *faculty support* were also assumed to be correlated with each other since both included similar support-related items. After rotation, 22 items with a factor loading of less than .40 were eliminated. Another analysis using the promax rotation was conducted with the remaining 36 items in order to refine the item list and five more items with a factor loading of less than .40 were deleted. The consequent factor analysis confirmed the seven-factor structure of the 26 items with at least .40 factor loadings. Table 2 shows the result of the factor analysis.

Table 2 Factor loadings for seven factors measuring learner perception of e-learning quality[a]

Item	Factor loading						
	1	2	3	4	5	6	7
31. Student interaction with other students	**.851**	−.012	−.116	.084	.024	−.066	.014
30. Student interaction with faculty and tutors	**.755**	.006	.039	−.001	−.091	.158	−.011
32. Asynchronous online interaction	**.706**	−.023	.052	−.089	.098	.046	−.049
33. Synchronous interaction	**.477**	.022	.130	−.108	.112	−.030	.072
55. On-demand training for staff	.054	**.824**	.033	−.011	−.181	.107	.039
57. Staff welfare	−.110	**.820**	−.108	.004	.313	−.164	−.019
54. Continuous assistance for staff in course development, delivery and management	.068	**.790**	.010	−.080	−.201	.069	.048
56. Policy for staff recruitment	−.049	**.627**	.050	.092	.013	.084	−.021
8. Periodic internal evaluation	−.001	.023	**1.040**	−.139	−.018	−.086	−.021
9. Periodic evaluation by external experts	−.024	−.068	**.792**	.120	−.106	.117	.042
7. An institution's development of quality standards specifically for e-learning	.125	.054	**.498**	.057	.189	−.042	−.063
10. Written guidelines for quality assurance	.016	−.003	**.448**	.301	.032	−.027	.038
12. International recognition of the e-learning institution	−.027	−.008	−.066	**1.026**	−.054	.049	−.050
11. External accreditation at the national level	−.084	−.069	.051	**.860**	−.030	.103	.096
13. Strong leadership in the e-learning institution	.239	.112	.043	**.441**	.062	−.189	−.018
53. Learner welfare	−.015	−.121	−.037	−.048	**.845**	−.017	.058
51. Administrative support for students	.047	−.010	−.086	.041	**.580**	.245	−.004
50. Psychological and social support for students	.188	−.003	−.051	.022	**.517**	.120	.021
41. Access to physical library resources	.082	.004	.087	−.083	**.513**	.044	.049
5. Policy for funding and financial management	−.049	.031	.115	.317	**.447**	−.115	−.066
44. Providing course information	.008	.007	−.017	−.032	.033	**.825**	.031
45. Clear indication of requirements for assignments	.074	.023	−.031	.066	.015	**.731**	−.038
46. Online provision of information	−.051	.197	.046	.056	.160	**.441**	−.049
23. Problem −based learning tasks	−.009	.035	−.008	−.040	.032	.041	**.808**
22. Individualized learning tasks	−.147	.021	.083	−.057	.156	.064	**.736**
21. Collaborative learning tasks	.239	.010	−.089	.155	−.086	−.171	**.624**

Note: Factor loadings over .40 appear in bold

Extraction Method: Unweighted Least Squares

Rotation Method: Promax with Kaiser Normalization

[a] Rotation converged in 7 iterations

Table 3 below indicates the factor correlations done with promax rotation. If an orthogonal rotation such as varimax had been done, this table would not appear in the output because the correlations between the factors are set to 0. As seen in Table 3, the factors were moderately or modestly correlated with each other.

To establish the reliability of the scales for the factors and assess their internal consistency, Cronbach's alpha was calculated. This evaluates how well the items of a scale measure a single dimensional latent construct. A high value indicates that the items included in the scale can measure the same underlying structure and thus form a reliable

Table 3 Correlations between seven factors measuring learner perception of e-learning quality

Factor	1	2	3	4	5	6	7
1	–						
2	.411	–					
3	.480	.446	–				
4	.525	.490	.595	–			
5	.556	.568	.513	.593	–		
6	.354	.517	.339	.283	.466	–	
7	.487	.512	.388	.424	.486	.292	–

Extraction Method: Unweighted Least Squares

Rotation Method: Promax with Kaiser Normalization

factor. Most of the scales had high values of Cronbach's alpha, around .8, as shown in Table 4. Each factor was named to reflect a common higher-level construct of those items that loaded on the same factor.

Factor 1 was labeled as *Interaction* since four items within the scale of this factor were closely related to interactions with faculty, tutors and other students and to both asynchronous and synchronous interactions. Factor 2 was named as *Staff Support* since four items dealt with various supports—continuous assistance, on-demand training, clear policies and procedures for recruitment, and welfare—for academic and general staff members. Factor 3, labeled as *Institutional QA Mechanism*, consisted of four items which saw to the existence of quality standards and written guidelines for QA in e-learning and periodic internal and external evaluations. Factor 4, *Institutional Credibility*, included three items that were related to the status of acquiring both national and international accreditations and strong leadership in the e-learning institution. Factor 5, named *Learner Support,* had five items that dealt with policy and guidelines for funding and financial management, access to physical library resources, psychological, social and administrative support and learner welfare. Factor 6, *Information and Publicity*, was composed of three items that dealt with the provision of course-related and other logistic information in a clear and detailed manner and on the Internet. Factor 7, labeled as *Learning Tasks,* included three items on the provision of collaborative, individualized and problem-based learning tasks.

Although both the initial list (See Table 1) and the list identified through the EFA include seven factors, the factors and item arrangements of the two lists differ. In the verified list, the *Evaluation and Assessment* dimension found in the initial list did not appear, and the dimension of *Institutional Support* was divided into two factors—*Institutional QA Mechanism* and *Institutional Credibility*. In addition, one item located under the dimension of *Learner support* in the initial list—online provision of information—was included in the factor of *Information and Publicity* in the verified list, and—access to physical library resources—listed under the dimension of *Teaching and Learning* in the initial list fell under the factor of *Learner Support*. Moreover, policy for funding and financial management—originally listed under *Institutional Support*, also fell in the category of *Learner Support*.

Structural features of e-learning quality dimensions

The result of CFA via SEM statistics confirmed that the seven-factor model was appropriate in explaining the learners' perceptions of e-learning quality.

Table 4 Cronbach's alpha for scales of seven factors and Item–Total (I–T) correlation

Scale		Item	α if item deleted	I–T correlation
Interaction	(α = .812)	Item31	.737	.683
		Item30	.757	.647
		Item32	.745	.670
		Item33	.812	.530
Staff Support	(α = .847)	Item55	.781	.750
		Item57	.803	.696
		Item54	.820	.650
		Item56	.817	.657
Institutional QA Mechanism	(α = .854)	Item8	.779	.778
		Item9	.788	.754
		Item7	.846	.615
		Item10	.838	.641
Institutional Credibility	(α = .837)	Item12	.670	.802
		Item11	.735	.737
		Item13	.896	.570
Learner Support	(α = .783)	Item53	.725	.610
		Item51	.728	.607
		Item50	.730	.602
		Item41	.773	.489
		Item5	.758	.511
Information and Publicity	(α = .792)	Item44	.659	.688
		Item45	.673	.679
		Item46	.817	.546
Learning Tasks	(α = .772)	Item23	.638	.663
		Item22	.681	.621
		Item21	.769	.559

The goodness-of fit of the seven-factor model was evaluated. In SEM, the chi-squares (χ^2) statistic represents the comparison between the covariance matrix for the observed data and the covariance matrix derived from a theoretically specified structural model, with lower and non-significant chi-squares suggesting a better fit (Fornell and Larcker 1981). However, χ^2 test is highly sensitive to sample size, such that tests involving large samples would generally lead to a rejection of the null hypothesis, even when the factor model is appropriate (Bentler 1990). Thus in this study other statistics that have been shown to be much less sensitive to sample size were adopted. The Root Mean Square Error of Approximation (RMSEA) which takes into account the complexity of the model and the degrees of freedom was calculated and the RMSEA cutoff was set at .08 or less (Byrne 2001). And Incremental Fit Index (IFI), Comparative Fit Index (CFI), and Tucker-Lewis Index (TLI) were also used to evaluate the model fitting (Meyers et al. 2006; Sink and Spencer 2007; Tabachnick and Fidell 2001). Values of these indices close to 1 indicate a very good fit between the data and the model. Goodness-of-fit measures of the study were RMSEA = .067, IFI = .920, TLI = .903, and CFI = .920, which indicate good fit of the seven-factor model to the observed data.

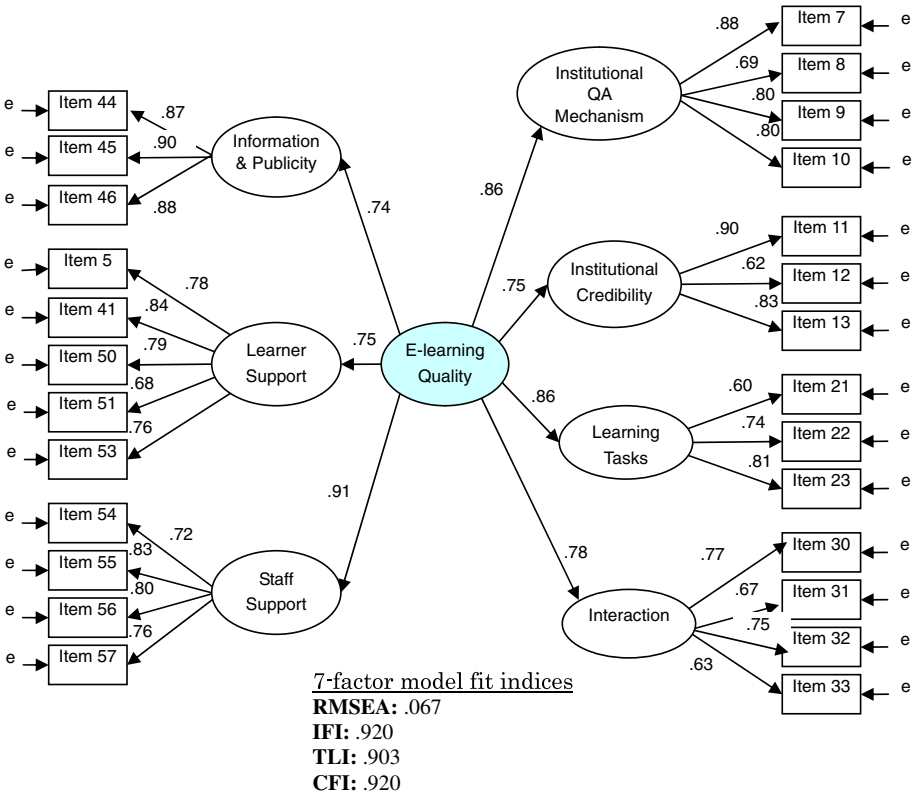

Fig. 1 The CFA model showing how seven dimensions explain learner perception of e-learning quality and its fit indices

The CFA model of the seven-factor structure is shown in Fig. 1. Factor loadings ranged from .74 (*Information and Publicity*) to .91 (*Staff Support*). The '*Staff Support'* dimension was the best indicator of e-learning quality perceived by the learner and explained about 80% of the variance in *E-learning Quality*. The clusters labeled '*Institutional QA Mechanism'* and *'Learning Tasks'* were the second most influential dimensions, each explaining 74% of the variance in learners' perceptions.

At the item level, the CFA result disclosed that factor loadings varied from .60 ('Collaborative learning tasks') to .90 ('External accreditation at the national level' and 'Clear indication of requirements for assignments'). In the *Interaction* dimension, 'Student interaction with faculty and tutors' appeared to be the most influential item explaining 59% of the variance in the quality of interaction aspect of e-learning. In the *Staff Support* dimension, 'on-demand training for staff' appeared to be highly influential, explaining 69% of the variance in the factor. In the *Institutional QA Mechanism* dimension, 'An institution's development of quality standards' was the most important item, explaining 77% of the variance of the factor. In the dimension of *Institutional Credibility*, 'External accreditation at the national level' was powerful, explaining 81% of variance of the dimension. In the *Learner Support* dimension, 'Access to physical library resources' appeared to be influential, explaining 71% of variance. In the *Information and Publicity* dimension, 'Clear indication of requirements for assignments' appeared to be influential,

explaining 81% of the variance. Finally, in the *Learning Tasks* dimension, 'Problem-based learning tasks' had high effects on the dimension, explaining 66% of the variance.

In short, the study data confirmed that the seven-factor model is a good fitting model in explaining the observed data from online learners. Among the factors or dimensions, *Staff Support* seems to be more influential than other dimensions whereas the *Information and Publicity* dimension shows less power in explaining students' views of e-learning quality.

Discussion

The purpose of this study was to identify dimensions affecting learners' perceptions of the quality of e-learning and to examine the structural features of those dimensions. The result of the EFA identified seven such dimensions: *Interaction, Staff Support, Institutional QA Mechanism, Institutional Credibility, Learner Support, Information and Publicity* and *Learning Tasks*. Intercorrelations among the dimensions moderately supported the discriminant validity of the components. The CFA via SEM confirmed that overall the seven-factor model is a good fit to the observed data from online learners and revealed that all seven dimensions are important in evaluating the quality of e-learning from the learner's perspective.

Kirkpatrick (2005) argues that quality is the total experience of the learner and thus should address an institution's reputation, curriculum and instruction, staff support, learner support, technology support, QA mechanisms and student outcomes. This study confirms that most of these dimensions that have been suggested from the provider's perspective are also perceived as important to learners.

Institutional QA Mechanism and *Institutional Credibility* appeared to be influential in reviewing the quality of e-learning from the learner's perspective. That is to say, learners perceive an e-learning program or institution that implements internal QA measures based on clear policies and guidelines and is nationally accredited and internationally recognized as being of high quality. Also, these two dimensions were highly correlated with each other (.595) as seen in Table 3, which indicates a close relationship between building trust and credibility as an e-learning institution and obtaining accreditation from external QA agencies. In this study, national accreditation was shown to be especially important in explaining institutional credibility. This may, in part, be explained by the fact that over 85% of the participants of the study were students of local cyber universities or e-learning programs offered by local conventional universities. Thus to them, national recognition is an indicator that raises the status of e-learning institutions, gives learners greater confidence in their studies and awards, and enables their qualifications to be recognized nationally.

The study also found that *Interaction* is an important dimension in evaluating the quality of e-learning. Ehlers (2004) provides additional evidence that social and discursive cooperation is perceived by many learners as an important dimension for high quality e-learning in the European context. In addition, interactive learning tasks that allow learners to engage in problem-based, individualized and collaborative activities appear to be important in assessing the e-learning quality. This finding supports previous studies conducted in various cultural contexts, which recommended offering authentic and personally meaningful problems in a collaborative learning environment (Cho and Lim 2002; Dhanarajan 2005; Ehlers 2004; Ehlers et al. 2005; Selim 2007; Sun et al. 2008).

The learners of this study saw *Staff Support* as another powerful dimension in determining the quality of e-learning. In particular, on-demand training and recruitment of good

staff were seen as important indicators in reviewing the quality of e-learning. This implies that there is a need to create an e-learning environment integrated with strong staff support to meet the learners' expectation of high quality e-learning.

Learner Support was also indicated as an important dimension in assessing the quality of e-learning. This finding confirms the conclusions by Kirkpatrick (2005) and Ehlers (2004) that needs-based learner services are essential for a quality e-learning system, and by Dolog et al. (2004) that personalized learner support has become more important with the development of e-learning. Despite its importance, an overall lack of learner support has been reported in several studies on e-learning programs. Leem and Lim (2007) found that only 40% of the conventional universities offering e-learning courses/programs provide tutors, assistants or digital library services for learners. A monitoring study of cyber universities (MEST 2007) reveals that several fail to provide adequate administrative support to learners, and in some cases, assign a single administrator to serve the needs of over 200 students. In another monitoring study (MEST 2008), the lack of sufficient learning support was again indicated as a serious problem. Considering a high correlation (.556) between *Learner Support* and *Interaction,* as seen in Table 3, the present study suggests that e-learning institutions must establish a strong personalized and interactive learner service system if they are to provide a quality learning environment for their learners.

This study also showed that learners consider *Information and Publicity* when assessing quality, as confirmed by Hailey, Keith, and Hult (2001) and Tao (2008). In the eyes of learners, clearly presented course-related information regarding to admission, course registration, finance, recording and other administrative and operational matters are important indicators of high quality e-learning. This finding shows the importance of providers ensuring that accurate, easily-understandable and frequently updated course, administrative and logistical information is available online.

However, the Korean learners of this study did not agree with the providers (e.g. Gillis 2000; Phipps and Merisotis 2000) and the European learners (Ehlers 2004) that course content and course structure are an important dimension in evaluating quality in e-learning. Although this dimension was included in the initial list (see Table 1) and emphasized by the providers, it was not found to be important to the learners in this study. This appears to contradict several existing QA guidelines (e.g. ELQ and ISO's framework) and to fly in the face of all the arguments regarding quality in instructional design. A possible explanation may be that the participants in this study were all adult learners, who often place less value on the content, and more on learning tasks or activities. This is consistent with Hay et al's (2008) contention that 'student learning quality is a product of student activities and behaviors (rather than any direct consequence of taught content)' (p. 1052). This result suggests that researchers and educators need to pay closer attention to learning activities than content in designing e-learning courses for adult learners. Yet another possible explanation may be that over 80% of the participants in this study were students of accredited cyber and conventional universities where content development is generally carried out by a team of experts at the institutional level rather than at the faculty level, and a variety of multimedia are used to deliver the different types of content (MEST 2008; Leem and Lim 2007). This may have meant that the learners were accustomed to working with quality content and instructional design, assumed it would be present in the programs/courses and thus placed less value on it when assessing the quality of e-learning. To confirm this finding, further research is needed with learners with different learning experiences with their content.

Unlike European learners and most providers (Ehlers 2004; McNaught 2001; Saito 2009), the learners in this study did not perceive technology support to be a critical dimension in judging quality. This may be due to the participants' previous experience with the technology (over 45% reported their experience with the Internet as 'extensive'). Thanks to the training provided in schools and universities and extensive social uses of the technology, most Koreans are well versed in technology use. Had this study been conducted with less experienced learners, the result might well have been different. This finding suggests the need for cross-validation studies with samples having different technology proficiencies and in different age groups.

Evaluation/assessment, which was included in the initial list (see Table 1), did not appear to be a critical dimension in judging e-learning quality. This finding runs counter to previous studies which emphasize the need to include evaluation/assessment in assuring the quality of e-learning (Frydenberg 2002; Lodzinski and Pawlowski 2006). One possible explanation may be that the participants of the study might have thought that institutional QA mechanism is enough to assure the quality of e-learning since it includes an evaluation/assessment component. Another explanation may be that Asian society traditionally has been more hierarchical than Western societies and the textbook, teacher and older person are therefore to be respected and not challenged (Suzuki and Jung, in press; Latchem and Jung 2009). In this culture, evaluation/assessment would be perceived as an area conferred by the institution or the teacher and thus considered to be granted. To investigate such differences between the perspectives of the learners and the providers, we need further research in diverse cultural contexts.

One constraint of this study is that it did not consider learner variables such as major study areas, ages, gender, technology skills and experiences with e-learning in examining the learner perception on e-learning quality. There may be some differences in the learner perceptions of males and females, humanities and natural science majors, older and younger learners or those with less and more e-learning experiences. Further studies into such variables can only enhance our understanding of learners' perceptions of e-learning quality. In particular, we need to identify changes in learners' perceptions as more 'digital natives' engage e-learning courses (Pedro 2009). And as pointed out above, the results of the study may not be generalized to all situations, since this study was carried out in the context where the participants had extensive Internet and e-learning experience and engaged in a content-oriented e-learning environment mixed with collaborative group tasks. Further research in various e-learning contexts is needed to improve the generalizability of the findings of the present study.

Conclusion

Educational and training institutions are increasingly adopting e-learning and consequently the quality and QA of e-learning are coming more to the fore. Defining the quality of e-learning is a complex task which needs to take into account the sometimes conflicting views of the various stakeholders, not least of which are learners. The quality of e-learning is typically defined mainly from the provider's perspective. The provider-centered approach to QA in e-learning may be unequal and ignore the interrelational nature of a QA. By identifying quality dimensions from the learner's perspective and illuminating similarities and differences between the perspectives of the learners and the providers, this study provides the basis for balancing both views and planning learner-oriented quality guidelines for e-learning. Moreover, the 26 items identified as the most important quality

concerns of learners can be used by providers as a basis for reviewing the existing QA guidelines and identifying their strengths and weaknesses from the point of view of their prime customers—the learners.

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