Review of eLearning knowledge quality dimensions: concepts and measurements

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Review of eLearning Knowledge Quality Dimensions: Concepts and Measurements

Mehwish Waheed
University of Malaya, Malaysia
Email: mahwish.phd@gmail.com

Kiran Kaur
University of Malaya, Malaysia
Email: kiran@um.edu.my

Abstract

This review presents the measures employed in the assessment of knowledge quality in the existing literature. It aims to identify the key determinants of knowledge quality in Open Educational Resources (OER). The quality of knowledge gain from the content available in OER is of key concern for this study.This review conduct a detailed analyses of the dimensions measuring Data Quality (DQ), information Quality (IQ) and Knowledge Quality (KQ) in studies ranging from research in eLearning, information system, knowledge and information management, and data warehouses. In subsequent section the Knowledge Quality Pyramid (KQP) is proposed to show the need of content quality to achieve the knowledge quality in OER. The findings reveal that there is an evident lack of research in measuring knowledge quality in OER. Furthermore, researchers' repeated use of the DQ and IQ dimensions to measure KQ has failed to develop a reliable KQ measure. It could be useful for the conceptualization and measure of knowledge quality in various environments, including eLearning and IS systems.

Introduction

"Where is the knowledge we have lost in information?" Eliot (1963)

The above statement highlights the need for quality knowledge. In this technological era, internet has given the edge to every single individual to put a variety of information on the web at an unmanageable rate. The computing 'garbage in, garbage out' mantra succinctly expresses this problem. It leads to the difficulty of identifying 'quality' information that helps in increasing the users' knowledge, from a bulk of information (Stvilia, Twidale, Smith, & Gasser, 2008). In educational perspective, quality is a critical issue in general, and more sensitive for Open Educational Resources (OER) (Alkhattabi, Neagu, & Cullen, 2011) due to the demand of high quality learning content.

The technological influence has shifted the educational sector towards online learning paradigm. College and universities are rapidly adopting eLearning platforms for their course delivery and training (Lim, Morris, & Kupritz, 2006; Zhang, Fang, Wei, & Wang, 2012), (e.g. (WOU), (SPeCTRUM), (OLIVE)). In the eLearning environment various methods like satellite TV, Live interactive chats,

audio/video tapes, CD/DVD media with course content, and online content management system are used to deliver content to users. The learning content from a variety of sources, helps the user to gain diverse knowledge and OER helps in supporting this construction process (Qwaider, 2011). ELearning is defined as "the use of new multimedia technologies and the Internet to improve the quality of learning by facilitating access to resources and services as well as remote exchange and collaborations'' (Communities, 2001, p. 2). The definition discusses the three essential aspects of eLearning i.e. technology, resources and services access, and quality of learning. This study is concerned about the quality of learning, specifically the explicit knowledge (not the tacit), in terms of quality knowledge gained from the content available in OER. The eLearning environment holds different type of open content like, reports, lectures, articles, notes, web links. The content may be in unstructured (data) or structured (information) format (Kulkarni, Ravindran, & Freeze, 2007), but the users' concern is about the quality knowledge gain from the available content in OER.

Despite the adequate work on measuring the knowledge quality in different domains, knowledge quality is still a vaguely defined concept. Interchangeable use of Information Quality (IQ) and Knowledge Quality (KQ) terms and use of IQ dimensions to measure the KQ is obvious in various studies (Chiu, Hsu, & Wang, 2006; Halawi, McCarthy, & Aronson, 2008; Jennex & Olfman, 2006; Liu, Chang, & Hu, 2010), which is the key problem raised in this study. Knowledge quality in general and particularly for online published content in OER is scantly discussed. Shin (2012) discussed the importance of content quality in 3DTV environment. Alkhattabi, Neagu, and Cullen (2010); Alkhattabi et al. (2011) has attempted to measure the online content quality, but they focused on information quality in eLearning environment. An evaluation criterion to measure the quality of knowledge is the core demand of this new information era. Specifically in education environment, with the growing number of OERs, measuring the quality of knowledge gained from online open content is essential. To measure the knowledge quality in general and specifically for the online content in OER, it is required to explore the essence of knowledge and its quality.

In order to figure out the lacking to measure knowledge quality, this study aims to accomplish the following objectives:

- Examine the essence of knowledge.
- Identify the elusive use of IQ dimensions to measure KQ.
- Investigate conceptual and operational measurement of Data Quality, Information Quality and Knowledge Quality through review of literature.

Essence of Knowledge

The multifaceted knowledge has multi-layered meanings. The epistemological belief discusses the theory of knowledge, which argues that knowledge must encompass 'justified, true, belief'; the three essential attributes of knowledge (Lehrer & Paxson, 1969; Plato, 1921). Collectively these attributes meet the essence and quality of knowledge. Plato's widely acknowledged tripartite definition of knowledge (Plato, 1921, 1967) considers the *Justified True Belief* (JTB) as a set of indispensable conditions to fulfil the essence of knowledge (Lehrer & Paxson, 1969; Ikujiro Nonaka, 1994; Plato,

1921; Sosa, 1969; Steup, 2006). To date sufficient researchers have used this definition as a working model (Artemov & Nogina, 2005; Dancy, 1991; Moser, 2010). The tripartite definition is only applicable to propositional knowledge (Dancy, 1991; Lacewing, 2009; Lehrer & Paxson, 1969; Moser, 1987, 2010; Ikujiro Nonaka, 1994; Thalberg, 1969). The necessary three joined conditions of tripartite definition for propositional knowledge are explained as: (i) anyone who knows that p believe that p, is the requirement of belief condition, (ii) the requirement of truth condition is that, any known proposition should be true, (iii) the requirement of justification condition is that, any known proposition should be sufficiently justified and evidentially supported (Moser, 1987, 2010). P is a hypothetical term used to refer to an object, person, system or environment. This account of knowledge was also considered by Plato (1921, pp. 201c – 202d) as "knowledge was true opinion accompanied by reason".

Apart from the epistemological nature of the knowledge, innovativeness of the acquired knowledge from listed or published sources in terms of their newness and novelty show the quality of that knowledge. Innovativeness is considered as the key antecedent to achieve the quality of knowledge (Soo, Devinney, & Midgley, 2004). The knowledge, which is new, innovative and useful for the organization/institution/system fulfils the requirements of quality knowledge(Chan, Oerlemans, & Pretorius, 2008).

"Knowledge is about action and must be used to some end" (I. Nonaka & Takeuchi, 1995). As quoted by Chekhov (1860 – 1904); "Knowledge is of no value unless you put it into practice". Similar is the case with the adaptability and expandability; the knowledge which is not adaptable and expandable according to the individual perspective and in different domain, then it does not meet the essence of quality knowledge. The knowledge which is idle, it is not worthy at all. The famous philosopher Gibran (1883 – 1931) once said, "A little knowledge that acts is worth infinitely more than much knowledge that is idle" used by Calabrese and Orlando (2006) in the study of knowledge management system.

Conceptualization of Knowledge Quality

Elusive use of "knowledge quality"

Bailey and Pearson (1983) confirms 39 factors as a tool for measuring computer user satisfaction in information system context. Rai, Lang, and Welker (2002) have measure the information quality by adapting seven items (Accuracy, Information Errors, Exact, helpful, Precise, output options, sufficient) from Bailey and Pearson (1983). Later, Kulkarni et al. (2007) have attempt to capture the quality of knowledge in a construct called "Knowledge Content Quality". They use the two constructs 'presentation style' and 'usefulness' to measure knowledge content quality and items extracted from Rai et al. (2002), which had been adapted from the Bailey and Pearson (1983) scale measured in information system context. Halawi et al. (2008) empirically investigate the knowledge management system (KMS) success and measured the knowledge quality by adapting the construct from Bailey and Pearson (1983).

The DeLone and McLean's (1992) proposed IS Success Model by reviewing conceptual and empirical studies and suggested its future research implications. They posit six major dimensions of IS success, that are system quality, information quality, user satisfaction, individual impact and organizational impact. The IS Success Model is adapted by Jennex and Olfman (2002) for their Organization Memory/Knowledge System (OM/KS) Modified IS Success Model. To measure the information quality, they use the three constructs linkages, richness and KM Strategy and Process (Davenport & Prusak, 2002).

DeLone and McLean have further extended their IS Success Model (1992) as updated IS Success Model (Delone & Mclean, 2003). In the context of e-commerce, they have postulated the Completeness, Ease of understanding, Personalization, Relevance and Security to measure the information quality of e-commerce content. The author here explains the extension of IS Success Model and the constructs used by Jennex and Olfman (2002) to measure the information quality due to its link with their next model.

Jennex and Olfman (2006) propose the Knowledge Management Success Model based on the widely cited Delone and Mclean's (2003) updated IS Success Model. In this KM Success Model, the information quality variable is renamed to knowledge quality. They argue, "since the KM Success Model is assessing the use of organizational knowledge, the Information Quality dimension is renamed the Knowledge Quality dimension" (Jennex & Olfman, 2006). The same information quality constructs i.e. linkages richness and knowledge strategy and process are used for measuring the knowledge quality. Using the same dimensions for two different constructs is not justifiable, only by renaming the terms in different perspectives.

Vicki McKinney, Kanghyun Yoon, and Fatemeh "Mariam" Zahedi (2002b) have proposed model of Expectation-Disconfirmation Effects on Web-Customer Satisfaction and measured the website quality by accessing information quality and system quality. They have used Perceived Usefulness, Relevance, Reliability, Scope and timeliness to measure web-information quality. Later, Chiu et al. (2006) and Liu et al. (2010) investigated the knowledge sharing in virtual communities and libraries, and measured the knowledge quality by adopting the information quality construct from Delone and Mclean (2003); Vicki McKinney, Kanghyun Yoon, and Fatemeh Mariam Zahedi (2002a).

One can infer from the above discussion on the elusive use of the term knowledge quality, that the authors have not yet considered the knowledge quality as a different construct from information quality. The same Bailey and Pearson (1983) and Delone and Mclean (2003); McKinney et al. (2002a) information quality constructs, validated within the IS domain, are modified by later researchers (Chiu et al., 2006; Halawi et al., 2008; Jennex & Olfman, 2006; Kulkarni et al., 2007; Liu et al., 2010) in KM domain to measure the knowledge quality. It is not justifiable to measure the knowledge quality by neglecting the essence of knowledge.

In **Table 1**, the author summarizes the studies, which are adapting Bailey and Pearson (1983); Delone and Mclean (2003); McKinney et al. (2002a) work, to measure knowledge quality in different domains.

Item extraction from IQ domain	Adapted by	KQ domain of measure	Sample	Item used	Methodology
Bailey and Pearson (1983)	Kulkarni et al. (2007)	Validating the KM Success Model	150 midlevel managers enrolled in executive & part-time MBA	Presentation format and Usefulness of the content	EFA
	Halawi et al. (2008)	Investigating the KMS Success Model	99 members from Companies	Convenience of Access, Accuracy, Timeliness, Precision, Reliability, Currency, Completeness, Language, Volume of Output, Relevancy, and Error Recovery	EFA
McKinney et al. (2002b), (Delone and Mclean, 2003)	Chiu et al. (2006)	knowledge sharing in virtual communities	310 member from virtual community	Relevance, Ease of Understanding, Accuracy, Completeness, Reliability, and Timeliness	CFA
	Liu et al. (2010)	knowledge sharing in Libraries	204 professional librarians	Relevance, Ease of Understanding, Accuracy, Completeness, Reliability, and Timeliness	SEM
Delone and Mclean (2003)	Jennex and Olfman (2006)	Knowledge Management Success Model	Content Analysis	Knowledge strategy/process, richness, and linkages between knowledge components Updated, relevance, accuracy, completeness, reliability, and timeliness	Theoretical Paper

Table 1 Elusive use of the information quality items for knowledge quality in different domains

Critique

Previous researchers have used the modified version of either Wang and Strong's (1996) DQ dimensions or Delone's (2003) IQ dimensions to measure KQ (Chiu et al., 2006; Halawi et al., 2007; Jennex and Olfman, 2006; Liu et al., 2010; Rao and Osei-Bryson, 2007). The DQ dimensions, which are Access Security, Accessibility, Accuracy, Appropriate Amount of Data, Believability, Completeness, Conciseness, Consistency, Current, Interpretability, Level of Detail, Objectivity, Relevancy, Reliability, Representation Consistency, Reputation, Timeliness, Understandability, Usefulness, and Value Added, are adapted for measuring IQ by introducing two further dimensions, i.e. Updated and Verifiability. Herrera-Viedma et al. (2006) and Roca et al. (2006) considered the measure 'Updated' due to the demand for up-to-date information on websites and eLearning environments. Stvilia et al. (2008) used the measure 'Verifiability' because it is important for verification purposes, for example, when evaluating the IQ of Wikipedia content. However, the KQ construct has faced serious negligence; none of the researchers proposed any new dimensions for measuring it. Also, the 'Verifiability' dimension identified in the IQ domain (Stvilia et al., 2008) is not incorporated in later studies to measure KQ. This shows the unmet need for a measure of KQ. To fill in this gap, it is first necessary to understand the essence of knowledge and its quality dimensions. Hence, this study builds on the theory of knowledge and present the comparison of DQ dimensions, IQ dimensions, and KQ dimensions used in the literature for measuring DQ, IQ and KQ, as depicted in the KQ pyramid (see **Figure 3**).

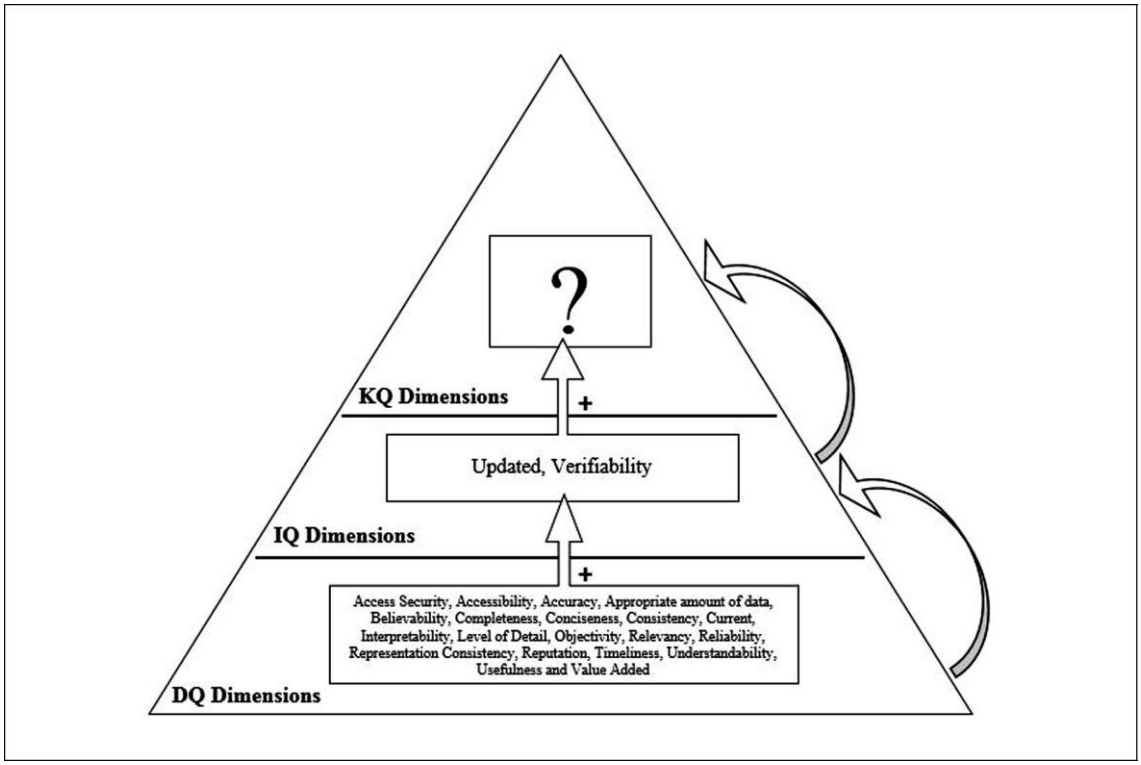

Figure 3 Knowledge Quality Pyramid (KQP)

Apart from the elusive use of KQ measures lack of focus on KQ in OER is also noticed. The review of the previous studies revealed that there is no prominent study, which measures knowledge quality in the OER. Alkhattabi et al. (2010, 2011) has measured the information quality in eLearning environment, but knowledge quality is still facing negligence. Researcher are putting their effort to measure the quality of information available on online learning portals either in educational institutions or private organizations, however, quality of knowledge which is the final goal of any learning process is not discussed.

Conclusion and Implications

This review shows that quality of knowledge from the content available in OER can be measured by understanding the essence of knowledge that has its roots in innovative, actionable nature of knowledge and three attributes of knowledge; 'justified, true, belief'.

Review of related research streams show two major findings. Firstly, information quality in eLearning environment is considered as an important aspect to be measured. While knowledge quality in OER has not received enough attention. However, the goal of OER is to provide knowledge of any relevant topic or course to a wider audience. Quality of data and information is essential but quality of knowledge gained from the content in OER is also important. Various information quality dimensions are proposed to measure the quality of content in eLearning environment, but the quality of knowledge is not discussed.

Secondly, analysis of studies in information system, data warehouses, eLearning and knowledge management studies advances the understanding of knowledge quality concept that is used interchangeably to date as the information quality.

Consequently, the review findings suggest some future considerations for the study of knowledge quality. Firstly, detail operationalization of the knowledge quality construct in OER context is needed. Operationalization must have theoretical roots and should consider the knowledge hierarchy. Secondly, comprehensive model of measuring OER knowledge quality is required that can be generalized in different domains. At last, the model should lead to the construction of knowledge quality scale in which each dimension may tap the quality of knowledge separately through specific items. The future research considering the suggested implications will be helpful to identify the quality of knowledge in OER and subsequently the user satisfaction.

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