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Exploring the Factors and Dimensions of Information Quality for E-learning Systems: A case of Tanzanian Higher Learning Institution

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Abstract: The role played by the E-learning system is crucial, especially in the urgent need for working away from the universities and colleges such as on holidays, weekends, and during pandemic situations like COVID-19. Researchers have constantly been producing more sophisticated alternatives for effective usage of E-learning systems and among them include models which explain how users accept, use, and evaluate such systems as they use them on daily basis. Due to the low ICT readiness in developing nations like Tanzania, there is a lack of grounds for the inclusion of various factors and dimensions to the conceptual models which in turn results in testing incomplete, intuitive, and ad hoc sets or irrelevant dimensions. This study closes this gap by conducting a systematic documentary review of studies from 2007 to 2020 on E-learning systems to identify the key factors and their associated dimensions. The findings provide foundations that further research on e-learning acceptance in the contexts of developing countries including Tanzania can adopt on formulating hypotheses and generating information on their research contexts.

Index Terms: E-learning system E-learning models, Information Quality, Tanzania, Factors, Dimensions, Systematic Review.

1. Introduction

The uptake of E-learning systems in Tanzania has been witnessed significantly, especially in universities. The statistics show that 46% of 33 universities (both public and private) have adopted these systems as of 2017 [1]. It was expected investment of 11.73 million dollars to finance such investment [2]. Hence, further effort is needed to study such systems for the welfare and prospects of universities.

An electronic learning system (herein referred to as an e-learning system) is a web-based Information System (IS) which is used specifically to create, and distribute learning information (contents) to the right learner at the right time [3]. An E-learning system is considered successful if it anticipates objectives which have been set, including learner access to learning information (reading materials, quizzes, assignments, tests and exams) at any place, any time, learner achieving a higher score compared to the traditional distribution of learning information (total classroom-based learning), an increase of learner interaction with the instructor and peer learner, personal learning information [2]. In that regard, one of the success factors of establishing an E-learning system in the context is the measure of how acceptable and used, the system is to the users taking into account the contextual specifics such as culture, level of ICT readiness, the enthusiasm of the leaders and the existence of regulations and policies to govern its use. One of the critical aspects of any system is how the quality of its information.

The researchers debated the concept of quality and argue that it is too abstract [4]. According to Wang and Strong [5], Quality means fitness for use by intended consumers. One of the prominent features of E-learning systems is Quality and particularly Information Quality [3,4]. The studies in E-learning systems are still struggling to find the best definition for Information Quality. One best way of defining Information quality is by clarifying the factors and dimensions which explain it. This justifies why there are debates on the real definition of information quality in different contextual settings. Factors in several studies on information quality mean main aspects of information quality whereas dimension means attributes of factors that are items making up a particular factor [4].

Researchers have tried to develop frameworks and models for information quality systems [4,6,7,8]. Such studies discuss the number of factors and their corresponding dimensions/items that contributed to Information Quality for e-learning systems which cover *Intrinsic Information Quality, Contextual Information Quality, Representational Information Quality and Accessibility Information Quality*.

The word *data* and *information* have been used interchangeably in most cases because it is based upon a perception of people [9]. Data can be regarded as output which is due to the data manufacturing process of a given organisation [4]. Information is further regarded as integral to data and fact [9]. However, Wang [10] simplify these three terms, *data*, *information* and *information system* by comparing them to typical manufacturing of product, data as analogous to materials, information system as analogous to the manufacturing system and information as analogous to the product. Specifically, in this paper information will be regarded as data being sent to, offered to, and interpreted by the user [11].

Shahid Farid et al. [12] mention universities as the main stakeholder of E-learning systems. The other stakeholders include students/users, instructors/faculty, institutions, administration, software developers, instructional designers, managers, online facilitators, multi-media designers and learning objects developers [13, 14]. Abdellatief et al. [13] is considering that out of those numbers of stakeholders of the E-learning system, users/students, managers and software developers are keys, whereas Selim [15] had a different thought that users/students, instructors, institutions and administration are the keys.

Shankar and Watts [16] affirm that the Information Quality attributes that fit in one application domain/context may not necessarily fit into another providing an example in the context of developing countries like Tanzania versus developed countries like the United Kingdom, and the USA to mention a few. Research that tested their factors and dimensions by combining context may not necessarily reflect well stakeholders' perceptions because they are explicitly two domains. The majority of information quality evaluation models and frameworks tend to generalise contexts and examples [17]. This study, therefore, explores the factors and dimensions associated with Information quality in e-learning systems in universities in Tanzania. In addition, the conceptual framework indicating the factors and dimensions explaining the information quality in E-learning will be presented. The rest of this article is arranged as follows:

2. E-learning Systems

An E-learning system is a typical Information system made up of technology (software, hardware, data and information), and stakeholders. Many terms are used to refer to e-learning systems, e.g. online learning, web-based training, distance learning, distributed learning, virtual learning and technology-based training [17]. An E-learning system in this context refers to a web-based Information System (IS) which is used specifically to create and distribute, learning information (contents) to the right learner at the right time using devices that are connected through the internet [3]. Web-browser is used to provide an interaction between the user and system and the internet as means of communication among sub-systems of e-learning [17]. E-learning system has characteristics of being accessed synchronously or asynchronously [2]. Synchronous means the learner and instructor are both online, while asynchronous, anyone may be online and another offline [2]. Information systems and e-learning information systems are both affected highly by information quality [3].

Global universities are fighting to embrace e-learning systems in a mode of teaching and learning. They all want to be "dual-mode institutions" and be attractive to students especially those who are living remotely [12]. In 2012, the record shows that more than 1,000 institutions of higher learning in 50 countries adopted e-learning systems [17]. In the USA nearly 75 per cent of 129 top universities are offering educational services using e-learning systems [18]. This shows the proliferation and dominance of e-learning systems globally, which are going together with substantial changes in teaching and learning in universities.

3. Information Quality

Quality is an abstract term as it can be defined differently in different contexts [17]. In general terms, quality can be defined as a measure of how fit is an artefact for final use [19]. From an information systems or E-learning information systems perspective, Information Quality is one of among desired key aspects [3]. Quality of systems and quality of information was among the two keys of communication as stated in Shannon and Weaver's (1949) theory. Empirically, Information Quality is proven the key element in e-learning systems [20]. The empirical results in table 1, show that currently, e-learning information quality in Tanzania has no impact on both intentions to use and satisfaction

of e-learning systems concerning students. Furthermore, there are no empirical studies that were conducted to find specifically, what are standard factors and their corresponding dimensions/items in E-learning systems in Tanzania.

Both studies focused on the acceptance, use and evaluation of E-learning in Tanzanian universities but they each used different sets of factors and dimensions for information quality. For instance, Lwoga [23] used the following dimensions/items: readability, clarity, well-formatted (*presentation information quality*) and knowledge (*contextual information quality*). Other factors like *Intrinsic Information Quality* (Believability, Accuracy, Objectivity and Reputation) and *Accessibility* (Access security and Accessibility) were not examined at all. Their omission might indicate that the resulting model is incomplete as it misses some key aspects of user perspectives.

Similarly, Lashayo [21] examined the following dimensions/items: easy user navigates through content (*representational information quality*), sufficient content (*contextual information quality*) and assessment quality (*intrinsic information quality*). Again, there are dimensions (accessibility and accessibility security) that were left unproposed and un-tested.

The missing out of factors explained in such previous studies indicate that there is a lack of pieces of information to be explained by the next scholars. Table 1 indicates that dimensions of information quality are ad hoc, intuitive and incomplete which can't produce a systematic and predictive standard explanation of quality information in e-learning systems. There is a need to come up with a proposition of a most concrete sample of factors and dimensions which can represent the information quality of E-learning in the context of Tanzania, which can serve as a basis for further studies. The significance of this study is therefore minimising the possibility of omitting some aspects or including a redundant dimension.

Table 1. Current findings on the impact of Information Quality on Intention to Use and Satisfaction

Author (s) and year	**Data (sample size).**	**Methods**	**Findings**
[21]	8-universities + 1,005 students	Quantitative	IQ → ITU…… (No)
[22]	1-university (UDSM) + 153 students	Quantitative	IQ → LS…… (No)
[23]	1-MUHAS+ 272 students	Quantitative	IQ → LS…… (No)

*IQ=Information Quality; *ITU=Intention to Use; *LS=Learner Satisfaction

4. Methodology

The current study involves a systematic review of the literature of research which is based on information quality development of both information systems and e-learning systems from the year 1996 onwards to investigate factors and dimensions (items) which are considered important from consumers' perspectives. The studies were sourced from Google Scholar, IEEE, IGI, Emerald, Taylor and Francis, Science Direct, Springer and MDPI and involved those published from the year 1996 to 2020. The keywords used *were Information Quality, E-learning systems, Information Quality, Online system, electronic learning system, web-based learning system, distance learning, distributed learning, and virtual learning.* A total of 20 high-ranked journals related to the quality of both information systems and e-learning systems were reviewed and their findings were outlined in table 2.

5. Results and Discussions

The results are compiled in Table 2. Some factors or dimensions appear to be involved in more studies than others, indicating that they are more significant than others. The information concerning the recurrence of the dimensions is compiled in Table 3.

Table 2. Comparison between quality dimensions in different frameworks

Quality factors	Quality dimensions	[14]	[8]	[6]	[24]	[25]	[26]	[27]	[7]	[4]	[28]	[29]	[30]	[31]
Intrinsic dimensions	Accuracy	X	X	X	X	X	X	X	X	X	X		X	
	Believability	X		X						X	X			
	Consistency	X			X			X	X	X	X			
	Objectivity			X		X	X			X				
	Reputation			X				X		X	X			X
	Authority				X						X			

Contextual dimensions	Appropriate amount of data		X	X	X	X	X			X	X		X	X
	Completeness	X	X		X	X	X	X	X	X	X		X	
	Relevancy	X	X	X	X	X	X	X	X	X	X		X	
	Timeliness	X	X	X	X		X	X		X	X			X
	Value-added									X	X			
	Verifiability								X	X				
Representational dimensions	Concise representation									X				
	Ease of understanding				X					X	X		X	
	Interpretability	X								X	X			X
	Representational consistency	X		X				X		X				
	Advertising										X			
	Ease of Navigation			X	X						X			
Accessibility dimensions	Accessibility			X	X			X	X	X	X			
	Access Security	X				X			X	X	X			
	Availability	X				X				X				
	Response time	X	X		X	X		X		X	X			
	Efficiency				X						X			

Table 3. Frequency of quality dimensions in the examined frameworks

S/n	Quality dimensions	Frequency
1	Accuracy	11
2	Believability	04
3	Consistency	06
4	Objectivity	04
5	Reputation	04
6	Authority	01
7	Appropriate Amount of data	08
8	Completeness	10
09	Relevancy	11
10	Timeliness	08
11	Value-added	02
12	Verifiability	02
13	Concise representation	01
14	Ease of understanding	04
15	Interpretability	03
16	Representational consistency	04
17	Advertising	01
18	Navigation	03
19	Accessibility	06
20	Access Security	05
21	Availability	03
22	Response time	07
23	Efficiency	02

Note. The two dimensions are Consistency and Representational Consistency they are closely related, and they have been merged to be Representational consistency.

5.1 Key Factors and Dimensions

The Quality dimensions which appear to have been involved in the previous studies are seen in Table 3. It can be seen that the 23 factors are the main issues that matter most in the context of both developed and developing countries. Since the factors have been empirically tested that means they mostly influence information quality in the E-learning system. In this case, the next studies on E-learning systems are likely to use the factors and dimensions which fall among these. On the other hand, this study also suggests that further studies consider these factors followed by making further justifications for adding or eliminating some of them based on the contextual specifics.

5.2 Highly significant Factors

The quality dimensions which are more recurrent than others are also seen in Table 3. It can be seen that "Accuracy" and "Relevancy" are the most appealing dimensions featuring 11 times in the previous studies followed by timeliness which appears 8 times. This information implies that these are the dimensions that have been tested most in the context of both developed and developing countries. In other words, these dimensions tend to explain more on the quality of information of E-learning systems based on previous empirical studies in an e-learning system. This implies that when a developer of an e-learning system is designing and implementing, the two dimensions (Accuracy and Relevancy) have to be emphasized as it reflects the preference of users.

5.3 Framework explaining Information Quality of E-learning System

The finding revealed that 23 dimensions were preferred in previously developed frameworks in both developed and developing countries. However, the current dimensions and factors of the e-learning system in higher learning institutions in Tanzania are still unknown.

The review shows that relevancy and accuracy are the two most important dimensions for users. This means that users love information which is accurate and relevant to the application domain (e.g. learning environment has contents that are quite dissimilar to the hospital environment). Furthermore, findings show that users also love information with an element of changes according to a particular time. On top of that structure of information in e-learning is required to be responsive enough. Users like the structure of information with an element of reactive (quick to respond). The information which provides interaction is likely to be preferred.

6. Conclusion

The objective of this study was to review various research conducted to investigate information quality aspects of E-learning systems. It analysed the factors and dimensions which were used in such previous studies through a systematic analysis followed by discussions on the matters which are key to the present and future research. Further studies may focus on testing each of the dimensions which were identified in the specific context through a survey.

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