

Challenges and Practices of Knowledge Sharing in E-learning: A Systematic Literature Review

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Abstract

As an emerging approach to delivering knowledge and information to students, e-learning increases the learners' independence, flexibility, and adaptivity in the learning process, which requires a higher level of the utilization and integration of knowledge sharing in the virtual learning community. E-learning presents significant challenges to sharing and understanding learners' knowledge, inquiries, interest, and needs. Educational organizations are expected to apply the appropriate practice to address knowledge-sharing challenges in the e-learning environment. In this study, we intend to systematically identify and synthesize knowledge-sharing challenges and practices as well as classify the most discussed challenges and practices in various contextual settings. The findings reveal that the knowledge-sharing challenges and practices in e-learning could be classified into several themes. This study aims to build a knowledge base to support future research and effective knowledge-sharing practices in the e-learning environment.

Keywords: e-learning, knowledge sharing, challenges, practices, online learning, literature review.

1. INTRODUCTION

E-learning (or online education, or virtual learning) has become a popular practice in many institutions. Generally, e-learning refers to the use of information and communication technology (ICT) (e.g., learning management systems, email, instant messaging, forums, blogs, social media, video conferencing tools, etc.) for knowledge delivery and learning (Levinsen, 2007). With e-learning, institutions can reduce education costs by increasing the student-to-teacher ratio without downgrading the learning quality, reduce physical plant costs, and reduce transportation costs (Wang & Chien, 2019). Also,

in an e-learning context, learners and instructors can work together asynchronously regardless of time and place, synchronously with coordinated sessions, or a combination. The learner has more flexibility to arrange their learning practices at their own pace. Evidence shows that e-learning has positively affected the number of students pursuing higher education (Ferran et al., 2019). E-learning taking advantage of IT is beneficial to education, corporations and all types of learners (Wang & Chien, 2019). However, e-learning has come with many challenges, such as interaction, communication, coordination, and collaboration (Ferran et al., 2019; Leem & Lim, 2007). One of the key areas is knowledge sharing in an e-

learning environment, as e-learning itself is a knowledge-intensive activity whose success heavily relies upon effective and efficient knowledge sharing among the subjects (Deng et al., 2019). Educators and learners may find it difficult to share both tacit and explicit knowledge within the e-learning context.

Knowledge sharing is an integral process of knowledge management (KM) through which explicit or tacit knowledge is communicated to other individuals (Becerra-Fernandez & Sabherwal, 2014). The goal of e-learning, to facilitate learning and to share knowledge, echoes the essence of KM. The advantages of e-learning, flexibility, personalization, and low cost enable an organization to enhance the practices of knowledge sharing. Simultaneously, knowledge sharing is the key to success for e-learning processes. Zach and Agosto (2009) identify three categories in their framework for maximizing learner's collaboration and knowledge sharing in e-learning: 1) keys to success for knowledge sharing, including three key educator behaviors (participation/engagement, personalization, and facilitation of learning) and two key learner behaviors (peer interaction and equal participation); 2) educational benefits including connection to practice, peer-to-peer learning, student control, teamwork skills, and critical thinking skills. Finally, 3) drawbacks to knowledge sharing include technology overload, technological learning curve, technological incompatibility, and student resistance.

Given the increasing trend of e-learning and the importance of knowledge sharing in e-learning, researchers and practitioners have been dedicating large amounts of work to help understand knowledge sharing challenges and devise appropriate practices to address the challenges. Our systematic literature review (SLR) on knowledge sharing challenges and practices in e-learning aims at contributing to a growing knowledge body of knowledge sharing. This SLR is expected to inform the research community about popularly reported challenges and solutions to support knowledge sharing in e-learning.

2. ARTICLE SEARCH PROCESS

In this literature review, we aim to understand knowledge sharing challenges and practices reported by empirical studies in e-learning and demonstrate the contextual settings from which the challenges and practices are reported. We propose three research questions: (1) What are the knowledge-sharing challenges in e-learning?

(2) What are the knowledge-sharing practices in e-learning? (3) In what contextual settings are challenges and practices reported?

We formulated the search string based on three compartments to locate relevant literature. The search string is ("e-learning" OR "online learning" OR "online education" OR "virtual classroom" OR "virtual learning" OR "virtual education" OR "remote learning" OR "remote education" OR "distance education") AND ("knowledge sharing" OR "knowledge transfer" OR "knowledge shift" OR "knowledge exchange" OR "knowledge distribution" OR "knowledge transfer process" OR "knowledge flow" OR "knowledge management" OR "knowledge integration") AND ("challenge*" OR "problem*" OR "barrier*" OR "obstacle*" OR "risk*" OR "best practices" OR "strategy*" OR "approach*" OR "solution*" OR "mechanism*" OR "assessment*" OR "Evaluation*" OR "practice*" OR "mitigate*"). We used Google Scholar to test all the segments and combinations of the searching string. After this testing, we conducted title/keyword/abstract searches from four prominent online databases: ABI/INFORM Collection, Education Database (Proquest), ScienceDirect (Elsevier), and ACM Digital Library.

For each database search, the criteria used for including/excluding papers are as follows:

- Peer-reviewed papers only – exclude wire feeds.
- Full text only.
- Limit the source type to: scholarly journals, conference papers & proceedings, dissertations & theses.
- Limit the document type to: article, conference paper, conference proceeding, dissertation/thesis, literature review, report, review.
- Limit the subject area to: "Computer Science", "Business, Management and Accounting", "Decision Sciences", "Economics, Econometrics and Finance".
- Limit language to: English.
- Limit the oldest publication date to: January 1, 2007

We manually scanned abstracts and parts of introductions and filtered out those less relevant articles focusing on government management, technology features, technology implementation, industry usage, etc. Moreover, we employed snowballing technique to enroll a few essential papers. Finally, 39 peer-reviewed academic articles were selected for the literature review.

3. DATA ANALYSIS

To answer the research questions, we identified the relevant information and extracted it from each paper. For synthesizing the extracted data, we divided the data into (i) demographic and contextual attributes and (ii) knowledge sharing challenges and practices. The first data set was analyzed through statistical techniques and produced descriptive results. The second set of data items was analyzed with a thematic analysis method.

Demographic Attributes

Figure 1 shows the number of selected papers published per year within the review period from 2007 to 2021. Overall, the number of published studies on knowledge sharing in e-learning has increased since 2015. 28 papers out of 40 (70%) were published in the last seven years, which shows the phenomenon of knowledge sharing in e-learning is receiving increasing interest and attention from researchers and practitioners.

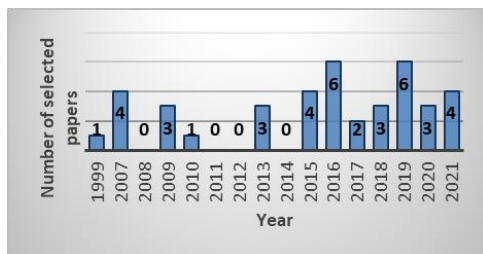


Figure 1: Papers Published by Year

Country	Paper Count	Country	Paper Count
United States	8	Brunei	1
Malaysia	4	Australia	1
Taiwan	3	Indonesia	1
China	3	Spain	1
India	3	UK	1
Turkey	2	Vietnam	1
Netherland	1	Czech	1
Denmark	1	Russia	1
Korea	1	Norway	1
Germany	1	Senegal	1
Mexico	1	Peru	1

Table 1: Locations of the e-Learning in Selected Studies

Table 1 shows that the reviewed studies were conducted in 22 different countries to address the knowledge-sharing issues and practices in the e-learning context. The most frequently involved country is the United States (8 papers), followed by Malaysia (4 papers), Taiwan, China, India (3

for each), Turkey (2 papers). Sixteen studies are from other 16 countries for each.

Information and communication technology (ICT) can facilitate knowledge sharing by reducing both time and spatial constraints among knowledge workers, thus enhancing their access to information related to knowledge (Hendriks, 1999). The success of knowledge sharing in e-learning relies on ICT such as Intranet, LMS platforms, social media, conference software, and so on. Therefore, we examined the applications and tools that had been reported in the reviewed papers (Table 2).

Technologies Used for Knowledge Sharing in e-Learning	Paper Count
Learning Management System (LMS), e.g., Moodle, Blackboard	12
Social network/social media, e.g., Facebook, Twitter	8
Synchronous conference system, e.g., Zoom, MS Teams	5
Blog and Forum, e.g., Blogger, Stack Exchange Forum	5
Semantic Web	5
Big data, data mining	4
Cloud computing	3
Artificial Intelligence (AI)	2
Others, e.g., expert system, intranet	3
Unclear	6

Table 2: Technologies Used for Knowledge Sharing in e-Learning

Research Methodology Attributes

We identified the research methods employed in the reviewed papers based on what was stated in the paper, e.g., we classified the paper under the case study category if the authors claimed that they had used a case study research method.

Figure 2 shows the percentage of different types of research methods used in all selected studies. The case study (36%) and empirical survey (29%) are two main-stream research methods in the research of knowledge sharing in the e-learning context. Four papers were based on design science, which was focused on demonstrating how to design new applications to help knowledge sharing in e-learning processes. Four studies used the experiment study method to examine the processes related to knowledge sharing by using a specific technology in online learning. Four papers conducted a literature review to examine the factors that affected the adoption and usage of a particular technology used for knowledge sharing in online learning and proposed their own research models. There were

two field studies (5%) and one action research (2%). Furthermore, we found that two papers used more than one research method, i.e., design science combined with survey and design science with experiment study.

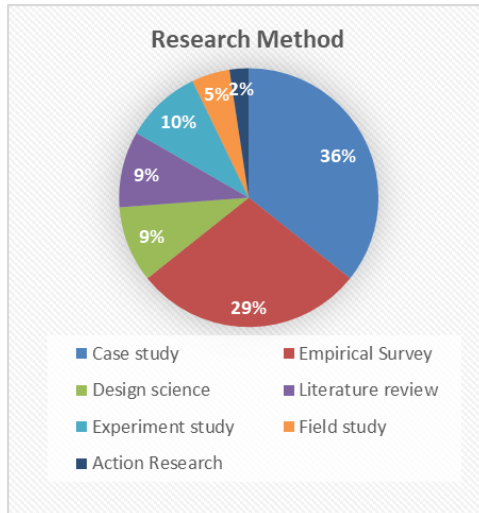


Figure 2: Distribution of Research Methods Employed in Selected Studies

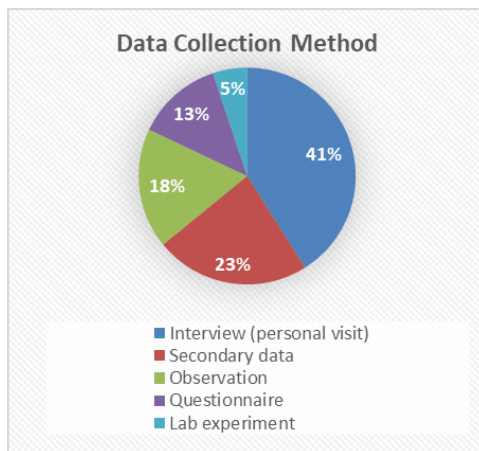


Figure 3: Distribution of Data Collection Methods in Selected Studies

Figure 3 shows that interview (41%) was the primary data collection method, followed by secondary data (23%), observation (18%), questionnaire (13%), and lab experiment (5%). Also, we noticed that some papers used more than one data collection method. For example, Rani et al. (2015) combined observation and questionnaire to get the data of using a new designed application; Anshari et al. (2016) blended secondary data and interviews to obtain the results of the usage of big data and social networks.

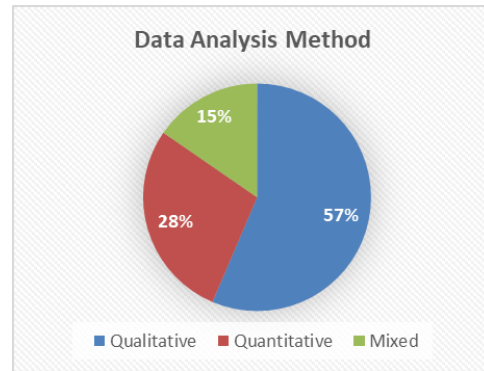


Figure 4: Distribution of Data Analysis Method in Selected Studies

Figure 4 presents that the most used data analysis approach was qualitative analysis (22 papers, 57%), followed by 28% of papers using quantitative analysis. Only six papers used both qualitative and quantitative analysis approaches.

Research Contextual Settings

The reviewed papers were sorted into education and industry cases. The education category refers to those studies conducted in educational settings (universities, colleges, high schools, etc.). The industry category includes the studies performed in business organizations. To gain a better understanding of knowledge sharing in the education context, we classified the studies into two sub-categories, which were 100% online e-learning and blended online e-learning.

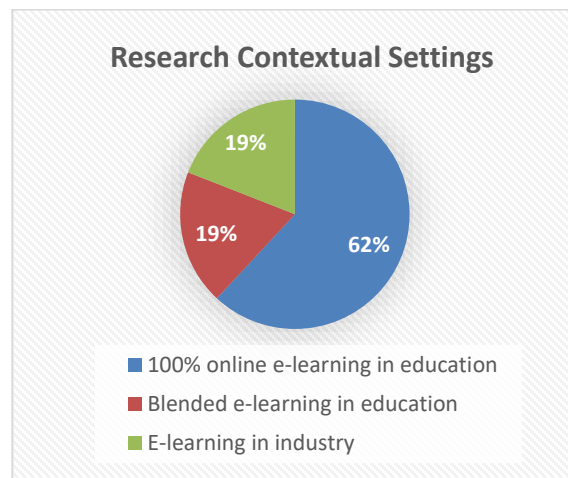


Figure 5. Distribution of Contextual Settings in Selected Studies

Figure 5 displays that most of the studies (81%) are education cases, with only eight papers (19%) in industry research. On the other hand, in the education settings, 62% of all selected studies are carried out in 100% online e-learning

context, and 19% report blended online e-learning cases.

Knowledge Sharing Challenges in e-Learning

To answer the first research question, "What are the key challenges of sharing knowledge in e-learning?", we adopted the thematic analysis method to analyze this data from all reviewed papers. Table 3 shows the knowledge-sharing

challenges in e-learning reported in the selected studies.

Knowledge sharing practices in e-learning

This section answers the second research question, "What are the key practices of sharing knowledge in e-learning?" Table 4 shows the knowledge-sharing practices in e-learning reported in the selected studies. Next, we present the practices and challenges from four perspectives.

	Challenge	Key Points	
Organization Perspective	1. Institutional Policies for Knowledge Sharing (KS)	* Knowledge management and communication policy (Damsa et al., 2021; Deng et al., 2019; Hendriks, 1999; Montoya, 2013; Pokrovskaja et al., 2021)	
		* Open Access Policy (Damsa et al., 2021; Montoya, 2013)	
		* Rewards for KS (Damsa et al., 2021; Ferran et al., 2019; Leem & Lim, 2007; Liou et al., 2016)	
	2. Community Culture for KS	* Cultures of Collaboration and online activity (Damsa et al., 2021; Ferran et al., 2019; Hew & Kadir, 2017; Kunthi et al., 2018; Leem & Lim, 2007; Sadiq Sohail & Daud, 2009; Wu & Zhang, 2015; Zanjani et al., 2016)	
		* Community Identification, e.g., reputation in the community (Hew & Hara, 2007; Liou et al., 2016)	
	3. Human Resource Support	* Evaluation System of Instructor's and Student's Performance (Dvořáková & Kulachinskaya, 2020; Leem & Lim, 2007)	
		* Staff work-life balance (Dvořáková & Kulachinskaya, 2020; Ferran et al., 2019)	
		* Online teacher's qualification impact knowledge sharing (Leem & Lim, 2007; Levinsen, 2007)	
	4. Budget and Cost	* Limited budget for human resource and technology (Ferran et al., 2019; Leem & Lim, 2007)	
	Individual Perspective	5. Teacher's Competence and Skills	* Teaching methods and teaching style for KS (Dvořáková & Kulachinskaya, 2020; Levinsen, 2007; Zach & Agosto, 2009; Zanjani et al., 2016)
* Teacher's digital capability (Altınay et al., 2019; Levinsen, 2007; Zach & Agosto, 2009)			
* Teacher's communication skills (Altınay et al., 2019; Levinsen, 2007; Zach & Agosto, 2009)			
6. Student's Competence and Skills		* Online learning skills, critical think skills (Hew & Kadir, 2017; Zach & Agosto, 2009)	
		* Technology skills (Damsa et al., 2021; Hew & Hara, 2007; Zach & Agosto, 2009)	
		* Communication skills and teamwork skills (Hew & Kadir, 2017; Zach & Agosto, 2009)	
7. Individual's Intention to Share Knowledge		* Knowledge sharing self-efficacy (Kunthi et al., 2018; Liou et al., 2016)	
		* The anticipated reciprocal relationship, norm of reciprocity (Hendriks, 1999; Liou et al., 2016)	
		* Perceived trust (Hew & Kadir, 2017; Kunthi et al., 2018; Yang et al., 2007)	
		* Perceived usefulness (Al-Emran & Teo, 2020; Kunthi et al., 2018)	
			* Knowledge power (Hew & Hara, 2007; Kunthi et al., 2018)

		* Competing priority (Hew & Hara, 2007)
		* Attitudes to knowledge sharing (Hew & Hara, 2007; Sadiq Sohail & Daud, 2009; Zach & Agosto, 2009)
Knowledge Perspective	8. Quality knowledge acquirement	* Difficulty in finding quality knowledge (Hendriks, 1999; Sabitha et al., 2017; Yang et al., 2007)
		* Lack of knowledge to share (Ferran et al., 2019; Hew & Hara, 2007)
		* Learning outcomes (Kunthi et al., 2018)
		* Nature of knowledge (Sadiq Sohail & Daud, 2009)
	9. Counter-knowledge	* Circulation of unverified information (Cegarra-Sánchez et al., 2018)
Technology Perspective	10. IT infrastructure support	* The quality of Internet connection (Dvořáková & Kulachinskaya, 2020; Ferran et al., 2019)
		* Cloud-based platform (Ferran et al., 2019; Zach & Agosto, 2009)
	11. Limitation of technologies for KS	* Need of collaborate tools (Ferran et al., 2019; Zach & Agosto, 2009)
		* Incompatibility of new technology (Zach & Agosto, 2009)
		* Technology learning curve (Agosto et al., 2013; Zach & Agosto, 2009)
	12. Defects of LMS platform	* Not running in real-time (Cheng, 2013)
		* Confidentiality consideration (Hew & Hara, 2007)
		* Content-focused than learner-focused (Cheng, 2013; Li, 2018; Sabitha et al., 2017)

Table 3: Knowledge Sharing Challenges in E-learning

	Practice	Key Points
Organization Perspective	1. Establish the KS virtual community	* Create basic rule and regulation for KS (Deng et al., 2019; Pokrovskaja et al., 2021)
		* Build the collaborative organization culture (Deng et al., 2019; Leem & Lim, 2007; Wu & Zhang, 2015)
		* Innovative models with open access systems (Montoya, 2013)
	2. Human Resource Support	* Facilitate all kinds of training (Montoya, 2013)
		* Acquire the tenant (Leem & Lim, 2007; Levinsen, 2007; Wu & Zhang, 2015)
	3. Increase the budget for KS	* Technology investment (Ferran et al., 2019; Leem & Lim, 2007)
* Human resource investment (Leem & Lim, 2007)		
Individual Perspective	4. Incentives and Motivations	* Reward for faculty to encourage KS (Leem & Lim, 2007; Sadiq Sohail & Daud, 2009)
		* Rating for individuals' knowledge sharing (Hew & Hara, 2007; Leem & Lim, 2007; Wu & Zhang, 2015)
		* Select the best-matched partners (Wu & Zhang, 2015)
	5. Competency development	* Pedagogical methods training (Dvořáková & Kulachinskaya, 2020; Levinsen, 2007; Zach & Agosto, 2009; Zanjani et al., 2016)
		* Technology and tools training (Altınay et al., 2019; Levinsen, 2007)
		* Online communication skills practice (Altınay et al., 2019; Levinsen, 2007; Zach & Agosto, 2009)
	6. Social trust relationship	* Knowledge sharing on the personal network (Hew & Kadir, 2017; Kunthi et al., 2018; Yang et al., 2007)
		* Build trust through offline activities (Hew & Kadir, 2017; Wu & Zhang, 2015)

Knowledge perspective	7. Acquire quality knowledge	* Knowledge quality assurance system (Hendriks, 1999; Leem & Lim, 2007; Sadiq Sohail & Daud, 2009; Yang et al., 2007)
		* Redefine the knowledge domain (Sadiq Sohail & Daud, 2009; Wu & Zhang, 2015)
		* Create collective knowledge at the inter-organization level (Wu & Zhang, 2015)
		* Increase awareness of the other agents' knowledge (Wu & Zhang, 2015)
Technology Perspective	8. Improve IT infrastructure	* Mobilization through innovation networks (Montoya, 2013)
		* Application of cloud-computing (Anshari et al., 2016; Ferran et al., 2019; Zach & Agosto, 2009)
	9. Implement novel technologies for KS	* Social media platform facilitating KS (Agosto et al., 2013; Cheng, 2013; Kara et al., 2020; Mbacké et al., 2021; Yang et al., 2007; Zhang et al., 2015)
		* Forum, ePortfolio, and e-newsletter applications (Ahmed et al., 2015; Wang & Chien, 2019; Zhang et al., 2009)
		* Semantic Web (Web 3.0) (Anshari et al., 2016; Rani et al., 2015; Welter et al., 2010)
		* AI technology (Maity, 2019; Sabitha et al., 2016)
		* Data mining and data analytics (Anshari et al., 2016; Marchena Sekli & De la Vega, 2021; Sabitha et al., 2017; Uhomoibhi et al., 2019)

Table 4: Knowledge Sharing Practices in E-learning

4. DISCUSSION AND FINDINGS

Based on the data retrieved from reviewed papers, we have classified challenges and practices into four categories from different perspectives: organization perspective, individual perspective, knowledge perspective, and technology perspective.

Perspective	Challenges	Practices	Total
Organization	16	8	24
Individual	15	15	30
Knowledge	8	5	13
Technology	8	20	28

Table 5: Distribution of Papers on KS Challenges and Practices

Table 5 shows the distribution of selected studies on knowledge sharing challenges and practices. This result accordingly demonstrates that the primary challenges and practices of knowledge sharing in e-learning are from individual, organization, and technology perspectives. Another interesting finding is that only 8 papers report technology challenges, but 20 papers report technology practices. We may posit that the e-learning community has more choices and more new technologies emerge to address the challenges from the technical aspect.

	Factors	Paper Count
Challenges	Community culture for knowledge sharing	10
	Individual's intention to share knowledge	9
	Organizational policies for knowledge sharing	8
	Teacher's competence and skills for knowledge sharing	7
	Quality knowledge acquirement	7
Practices	Implement novel techniques for knowledge sharing	18
	Establish the knowledge sharing virtual community	5
	Individual's competency development	5
	Human resource support	4
	Incentives and motivations for individuals	4

Table 6: Top 5 Challenges and Practices Most Frequently Reported

Table 6 shows the most frequently presented challenges and practices in the reviewed studies. Among all the reported challenges explained in the previous section, community culture for knowledge sharing, individual's intention to share knowledge, and organization's policy for knowledge sharing has been proposed more frequent than any others, followed by teacher's competence and skills for knowledge sharing and the acquirement of quality knowledge. Technology challenges are not in the top 5. It also shows the top 5 reported knowledge sharing practices in the e-learning environment. Eighteen studies present the practice of implementing novel techniques for advancing knowledge sharing. At the organization level, five papers reported establishing the knowledge-sharing virtual community, and four papers proposed the practice of support from human resources. At the individual level, five papers reported developing individual competency, and four reported the practice related to incentives and motivations for instructors and learners. The practices associated with knowledge itself are not in the top 5.

From the list of most popular practices, our review shows that ICT is one of the most important key factors that affect knowledge sharing activities. Researchers believe that the leverage of emergent technologies can address most challenges in the e-learning community. Our review also reveals that the challenge of counter-knowledge (knowledge that was correct at one time but has changed) has not been paid enough attention in both academic areas and industry, which means that this topic may attract more researchers and practitioners in the future.

Technologies provide individual learners and instructors with the tools to support and improve their knowledge-sharing capabilities and skills. Our review discovered that many researchers proposed different emergent technologies to address knowledge sharing in the e-learning context. A LMS e-learning platform is the most frequently reported technology practice for facilitating knowledge sharing, followed by social media, big data analytics, and semantic web techniques. In these empirical studies, most researchers examined the factors that affect the adoption of the technologies for knowledge sharing, designed and verified the validity of the new knowledge-sharing systems, and demonstrated how the technologies support knowledge sharing. However, in all reviewed studies, we have not found any paper that conducted a comparison study on the different supports for knowledge sharing between technological practices and non-technological

practices. Moreover, there was little work on how a specific technical practice incorporating non-technological practices facilitates knowledge sharing. In addition, there is a lack of research on how the various technologies support knowledge sharing in 100% online e-learning, blended e-learning, and industry e-learning contextual settings.

5. LIMITATIONS

This paper only addressed research found in four databases. These were selected due to their availability and relation to computer science and information systems. There would be more articles to examine if the search terms were to be used in other databases so the findings could change with additional databases. Also there could be other search terms and combinations that could be used to find similar articles.

6. CONCLUSIONS

Naturally, e-learning involves highly intellectual activities that share knowledge between instructors and learners and among learners (Altinay et al., 2019). Sharing knowledge is essential for successfully delivering and gaining knowledge in the e-learning process. Future studies could examine the literature to see if there are differences between 100% online and hybrid e-learning as it related to knowledge sharing. This literature review is potentially beneficial to both e-learning and knowledge management fields. On the one hand, this review provides information to understand the challenges in the e-learning process from the knowledge sharing perspective. On the other hand, this research explores the challenges and practices of knowledge sharing in various e-learning settings. This review is expected to help both e-learning and knowledge management communities understand knowledge sharing needs and challenges and provide suitable solutions for the e-learning context.

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