SCOPING REVIEW

Shirin Hasanvand[1,*], Rita Mojtahedzadeh[2], Aeen Mohammadi[2], Mahnaz Samadbeik[3], Mehdi Vatankhah[4]

[1]Department of Nursing and Midwifery, Lorestan University of Medical Sciences, Khorramabad, Iran

[2]Department of E-Learning in Medical Education, Center of Excellence for E-learning in Medical Education, School of Medicine, Tehran University of Medical Sciences, Tehran, Iran

[3]Social Determinants of Health Research Center, Lorestan University of Medical Sciences, Khorramabad, Iran

[4]Nurse, Lorestan University of Medical Sciences, Khorramabad, Iran

[*]Lorestan University of Medical Sciences, Kilometer 4 of Khorramabad- Boroujerd Road, Khorramabad Nursing and Midwifery Faculty Khorramabad, 6814993165 Iran

Tel: +98 165-06633120155
Email: Hasanvand.sh1390@gmail.com

Quality of interpersonal interactions in e-learning at the higher education: A scoping review

Background: The quantity and quality of interaction are critical elements of perceived interactions. This study aimed to summarize findings on the quality of interpersonal interactions in E-Learning at higher education and suggestions that inform future measurement efforts.

Method: The scoping review proposed by Arksey and O'Malley (2005) was used. This approach consists of 5 steps: 1) identifying the research question, 2) identifying relevant studies, 3) study selection, 4) charting the data, and 5) reporting the results. PubMed, Scopus, and Web of Science have searched three databases, including manuscripts in English. The search was conducted from 2000 to July 2021. A PCC (population, concept, and context) was used as eligibility criteria and included the most relevant. The present PCC was defined as a population: university students, context: higher education, and Concept: E-learning and Interpersonal Interactions.

Results: This review included twenty-five articles chosen for inclusion. With the thematic analysis, the results of this scoping review were presented in the form of four themes: interaction in the online environment affects learning outcomes, numerous factors affect the interaction of learners in online settings, online interaction and hidden curriculum, and the importance of forming an online learning community.

Conclusion: Findings showed that the quality of interpersonal interactions in e-learning seems to be a neglected link in e-learning. Further studies are needed focusing on the quality of interpersonal interactions in e-learning. It is necessary to develop appropriate tools to measure the quality of interpersonal interactions and further evaluate these interactions at the international level.

Keywords: E-learning, Communication, Interpersonal interactions, Online learning, Higher education

جودة التفاعلات بين الأشخاص في التعلم الإلكتروني في التعليم العالي: مراجعة تحديد النطاق

الخلفية: تعتبر كمية ونوعية التفاعل عنصرين حاسمين في التفاعلات المدركة. تهدف هذه الدراسة إلى تلخيص النتائج المتعلقة بجودة التفاعلات بين الأشخاص في التعلم الإلكتروني في التعليم العالي والاقتراحات التي تفيد جهود القياس المستقبلية.

الطريقة: تم استخدام مراجعة النطاق التي اقترحها أركسي وأومالي (٢٠٠٥). يتكون هذا النهج من ٥ خطوات: ١) تحديد سؤال البحث، ٢) تحديد الدراسات ذات الصلة، ٣) اختيار الدراسة، ٤) رسم البيانات، و ٥) الإبلاغ عن النتائج. قامت PubMed وScopus وWeb of Science بالبحث في ثلاث قواعد بيانات، بما في ذلك المخطوطات باللغة الإنجليزية. تم إجراء البحث في الفترة من عام ٢٠٠٠ إلى يوليو ٢٠٢١. وتم استخدام PCC (السكان، والمفهوم والسياق) كمعايير للأهلية وتضمنت المعايير الأكثر صلة. تم تعريف PCC الحالي على أنه مجموعة سكانية: طلاب الجامعات، والسياق: التعليم العالي، والمفهوم: التعلم الإلكتروني والتفاعلات بين الأشخاص.

النتائج: تتضمن هذه المراجعة خمسة وعشرين مقالة تم اختيارها لإدراجها. من خلال التحليل المواضيعي، يتم عرض نتائج مراجعة النطاق هذه في شكل أربعة مواضيع: يؤثر التفاعل في البيئة عبر الإنترنت على نتائج التعلم، وتؤثر عوامل عديدة على تفاعل المتعلمين في الإعدادات عبر الإنترنت، والتفاعل عبر الإنترنت والمناهج المخفية، وأهمية التعلم عبر الإنترنت. تشكيل مجتمع التعلم عبر الإنترنت.

الاستنتاج: أظهرت النتائج أن جودة التفاعلات بين الأشخاص في التعلم الإلكتروني تبدو حلقة مهملة في التعلم الإلكتروني. هناك حاجة إلى مزيد من الدراسات التي تركز على جودة التفاعلات بين الأشخاص في التعلم الإلكتروني. ومن الضروري تطوير الأدوات المناسبة لقياس جودة التفاعلات بين الأشخاص ومواصلة تقييم هذه التفاعلات على المستوى الدولي.

الكلمات المفتاحية: التعلم الإلكتروني، التواصل، التفاعلات الشخصية، التعلم عبر الإنترنت، التعليم العالي

کیفیت تعاملات بین فردی در یادگیری الکترونیکی در آموزش عالی (مطالعه مروری)

زمینه و هدف: کمیت و کیفیت تعامل، عناصر حیاتی تعاملات بین فردی درک شده است. این مطالعه با هدف خلاصه‌سازی یافته‌های مربوط به کیفیت تعاملات بین فردی در یادگیری الکترونیکی در آموزش عالی و پیشنهادهایی جهت مطالعات آتی انجام شده است.

روش: از رویکرد مرور دامنه‌ای پیشنهاد شده آرکسی و اومالی (۲۰۰۵) استفاده شد. این رویکرد شامل ۵ مرحله ۱) تدوین سوال تحقیق ۲) شناسایی مطالعات مرتبط ۳) انتخاب مطالعات اصلی ۴) ثبت و خلاصه سازی داده‌ها و ۵) گزارش نتایج است. جستجوی مقالات به زبان انگلیسی در سه پایگاه داده‌ای پاب مد، اسکوپوس و وب آو ساینس انجام شد. جستجو در بازه زمانی ۲۰۰۰ تا ژوئیه ۲۰۲۱ انجام شد. از PCC (جمعیت، مفهوم و زمینه) به عنوان معیارهای مطالعه استفاده و مرتبط‌ترین مقالات وارد مطالعه شدند. جمعیت در این مطالعه شامل دانشجویان و زمینه و مفهوم به ترتیب شامل آموزش عالی و یادگیری الکترونیکی و تعاملات بین فردی بودند.

یافته‌ها: در این مرور دامنه‌ای ۲۵ مقاله مورد ارزیابی قرار گرفتند. با کمک تحلیل تماتیک، نتایج این مرور در قالب چهار تم؛ تأثیر تعامل در محیط آنلاین بر پیامدهای یادگیری، عوامل متعدد تاثیرگذار بر تعامل فراگیران در بسترهای آنلاین، تعامل آنلاین و برنامه درسی پنهان و اهمیت تشکیل یک جامعه یادگیری آنلاین ارائه شد.

نتیجه‌گیری: به نظر می‌رسد کیفیت تعاملات بین فردی در یادگیری الکترونیکی حلقه مفقوده یادگیری الکترونیکی باشد. مطالعات بیشتری با تمرکز بر کیفیت تعاملات بین فردی در یادگیری الکترونیکی مورد نیاز است. همچنین، طراحی و توسعه ابزارهای مناسب برای سنجش کیفیت تعاملات بین فردی و ارزیابی بیشتر این تعاملات در سطح بین المللی ضرورت دارد.

واژه های کلیدی: یادگیری الکترونیکی، تعاملات، تعاملات بین فردی، یادگیری آنلاین، آموزش عالی

اعلی تعلیم میں ای لرننگ میں باہمی تعامل کا معیار: ایک اسکوپنگ جائزہ

پس منظر: تعامل کی مقدار اور معیار سمجھے جانے والے تعاملات کے اہم عناصر ہیں۔ اس مطالعے کا مقصد اعلیٰ تعلیم میں ای لرننگ میں باہمی تعامل کے کیفیت کے معیار اور مستقبل کی پیمائش کی کوششوں سے آگاہ کرنے والی تجاویز کا خلاصہ کرنا تھا۔

طریقہ: (Arksey and O'Malley (2005 کی طرف سے تجویز کردہ اسکوپنگ کا جائزہ استعمال کیا گیا۔ یہ نقطہ نظر ۵ مراحل پر مشتمل ہے: ۱) تحقیقی سوال کی شناخت، ۲) متعلقہ مطالعات کی شناخت، ۳) مطالعہ کا انتخاب، ۴) ڈیٹا کو چارٹ کرنا، اور ۵) نتائج کی اطلاع دینا۔ پب میڈ، اسکوپس، اور ویب آف سائنس نے تین ڈیٹا بیس تلاش کیے ہیں، بشمول انگریزی میں مخطوطات۔ یہ تلاش ۲۰۰۰ سے جولائی ۲۰۲۱ تک کی گئی تھی۔ ایک پی سی سی (آبادی، تصور، اور سیاق و سباق) کو اہلیت کے معیار کے طور پر استعمال کیا گیا تھا اور اس میں سب سے زیادہ متعلقہ شامل تھا۔ موجودہ پی سی سی کی تعریف ایک آبادی کے طور پر کی گئی تھی: یونیورسٹی کے طلباء، سیاق و سباق: اعلیٰ تعلیم، اور تصور: ای لرننگ اور باہمی تعاملات۔

نتائج: اس جائزے میں شامل کرنے کے لیے منتخب کیے گئے پچیس مضامین شامل ہیں۔ موضوعاتی تجزیہ کے ساتھ، اس اسکوپنگ جائزے کے نتائج چار موضوعات کی شکل میں پیش کیے گئے ہیں: آن لائن ماحول میں تعامل سیکھنے کے نتائج کو متاثر کرتا ہے، متعدد عوامل آن لائن سیٹنگز، آن لائن تعامل اور پوشیدہ نصاب میں سیکھنے والوں کے تعامل کو متاثر کرتے ہیں، اور اس کی اہمیت۔ ایک آن لائن سیکھنے کی کمیونٹی کی تشکیل۔

نتیجہ: نتائج سے پتہ چلتا ہے کہ ای لرننگ میں باہمی تعامل کا معیار ای لرننگ میں ایک نظر انداز کڑی لگتا ہے۔ ای لرننگ میں باہمی تعاملات کے معیار پر توجہ مرکوز کرتے ہوئے مزید مطالعات کی ضرورت ہے۔ باہمی تعاملات کے معیار کی پیمائش کرنے اور بین الاقوامی سطح پر ان تعاملات کا مزید جائزہ لینے کے لیے مناسب اوزار تیار کرنے کی ضرورت ہے۔

مطلوبہ الفاظ: ای لرننگ، مواصلات، باہمی تعاملات، آن لائن سیکھنے، اعلیٰ تعلیم

INTRODUCTION

Interaction is fundamental to effective teaching and learning processes (1, 2). A lack of effective interaction negatively impacts the learning outcome (3). Satisfaction with interpersonal interaction is how these needs are met. When positive expectations are met, satisfaction with communication is experienced as a natural response to achieving their interaction goals and fulfilling their expectations (4). Online interactions are also essential components of distance education (5).

Numerous studies on communication satisfaction in education have been conducted, but there are limited studies in online settings (6). In education, due to the desire of learners to establish interpersonal interactions, teachers need to engage in positive forms of communication with their learners (7). Because increased student satisfaction leads to more competitive conditions, it attracts new students and helps retain existing ones (8).

In addition, interacting with students is one of the teachers' most critical responsibilities in traditional curricula and online courses. The ease of communication partly influences the teacher's interactions with the student, the degree to which students feel comfortable asking questions (9). In particular, online communities' communication processes are essential (10). Like face-to-face (F2F) communication, the goal of online communication is to exchange information, be heard, and be understood (7).

Online communication also enables students to use messages, images, audio, and video from asynchronous or simultaneous interaction systems and converse directly and simultaneously with their teachers. In contrast, asynchronous communication does not happen in real-time and enables learners and teachers to talk indirectly without committing to a specific time(5). However, students' interaction experiences in online environments are very different from F2F classes.

One of the factors affecting students' dissatisfaction with online education is the providing various forms of communication with the student or between students. There are several methods for interaction in traditional classes. Nevertheless, the online learning platform has few configurations for teaching interaction (11). Learners are not physically present in the same environment. Student-student and student-teacher interactions must be carefully integrated with the online course (9) because teachers do not have the advantage of using body language to help them communicate with learners (5).

According to an online survey, students faced many problems when attending online classes such as reduced motivation comprehension, especially the level of communication between them and teachers, isolation caused by online courses (4). In another study, the main challenges arising included educational, organizational, ethical, technical, supportive, evaluation, managerial, and communication challenges (12).

Teachers must interact through communication tools to create an influential learning community (4). The quality of successful online programs depends on the advanced level of computer-aided interaction, and the form and type of communication influence the teacher-student interaction.

In online learning, peer interaction is crucial, including engaging with specific texts and students. Interactions with these components can be more significant than interactions with professors and peers (5). The study done by Hunter and Ross confirmed a positive linear relationship between interactions for each student and the quality perceived by a student (13).

In conclusion, although several studies have been conducted on communication satisfaction and learners' perceptions of the quality of interaction (14) and related evidence in other communication contexts, little attention has been paid to this in higher education (4). The quality of communication and its effects on people's lives can be improved once we clarify its meaning and the meaning of education, which is the primary concept on which a structured society is based. Previous studies on communication satisfaction and quality have mainly focused on F2F communication in organizations. Few studies have linked learners' emotional reactions to their online interactions in educational settings. In recent years satisfaction with communication and the quality of virtual interactions have been considered (15).

On the other hand, the importance of interactions in the online learning environment has been the focus of many studies. The quantity and quality of interaction are critical elements of perceived interactions (15). The specific objective of this study was to summarize findings on the quality of interpersonal interactions in e-Learning and suggestions that inform future measurement efforts.

METHODS

This study employed a scoping review, which outlines the underlying concepts of a research area and the types of evidence available (16). This methodology was proposed by Arksey and O'Malley in 2005. This approach consists of five steps as follows:

Stage 1: identifying the research question
This study was designed to answer this question: What is known from the existing literature about the quality of interpersonal interactions in e-learning? What recommendations does the literature provide for future studies?

Stage 2: identifying relevant studies
Search terms were chosen based on the research question. The main keywords include e-learning, online, education, communication, and university students. The logical operators AND, OR were used to combine different search terms. Three primary databases of PubMed, Scopus, and Web of Science were searched using a search strategy to identify all the relevant literature (Table 1). The search was conducted in July 2021. Grey literature was hand-searched through Google Scholar.

Stage 3: study selection and review
A PCC (population, concept, and context) was used as eligibility criteria, and the scoping review's research question to screen the articles including the most relevant ones. The present PCC was defined as a population: university

Table 1. Search strategy for the scoping review		
NO	Construct	Search field/Limits
#1	ELearning OR e-learning OR m-learning OR m-learning OR "virtual learning" OR "digital learning" OR "online learning."	In: Title
#2	education OR learning OR training OR teaching	In: Title
#3	online OR "Computer-assisted" OR Internet OR distance OR remote OR web OR internet OR electronic OR virtual OR "mobile phone" OR "cell phone" OR smartphone OR smartphone OR hybrid or blended or mobile or virtual	In: Title
#4	#1 OR (#2 AND #3)	In: Title
#5	Communication OR communications OR Interpersonal OR Interaction OR Interactions OR relationship OR relationships	In: Title
#6	student or students	In: Topic (Title, Abstract, Keywords)
#ᵛ	university OR universities OR faculty	In: Topic (Title, Abstract, Keywords)
#7	#4 AND #5 AND #6 AND #7	Language: English

students, context: higher education, and Concept: E-Learning and Interpersonal Interactions. Articles that did not meet the eligibility criteria and did not align with the study's aims were excluded. In addition,, editorials, letters, conference proceedings, and books were excluded.

A single reviewer (MS) conducted the primary database searches, and the references were uploaded into a citation manager (Endnote). The duplicates were excluded according to the inclusion and exclusion criteria, and other articles were screened by title and abstract. The reference list searched for further relevant articles. The first and fifth authors retrieved and read the full text of the articles. Subsequently, final articles were included in this review, as shown in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) diagram in Fig 1. Discrepancies between the reviewers were resolved via discussions until consensus was reached. (Inter-rater reliability, IRR=o.84) (Figure 1).

Stage 4: *charting the data*
The data extraction form was designed in Microsoft Excel 2013, containing the first authors` name, year of publication, country, method, population, aim, type of communication, conclusion, and focus. Two authors (first and fifth) completed data extraction, and the third research member made the final decision at times of disagreement.

Stage 5: *collating, summarizing, and reporting the results*
A thematic analysis approach was applied for evidence synthesis.

The ethics code was obtained from the Deputy for Research and Technology of Tehran University of Medical Sciences (IR.TUMS.MEDICINE.REC.1400.686).

RESULTS
According to the inclusion and exclusion criteria, the duplicates (n=205) were excluded, and 789 articles were screened by title and abstract. Subsequently, this review screened the full texts of 131 articles (Figure 1). Twenty-five
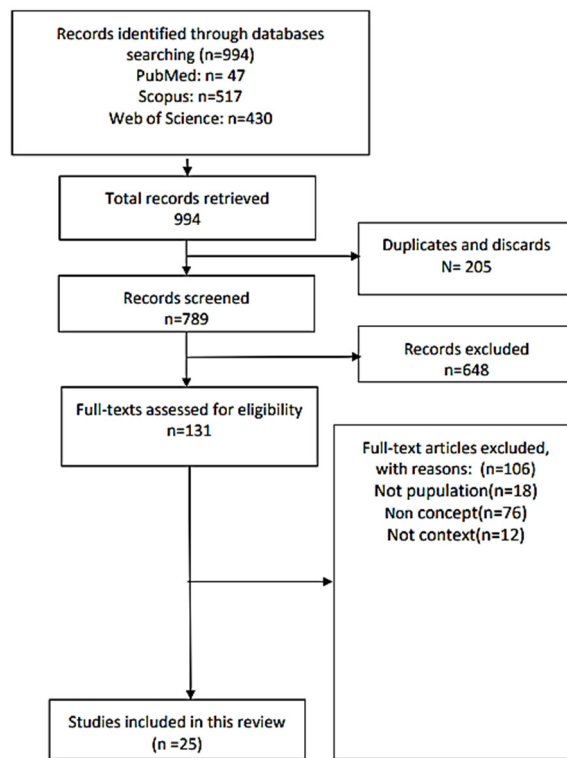

Figure 1. The PRISMA flowchart of the scoping review

articles were chosen for inclusion following the full-text evaluation. Recent research from the United States (8 articles), Australia (2), Malaysia (2), Turkey (2), UAE, Indonesia, Vietnam, Germany, Greece, Colombia, Korea, Pakistan, Slovakia, and Hong Kong (each with one article) were examined. With the thematic analysis, the results are presented as below:

Theme 1. *Interaction in the online environment affects learning outcomes.*
Many studies have confirmed learners' engagement and

interpersonal interactions (17-20). A study pointed to the relationship between emotional engagement and levels of interpersonal interactions. Learners' interactions are essential for emotional engagement and social sense(18). The learners' engagement has been cited as a critical factor in learning and a challenging aspect of online teaching (20). E-teachers can use different communication methods to increase learners' cognitive engagement (21). Several studies have also emphasized learner-teacher and learner-learner interactions in fostering academic achievement, promoting learning outcomes, and enhancing student satisfaction (17, 19, 22, 23). In Smith's study, the experiences of nursing teachers showed that learners who did not interact with their peers were less successful in learning (20). However, another study showed that only interaction with content can be a predictor of learners' satisfaction (24). Also, learners' interactions with each other and teacher strongly predict academic success (25).

Nevertheless, the critical point is that the quality of communication, not its quantity, can effectively enhance learning, and high levels of interaction do not necessarily facilitate meaningful learning. According to Mehall et al., interaction should be structured, purposeful, and accompanied by leadership, and the qualitative aspect of interaction is more important than measuring its quantity (26). In general, interaction should be the basis for reflection, discussion, and learners' participation (27).

Theme 2. Numerous factors affect the interaction of learners in online settings.
In several studies, various factors have been mentioned:

2.1. Delivery method of education: The superiority of online interaction over F2F interaction was reported in a study due to the rapid exchange of information between learners and teachers and learners (28). This approach is especially true for postgraduate students who want asynchronous education due to job restrictions and family issues (29). F2F interaction is vital in situations that require high degrees of cognitive presence, and online interactions are essential in cases that require high degrees of social presence and establishing social (30). Such forums also allow learners to interact as a practice community (31). In a study on holding discussions through forums, active participation in chat text was emphasized in social interaction and rapid feedback. However, according to other evidence, there is no one-size-fits-all communication tool. Depending on the situation, group structure, learners' motivation, simultaneous and asynchronous tools can be used (32). According to Zheng et al., the atmosphere of secure psychological communication and perceived responsiveness, directly and indirectly, affects learner participation (30).

2.2. Technology: According to reviewed studies, technology transforms communication and thus stabilizes the position of the teacher in the center of the development of interpersonal relationships. According to Sher and Gdanetz et al., with technology, learner-learner and learner interaction with the teacher is facilitated (22, 33). Of course, technical resources need to be used to enable high-level interactivity. However, in a study, learners' concerns about the cost of using technology and technophobia have been cited as barriers to

interaction (34).

2.3. Support: Due to the separation of students from the teacher, it is essential to provide technical, moral, etc., support to the teacher in communication with learners with various methods in online environments. For example, students must be supported in navigating a learning management system (26).

Theme 3. Online interaction and hidden curriculum
Due to student-teacher interaction in e-learning, e-learners are clearly deprived of practical life experiences. The lack of opportunity for developing learners' critical thinking and moral reasoning is also emphasized. They referred to the hidden curriculum; Malik and Churche state that many ethical and social values are practically learned through interaction with the teacher and the educational atmosphere. However, in virtual lessons, this aspect is missed (35). Mehall et al. confirm this in another way and state that informal learning, unlike F2F teaching, is reduced by the lack of appropriate interaction (26).

Theme 4. The importance of forming an online learning community
In Gdanetz's study, students and professors reported the importance of creating a virtual learning community as part of the online learning environment(33). The interviews with students in another study showed that at the basic levels of interaction, sharing and creating a social bond provide the ground for forming a community of practice (31).

DISCUSSION
With the thematic analysis, the results of this scoping review are presented in the form of four themes: interaction in the online environment affects learning outcomes, numerous factors affect the interaction of learners in online settings, online interaction and hidden curriculum, and the importance of forming an online learning community.

The first theme discusses how interpersonal communication influences learning outcomes. Due to the impact of student engagement on learning stimulation, especially in online environments, many researchers have considered it (36). Student engagement in online learning occurs when this platform is used for education (37). According to Martin and Bolliger, learner interaction with the instructor causes them to engage more in online courses. The use of multiple communication channels between the learner and the teacher may be related to learners' engagement (38). In addition, interaction is considered one of the most powerful predictors of success in distance education. Joksimovic et al. also pointed to the predictive role of interaction on academic achievement (1). Agudo-Peregrina et al. also showed a relationship between academic performance and learner-teacher interactions (39).

The second theme included the factors affecting interpersonal interactions. A study showed that lesson structure, class size, feedback, and previous experience with CMC from the perspective of both teachers and students. Providing interaction is essential. Simultaneous voice or text chat rooms allow interaction between transmitter and learner (40). According to Turon et al., e-learning tools simultaneously facilitate people's online participation. Direct

interaction between the instructor and the learner in real-time is much like a traditional F2Fe classroom, but even better (41). Face and tone of voice can help them feel human on a broader range and provide interaction with minimal cost (40).

Nevertheless, asynchronous technologies allow learners to communicate with teachers and peers through full-time access to content but provide less participation (41). In addition, asynchronous technologies enable learners to respond with delay, allowing them to use higher-level learning skills and sometimes leading to divergent thinking (40). According to Colin et al., electronic forums can be helpful in reflection exercises, even for teachers, due to their participatory nature (42). The role of technology in e-learning was also mentioned. Technology for the teacher is a way to play the role of mentor, coach, or facilitator to transmit knowledge (41).

The third theme was about the role of the hidden curriculum in e-learning. The hidden curriculum expresses attitudes, knowledge, and behaviors as an implicit curriculum. It shows that it is unintentionally and indirectly transmitted through speech and action and is part of the life of all people in a society (43).One of the dimensions of the hidden curriculum is learning for learning. "Learning to learn in online environments exposes teachers and learners to many epistemological challenges. For example, creating and maintaining credibility and accuracy in virtual environments is a challenge that requires understanding the complexities of the virtual world, such as anonymity, online culture (44). Lack of interaction between the learner and the learner or even learners themselves in online learning can slow down the formation of values in the teaching and learning process or hinder the development of attitudes as an essential part of education (45).

The fourth theme referred to the position of the online learning community in online communication. In this online learning community, people must feel free to discuss ideas. All information must be visible to other members, and all members must attend. It is a virtual entity that combines learning and society (46). According to Chih-Hung et al., continuous interaction and participation of learners are two critical indicators of the development of the online learning community (46). Shackelford and Maxwell cited the development of an online learning community as an essential factor in increasing learner satisfaction (47).

One limitation of this study is the no consideration of non-English and conference articles, which may have excluded articles of significance to our study objective.

A comprehensive review of existing studies revealed that the majority of research focused on the consequences of e-interaction, the factors influencing interpersonal communication in eLearning, the role of hidden curricula, and the formation of online learning communities. Notably, a single study centered on the quality of interactions in eLearning, underscoring the importance of this topic. However, the quality of interpersonal interactions in eLearning appears to be a neglected aspect of research in this field, warranting further investigation. To address this gap, it is essential to develop suitable instruments to measure the quality of interpersonal interactions and conduct international evaluations to assess these interactions.

Ethical considerations
Ethical issues including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc. have been completely observed by the authors.

REFERENCES

1. Joksimović S, Gašević D, Loughin TM, Kovanović V, Hatala M. Learning at distance: Effects of interaction traces on academic achievement. Computers & Education. 2015;87:204-17.

2. Mawad G. Impact of electronic interaction patterns in a collaborative learning and instructional anchors-based environment on developing instructional design skills and achievement motivation. International Journal of Education and Practice. 2020;8(1):86-105.

3. Chen Y-RR, Schulz PJ. The effect of information communication technology interventions on reducing social isolation in the elderly: a systematic review. Journal of medical Internet research. 2016;18(1):e4596.

4. Goodboy AK, Martin MM, Bolkan S. The development and validation of the student communication satisfaction scale. Communication Education. 2009;58(3):372-96.

5. Vlachopoulos D, Makri A. Online communication and interaction in distance higher education: A framework study of good practice. International Review of Education. 2019;65(4):605-32.

6. Casey DM. The impact of distance learning on interpersonal communication satisfaction: A comparison of online and face-to-face community college classrooms: University of Miami; 2004.

7. Alawamleh M, Al-Twait LM, Al-Saht GR. The effect of online learning on communication between instructors and students during Covid-19 pandemic. Asian Education and Development Studies. 2020.

8. BOZTEPE Ö. The adaptation of student communication satisfaction scale into Turkish culture. International Journal of Educational Research Review. 2016;2(1):27-33.

9. Peltier JW, Schibrowsky JA, Drago W. The interdependence of the factors influencing the perceived quality of the online learning experience: A causal model. Journal of Marketing Education. 2007;29(2):140-53.

10. Petrič G. Perceived quality of conversations in online communities: conceptual framework, scale development, and empirical validation. Cyberpsychology, behavior, and social networking. 2014;17(2):82-90.

11. Chen T, Peng L, Yin X, Rong J, Yang J, Cong G, editors. Analysis of user satisfaction with online education platforms in China during the COVID-19 pandemic. Healthcare; 2020: Multidisciplinary Digital Publishing Institute.

12. Shafiei Sarvestani M, Mohammadi M, Afshin J, Raeisy L. Students' experiences of e-learning challenges; a phenomenological study. Interdisciplinary Journal of Virtual Learning in Medical Sciences. 2019;10(3):1-10.

13. Hunter Dr J, Ross B. Does increased online interaction between instructors and students positively affect a student's perception of quality for an online course? Journal on Empowering Teaching Excellence. 2019;3(2):4.

14. Ehlers LN. The relationship of communication satisfaction, job satisfaction and self-reported absenteeism: Miami University; 2003.

15. Hung M-L, Chou C. The development,

validity, and reliability of communication satisfaction in an online asynchronous discussion scale. The Asia-Pacific Education Researcher. 2014;23(2):165-77.

16. Tricco AC, Lillie E, Zarin W, O'Brien K, Colquhoun H, Kastner M, et al. A scoping review on the conduct and reporting of scoping reviews. BMC medical research methodology. 2016;16(1):1-10.

17. Muzammil M, SUTAWIJAYA A, HARSASI M. Investigating student satisfaction in online learning: the role of student interaction and engagement in distance learning university. Turkish Online Journal of Distance Education. 2020;21(Special Issue-IODL):88-96.

18. Salta K, Paschalidou K, Tsetseri M, Koulougliotis D. Shift from a Traditional to a Distance Learning Environment during the COVID-19 Pandemic. Science & Education. 2022;31(1):93-122.

19. Kim S, Kim D-J. Structural relationship of key factors for student satisfaction and achievement in asynchronous online learning. Sustainability. 2021;13(12):6734.

20. Smith YM, Crowe AR. Nurse educator perceptions of the importance of relationship in online teaching and learning. Journal of Professional Nursing. 2017;33(1):11-9.

21. Kayode BK. Effect of communication management on distance learners' cognitive engagement in Malaysian institutions of higher learning. International Review of Research in Open and Distributed Learning. 2018;19(4).

22. Sher A. Assessing the relationship of student-instructor and student-student interaction to student learning and satisfaction in web-based online learning environment. Journal of Interactive Online Learning. 2009;8(2).

23. Cung B, Xu D, Eichhorn S. Increasing Interpersonal Interactions in an Online Course: Does Increased Instructor Email Activity and Voluntary Meeting Time in a Physical Classroom Facilitate Student Learning? Online Learning. 2018;22(3):193-215.

24. Kuo Y-C. Accelerated online learning: Perceptions of interaction and learning outcomes among African American students. American Journal of Distance Education. 2014;28(4):241-52.

25. Abdullah Z, Hui J. The relationship between communication satisfaction and teachers' job satisfaction in the Malaysian primary school. Asian Journal of Humanities and Social Sciences (AJHSS). 2014;2(2):58-71.

26. Mehall S. Purposeful Interpersonal Interaction in Online Learning: What Is It and How Is It Measured? Online Learning. 2020;24(1):182-204.

27. Bliuc AM, Ellis R, Goodyear P, Piggott L. Learning through face-to-face and online discussions: Associations between students' conceptions, approaches and academic performance in political science. British Journal of Educational Technology. 2010;41(3):512-24.

28. Kollalpitiya KY, Partigianoni CM, Adsmond DA. The role of communication in the success/failure of remote learning of chemistry during COVID-19. Journal of Chemical Education. 2020;97(9):3386-90.

29. Eriksson T, Goller A, Muchin S, editors. A comparison of online communication in distance education and in conventional education. 31st Annual Frontiers in Education Conference Impact on Engineering and Science Education Conference Proceedings (Cat No 01CH37193); 2001: IEEE.

30. Zheng B, Warschauer M. Participation, interaction, and academic achievement in an online discussion environment. Computers & Education. 2015;84:78-89.

31. ALPAL O, ANNE C. Electronic Engineering students' interactions through forums in the virtual component of a blended learning course. Cuadernos de Lingüística Hispánica. 2014(23):121-50.

32. Kastler T, Grendus B, editors. Efficient Communication Strategies for Online Training in Geoinformatics. ISPRS Commission VI Mid-Term Symposium „Cross Border Education for Global Geoinformation", Enschede, Netherlands (CD-ROM); 2010.

33. Gdanetz LM, Hamer MK, Thomas E, Tarasenko LM, Horton-Deutsch S, Jones J. Technology, educator intention, and relationships in virtual learning spaces: a qualitative metasynthesis. Journal of Nursing Education. 2018;57(4):197-202.

34. Mash B, Marais D, Van Der Walt S, Van Deventer I, Steyn M, Labadarios D. Assessment of the quality of interaction in distance learning programmes utilizing the Internet or interactive television: perceptions of students and lecturers. Medical Teacher. 2006;28(1):e1-e9.

35. Malik SK, Khurshed F. Nature Of Teacher-Students' Interaction In Electronic Learning And Traditional Courses Of Higher Education-A Review. Turkish Online Journal of Distance

Education. 2011;12(4):157-66.

36. Daher W, Sabbah K, Abuzant M. Affective engagement of higher education students in an online course. Emerging Science Journal. 2021;5(4):545-58.

37. Hu M, Li H, editors. Student engagement in online learning: A review. 2017 International Symposium on Educational Technology (ISET); 2017: IEEE.

38. Martin F, Bolliger DU. Engagement matters: Student perceptions on the importance of engagement strategies in the online learning environment. Online Learning. 2018;22(1):205-22.

39. Agudo-Peregrina ÁF, Iglesias-Pradas S, Conde-González MÁ, Hernández-García Á. Can we predict success from log data in VLEs? Classification of interactions for learning analytics and their relation with performance in VLE-supported F2F and online learning. Computers in human behavior. 2014;31:542-50.

40. Perveen A. Synchronous and asynchronous e-language learning: A case study of virtual university of Pakistan. Open Praxis. 2016;8(1):21-39.

41. Torun ED. Synchronous interaction in online learning environments with Adobe Connect Pro. Procedia-Social and Behavioral Sciences. 2013;106:2492-9.

42. Collin K, Karsenti T. The role of online interaction as support for reflective practice in preservice teachers. Formation Profession. 2013:64.

43. Alsubaie MA. Hidden curriculum as one of current issue of curriculum. Journal of Education and practice. 2015;6(33):125-8.

44. Anderson T. The hidden curriculum in distance education an updated view. Change: the magazine of higher learning. 2001;33(6):28-35.

45. Karnadi DY, Sari E. Implementation of Hidden Curriculum in Online Learning at PKVM Al Ishlah Central Jakarta, Indonesia. International Journal of Social Science and Human Research. 2022:409.

46. Chen G, Chiu MM. Online discussion processes: Effects of earlier messages' evaluations, knowledge content, social cues and personal information on later messages. Computers & Education. 2008;50(3):678-92.

47. Shackelford JL, Maxwell M. Sense of community in graduate online education: Contribution of learner to learner interaction. International Review of Research in Open and Distributed Learning. 2012;13(4):228-49.