

Investigating the Drivers of Student Interaction and Engagement in Online Courses: A Study of State-of-the-art

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Abstract. Online learning has become a widespread method for providing learning at different levels of education. It has facilitated the learning in many ways and made it more flexible and available by providing learners with more opportunities to learn information, further access to different learning resources, and collaboration rather than face-to-face learning. In spite of these benefits and rapid growth of online education, success and persistence in such courses is one the important aspects of online learning research and it relies on different factors. Therefore investigating the reasons of students' dropout of an online education course or program and its contributing factors is essential in this area. One of the most barriers in online learning system is lack of interactions. In learning, interaction between students themselves, with the course content, and course instructors is important for conveying information, enhancing teaching quality, give directions, and many more functions. The aim of this research is to review the literature to propose a clearer picture of studies have been conducted regarding online interaction and factors that impact it in online education systems.

Keywords: online interaction, student engagement, online learning.

1. Introduction

One of the essential elements of online learning is student interaction that substantially influencing effective learning by exchanging ideas and intellectual stimulation (Wanstreet, 2009). Past studies suggested that interaction in online education and interactivity in course has a direct impact on level of student satisfaction (Durrington, Berryhill, & Swafford, 2006) and student achievement and learning outcomes (Bernard *et al.*, 2009). Moore (Moore, 1989) proposed three ways of interaction: interac-

tion with the content, interaction with instructor, and interaction with other students. He argued that student-content interaction is “the process of intellectually interacting with the content that results in changes in the learner’s understanding, the learner’s perspective, or the cognitive structures of the learner’s mind” (Moore, 1989, p. 2) when learners have access to course materials via the Internet and contain video, text, audio, and/or graphic images.

Learner-instructor interaction is very important to nurture students’ interest to the course contents and stimulating their motivation of learning. Instructor can have a considerable contribution in students’ understanding of course concepts and clarify their misunderstanding through different strategies. Learner-learner interaction is the last type of interaction that happen among students individually or in a group that may focuses on building knowledge and developing specific skills (Moore, 1989). In traditional face-to-face learning system that was mainly a teacher-centric style, students interact with instructors directly by F2F interaction. Distance education and online learning environments caused a big shift in learning decentralization and provided more online learners. Nowadays e-learning technologies have brought about many fundamental changes in learning styles and focuses more on students “by enabling multiple interactions among all the different agents involved – learners, instructors and course designers, tutors, contents, interfaces, administrative staff, code, environments, etc.” (Agudo-Peregrina, Iglesias-Pradas, Conde-González, & Hernández-García, 2014, p. 542).

According to the literature, developing and promoting online interaction is vital in online learning and there are different studies regarding this issue. Some of them apply a specific technology such as social media to increase interaction and create an interactive environment in their online courses (Bubas, Coric, & Orehovački, 2010; Cardona-Divale, 2012). Other studies uses various Learning Management Systems (Carrick-Simpson & Armatas, 2003; Kang & Im, 2013; Ke & Kwak, 2013; Sargeant, Curran, Allen, Jarvis-Selinger, & Ho, 2006), Web 2.0 technologies (Purarjomandlangrudi, Chen, & Nguyen, 2015; Torun, 2013), video teleconferencing (Kirby, 1999) etc. In addition to technologies and administrative features, individual and behavioural factors of students that significantly influence online interaction and engagements of students have been considered. These factors contain students’ self-efficacy (Kuo, Walker, Belland, Schroder, & Kuo, 2014), levels of readiness and computer literacy (Kaymak & Horzum, 2013), interaction behaviours (Daradoumis, Xhafa, & Marques, 2003), age and ethnicity (Ke & Kwak, 2013), learning styles (Hao, 2006), cultural diversity (Bing & Ping, 2008), attitude toward distance and online learning (Brooks, Resta, & Schmidt, 2004) and etc.

Despite all the merits mentioned in last section for online learning, there are major concerns with it that needs to be brought to light. One of the biggest drawbacks of online learning is the lack of physical presence and interaction, particularly for students of special learning style like those that learn via tactile or kinaesthetic modality and used to move, touch and being active when learning. Learning through online classes and not having physical presence on campus make students suffer from lack of social interaction, belonging, and adequate support and guidelines for their study as they are

supposed to do their assignment and exams on their own. According to Sims (1999), interaction in electronic learning processes has many educational functions, related to learner control over system responses, adaptation to user's input, allowing for participation and communication and helping to provide meaningful learning (Sims, 1999).

Given the importance of interaction in online learning, the objective of this study is to have a deeper insight to the literature to extract and explore different factors that contribute to the student online interaction. It aims to provide a better understanding of the impact of various characteristics and elements on doing interaction and engagement of students in an online learning environment. To do so, this study provides a literature review on online interaction in education. It **proposes a classification for the main factors** impact students' online interaction and also highlights some of their applications by learners and instructors to improve online interaction in online learning settings. In section 2, the research methodology, the review steps and criteria are discussed and study process is explained. Section 3 contains the results of analysing the selected data set and proposes the factors' categorization. Section 4 discusses the importance of implementing these results for both researchers and university course design departments. And finally the study ends with a conclusion in section 5.

2. Research Methodology

This systematic literature review was conducted on studies done regarding online interaction in online learning in higher education entities to identify what factors influencing online interaction and engagement of students. As mentioned before, a systematic literature review as a research methodology aims to address research questions by elaborating and interpreting existing research and propose a big picture of the area. The steps of the review are planning, conducting and reporting the review. Next steps are carried out to meet these purposes.

2.1. Study Selection Process and Criteria

A comprehensive study has been done in this literature review. There are no excluding or including criteria about sources and we searched in different databases such as: "Google Scholar", "Taylor & Francis", "Elsevier", "Wiley", "Editlib", "Springer", "Eric", and etc. that the exact details of each database and the number of research we have found in them are indicated in Fig. 1. It shows that Taylor & Francis" has constituted the most percentage of the total, 24% and then "Elsevier" is the second databases by 13%. Research terms includes: "online interaction and engagement in education", "online interaction and engagement in learning", "factors influencing online interaction", and "online interaction parameters". Then to present a state-of-the-art analysis of recent studies about online interaction and engagement, the review

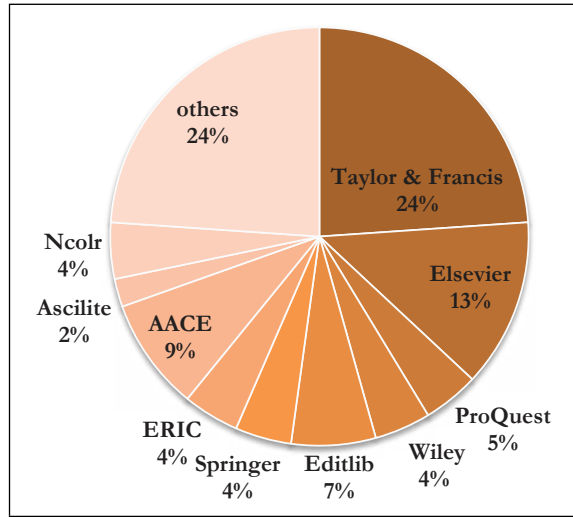


Fig. 1. Databases and proportion of studies of each one.

has been focused on research done after 2000. Another excluding criteria is applied regarding research has been done on higher education entities including colleges and universities.

2.2. Study Process

Reviewing studies that have been carried out after 2000 and using the above mentioned search terms, the total number of studies found was about 362. Afterward, the titles of the papers were considered and those that are not related to the area were excluded, this resulted in 156 studies remaining. In next step, the studies were reduced to 74 once their abstracts were studied carefully. Finally after reading the full remain studies, I have come out with 66 research to be included in this literature review. Fig. 2 indicates the study process and the final set of papers and a summary of their research objectives are in appendix A.

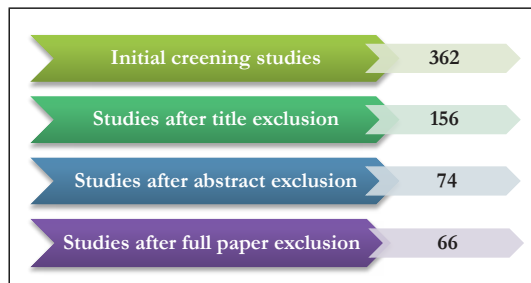


Fig. 2. Stages of study process.

3. Results

3.1. Research trend and Geographical Locations

This review has verified factors that impacts on online interaction and engagement in online education systems. The outcomes of this review regarding research trends and frequency in different geographical locations are displayed in figures bellow. Fig. 3 illustrates the trend between 2000 up to current time, which is 2015. It shows a steady increase in research activities within 2000 and 2009, but it experienced a dramatic upward trend in 2010. However, there is sharp reduction in 2011. So, it can be concluded that this is a very open area of research and attractive topic in the recent years.

Fig. 4 displays the frequency of the studies authored in different countries. The results show that USA has surpassed others by publishing 40 publications in this period. Other countries are substantially in the lower rate, which researchers have paid less attention to this area. They include: Spain and Turkey with 4 each, Australia and Taiwan contains 3 each, Hong Kong, Croatia, Chine, and Malaysia are at 2 each, and finally Korea, UAE, Canada, and Finland that have 1 each.

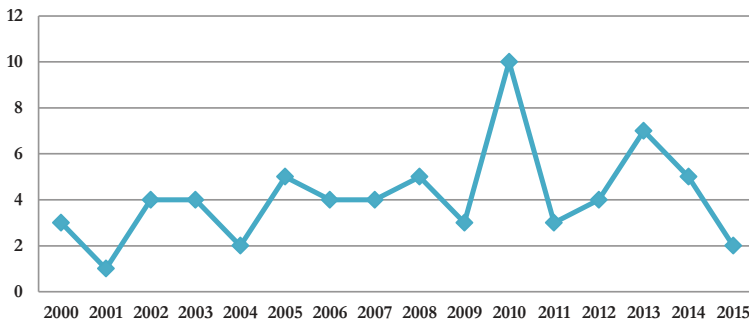


Fig. 3. Trend of research.

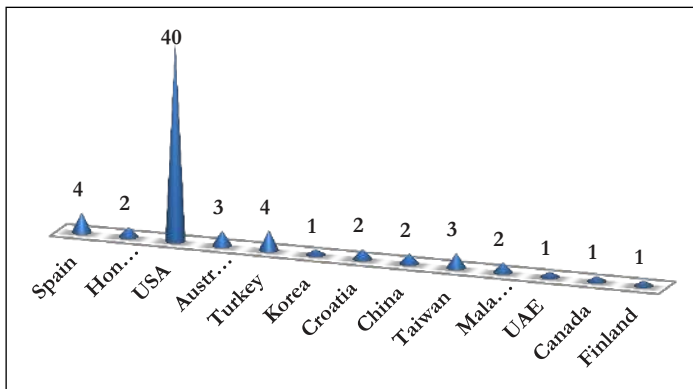


Fig. 4. Frequency of research in geographical locations.

3.2. Type of Participants and Research Methodology

This literature review is conducted on higher education organisations. We have classified the participants of the reviewed research to five main categories university graduate, undergraduate and postgraduate, college graduate and undergraduate students. Fig. 5 shows the bar chart of these categories and the number of studies for each one. It can be implied that most of the studies have been conducted on university undergraduate students.

Different research approaches and methodologies have been employed in reviewed literature. Some studies applied quantitative methods, which is an objective and systematic process where numerical data are used to obtain information about the research objectives. As Fig. 6 shows, it dominates the other methods and contains 61% of the total percentage. Some authors have selected qualitative approach to find out underlying reasons, opinions, and motivations and provide a deeper insight into the issues or help to develop ideas or hypotheses for potential quantitative research, which is 14%. The last approach applied in the reviewed studies is mixed-method that means their research contains both quantitative and qualitative methodology and it contains 25% of the total amount.

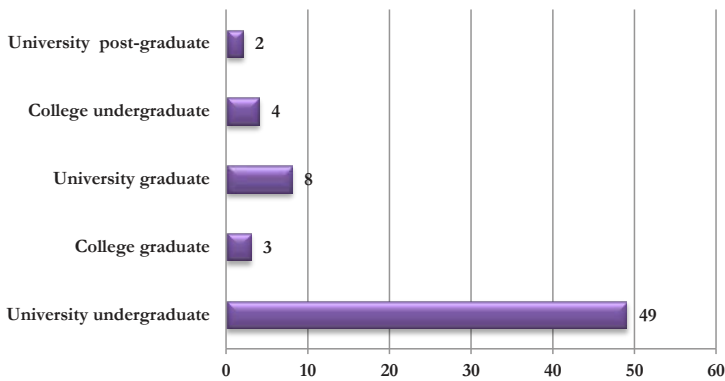


Fig. 5. Research participants.

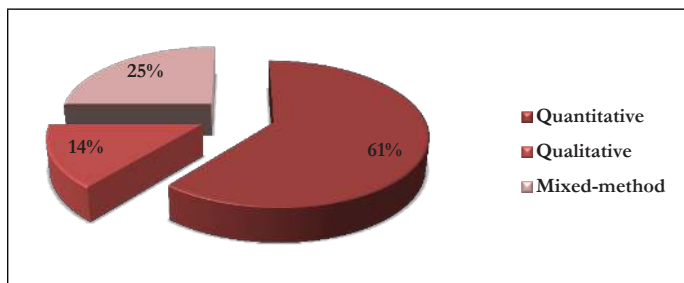


Fig. 6. Frequency of research methodology.

As Fig. 6 shows, most of past studies used quantitative research methodology. For instance, authors in (Kang & Im, 2013) have investigated factors in learner–instructor interaction that can predict the learner’s outcomes in the online learning environment. Agudo *et al.* have defined three system-independent classifications of interactions and evaluated the relation of their components with academic performance across two different learning modalities: virtual learning environment (VLE) supported face-to-face (F2F) and online learning (Agudo-Peregrina *et al.*, 2014).

Pure qualitative research method is adopted the lowest amount of previous studies of literature. Some examples such research are: Wang in (M.-j. Wang, 2010) has conducted research to find out students’ online utterances and offline interactions, to determine the extent of collaborative learning among students, Sargeant *et al.* have explored instructor roles in enhancing online learning through interpersonal interaction (Sargeant *et al.*, 2006).

Mixed method that contains both quantitative and qualitative methodology are used in some authors’ research such as F. Ke and D. Kwak (Ke & Kwak, 2013) that claims online learning interaction participation, perception, and learning satisfaction would be consistent across varied age and ethnicity groups. Also authors in (Nor, Hamat, & Embi, 2012) have attempted to realize how the students interact and collaborate in the process of online learning topics that had previously been discussed in a face-to-face mode. Other samples of these research are: different aspects of the online courses impact the way students enter into discussions online, and consequently, what they have opportunities to learn (McCrorry, Putnam, & Jansen, 2008), how instructors and students perceive the importance of online interaction and which instructional techniques enhance those interactions (Su, Bonk, Magjuka, Liu, & Lee, 2005), Focusing on e-connectivity, instructor presence and positive communication in online courses (Cheng & Suan). Appendix B contains more details about all investigated studies in literature of this review.

3.3. *Students’ Positive Outcomes*

Past research has shown that online interaction and engagement have a large impact on different student positive outcomes such as student satisfaction and motivation (Kuo, Walker, & Schroder, 2010; Kuo, Walker, Belland, *et al.*, 2014; Moallem, Pastore, & Martin, 2013; Shank & Doughty, 2002), active learning (Kuo *et al.*, 2010), learning outcomes, prospects, and performance (Beatty, 2002; Daradoumis *et al.*, 2003; Heinemann, 2007; Kang & Im, 2013; Kuo *et al.*, 2010; Okonta, 2010; Tatar, Gray, & Fusco, 2002). Some researchers introduced new ways to improve online interaction and engagement within online courses. For instance, Kang, M. and T. Im (2013) tried to identify what factors in online interaction can predict the learner’s outcomes. They have concluded that “factors related to instructional interaction predicted perceived learning achievement and satisfaction better than factors related to social interaction. However, it was revealed that social interaction such as social intimacy could negatively affect perceived learning achievement and satisfaction” (Kang & Im, 2013) (p. 292). Abrami, P. C., *et al.* (2011) discuss about different types of online interactions and suggest how these results may foster

instructional improvement. They also highlight several evidence-based approaches that may be useful in the next generation of distance and online learning (Abrami, Bernard, Bures, Borokhovski, & Tamim, 2011; Bing & Ping, 2008; Brooks *et al.*, 2004).

On the other hand, there are some studies that experienced failure in adopting some techniques for stimulating online interaction and engagements. To give an example Okonta (Beatty, 2002; Okonta, 2010)(2010) investigated the effect of parallel use of Facebook and Twitter for increasing online interaction among the college undergraduate students and the results indicated that there was interaction between learners and other learners but it was minimally used in their courses and academic purposes (Okonta, 2010). Belinda Carrick-Simpson and Christine Armatas from Deakin University, Australia, explore the factors that influence online interaction and better engagement because the results of their study has proven that designing online learning activities with opportunities for interactivity is not sufficient to engage students' interest (Carrick-Simpson & Armatas, 2003).

Fig. 7 displays all positive outcome factors extracted from literature and its sub-categories. There are three main factors categories including 1-psychological factors, 2-learning factors, and 3-behavioural factors. The first one contains variables such as student motivation, student self-regulation, student appreciation, and student problem solving. The second category includes learning outcome/performance, student learning style, learning quality, learning effectiveness, academic achievement, and student success. The last one comprises student interaction, student collaboration, student engagement, student attrition, and student perception.

3.4. Factors Impacting on Online Interaction

As mentioned before, there are several factors contributing to online interaction and engagement improvement and development. The main contribution of this review is to identify and classify these factors. This literature review proposes four main groups for these influencing factors: 1 – Student's Individual characteristics, 2 – Student's Behavioural factors, 3 – Course design factors, and 4 – Administrative factors. Fig. 7 shows the details of classifications and all contributing factors categories.

Individual characteristics can be identified as having originated with a particular person or source with a high degree of certainty. In this study they refer to traits that are instinctively institutionalized in each individual. The characteristics that have extracted from the literature has been done in the area of online interaction and engagement in higher education entities include student expectation, self-expression, interest, cognitive abilities, leadership, self-efficacy, creative thinking, confidence, learning flexibility, and knowledge sharing (Hao, 2006; Ke & Kwak, 2013; Kuo, Walker, Belland, *et al.*, 2014). Behavioural factors are traits that are done by an individual. The behavioural factors that are identified so far in literature, which effect online interaction and engagement are social intimacy, attitude, readiness, interaction, content understanding, group functioning, collaboration, cooperation, and participation (Kaymak & Horzum, 2013; Sher, 2009).

Course design factors are explained as factors in relation to instructing and developing course materials and contents and refer to the traits that are directly contributed to

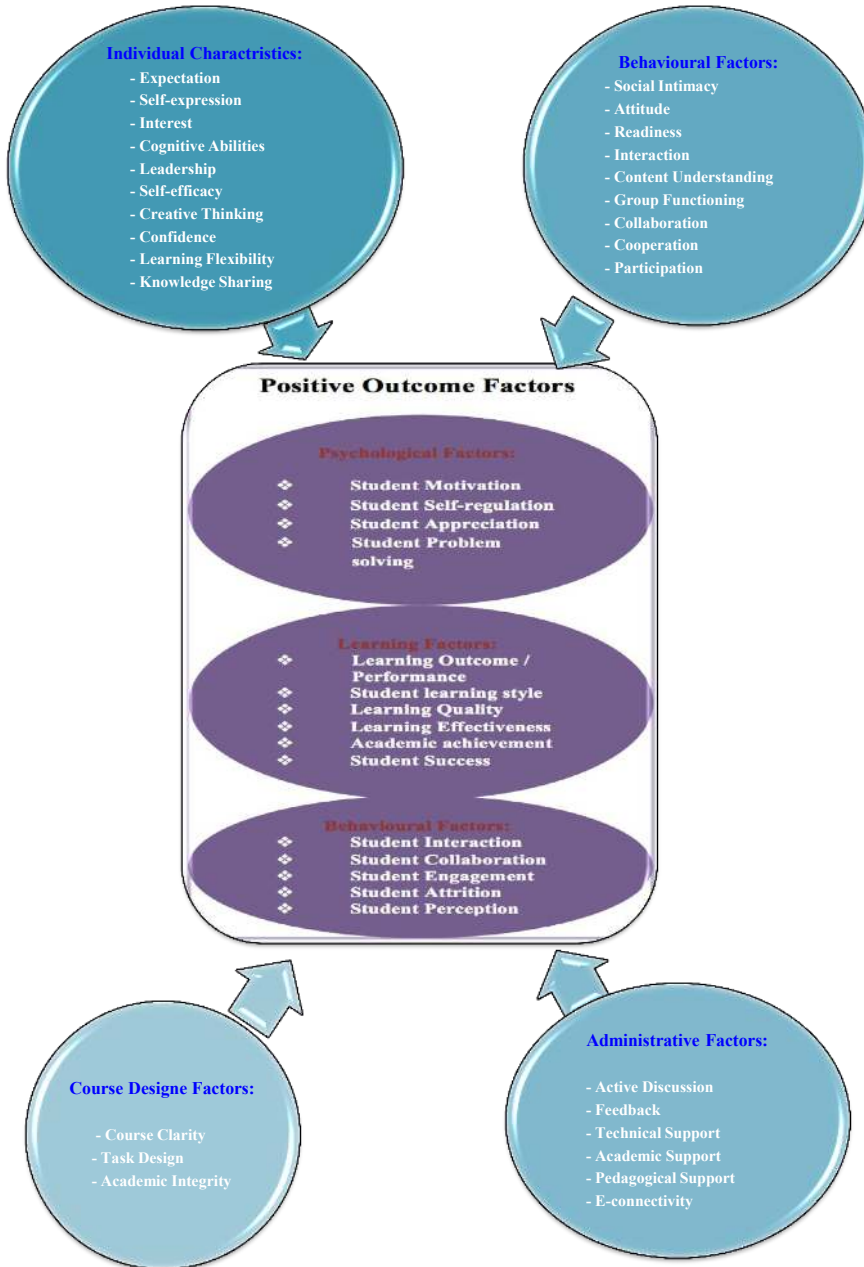


Fig. 7. Factors impacting on student interaction and engagement

presenting a course. Those that are found in literature that impact online interaction and engagement in online learning are course clarity, task design, and academic integrity (Bubas *et al.*, 2010; Lamy & Hassan, 2003; Swan, 2002; Torun, 2013). Administrative

factors are pointed out to parameters that are related to administration of the course such as active discussion, feedback, technical support, academic support, and pedagogical support (Mohamad, Yusof, & Aris, 2014; Nor *et al.*, 2012; Swanson, 2010).

According to the literature regarding course design and administrative factors, various parameters have been considered such as focusing on e-connectivity and instructor presence (Swanson, 2010) which used a mixed method of a qualitative study with a quantitative component in the affective domain emphasizing on e-connectivity, instructor presence, and positive communication. Instructors' role and course content to enhance online learning through interpersonal interactions is other interest of researchers of this area in this area (Cheng & Suan). Authors in (Lamy & Hassan, 2003) presented the relationship between changing task designs and learner behaviour in online course and their results showed that task type is the main predictor of the volume of reflective interaction.

In terms of individual and behavioural traits, there are some research conducted in regard with students characteristics that have an impact on their online interactions. Some examples of them are: the effect of interactions and Internet self-efficacy on student satisfaction (Kuo, Walker, Belland, *et al.*, 2014), students' readiness levels of the online learning (Kaymak & Horzum, 2013), interaction behaviours of different collaborative group types (Daradoumis *et al.*, 2003), age and ethnicity of students (Ke & Kwak, 2013), learners' learning styles (Hao, 2006), cultural diversity (Bing & Ping, 2008), students' attitude toward distance and online learning (Brooks *et al.*, 2004) and etc.

4. Discussion

Moving to the new millennium and with the emergence of the Internet, it provides the opportunity to stimulate participation and interaction within a technologically mainstream and cost-effective learning environment. Beside various interactive opportunities that are available in the online environment, this improvement can achieve in the light of the fact that high levels of interaction have positive effects on the learning experience (Chen & Chen, 2007; J. Richardson, Tunwall, & Carnevale, 2000; Sher, 2009; Wilson, 2007). Failure to adequate consideration to the relational dynamics in OLEs may incur feelings of isolation in online courses, decrease students' satisfaction, deficient learning outcome and performance, and high attrition rate. Given the current condition, online interaction is one of the most important components of online learning setting, therefore, it is needed to explore and elaborate different parameters and factors that contributing to higher and more effective interaction.

This review study represents significant findings for research and practice. The potential implications of categorizing contributing students' interaction factors for the potential implications for instructors, university faculties, students and learners, course designers and conveners is that it provides a big picture of several factors that are influencing learners online interaction and engagement. Therefore, they can take into account these factors when designing an online course to promote and cultivate the online interaction to attain better student academic performance and satisfaction. In addition to having several practical implications, it could help researchers, particularly new researchers, to inform about these factors in a very convenient way.

Moreover, getting to know that what specific students' individual, behavioural, course design, and administrative factors could participate in improving and enhancing students' online interaction and engagement, they can achieve better result and outcome of online learning by manipulating and controlling these traits. For instance, if learners' attitude toward OLEs is one of these factors that have a positive impact on online interaction, educational expertise and instructors will be able to increase online interaction in their courses by working in this specification and try to give accurate and aggregate perspectives to learners. On top of that, the students can be aware of these characteristics and try to improve them. Additionally, investigating these aspects will enrich the literature and provide a clearer realization of different elements that could help interaction improvement in online learning systems and could assist researchers to contribute a better understanding of these fields and give directions to them to form the future of their research, as well as identifying gaps in the body of knowledge in this area.

5. Conclusion

The emergence of technology has made a huge shift in educational systems and created a variety of opportunities and facilities for today's learners and has been expanded by the development of the Internet worldwide. Online learning is a new way of learning that is employed nowadays with many educational providers throughout the world particularly in higher education entities. However, there are some barriers and obstacles with this way of learning which lack of interaction is the most important of them. To fulfill this objective and provide a comprehensive view of the contributing factors in learners' online interaction and give a big picture of them to educators, this study has conducted an in-depth review of current literature to elaborate and explore different factors that have influence on students' online interaction. The results show that they typically can be divided into four major categories: individual, behavioural, course design, and administrative factors. Providing all these factors and their sub categories that contains different traits could help researchers and instructors and gives them an entire perspective to improve online interaction in their educational settings and lead to a better and higher result in student' outcomes and increase level of cognition.

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Appendix A. Final set of papers and their brief abstract

Year	Journal/Conference name	Methodology	Subject
a	b	c	d
2015	Technology, Pedagogy and Education	Qualitative	Communication between teachers and students in the process of virtual teaching (Gallego-Arrufat, Gutiérrez-Santiuste, & Campaña-Jiménez, 2015)
2005	Annual Conference on Distance Teaching and Learning	Qualitative	ELearning Strategies with Enriched Interactions (Csete, Lam, & Wong, 2005)
2012	Capella University thesis	Quantitative	Parallel use of Facebook and Twitter influence on sense of classroom community (Cardona-Divale, 2012)
2003	20th Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education	Quantitative	Impact of individual factors students bring to online learning effect on their engagement (Carrick-Simpson & Armatas, 2003)
2010	Capella University thesis	Quantitative	Effects of the four modes of online interaction on an e-mathematics learning outcome (Okonta, 2010)
2014	The International Review of Research in Open and Distributed Learning	Quantitative	The effect of interactions and Internet self-efficacy on student satisfaction (Kuo, Walker, Belland, <i>et al.</i> , 2014)
2000	World Conference on Educational Multimedia, Hypermedia and Telecommunications	Quantitative	Relationships that exist between students' perceptions of interaction in online courses and overall course satisfaction (J. Richardson <i>et al.</i> , 2000)
2007	The Journal of Human Resource and Adult Learning	Quantitative	Effect of online interaction on levels of Satisfaction and Learning occurring in an online program (Chen & Chen, 2007)
2013	Educational Sciences: Theory & Practice	Quantitative	Relationship exists between readiness levels of the online learning students for online learning and the perceived structure and interaction in online learning environments (Kaymak & Horzum, 2013)
2013	Procedia – Social and Behavioral Sciences	Quantitative	Effect of Adobe Connect Pro on synchronous interaction of online course's students (Torun, 2013)
2010	Southern University and A & M College thesis	Quantitative	Asynchronous interaction, online technologies self-efficacy, and self-regulated learning, influence academic achievement (McGhee, 2010)
2001	University of Cincinnati thesis	Qualitative	Influence of interaction on active learning, learning outcomes, and community bonding (Hammer, 2002)
2007	University of Southern Queensland	Mixed-method	Interaction impact on the outcomes or satisfaction of learners (Wilson, 2007)
2013	Journal of computer assisted learning	Quantitative	What factors in learner-instructor interaction can predict the learner's outcomes in the online learning environment (Kang & Im, 2013)
2010	21st Central European Conference on Information and Intelligent Systems	Quantitative	Uses of the online community tool Ning in a hybrid university course (Bubas <i>et al.</i> , 2010)
2008	Asian Association of Open Universities Journal	Quantitative	Will the cultural diversity of learners affect their learning and interaction behavior in the web-based environment (Bing & Ping, 2008)
2011	The Turkish Online Journal of Educational Technology	Quantitative	Knowledge sharing is applied to achieve the appropriate interaction among participants in an online learning environment (Chao, Hwu, & Chang, 2011).

a	b	c	d
2011	Journal of Systemics, Cybernetics and Informatics	Qualitative	Explore ways in which NodeXL, a relatively new tool for social network analysis, could be used as an element in evaluation of online learning experiences (Doran, Doran, & Mazur, 2011)
2003	World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education	Quantitative	Assess the quality of student participation in an asynchronous learning environment (Ho, 2003)
2009	WSEAS transactions on information science and applications	Qualitative	Analyse the potential of online communication tools in creating student-centered digital communities of inquiry (Aleksić-Maslač, Magzan, & Jurić, 2009)
2002	Conference on Computer Support for Collaborative Learning: Foundations for a CSCL Community	Quantitative	The relationship of interaction of joint project in virtual environment and learning prospects (Tatar <i>et al.</i> , 2002)
2012	Journal of Asynchronous Learning Networks	Qualitative	Determine factors increase interaction among students (York & Richardson, 2012)
2002	World Conference on educational Multimedia, Hypermedia and Telecommunications	Quantitative	Students' perception of an asynchronous on-line discussion and learning to interact with others (Shank & Dougherty, 2002)
2003	Groupware: Design, Implementation, and Use workshop	Qualitative	Exploring the interaction behaviour of different collaborative group types with respect to their performance (Daradoumis <i>et al.</i> , 2003)
2004	The University of Texas thesis	Mixed-method	Students' attitudes toward four types of interactions: instructional, affective, collaborative, and vicarious (Brooks <i>et al.</i> , 2004)
2005	International Journal of Technology in Teaching and Learning	Qualitative	Effect of social and interpersonal interaction in an online programme (H. Wang, 2005)
2013	Computers & Education	Mixed-method	Online learning interaction participation, perception, and learning satisfaction would be consistent across varied age and ethnicity groups (Ke & Kwak, 2013)
2013	Internet and Higher Education	Quantitative	Students' self-regulation for interaction with others in online learning environments (M.-H. Cho & Kim, 2013)
2013	Society for Information Technology & Teacher Education International Conference	Mixed-method	Investigated whether various communication tools and methods influence student learning process, learning outcomes, motivation, self-regulation and satisfaction (Moallem <i>et al.</i> , 2013)
2002	Department of Instructional Systems Technology, Indiana University thesis	Mixed-method	Develops a "situationalities framework" that describes the situationalities – learning goals, values, conditions and effectiveness outcomes (Beatty, 2002)
2010	Educational Media International	Mixed-method	Examine relations between students' learning styles and factors influencing students' participation in asynchronous interactions in online courses (Küçük, Genç-Kumtepe, & Taşçı, 2010)
2003	Open Learning	Mixed-method	Whether reflective interaction is more likely to arise from some task types than others (Lamy & Hassan, 2003)
2009	Educational Psychology	Quantitative	Development and validation of the Online Self-Regulated Learning Inventory (OSRLI) (M. H. Cho & Jonassen, 2009)

a	b	c	d
2012	Computer Assisted Language Learning	Mixed-method	How the students interact and collaborate in the process of learning topics that had previously been discussed in a face-to-face mode (Nor <i>et al.</i> , 2012)
2005	Educational Media International	–	A framework for deep learning for dynamic online discussion in distance education (Du, Havard, & Li, 2005)
2010	Australasian Journal of Educational Technology	Qualitative	Students' online utterances and offline interactions, to determine the extent of collaborative learning among students (M.-j. Wang, 2010)
2000	Society for Information Technology & Teacher Education International Conference: Proceedings of SITE 2000	Mixed-method	Redefine the social learning theory for the online learning environment (Tu, 2000)
2006	Journal of Continuing Education in the Health Professions	Qualitative	Explore instructor roles in enhancing online learning through interpersonal interaction (Sargeant <i>et al.</i> , 2006)
2009	Journal of Interactive Online Learning	Quantitative	The relationship of interaction variables with student learning and satisfaction (Sher, 2009)
2004	Open Learning	Mixed-method	Lack of time and the learners' preference for spending time on reading affect interaction on online discussion (Fung*, 2004)
2002	Education, Communication & Information	Quantitative	Course design factors affecting the success of asynchronous online learning (Swan, 2002)
2006	World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education	Quantitative	the relationships of student attitudes toward four types of interactions learning styles, and their online learning readiness (Hao, 2006)
2007	International Association for Computer Information Systems	Quantitative	How one may enhance interaction with instructors and classmates through the use of virtual collaboration, voice, and video (Girard, Willoughby, & Berg)
2013	The International Review of Research in Open and Distributed Learning	Quantitative	Examined how effectiveness varies with the degree of interaction intensity (Castaño-Muñoz, Sancho-Vinuesa, & Duart, 2013)
2007	Christian Higher Education	Quantitative	Examining the relationships between three major types of teacher-student interaction (organizational, social, and intellectual) and two types of learning outcomes (cognitive and affective) (Heinemann, 2007)
2008	World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education	Mixed-method	Students' perceptions of synchronous and asynchronous modes of instructional and information delivery in an e-learning environment (Ellis & Romano, 2008)
2014	Internet and Higher Education	Quantitative	Interaction impact on the context of other critical student- and class-level predictors (Kuo, Walker, Schroder, & Belland, 2014)
2008	Journal of Computing in Teacher Education	Quantitative	Student perceptions of using instant messaging software for online interactive chapter discussions (Chen Wang & Morgan, 2008)
2005	Christian Higher Education	Quantitative	Examining the relationships between three major types of teacher-student interaction (organizational, social, and intellectual) and two types of learning outcomes (cognitive and affective) (Heinemann, 2005)

a	b	c	d
2010	Australasian Journal of Educational Technology	Mixed-method	The attitudes of students enrolled in a distance education MBA program towards interacting more with other students online (Watson, 2010)
2014	Jurnal Teknologi	Mixed-method	Students' opinion on using online forum discussion (FR), text chatting (CH), and online learning interaction (LI) (Mohamad <i>et al.</i> , 2014)
2008	Journal of Technology and Teacher Education	Mixed-method	Aspects of the online courses impact the way students enter into discussions online, and consequently, what they have opportunities to learn (McCrorry <i>et al.</i> , 2008)
1999	Society for Information Technology & Teacher Education International Conference	Quantitative	Meaningful interaction that contributes to student growth and learning (Kirby, 1999)
2011	Journal of Computing in Higher Education	Quantitative	How three types of interaction may foster instructional improvement (Abrami <i>et al.</i> , 2011)
2005	Journal of Interactive Online Learning	Mixed-method	How instructors and students perceive the importance of online interaction and which instructional techniques enhance those interactions (Su <i>et al.</i> , 2005)
2010	Society for Information Technology & Teacher Education International Conference	Quantitative	Which interaction and other predictors contributed to student satisfaction in online learning setting (Kuo <i>et al.</i> , 2010)
2008	University of Wisconsin-Stout thesis	Quantitative	The Relationship between Learning Styles and Interaction in Online Discussions in Distance Education Courses (Freyer, 2008)
2012	College of Education and Organizational Leadership thesis	Quantitative	Identify the level of satisfaction as well as the preferences of students of online education and interaction (Yousef, 2012)
2010	University of Phoenix Thesis	Mixed-method	Focusing on e-connectivity, instructor presence and positive communication in online courses (Cheng & Suan)
2010	MARYWOOD UNIVERSITY Thesis	Quantitative	Importance of interaction to students involved with online graduate education courses (Cheng & Suan)
2006	Jyväskylä University Thesis	Quantitative	Learner interaction and the way in which learners built and maintained common ground so as to enable themselves to collaborate and learn together (Cheng & Suan)
2010	Journal of Interactive Online Learning	Quantitative	Investigate the educational benefits associated with the use of SNSs such as Ning in online interaction (Cheng & Suan)
2014	Computers in Human Behavior	Quantitative	Defines three system-independent classifications of interactions and evaluates the relation of their components with academic performance across two different learning modalities: virtual learning environment (VLE) supported face-to-face (F2F) and online learning (Agudo-Peregrina <i>et al.</i> , 2014)
2015	Eurasia Journal of Mathematics, Science & Technology Education	Quantitative	Examine the relationship among interaction, structure, social presence and satisfaction in online learning (Horzum, 2015)
2014	Internet and Higher Education	Quantitative	Examine the relationship between instructor scaffolding for interaction and students' academic engagement in an online learning environment (M.-H. Cho & Cho, 2014)
2006	Distance Education	Quantitative	Investigated the degree to which students cognitively engage with their online courses (J. C. Richardson & Newby, 2006)