Using Awareness Information to Enhance Online Discussion Forums: A Systematic Mapping Study

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***Abstract*—Context: Since online discussion forums are widely used in Distance Learning platforms, instructors ought to be aware of what is happening in them. Goal: Our study aimed to identify scientific studies that investigate awareness in online forums in Learning Management Systems (LMS) and Massive Open Online Courses (MOOC). Method: We conducted a systematic mapping to identify, filter, and classify primary studies. Results: We selected 51 papers and categorized the difficulties faced by discussion forum users into four groups: visualization, motivation, structural, and accompaniment. In addition, we identified six types of awareness elements: informal, group-structural, workspace, social, task, and concept awareness. The results were divided into two types: system/framework and approach/investigation. Conclusion: our study provides an overview of the state of the art and challenges concerning awareness information in online forums and may guide future studies and tool development.**

Keywords—awareness, perception, alerts, online discussion forum, asynchronous communication, mediation, distance education, online learning.

I. INTRODUCTION

Learning Management Systems (LMS) have a wide range of pedagogical benefits, but the geographical distance and asynchrony normally associated with them bring challenges to mediating learners' interactions. Instructors often miss awareness information that could assist them in communicating, coordinating, and cooperating within these environments. According to Filippo et al. [1], awareness information reveal, for example, students who monopolize the discussion or do not participate.

Without such kind of awareness, it is challenging to guide discussions in productive directions. Moreover, maintaining awareness of the activities of other individuals is essential to the workflow and naturalness of work and to diminish feelings of impersonality and distance, which are common in virtual learning environments [2]. Therefore, it is important that online environments provide awareness elements that enable individuals to interpret events and transmit information in an organized way [3, 50].

Mapping what has been scientifically studied is relevant to understand how to enhance current online discussion forums and aid in identifying research opportunities. Our main purpose was to identify what awareness information can be made available in online discussion forums to assist instructors in mediating discussion. We conducted a systematic mapping aimed to identify and analyze the scientific production related to awareness information in Learning Management Systems (LMS) and Massive Open Online Courses (MOOC). The mapping sought ways to enhance discussion forums by leveraging awareness information. It also sought to identify difficulties in using the forums and relate these difficulties to awareness information.

In addition to this Introduction, this paper is structured as follows: Section II presents related work, Section III details the research method, Section IV presents and discusses the results, and section V presents conclusions and future work.

II. RELATED WORK

To the best of our knowledge, there is no mapping study or systematic literature review in the context of awareness for distance learning discussion forums. However, besides the 59 studies identified in this review, we point out three related works.

The first is the work of Steiner *et al*. [48], who present a Literature Review to analyze the influence of incentives and LMS components on student motivation. The results consisted of an analysis of 156 studies. The findings suggest that clear communication positively influences students in attention, confidence, and perceived relevance. Moreover, according to the work, incentives can influence the perception of components.

There is also the work of Reis *et al*. [49], which investigates ways to promote student collaboration through technology and presents a systematic literature mapping for the summarization of results and discussion of use of affective states and socioemotional factors to support the development of smart CSCL environments. In this mapping, 58 studies were analyzed and categorized. The results obtained by the authors identified three main challenges to be addressed by the community for adequate incorporation of affective states into CSCL environments: emotional awareness, orchestration of student interaction, and group formation.

Finally, the work of Loncar et. al. [51] present a phenomenological critical literature review on forum use and Asynchronous Online Discussion (AOD)-focused research in educational contexts. In this work 84 journal papers were analyzed in order to identify and document current trends in

research types, and platforms with base on forum. The results provides two aspects important: a quantitative and phenomenological qualitative snapshot of the state of the literature for forums and AOD.

III. Research Method

Our method follows the Systematic Literature Review (SLR) guidelines proposed by Kitchenham & Charters [4]. The systematic mapping was conducted to identify scientific studies investigating awareness in online discussion forums of LMS and MOOCs. This section describes the main steps performed: (a) identification of research questions; (b) search for relevant studies; (c) paper screening; and (d) data extraction.

A. Research Questions

Main Research Question: What awareness information can be provided in online discussion forums and how can this information assist instructors to mediate interaction?

To answer this question, three specific Research Questions (RQ) were defined:

- RQ1 – What are the difficulties faced by instructors and students in online discussion forums?
- RQ2 – What awareness information is provided in online discussion forums?
- RQ3 – How can awareness information enhance discussion forums?

B. Systematic Search

After defining the research questions, we defined the scope of the search and the search string following steps defined by Kitchenham & Charters [4]:

i. Deriving the main terms of the question; identifying the population, intervention, and results;
ii. Identifying relevant concepts;
iii. Identifying alternative spellings and synonyms;
iv. Checking keywords from known studies;
v. Using the OR Boolean to incorporate alternative spellings and synonyms; and
vi. Using the Boolean AND to link the main terms.

As a result, the following search string was defined:

TABLE I. Search String

"learning management system" **OR** "learning management systems" **OR** "LMS" **OR** "virtual learning environment" **OR** "virtual learning environments" **OR** "VLE" **OR** "learning content management systems" **OR** "LCMS" **OR** "online learning platform" **OR** "MOOC" **OR** "MOOCs" **OR** "massive open online courses" **OR** "distance learning environment" **OR** "distance learning environments" **OR** "distance learning course" **OR** "distance education" **OR** "e-learning"
AND
"mediation" **OR** "awareness" **OR** "perception" **OR** "perceptions"
AND
"forum" **OR** "forums" **OR** "asynchronous discussion"

For the scope of this research, we used the search engines of Scopus, IEEEXplore, ACM Digital Library, and Science Direct. In addition, a manual search was also conducted following the snowballing approach as defined by Wohlin [5]. We screened the reference list of the papers to identify additional documents. Table II shows the results obtained from each source. We checked our results against a list of control papers, which we previously knew to be related. We adjusted the search string until we could cover all or most of the control papers.

TABLE II. Digital Libraries and the Results of the 1st Search

Base	Total Nº of Publications
ACM[1]	20
IEEE Xplore[2]	8
Science Direct[3]	9
Scopus[4]	139
Snowballing	25
TOTAL	201

C. Papers Screening

In the screening process, we selected the studies considered relevant to this research. We selected papers that met one of our 5 inclusion criteria (IC):

- IC1. Publications should identify mediation or awareness needs in the context of Learning Management Systems (LMS) and Massive Open Online Courses (MOOC);
- IC2. Publications should mention or identify awareness information in the context of LMS and MOOC;
- IC3. Publications should describe awareness information used to improve the quality of teaching and learning within an LMS or MOOC;
- IC4. Publications should discuss usage difficulties or improvements to online discussion forums;
- IC5. Publications should identify awareness or mediation needs to enhance online discussion forums.

In addition to the inclusion criteria, 5 exclusion criteria (EC) were also used to screen the papers:

- EC1. Publications that do not meet any of the inclusion criteria;
- EC2. Publications not written in English;
- EC3. Publications not available for download;
- EC4. Incomplete publications;
- EC5. Duplicate publications.

All papers went through the triage procedure that took place in three stages: identification of studies, selection of publications (1st filter), and exclusion of publications (2nd filter).

[1] http://dl.acm.org/
[2] http://ieeexplore.ieee.org/Xplore/home.jsp
[3] http://www.sciencedirect.com/
[4] http://www.scopus.com

D. Data Extraction

During the Systematic Mapping process, we used the Start[5] and Mendeley[6] Desktop software tools. Each publication was catalogued and evaluated according to the selection criteria of the screening phase. Publications that were detected more than once in the query were considered "Duplicate."

The first filter was applied considering title, abstract, and keywords. In the second analysis, the approved articles went to the extraction procedure. This procedure looked for a series of information, as described in Table III.

TABLE III. TABLE TYPE STYLES

Data Extraction	Description
Title	Title of the work being analyzed
Author	Authors' names
Year	Year of publication
Keywords	Keywords of the work
Objective	Work's objective
Methodology	Case study, controlled experiment, action research, survey, among others
Need for a forum	Difficulties and needs faced by users of a forum
Awareness information	Awareness or mediation information that can assist online discussion forums
Generated output	Artifacts generated in each work, which can be a model, a framework, an approach, among others

IV. RESULTS AND DISCUSSION

The systematic mapping was performed from November 2016 to February 2018 and the selected papers were analyzed according to the Inclusion and Exclusion criteria. The complete list of selected papers is available in the appendix.

A. Overview

An initial analysis consisted of providing general information about the selected papers: year of publication, location of the authors, and publication venue.

Fig. 1 summarizes the distribution of articles taking into account the "Year of publication." On overage 4 articles are published per year.

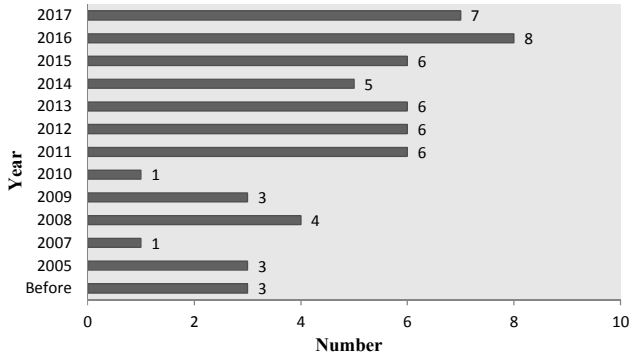

Fig. 1. Distribution of papers per year.

The information regarding the authors' location is presented in Fig. 2. The figure presents a Power Map with the percentage of publications from each continent. The results show that Europe has a significant number of authors who publish in this area (34%). North America and Asia are followed by 18 % and 17%, respectively. The countries that stood out were the USA with 14%, Brazil with 14%, Australia with 12%, Spain with 11%, and Canada and the United Kingdom with 5% of published works.

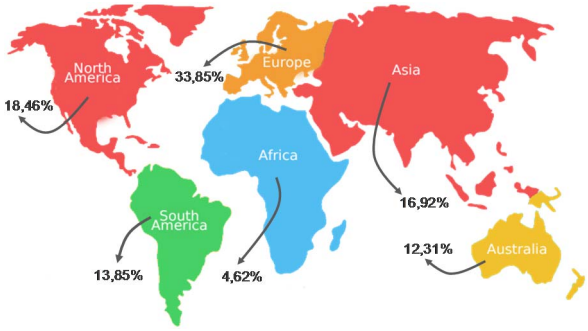

Fig. 2. Paper distribution.

Finally, 52.5% of the studies analyzed were published in event proceedings, mainly of the Conference on Computer Support for Collaborative Learning, Frontiers in Education, and the International Conference on e-learning. The others, equivalent to 47.5%, were published in Journals, such as Computers & Education, Educational Technology Society, and Information Technology Education.

B. Answers to Research Questions

In the following, we discuss the answers for our research questions.

- **RQ1: What are the difficulties faced by instructors and students in online discussion forums?**

Several types of difficulties regarding the use of forums were mentioned in the selected papers. These difficulties were classified into 4 categories:

i. Difficulties in following the discussion: Many participants found it difficult to keep up with the discussions taking place in forums. Often, distance learning courses involve a significant number of participants and consequently of postings, making it difficult for instructors to follow up and provide feedback in a timely manner.

According to Liu et al. [6], lack of feedback affect student participation and the perception of the usefulness of the tools. In this way, monitoring by instructors is indispensable for the steady progress of forum discussions and to influence students' participation. To meet this need, some papers [7, 8, 9, 12] make use of intelligent agents or intelligent tutoring systems to monitor students' activities in the forums so that students always have feedback. An example is the work Faria et al. [9], who use intelligent agents to mediate forum activities, maintaining the balance of participants' interactions.

[5] http://lapes.dc.ufscar.br/tools/start_tool

[6] http://www.mendeley.com/download-mendeley-desktop/

ii. Difficulties related to the hierarchical structure of the forum: several studies [6], [10], [11] report that the structure of the forum does not facilitate understanding. For instance, responding to another person's comment becomes a difficult activity when one has several comments [12], [13]. Sometimes participants respond in a wrong way or do not obey the structure provided by the forum. Many forums have a "poor" or low-quality interface design [6].

Another example that highlights the structural difficulty is the work of Sayfouri [10], which emphasizes the usability of an LMS as a significant contributor to student satisfaction, as students should be able to focus on learning content instead of worrying about navigating the LMS tools.

iii. Difficulties in motivating participants: many instructors have difficulty in motivating students to interact in the forum. These difficulties are also due to the structure of the forum and the lack of motivational resources. The work of Vigentini and Clayphan [14] presents strategies to motivate participants to contribute to forums, such as the formulation of open questions and interaction of students with instructors and other students. In addition, the work analyzes the combination of the forum with social network analysis. Other works also mention issues related to motivational difficulties within LMS or MOOC, such as [7, 10, 15, 16, 17, 18].

iv. Exhaustion: since forums do not have tools to aid the handling of the discussions, many instructors manually check for interactions—a time-consuming, exhausting action [12].

- **RQ2: What awareness information is provided in online discussion forums?**

Several types of awareness information were identified in the studies: social, workspace, task, group-structural, concept, and informal awareness. The relationship between the types of awareness information and the papers is presented in Table IV.

TABLE IV. ARTICLE DISTRIBUTION BY AWARENESS INFORMATION

Awareness Information	Paper
Social	[6], [9], [12], [14], [16], [19], [20], [21], [22], [23], [24], [25], [26], [27], [28]
Workspace	[6], [7], [10], [15], [16], [21], [29], [30], [31], [32], [33], [47]
Task	[8], [17], [18], [33], [34], [35], [36], [37], [45]
Group-structural	[10], [11], [14], [38], [39], [40], [46]
Concept	[8], [35]
Informal	[41]

The definitions below are based on the concepts of Gutwin et al [42], [43]:

i. Workspace Awareness: the collection of up-to-date knowledge that a person maintains about the interaction state of others in the workspace. This helps people to move between individual and shared activities, providing a context in which it is possible to interpret and anticipate the actions of others and reduce the effort required to coordinate tasks and resources.

ii. Informal Knowledge Awareness: the general sense of who is around and what they are doing, for example, the shared knowledge people have working together in the same office. Informal awareness facilitates casual interaction.

iii. Group-structural Awareness: knowledge about people and responsibilities: their positions on a problem, their status, group processes, and group interactions.

iv. Social Awareness: the information that a person holds about others in a social or conversational context, for example, whether the other person is paying attention and their emotional state or level of interest.

v. Task Awareness: the individual's perception of a task, for example, how a certain task will be completed.

vi. Concept Awareness: the awareness of how one particular activity or part of knowledge fits into the existing knowledge of another individual.

According to Slavin [44], using tools that supply task awareness and concept awareness within a learning environment can provide students with explicit structures to help them focus on learning tasks. In addition to identifying awareness information, we identified the most discussed topics.

As shown in Table V, the most common group is Social Awareness, which refers to the publications that investigated the social context of the forum, as well as social presence, social network analysis, and analysis of interactions. The latter, in turn, had a significant impact on the works analyzed and was divided into 3 subgroups. The first subgroup refers to the publications that evaluated instructors' feedback regarding interactions. The second subgroup comprises the works that investigate the interactions, whether student-student or instructors-student. These investigations provide data that aid in coordination or collaboration in forums. Finally, the third subgroup relates to the works that present some software or framework to measure the interactions.

The second group was divided into the 3 most discussed subjects by the papers that have the characteristics of workspace awareness. The first topic is related to LMS and MOOCs workspace investigation [10, 21, 29, 32]. The second topic is related to participants' perceptions of the teaching-learning environment, for example how the participants perceive and use the environment [7, 10, 15, 33]. Finally, the last topic addressed the distance learning platform tools, such as forums, wikis, chats, and messages. In the latter, the work sought to investigate the instructors' or students' perception towards the tool, such as the students vision-driven forum tool: how they viewed and participated in the forum learning space [33].

The third group, related to Task Awareness, is divided into two subgroups. The first subgroup comprises papers that analyze students' perceptions regarding activities: how they perceive and interact with the activities or tasks that are posted. The second subgroup analyzes activities seeking to elaborate and test tools

that assist in the execution of tasks or present some tool to monitor the tasks and assist instructors. Watson's work [18] analyzes teachers' perceptions regarding asynchronous discussions and presents an image of the problems contained in the online discussion forums, which can assist in executing activities and facilitating collaboration among forum participants.

TABLE V. DISTRIBUTION OF PAPERS FOR AWARENESS ELEMENTS

ID	Awareness Elements	Topics Discussed		Paper
1	Social Awareness	Social presence analysis		[19], [25]
		Social network analysis		[12], [14], [24]
		Analysis of interactions	Feedback measurement	[16], [22]
			Investigation of interactions	[6], [12], [20], [22], [23], [26], [27]
			Software for measure interactions	[9], [28]
2	Workspace Awareness	Investigation of virtual space		[10], [21], [29], [32]
		Investigation of the participants with the environment		[7], [10], [15], [33]
		Investigation of tools	Forum	[6], [31], [47]
			Forum and others	[16], [30], [33]
3	Task awareness	Students' perception of activities		[17], [35], [36], [45]
		Analysis of activities	Tools that help in task execution	[18], [33], [34], [37]
			Tools that monitor tasks	[8], [35]
4	Group-structural Awareness	Investigation of possibilities that contribute to group interactions.		[11], [14], [38], [39], [40]
		Investigation of the group position of each individual within the forum.		[10], [40], [46]
5	Concept Awareness	Feedback to the student, to help students with the definitions studied or possible doubts.		[8], [35]
6	Informal Awareness	Investigation of the typical actions of distance learning instructors.		[41]

The fourth group presents the information related to Group-structural Awareness. Some of the papers [11, 14, 39] investigate ways to contribute in group interactions, either by implementing tools that provide group information or by recommending study partners to students according to the affinities analyzed. The other part of the papers investigates the group positions of each individual within the forum and presents this information to instructors to help them understand the group interactions.

The fifth group analyzes and implements Concept Awareness information. This group presents ways to help the student with the construction of knowledge. For example, the work of Berman et al [35] explores students' perceptions about using virtual patients in a behavioral medicine MOOC and describes ways to disseminate knowledge in health-related areas.

Finally, the sixth and last group relates to Informal Awareness. In this group, we can find the work of Vettorel & Corizzato [41], which helps other instructors and researchers to understand the typical actions and behaviors of distance education instructors in distance learning platforms.

The analysis of the awareness elements and the identification of the subjects addressed by the works facilitate and aid in understanding the topics investigated and the forms that can be used to improve the use of online discussion forums or other distance learning tools. In addition, we noted that some papers use or investigate more than one element in their context, such as [6, 8, 14, 16, 35], as can be checked in Table IV (for more details see Appendix A).

- **RQ3: How can awareness information enhance discussion forums?**

We found publications that carry out investigations aiming to strengthen forums or promote social interaction among the participants. Works developed tools and frameworks that provides awareness information. Finally, some papers present models to aid in the didactics of the forum. In addition, we found publications that conduct an awareness analysis combined with the 3C Collaboration Model, for example [38] and [13]. In the following, we categorize the works according to two types of outputs generated:

i. Approach/model: these are the publications that present as results some research, an approach, analysis, or conceptual model. Works that did not develop any tool are found in this category.

ii. System/framework: this group comprises works that present some system, framework, or plug-in.

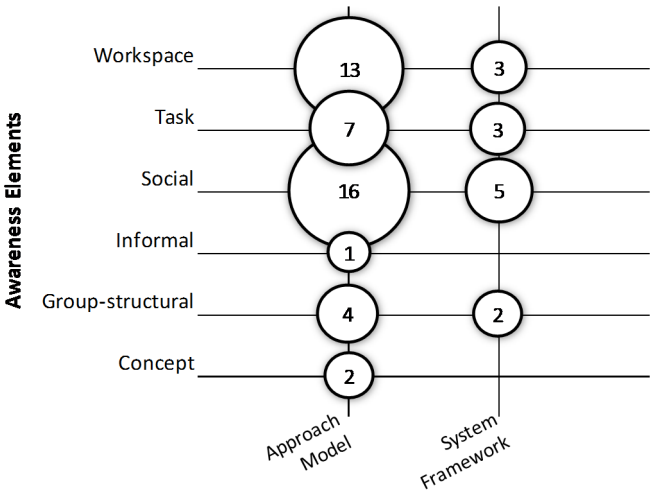

Fig. 3. Bubble Chart - Awareness elements and their relation to the results.

Fig. 3 illustrates the awareness information investigated and its relation to the generated results. As can be observed, most publications generated some approach or investigation. Within this group, the awareness information investigated that had more incidences were Social and Workspace awareness. Moreover, out of the 59 publications analyzed, only 13 generated some result in the form of a system, such as [8, 9, 12, 23, 24, 28, 29, 32, 35, 36, 39, 40, 47]. This fact can be justified due to the complexity of implementing a system that meets the needs of awareness, mainly focused on the context of groupware.

- **Main Research Question: What awareness information can be provided in online discussion forums and how can this information assist instructors to mediate interaction?**

Based on the results obtained from the research questions, we can say that 6 types of awareness elements have been identified and can be applied to online discussion forums: concept, group-structural, informal, social, task, and workspace. In addition, some difficulties faced by users of discussion forums were also identified: following the discussion, structure of the forum, motivating participants, and instructor exhaustion.

For each difficulty found, one or more awareness elements may be applied to mitigate the difficulty. For example, for difficulty in following the discussion, a workspace awareness mechanism can be implemented that provides instructors or students with a perception of a shared learning space. The work of Ulrich & Nedelcu [7] investigates the perceptions of teachers and students and their expectations towards the MOOCs. The investigation and collection of this information aims to improve the workspace used. Other elements that can be used in this type of difficulty are concept or task awareness.

For the difficulty with forum structure, for example, workspace awareness information can be provided. This kind of awareness may provide information that helps people in individual and shared activities, providing a context for interpreting and anticipating actions.

For the difficulty in motivating participants to interact in a forum, a variety of awareness information can be provided. For example, group-structural awareness can provide group information to instructors [12], [39]. With this information, didactic strategies can be adopted to promote collaboration between students or to encourage more participation from a student who is not very active in the discussions. Concept and task awareness can also be used to provide information that helps students understand a given task, clarifying doubts and providing feedback in a timely manner, for example [8] and [35]. Social awareness can also help motivating participants by providing instructors with social information about the class, as presented in [19, 24, 12, 27]. These elements can provide information that helps to promote collaboration.

Finally, exhaustion is related to the lack of automatic mechanisms that help instructors to follow their class or understand the interactions. To mitigate this difficulty, workspace awareness can be used to provide instructors with information about what is happening in the environment. Informal awareness can also be used, which can provide communication tips for improved interaction with students. Concept awareness can also be provided, for example, in some mechanisms that recommend materials or other information to students. The work of Xu & Yang [11] provides methods for recommending study partners for students to answer their doubts in a direct way.

We can note that awareness information can be used for different purposes to improve discussion or to mitigate difficulties. The analyzed works help us to understand the themes related to this mapping, as well as provide an overview of the state of the art and what has been developed.

V. CONCLUSION

This work presents a Systematic Literature Mapping (SLM). Initially, 201 publications were identified that passed the inclusion criteria. After the 1st and 2nd filters, 59 publications remained and were integrally read to have their information analyzed to answer our research questions.

The first question (What are the difficulties faced by instructors and students in online discussion forums?) revealed difficulties categorized into 4 groups: difficulties in following the debate, difficulties with the structure of the forum, difficulties in motivating students, and the exhaustion of instructors.

For the second question (What awareness information is provided in online discussion forums?), we identified 6 elements of awareness that focused on the context of distance learning: workspace, social, informal, group-structural, task, and concept awareness. These elements can critically enable participants to gain insight into the distance learning environment.

Finally, for the last question (How can awareness information enhance discussion forums?), the data were categorized into two groups of outputs generated. The first group comprises publications that developed conceptual models or conduced scientific investigations but did not develop systems. The second group comprises publications that have developed some system/framework/plug-in to test and validate the proposals.

To answer the main question (What awareness information can be provided in online discussion forums and how can this information assist instructors to mediate interaction?), we observed the different types of difficulties encountered in the forums and related these difficulties to the elements identified in the mapping. For each difficulty, awareness information can be provided. For example, in the accompaniment difficulty, a workspace awareness resource could be used that would allow a view of what is happening in the workspace, among other examples that were explored in detail in the work.

The results presented in this Systematic Mapping help to understand what is being investigated in relation to the use of awareness in the context of forums. We expect that the mapping will help researchers in the identification of works that investigate the applicability of awareness and its elements in the context of distance learning.

As a future work, we suggest an in-depth analysis of the difficulties faced by users of online forums. In addition, we intend to implement a tool that provides workspace and group-structural awareness, thereby providing instructors with information to assist in the monitoring of the forum and coordination of interactions.

ACKNOWLEDGMENT

We would like to thank the Coordination of Superior Level Staff Improvement (CAPES) of Brazil, for the financial support provided for the realization of the project in which this paper belongs.

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APPENDIX A. SELECTED STUDIES

ID	TITLE	YEAR	PATTERN AWARENESS	METHODOLOGY
S01	Applying Social Network Analysis in a course supported by a LMS: Report of a case study	2017	Social awareness	Case study
S02	E-assessment of online academic courses via students' activities and perceptions	2017	Group-structural awareness	Case study
S03	How Effective is Your Facilitation? Group-Level Analytics of MOOC Forums	2017	Social awareness	Empirical study
S04	Integrating Learning Management System with Facebook Function: The Effect on Perception towards Online Project Based Collaborative Learning.	2017	Social / Task awareness	Qualitative research
S05	iTimeline: Uma Ferramenta Visual para Identificação e Acompanhamento das Interações Sociais em Ambientes Virtuais de Aprendizagem	2017	Workspace awareness	Case study
S06	Students' perceptions and attitudes towards asynchronous technological tools in blended-learning training to improve grammatical competence in English as a second language	2017	Task awareness/ Concept awareness	Qualitative research
S07	Virtual Patients in a Behavioral Medicine Massive Online Course (MOOC): A Qualitative and Quantitative Analysis of Participant's Perceptions	2017	Task/ Concept awareness	Mixed search
S08	Design and Effects of a Concept Focused Discussion Environment in E-Learning	2016	Task / Workspace awareness	Comparative study
S09	Effects of four CSCL strategies for enhancing online discussion forums: Social interdependence, summarizing, scripts, and synchronicity	2016	Social awareness	Other
S10	Evaluation of the learning management system using students' perceptions.	2016	Workspace awareness	Qualitative research
S11	Fostering awareness of the pedagogical implications of World Englishes and ELF in teacher education in Italy	2016	Informal awareness	Case study
S12	How Wiki-based Tasks, and Forums Favor University Students' Writing Skills and Promote Collaborative Autonomy	2016	Task awareness	Quantitative research
S13	Investigating Students' Interactions with Discussion Forums, Facebook, and Twitter in a MOOC and their Perceptions	2016	Social / Workspace awareness	Mixed search
S14	Providing a multi-fold assessment framework to virtualized collaborative learning in support for engineering education	2016	Social awareness	Empirical study
S15	The Relationship between Social Presence and Critical Thinking: Results from Learner Discourse in an Asynchronous Learning Environment	2016	Social awareness	Quantitative research
S16	An empirical study of online discussion forums by library and information science postgraduate students using technology acceptance model 3	2015	Social awareness	Empirical study
S17	Análise dos Resultados de um Sistema Multiagente que Identifica e Caracteriza as Relações Sociais dos Alunos de um Ambiente Virtual de Aprendizagem	2015	Group-structural awareness	Case study
S18	Exploring the function of discussion forums in MOOCs: comparing data mining and graph-based approaches	2015	Group-structural / Social awareness	Case study
S19	MOOCs in Our University: Hopes and Worries	2015	Workspace awareness	Case study
S20	Online mediations in distance education courses for Portuguese-speaking teachers in question	2015	Workspace awareness	Case study
S21	Study Partners Recommendation for xMOOCs Learners	2015	Concept / Social awareness	Quantitative research

S22	Exploring the antecedents of screenshot-based interactions in the context of advanced computer software learning	2014	Workspace / Task awareness	Case study
S23	Evaluating a Linked Open Online Course	2014	Task / Concept awareness	Comparative study
S24	Question Recommendation with Constraints for Massive Open Online Courses	2014	Task awareness	Concept proof
S25	Students' perception and behavior of academic integrity: A case study of a writing forum activity	2014	Task awareness	Case Study
S26	Towards an Emotion Labeling Model to Detect Emotions in Educational Discourse	2014	Social awareness	Case study
S27	A case study of developing student-teachers' language awareness through online discussion forums.	2013	Concept awareness	Case study
S28	Architecture for Social Interactions Monitoring in Collaborative Learning Environments as a support for the Teacher's Awareness	2013	Social awareness	Quantitative research
S29	Awareness learning is a function of educational technology in e-learning.	2013	Workspace awareness	Qualitative research
S30	Paradigms, paradoxes and professionalism: An exploration of lecturers' perspectives on technology enhanced learning	2013	Concept awareness	Other
S31	The influence of learning management system components on learners' motivation in a large-scale social learning environment	2013	Social / Group-Structural awareness	Mixed search
S32	Using a Facebook Group as a Forum to Distribute, Answer and Discuss Content: Influence on Achievement.	2013	Social awareness	Mixed search
S33	Accounting students' perceptions of a Learning Management System: An international comparison.	2012	Workspace awareness	Qualitative research
S34	Perceptions towards Computer Supported Collaborative Learning: A Case Study of Sudanese Undergraduate Students	2012	Workspace awareness	Case study
S35	The dialogical process of knowledge construction in discussion forums.	2012	Concept awareness	Qualitative research
S36	The impact of student activity in a virtual learning environment on their final mark.	2012	Task awareness	Quantitative research
S37	The impact of student activity in a virtual learning environment on their final mark.	2012	Task / Workspace awareness	Qualitative research
S38	Usage of technology enhanced learning tools and organizational change perception.	2012	Task / Workspace awareness	Qualitative research
S39	Assessing the acceptance of a blended learning university course.	2011	Workspace awareness	Mixed search
S40	Assessing the value of using an online discussion board for engaging students.	2011	Social / Workspace awareness	Case study
S41	Communication, interaction and speech in virtual learning environment (VLE): The perception of students and teachers	2011	Workspace awareness	Other
S42	Improving cooperation in Virtual Learning Environments using multi-agent systems and AIML	2011	Task / Concept awareness	Other
S43	Online Interactive Forums As A Learning Tool Among The Media students-An Analysis.	2011	Task / Social awareness	Qualitative research
S44	Online Learning Environment: Taxonomy of Asynchronous Online Discussion Forums	2011	Workspace awareness	Case study
S45	Facilitating discourse and enhancing teaching presence: Using mini audio presentations in online forums	2010	Task awareness	Case study
S46	Asynchronous discussion forums: success factors, outcomes, assessments, and limitations.	2009	Workspace awareness	Qualitative research
S47	Designing learning environments improving social interactions: essential variables for a virtual training space	2009	Social / Workspace awareness	Exploratory research
S48	Fostering collaborative knowledge building by the effective provision of knowledge about the discussion process	2009	Group-structural awareness	Case study
S49	Developing teaching practice for more effective use of asynchronous discussion: A preliminary investigation	2008	Task awareness	Other
S50	Intelligent Software Agents Mediating the Pair Participation in a Distributed Intelligent Pair-Software Development Environment	2008	Social awareness	Case study
S51	Interaction Analysis as a multi-support approach of social computing for learning, in the "Collaborative Era": Lessons learned by using the DIAS system	2008	Social awareness	Case study
S52	Notification-action: Information and Access to the Learning Environment through Notifications to Support the Coordination of Distance Learning Forums	2008	Social awareness	Action research
S53	When to jump in: The role of the instructor in online discussion forums	2007	Workspace awareness	Case study
S54	Evaluating threaded discussion forum activity - faculty and student perspectives on categories of activity	2005	Social awareness	Qualitative research
S55	Macroscopic Study of the Social Networks Formed in Web-based Discussion Forums	2005	Social awareness	Concept proof
S56	No need to read messages right now: helping mediators to steer educational forums using statistical and visual information	2005	Group-structural awareness	Case study
S57	A field study of use of synchronous chat in online courses	2003	Social / Workspace awareness	Quantitative research
S58	OSCAR: a Framework for Structuring Mediated Communication by Speech Acts	2003	Social awareness	Concept proof
S59	A descriptive framework of workspace awareness for real-time groupware.	2002	Workspace awareness	Other