



Towards the refinement of forum and asynchronous online discussion in educational contexts worldwide: Trends and investigative approaches within a dominant research paradigm



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ABSTRACT

The growth of asynchronous online discussion (AOD) in primary, secondary, undergraduate, and post-graduate contexts and courses has resulted in a growing body of literature that provides valuable insights into the issues surrounding the use of online writing, online discussion, and distance and blended learning in formal education worldwide. This phenomenological critical literature review provides an overview of research focused on forum use and AOD published from 2008 to 2012. Papers were chosen based on a selection process suggested by Wu et al. (2012), where nine of the most influential e-learning education and educational review journals were searched according to year, 2008–2012, and the following keywords: forum, threaded discussion, and threaded chat. Three teachers/educational researchers, each with at least five years of experience using forum and AOD in university contexts, further filtered the corpus through following a detailed inclusion/exclusion procedure, which resulted in a refined corpus of 43 journal papers. Quantitative analyses of results reveal most AOD research in educational contexts from 2008 to 2012 was carried out through or on Learning Management Systems (LMS) platforms in university settings, within computer and education classes, with blended learning dominating distance learning contexts. Most research settings were based in Asia and Europe, while the three countries with the most AOD publications were Singapore, Taiwan, and the U.S. In addition, the journals dominating the field were *Computers & Education*, followed by *Journal of Computer Assisted Learning*, and *Australasian Journal of Educational Technology*. The refined corpus was also analysed qualitatively via phenomenological method (Smith, Flowers, & Larkin, 2009), in order to identify and contextualize meaningful statements and themes. Discussion focuses on the existence of a dominant research paradigm that we divide into four investigative impulses and discuss: argumentative, comparative, relational, and analytical. Specific representative examples of each investigative impulse are thoroughly discussed and critiqued, and as a result, should be of significant value to all stakeholders, including researchers, instructors, and students, involved in forum and AOD use in educational contexts globally.

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1. Introduction

As technology has advanced, so has the rise of instructional-based technology (IBT). Advances in technology and tools, such as computer-mediated communication (CMC), Learning Management Systems (LMS), Course Management Systems (CMS), and E-platforms, as well as the widespread reach of the internet due to advances in connectivity and coverage, have led to a profound paradigm shift: the emergence of

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distance and blended learning environments (Liu, 2011; Mayadas, Bourne, & Bacsich, 2009). In both distance and blended learning environments, students are asked to discuss and interact with peers and with course materials. Teachers, from primary school to university, are increasingly aware of the affordances of online forums to promote interaction and complex thinking that is not always effective in traditional face-to-face learning situations (Chen & Wang, 2009). Asynchronous online discussion (AOD) not only extends knowledge construction from the classroom but also provides students with the time and space to work with, explore, and critically discuss topics by interacting and building interactive online communities (Gao, Zhang, & Franklin, 2013). This fact has led to the development of subfields such as Computer Supported Collaborative Learning (CSCL) (Hewitt, 2005), where deeper knowledge construction and social interaction occur in tandem to promote effective learning (Chen & Wang, 2009). Forums are often used in a format commonly referred to as threaded forums. In a threaded forum, the user has a choice to reply to an existing topic or start a new topic for discussion, as all the posts in a forum thread are presented in chronological order (Gao et al., 2013).

The growth of forum and AOD use in primary to university courses has resulted in a growing body of literature that provides valuable insights into the issues surrounding forum and AOD in formal education. Andresen (2009), in a literature review of asynchronous online forums from 1999 to 2007, found that the literature began by investigating forum as a writing tool, but has matured to focus on several themes including the following: Student interaction in the forum (Hewitt, 2005), the role of the instructor (Guldberg & Pilkington, 2007), complex issues arising in the assessment of forums (Yang, Richardson, French, & Lehman, 2011) and the efficacy of instructional material (Lee, 2008; Liu, Liu, & Hwang, 2011).

We believe that since the development of online chat tools, as well as academic institutions adoption of Course Management Systems (CMS) and Learning Management Systems (LMS) are recent phenomena (Liu, 2008; Liu, 2011; Liu & Chen, 2007), there should be powerful changes in the aforementioned themes reflected in the literature and that it is important to identify the latest findings in order to offer the major stakeholders, such as future researchers, course designers, instructors, and students, insights into the current and future directions of this field. The purpose of this paper is to gather, analyse, and synthesize data in order to isolate and critically reflect upon these findings. Furthermore, we hope to address how the literature is responding to the changes in classroom and educational practice involving online discussion.

In addition, this study hopes to provide an overview of the research contexts (including country, region, level of education, and discipline), platforms, and tools being used for forum-based discussion. The papers were selected based on a selection process by Wu et al. (2012), where nine of the most influential indexed e-learning education and educational review journals were searched according to the following key words: forum, threaded discussion, and threaded chat. Following this, the researchers employed a phenomenological review method in order to document and better understand the research concerning forum use and AOD in education contexts in general, and to identify and discuss meaningful statements, salient themes, and key trends and relationships.

2. Literature review

Asynchronous online discussion is an online computer-mediated communication (CMC) system that allows students to read and participate in online discussions at their own pace, i.e., when they feel they are ready to contribute, making the discussion 'asynchronous' in nature (Thomas, 2013). A discussion forum is a tool used in a web-based learning environment for learners to construct, collaborate and engage with knowledge asynchronously or synchronously. It often consists of facilitative questions or examples of real-life situations with which learners interact (Topcu & Ubuz, 2008). Gerosa, Filippo, Pimentel, Fuks, and Lucena's (2010) define educational forum as "an asynchronous textual communication tool, largely used to delve deeper into a course subject" (p. 528). Many studies into online forum discussions have been framed under the theory of social constructivism, and this type of learning is referred to as computer-supported collaborative learning (CSCL) (So, 2009). Studies into CSCL focus on how instructional material and software mediates social interaction through technology. Within CSCL studies, the focus has been split between instructional materials, software used to mediate learning (So, 2009), and how learners interact in asynchronous discussions (Yang et al. 2011).

Four previous literature reviews investigated themes in online forum discussions. Hammond (2005) reviewed 62 papers published between 2000 and 2004 looking at teaching and learning assumptions and curriculum design. The majority of papers were based on studies in higher education institutions. He noted that there was a broad consensus towards social constructivism, or a commitment from course designers and instructors to encourage interaction. Many studies reported students' perceptions towards the benefits of forum collaboration, but there was no consistent way to categorize or measure these perceptions. It was also reported that the papers in his corpus identified curriculum design and instructor support as crucial for learner engagement, and the software or design model as less important. Interestingly, interaction was often reported in terms of frequency, not in terms of quality of interaction; as a result, it may have overlooked deep learning gains.

Gao et al. (2013) synthesized the literature in terms of what they called "Asynchronous Learning Environments" and how these environments influence learning. A previous paper by Gao, Wang, and Sun (2009) developed the Productive Online Discussion Model (PODM) that contained the following discussion environments: constrained environments, visualized environments, anchored environments, and combined environments. They searched six refereed educational technology journals between 2000 and 2011. This was narrowed down to 13 papers that fit their four learning environments. While they stressed it was not a comprehensive review, by having fixed themes they may have missed changes in the field. Nevertheless, their study does provide valuable insights into these learning environments and more importantly, explores the possibility of alternative environments and tools for threaded discussions.

In Andresen's (2009) review, he finds and discusses key research areas that include (1) the makings of a successful asynchronous discussion, which center on (a) the role of the instructor and (b) attempts to achieving deeper/high learning; (2) a movement for more accurate assessment of asynchronous discussion forums; and (3) the limitations of asynchronous teaching. Although Andersen's (2009) study does distill a number of key issues and studies, his review offers few specifics on the larger picture of research, offering little quantitative evidence of the scope of the field.

Thomas (2013) carried out a literature review into asynchronous online discussion (AOD) used specifically in health care education. She reviewed fourteen studies that met her specific quality criteria. The main aim of the review was to explore and identify the different types of online asynchronous discussion and their impact on learning. Although the results of the studies were positive, the author questioned the robustness of the evidence as many of the studies showed only small increases and several lacked control measures. For example some of

the studies compared online asynchronous discussion with face-to-face discussion, while the author believed comparing moderated and non-moderated online discussion would help explore the pedagogical uses of this technology. The review did uncover several potential areas for learning with asynchronous online discussion that warrant further research such as comparing voluntary and obligatory use of asynchronous online discussion and moderated versus non-moderated discussion.

The above studies are important to our understanding of the trends in online discussions but do not provide an overview of the research types, contexts, and platforms for online forum-based discussion, nor do they discuss directly how themes are related to a research paradigm. This study intends to fill this research gap, as well as provide a new critical literature review methodology, phenomenology, in order to offer new perspectives of the most recent literature on forum and AOD in educational contexts.

2.1. Research questions

- (1) What are the current trends in research types, contexts, and platforms for research focusing on forum and AOD in educational contexts?
- (2) What investigative approaches and paradigms are currently in ascendance in research focusing on forum and AOD in educational contexts?

3. Methods

3.1. Phenomenological review method

Since forum and online discussion are recent phenomena with a relatively short history of use in educational contexts, the researchers chose a phenomenological (Smith, Flowers, & Larkin, 2009) method fashioned after Randolph (2009, p. 10), who asserts “In using phenomenology as a review technique, the unit of analyses is the research report.” Before beginning the search, the researchers (1) identified phenomenon under focus, research reports focused on forum and AOD in academic contexts; (2) bracketed our experiences of using forum as both professional educators and graduate students; (3) collected all data/corpus focused on the phenomenon under examination: forum and AOD in educational contexts; (4) Identified meaningful statements and themes; (5) attempted to give “meaning,” “context,” and to critique these themes through thick rich description of “the essence of primary researchers experiences with the phenomenon” (Randolph, 2009, p. 11) (see Fig. 1).

3.2. Search strategies

The papers for this critical literature review were adapted from a selection process used by Wu et al. (2012). Studies for this review were collected according to three important factors: (1) academic journals searchable via ISI Web of Knowledge (WOK) database, in order to offer easy replication, i.e., so the search could easily be repeated to track future evolution of the field; (2) included major journals in the fields of e-learning education and educational review with a high impact factor (IF) in the 2013 Journal Citation Reports (Thomson Reuters, 2013); and (3) journals with at least a 20-year publication history. Thus we conducted a search via the ISI Web of Knowledge (WOK) database for the following major journals: *Computers & Education* (IF = 2.775), *British Journal of Educational Technology* (IF = 1.313), *Journal of Computer Assisted Learning* (IF = 1.632), *Educational Technology Research and Development* (IF = 1.155), *Australasian Journal of Educational Technology* (IF = 1.363), *Educational Technology & Society* (IF = 1.171), *Review of Educational Research* (IF = 4.229), *Educational Research Review* (IF = 2.586), and *Educational Researcher* (IF = 2.779). The search was carried out by three teachers/educational researchers, each with at least five years of experience using forum and AOD in university contexts, who had agreed on the following keywords: forum, threaded discussion, and threaded chat. Results showed 87 papers, which after removing duplicates included 84 papers. Fig. 2 provides a summary of how the documents were selected.

The three researchers then manually assessed the papers to ensure they met rigorous selection criteria (see Appendix A), which included the following inclusion/exclusion categories (1) papers concerning wiki and blog discussion were excluded; (2) only articles where online discussion/forum use was the primary focus on the research were included, i.e., papers focusing on LMSs or distance learning for example, where Forum or AOD use were only parts of a larger phenomenon under investigation, were excluded; (3) discussion had to be asynchronous in a threaded format; (4) only empirical-based research rather than theoretical-based research was included; (5) there had to be some direct analysis, qualitative or quantitative, of the AOD discussion itself, i.e., studies using only questionnaires or interviews about forum or AOD were excluded; and (6) review articles and book reviews were removed. The final inclusion was verified via an inter-rater

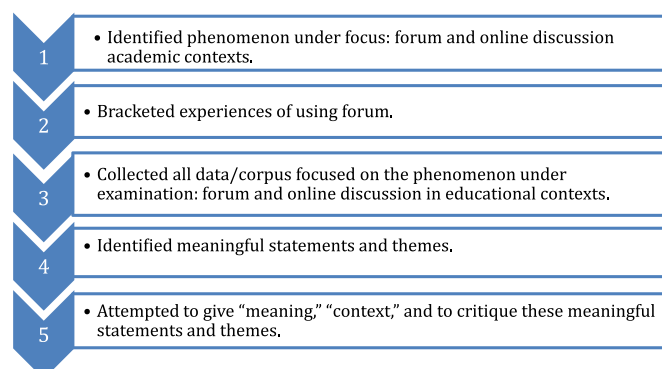


Fig. 1. Phenomenological review method (adapted from Randolph, 2009).

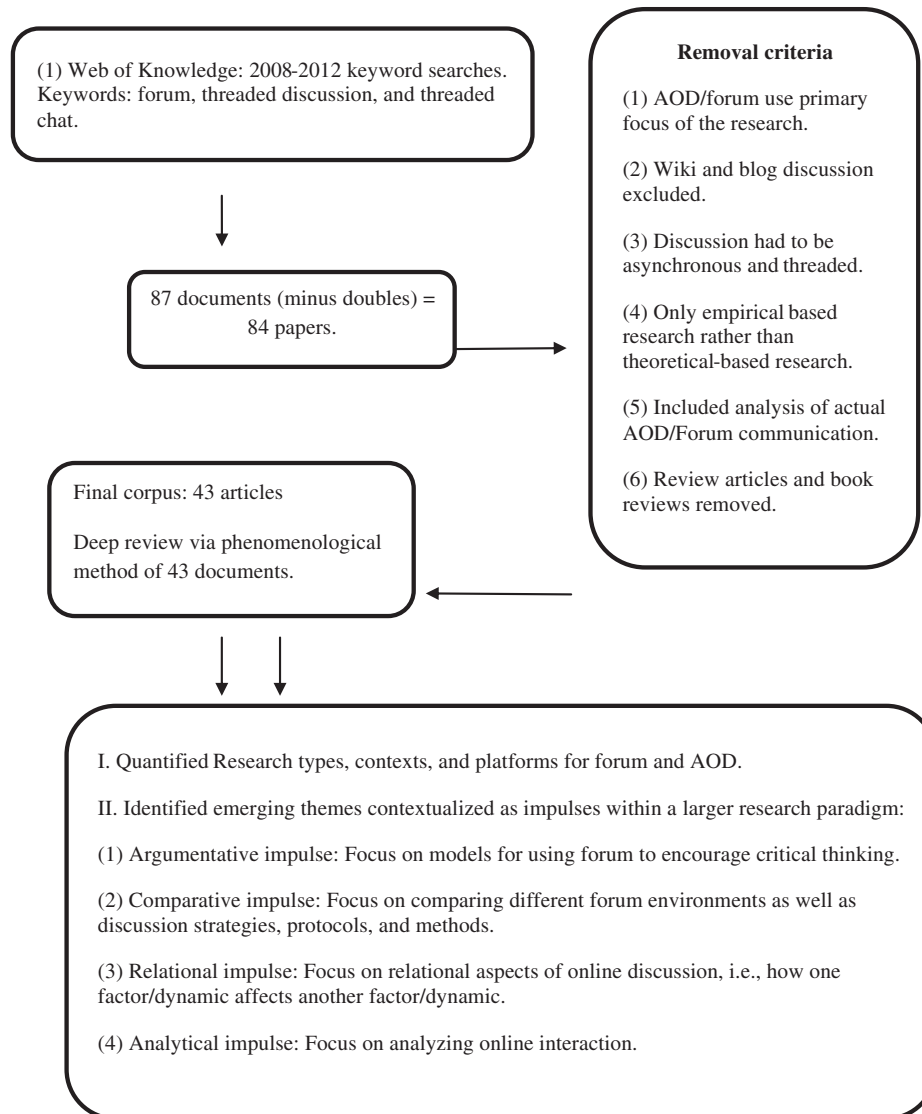


Fig. 2. Summary of article selection.

reliability test, which found 94% agreement between the two raters, which is well above the 80% threshold (Riffe, Lacy, & Fico, 1998). Any problems with the selection were discussed and resolved via face-face discussion, resulting in a refined corpus of 43 papers to be analyzed for results and discussion.

3.3. Data coding and analysis

After multiple consultations between the three researchers, nine features were identified, based on Wu et al.'s (2012) research methodology but adapted for forum/asynchronous online writing, and the corpora was coded to get an overall picture of the trends in online forum and AOD, including: (a) Research site by country and area; (b) Forum platform (open source web/LMS/CMS); (c) Academic context (primary, secondary, undergraduate and post-graduate); (d) Academic discipline (e.g., education, computer science, etc.); (e) Delivery method (distance/blended); and (f) Mobile or Ubiquitous online discussion/forum.

After quantifying the results of the refined corpus of 43 papers (see Appendix B), the researchers utilized an adapted phenomenological review approach to qualitatively examine and contextualize the refined corpus of 43 research papers. The process and experience of identifying, coding, analyzing, and discussing meaningful statements, themes, and dynamics extrapolated from the refined corpus of research articles led the researchers to analyze how essential themes were interconnected and contextualized as four impulses—comparative, relational, argumentative, and analytical—within a larger dominant research paradigm.

4. Results

The larger corpus of 43 papers was analysed in order to better understand the broad specific trends in research types, contexts, and platforms for research focusing on online forum and AOD published between 2008 and 2012.

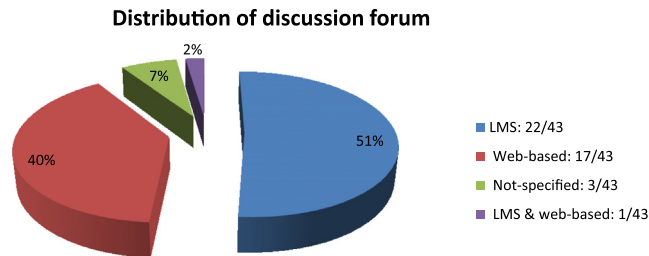


Fig. 3. Distribution of discussion forum platforms.

4.1. Distribution of forum platforms

Fig. 3 indicates that among the studies, LMSs were the most common platform for forum discussion (51%), followed by web-based forums (40%), and some studies used both (2%). LMS includes the popular e-learning platforms such as Moodle and Blackboard. There were 7% of the papers that did not specify if they used LMS or a web-based platform.

4.2. Distribution of academic contexts

Fig. 4 indicates educational contexts of the studies in the refined corpus and shows the most common context to base research in forum and AOD research to be post-graduate (40%), followed by undergraduate (37%), K-12 (21%), and mixed undergraduate/post-graduate groups (2%).

4.3. Academic discipline

For academic disciplines (see Fig. 5), all studies involving technology science, computers, and multimedia technology were grouped as “computer technology.” Liberal Arts included Language Learning, Psychology, etc. Education included any course that included education as the primary focus. The highest percentage of papers was conducted in education (32.5%), followed by computer technology (27.9%), and other (16.3%), which included math, medicine and business amongst others. Only a small percentage of science (9.3%) and liberal arts (9.3%) disciplines were found in the corpus.

4.4. Delivery method

Fig. 6 shows the delivery method or mode of context in research on online discussion forums, and this was divided into distance (no classroom interaction), and blended (involving classroom interaction). The most frequent type of delivery method was blended (70%) followed by distance (30%).

4.5. Research site by region

The regions were grouped according to research sites per continent (see Fig. 7), and the region that produced the most research papers was Asia (46.5%), followed by Europe (27.9%), the Americas (23.2%), and other regions (2.3%). In terms of individual countries (see Fig. 8), Singapore produced the most papers (20.9%) with Taiwan (18.6%) and the USA (16.3%) also producing a substantial amount of publications.

4.6. Research papers per journal

Fig. 9 indicates that over 55% of the papers were published in *Computers & Education*, followed by *Journal of Computer Assisted Learning* (13.9%), and *Australasian Journal of Educational Technology* (11.6%). However, there were none found (using our keyword search) for 2 of those journals, *Review of Educational Research* and *Educational Research Review*, and only one found from *Educational Researcher*, but forum was not the focus in this study.

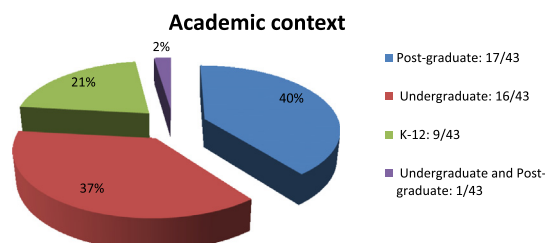


Fig. 4. Distribution of academic context.

Percentage of papers per discipline

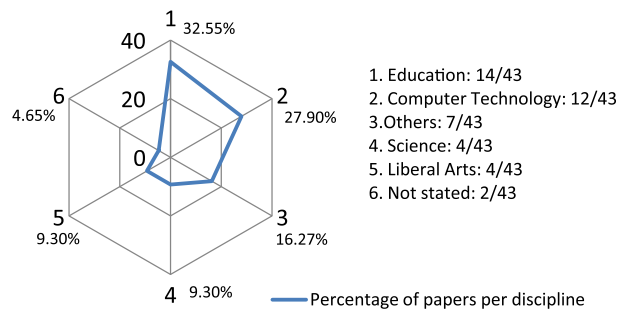


Fig. 5. Distribution of papers per academic discipline.

4.7. Number of papers per year

Fig. 10 shows that with the exception of 2010, the papers are evenly distributed between the five study years with the highest being 2008 (11 papers, 25.6%) and the lowest 2010 (4 papers, 9.3%).

5. Discussion

5.1. Current trends in research types, contexts, and platforms

Results show that most online forum discussions were carried out through or on LMS platforms. This is due in large part to the expansion of LMS adoption, most all of which include some forum or AOD component, among universities and colleges, as well as the rise of blended and distance learning. Another possible explanation is because most of the research is based in higher education settings where LMSs such as Moodle and Blackboard are frequently used. This was something that was also noted by Hammond (2005). Researchers, often based in higher education institutions, have greater access to students, information systems, course materials, as well as greater funding resources and encouragement supporting research. However, this shows that there is a strong need for research on learners outside the walls of higher education such as in primary, secondary, and adult education. This can be seen from the academic context where only 9 of the 43 (21%) research papers took place in K-12 environments. Although there is little quantitative research on forum and AOD use in K-12 in the years prior to 2008, we hypothesize the 21% to have grown from the five previous years (2003–2008) and to expand in the future.

In terms of academic discipline, most of the research took place in education disciplines (14/43) and computer technology disciplines (12/43). We believe that this is to be expected, as forum and AOD are naturally a blend of education and technology; thus, one could expect the stakeholders of both these disciplines, including researchers, instructors, and students, to be at the fore of this research. However, research into forum use in other disciplines is taking place, and suggests that there is rich potential for cross-discipline research as well as growth in other disciplines as blended and distance learning becomes more entrenched in educational contexts among all disciplines.

Another salient feature from the results was the predominance of research papers for blended learning (30/43), compared with distance learning (13/43). Again, although there is a lack of historical quantitative data on forum and AOD use in distance learning, as well as blended learning, we expect to see the percentage of papers on distance learning rise in the future, due to the fact of the importance of AOD and forum in distance education because of the lack of face-to-face (FtF) contact, as well as the rise of distant learning in general (Mayadas et al., 2009).

5.2. Investigative impulses within a dominant research paradigm in the literature

In general, the researchers find that the current literature on forum conversation and use of AOD has evolved passed an initial stage of euphoria and high expectations over the promise and affordances these new technologies and practices promise; in addition, a number of “truths” about their use in educational contexts have settled and shaped current research into a dominant research paradigm. The first is

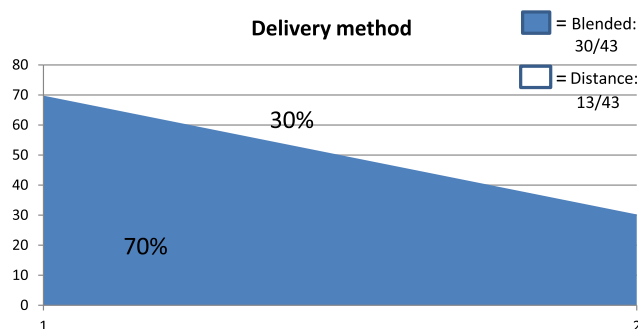


Fig. 6. Distribution of delivery method or mode in research on discussion forums.

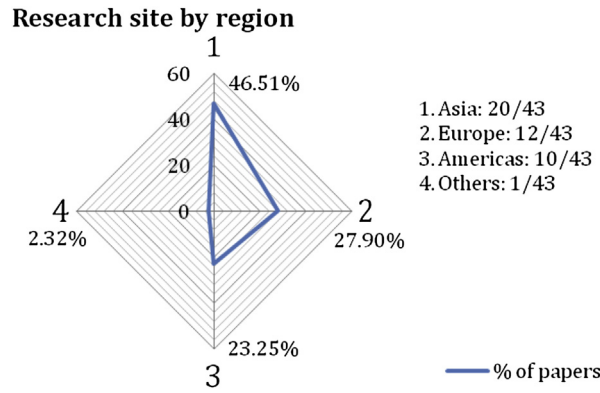


Fig. 7. Research site by region.

that un-mediated, uncontrolled, or un-facilitated forum or AOD use by students will likely not result in “effective” discussion, learning, or knowledge construction. The second is that instructors need to more carefully and forcefully plan and control the discussion and learning, even if that involves an instructor planning more student, peer, or facilitator control. The third is that instructors need to identify and preference specific definitions of higher learning, as well as offer ways to assess whether these specific definitions of higher learning have taken place in forum and AOD, in order to engender more effective use of forum and AOD. The final truth we see evident in the literature is a general acceptance that instructors, in the age of blended and distance learning, need to teach students how to “use” forum and AOD, often through the use of complex scaffolds, models, protocols, and assignment parameters.

Although we find the majority of the research in the corpus powerfully influenced by this paradigm in some manner, there is patterned variation in the investigative impulses informing the paradigm. In the following discussion, a number of representative papers of each impulse will be discussed in order to shed light on how current research is conceptualizing and adapting AOD and forum use to various educational contexts (see Appendix B for complete refined corpus of 43 papers organized by investigative impulse; Author, Title, and Year; Academic Level and Discipline; Research Goal; and Research Outcomes).

5.2.1. Argumentative impulse/critical thinking

Three papers in the corpus are primarily argumentative in that they essentially argue forum and AOD can and needs to be structured by instructors in order to improve critical thinking skills. In a highly cited paper, Yang (2008) sought to measure the effects of using asynchronous discussion forums (ADFs), with the aid of teaching assistants, in order to teach critical thinking skills (CTS) in large lecture classes in Taiwanese university settings. Using a quasi-experimental design in a blended learning setting, the ADFs were structured, with and without the use of Socratic dialogues, and compared. Students’ level, patterns, and range of critical thinking skills (CTS) were measured by two means: (a) the California Critical Thinking Skills Test; and (b) the Coding Scheme for Evaluating Critical Thinking in Computer Conferencing.

Yang (2008) cites Ennis’ (1985) definition of critical thinking: “reasonable, reflective thinking that is focused on deciding what to believe or do” (p. 46), and argues that it is an important objective and privilege of higher education. Yang (2008) states that discussion in traditional FtF educational environments has two important disadvantages, namely “limited class time and unequal access of interaction (e.g., a small number of students dominate the discussion)” (p. 242), and argues the affordances of newer discussion-based tools such as forum, including allowing more time for students to write and unique interaction aspects for instructors, are promising (Duffy, Dueber, & Hawley, 1998, cited in Yang, 2008). Yet Yang (2008) believes that without an instructor-imposed structure to a discussion, students will fail to ask deeper questions and the discussion, and critical thinking, and thus learning in general, will all suffer.

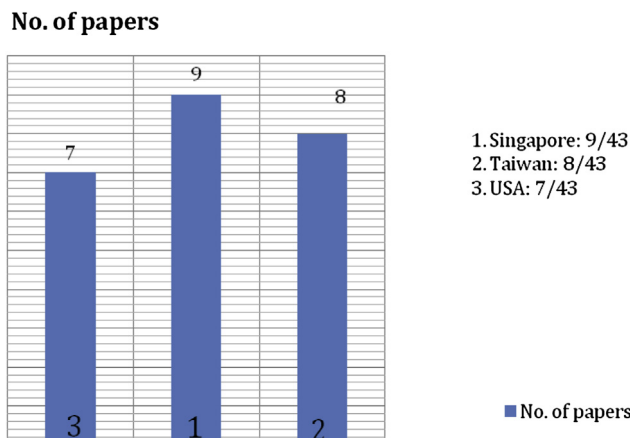


Fig. 8. Top 3 countries for AOD publications.

Research paper by journal

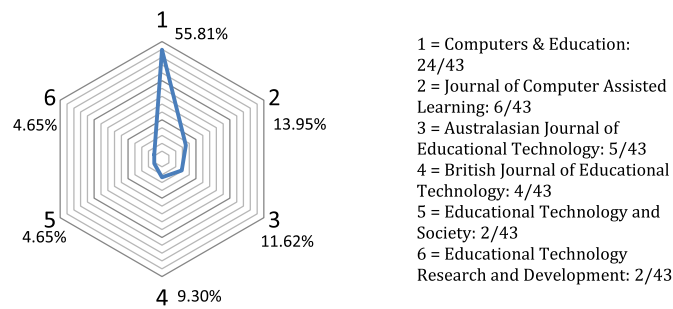


Fig. 9. Research papers by journal.

Yang's (2008) study concludes that instructional intervention in the form of smaller discussion groups (13–15 students) and use of facilitated Socratic dialogues indeed can have a positive effect on fostering critical thinking, although Yang (2008) stresses that “unless the instructor and the TAs play a pedagogical role in teaching, modeling, and prompting Socratic dialogues, an interactive dialogue alone cannot effectively help students become independent critical thinkers over a short period of time” (p. 262). What exactly this “pedagogical role” is not entirely clear, but its extension to the use of teaching assistants is novel and practically appropriate for larger university classes.

The goal of de Leng, Dolmans, Jöbssis, Muijtjens, and van der Vleuten (2009) quasi-experimental study is to explore and evaluate the effectiveness of their self-designed e-learning model, which is designed to increase critical thinking in higher education science students and was tested via a distance education mode to medical students in the Netherlands. de Leng et al. (2009) divided their students into small virtual groups of around four students, each located at different hospitals, where the students used AOD to “discuss pathophysiological concepts in a paediatric workplace setting” (p. 3). In their presented e-model, discussions were based on the Practical Inquiry model of Cognitive Presence (Garrison, Anderson, & Archer, 2001), where “critical thinking is defined as cognitive activities geared to four consecutive phases: triggering event, exploration, integration, and resolution” (p. 3). Outcomes in the study suggest that while levels of critical thinking were moderate, a focus on following the model did promote on-topic discussion. This is an issue, perhaps problematic, in many studies evaluating the use of models. In exerting maximum effort to have students strictly follow a model, positive outcomes outside the scope of the model may be negatively affected or overlooked.

The study by de Leng et al. (2009), however, does reveal a number of conclusions interesting for future research in AOD use in distance settings. The first is that participants found their e-model useful in helping promote a sense of community “in which they could pursue shared and personal goals” (2009, p. 12), and the second is that moderators suggested that the model could include some synchronous communication in order to compliment discussion. More research needs to explore the blending of synchronous and asynchronous online discussion in order to improve learning outcomes.

5.2.2. Comparative impulse

5.2.2.1. Comparing environments and tools

Three papers in the corpus are primarily comparative in that they are to some extent concerned with the comparison of different forum and AOD environments and/or tools. In a highly cited study focused on investigating online interactive feedback in two different blended undergraduate settings in the Netherlands, van der Pol, van den Berg, Admiraal, and Simons (2008) examine the relationship between the nature of feedback, as well as its reception by a receiver and its constructive use. The study provides a comprehensive review of peer assessment and argues convincingly that the affordances of forum and AOD, namely reductions in time spent copying, distributing, and keeping records of student materials, are uniquely qualified to streamline traditional peer assessment processes. In the second of the two studies analyzed, the author's compare the regular online learning environment, Blackboard, as a normal threaded forum, with a tool or environment developed by van der Pol et al. (2006) and designed for anchored discussion called the Annotation system, in essence comparing normal threaded discussion with anchored discussion. Results showed that for the Annotation system, students AOD showed less evaluative feedback and more feedback with suggestions for revisions than in Blackboard, and illustrate the important point that specific forum environments or tools can substantially shape student discussion and learning, a point not to be forgotten for instructors using AOD in order to attain specific learning goals.

No. of papers per year 2008-2012

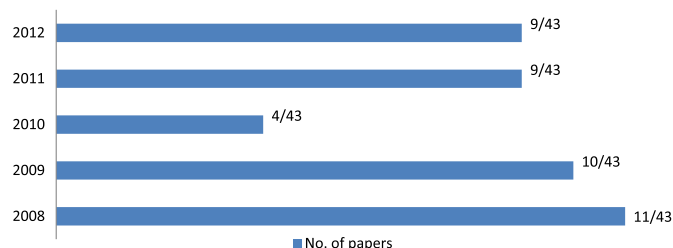


Fig. 10. Number of papers per year.

In one of the few studies in the refined corpus to focus on AOD and the use of mobile devices, [Lan, Tsai, Yang, and Hung \(2012\)](#) develop and test a mobile learning system, mobile interactive teaching feedback system (MITFS), in order to compare the social knowledge construction behavioral patterns of problem-based asynchronous discussion in e-learning and m-learning environments. In their experimental study, they tested AOD with and without MITFS, and found that using additional environments lead to more choice or options for students, and that using mobile devices positively influenced students' learning performance. Whether or not this is related to m-learning's affordances of ubiquitous mobility and situated context, as the authors suggest, or the design of the learning activity in the experiment, are subject to debate. Whatever the case, [Lan et al.'s \(2012\)](#) study is surely a valuable addition to the study and understanding of AOD in e and m-learning contexts.

5.2.2.2. Comparing discussion strategies, protocols, and methods

Seven papers in the refined corpus were concerned with comparing not AOD environments or tools, but rather discussion strategies, protocols, and methods. [Hou's \(2011\)](#) highly cited case study is a good example of how recent research in AOD is providing studies on more specific educational contexts as well as specific pedagogical guidance on how best to use AOD for desired learning outcomes. [Hou's \(2011\)](#) research focuses on higher education courses that focus explicitly on case studies and argues "teachers can provide situated scenarios (such as business bottlenecks and medical cases) and problem-solving discussion tasks for students to promote their cognitive skills" (p. 712). Based on the concept of situated learning, use of AOD, situated scenarios, and problem-solving activities, [Hou \(2011\)](#) designed a study that essentially compares the same students engaging in situated AOD and problem solving activities with and without a role-playing activity. Outcomes suggested that the AOD incorporating role-playing facilitated deeper discussions.

In a similar fashion, [Schworm and Gruber \(2012\)](#), offer an experimental study examining the effectiveness of instructor prompts, which they argue are essential to self-regulated learning in virtual e-learning course environments, by comparing students who received prompts with those who didn't. The results of [Schworm and Gruber's \(2012\)](#) study were mixed. Although prompts were seen to improve overall help-seeking activities and were associated with improved learning outcomes, they were not specifically seen to lessen the level of perceived help-seeking threat as predicted by the researchers.

5.2.3. Relational impulse

Eleven papers of the refined corpus focused on relational aspects. These papers basically all examined how some aspect of forum or AOD use affected another aspect. The goal of [Chen and Chiu's \(2008\)](#) highly cited study analyzing 131 messages posted by 47 participants across seven topics in the mathematics forum of Peking University's Bulletin Board System (BBS) was to examine how earlier messages affected later messages along five dimensions: (1) evaluations; (2) knowledge content; (3) social cues; (4) personal information; and (5) elicitation. [Chen and Chiu \(2008\)](#) posit that BBS's are more independent and free of instructor interference and control than course dependent forums. Results of their analyses suggest disagreement often built upon previous disagreement, which they see as similar to FtF interaction studies. However, [Chen and Chiu \(2008\)](#) note that unlike FtF discussion, disagreement in AOD doesn't seem to lead to termination of the discussion in the same way as FtF interaction; as a result, they conclude that controversial topics inviting disagreement are well suited to AOD and are possibly also one of the key ways in which AOD can encourage critical thinking.

In a somewhat similar study that also investigates the temporal relational aspects of argument and disagreement in AOD, [Jeong and Frazier \(2008\)](#) explore how day of message posting (early, midweek and weekend) affect number of responses elicited by arguments and challenges, and how its effects vary according to four categories of exchanges, based on the dialogic theory of language ([Bakhtin, 1981](#); [Koschmann, 1996](#)), that function as markers of critical discourse: (1) argument–challenge; (2) challenge–counterchallenge; (3) challenge–explain; and (4) challenge–evidence. The study found significant differences between the day of posting in the number of responses generated across the four types of exchanges, and in general suggests that students who post earlier are more likely to receive responses posted from other students. Thus [Jeong and Frazier \(2008\)](#) argue that instructors need to be heavy handed in encouraging and enforcing early deadlines for posting as well as replies.

It should be noted that a majority of the studies grouped in the interaction impulse, including both [Chen and Chiu's \(2008\)](#) and [Jeong and Frazier's \(2008\)](#) studies, looked at large group interactions rather than discussion between smaller groups. In [Naranjo, Onrubia, and Segués \(2012\)](#) multi-methods case study analyzing the relationships between participation and the cognitive quality of the contributions made in an online discussion forum of 17 education undergraduates completing their educational psychology unit in a distance mode, the instructor assigned the students into two heterogeneous groups according to their position in the debate. It is easy to see how this type of instructor intervention, structuring students according to a position, when asked to discuss and debate on forum, could inform participation. Their findings propose that although high levels of presence and connectivity are necessary, they alone are not enough to ensure high-quality contributions throughout the discussion.

5.2.4. Analytical impulse

The majority of papers in the refined corpus, 19 in all, illustrated a more open analytical impulse, and almost all focused on analyzing interaction according to various models and methods, with both quantitative, usually participation, and qualitative, usually content, analyses of actual forum and AOD discussion. The affordances of AOD and forum online discussion, first and foremost, the ease at which researchers can collect transcripts of discussion to analyze through various computerized methods, has allowed researchers access to a level of discourse analysis not readily available in FtF educational contexts. Thus this analytical impulse is in full ascendancy in research regarding use of forum and AOD in educational contexts. The following discussion will critically summarize a few representative papers illustrating this analytical impulse.

5.2.4.1. Interaction patterns

In [Liu and Tsai's \(2008\)](#) highly cited analysis of peer interaction patterns, the authors randomly divided 57 computer science undergraduates into small groups in order to analyze their interaction in AOD during problem solving activities. [Liu and Tsai \(2008\)](#) used the issue-based information system (IBIS) model ([Kunz & Rittel, 1970](#)), a model used in collaborative design and analysis for student on-line group work, in order to analyze the peer interactions. The authors propose the existence of five peer interaction patterns, including

centralized knowledge exchange, distributive knowledge exchange, group development impediment, ability impediment, and partial knowledge exchange. By comparing the usage patterns to final scores received on the assignments, the researchers find the group development strategy as perhaps most important for enhancing effective knowledge exchange during group work. In discussing pedagogical implications, [Liu and Tsai \(2008\)](#) suggest that for small groups discussion, even for groups of high achievers, teachers or moderators need to scaffold the process of peer interactions and learning.

The necessity for teachers and mediators to methodically guide and shape AOD is a chorus found in the majority of these papers focusing on analyzing interaction. However, this solution gives rise to another problem: How can teachers or mediators keep up with the tremendously confusing and time-consuming task of monitoring so many messages and conversations? [Gerosa et al. \(2010\)](#), in one of the few action research studies in the corpus, conducted in a solely online Information Technology Applied to Education course through the AulaNet LMS by the Pontifical Catholic University of Rio de Janeiro, investigate the use of a visual tool in order to “improve coordination support in a forum using mobile devices for mitigating mediator’s difficulties in following the status of a forum” (p. 528). [Gerosa et al. \(2010\)](#) posit to some extent that the key problem is how to keep track of the unfolding of discussion when a teacher or moderator is away from their desktop computer, and that summarized awareness information, including visual representations of message chaining and message meta-data sent directly to mobile devices, offer a promising solution to their problem. Throughout their action cycles, they find that the mobile notifications do indeed help moderators improve coordination of AOD. The results of their study seem particularly promising with the rise of mobile-based technology and the proliferation of smart phones ([Liu & Hwang, 2010](#); [Liu, Hwang, Kuo, & Lee, 2013](#)) and more such studies could have a profound effect on forum and AOD in educational contexts in the future.

5.2.4.2. Depth of discussion

Instead of focusing on the importance of instructor intervention, [Hew and Cheung’s \(2008\)](#) case study explores the effect of student facilitation on participation in AOD for small groups of educational technology post-graduate students. In order to identify successful student participation, [Hew and Cheung \(2008\)](#) looked at depth of discussion threads, chose a depth of six or more levels of students’ postings, and then identified seven facilitation techniques by student facilitators which were characteristic for the longer, more in-depth, qualitatively better threads: (a) giving own opinions or experiences; (b) questioning; (c) showing appreciation; (d) establishing ground rules; (e) suggesting new direction; (f) personally inviting people to contribute; and (g) summarizing. These seven techniques were also grouped into three critical phases: Introduction, Engagement, and Monitoring. As for pedagogical implications, the author’s suggest instructors interested in having student facilitators facilitate more effective discussion should impress upon these student moderators the importance of providing personal opinions and questioning, as they were found to be the most popular technique for more dense threads. The authors also point out that questioning, as well as clarification and asking for viewpoints, fit into a taxonomy of Socratic dialogue; as a result, they both extend discussion as well as engender critical thinking.

5.2.4.3. Effective collaborative interactions

[Calvani, Fini, Molino, and Ranieri \(2010\)](#) subscribe to the central tenet of cognitive conflict theory ([Doise & Mugny, 1984](#)), that knowledge is constructed through discussion, a claim they purport as essential to computer-supported collaborative learning (CSCL) and embodied in the role of threaded web forums. Yet they note that despite the promise of online learning-oriented discussions, many limitations exist, mainly “incoherence, dispersion and lack of convergence” ([Calvani et al., 2010](#), p. 214).

In seeking to find helpful ways increase the effectiveness of collaborative groups management, [Calvani et al. \(2010\)](#) created an interaction model capable of giving an immediate picture of the effectiveness level of a collaborative group, which could be used by an instructor or tutor, and then designed and released the model as an add-on module for Moodle aimed at improving the monitoring of the standard forum discussion. The module, “designed to improve metacognitive, monitoring and reflection capabilities of collaborative groups,” contains three sections: (1) Forum Plus; (2) Reflection Board; and (3) Planner ([Calvani et al., 2010](#), p. 215).

Findings of the study are fairly positive between the automatic data processing and qualitative observations, although the authors do state that further refinements need to be made on the technological and methodological levels. The study as a whole can be seen as part of a larger movement to find methodological and technological tools to allow for more precise monitoring of the quality of forum interaction.

While some might critique the study for the lack of concrete definition for “effective interaction” as related to collaborative processes, the authors themselves dismiss the idea, and rightly so, of the reduction to any one-size-fits-all mathematical formula. They state “We just use it as a conventional notion for describing collaborative interactions and without presuming that an effective group might achieve better and more original results (or greater productivity) compared to a ‘less effective’ group” ([Calvani et al., 2010](#), p. 217), yet do define some general characteristics, such as “a good social atmosphere, group involvement and consideration of the other members and of the collaborative process ecology” ([Calvani et al., 2010](#), p. 217). The results of this study are applicable to instructors as well as peer or student-moderated discussion groups.

5.2.4.4. Help-seeking behavior

If instructional intervention in forum and AOD is important, as the dominant paradigm assumes, then knowing more about students help-seeking behaviors is essential. In [Puustinen, Volckaert-Legrier, Coquin, and Bernicot’s \(2009\)](#) study, the authors set out to analyze middle school students’ spontaneous mathematics-related help-seeking behavior, in order to formulate ecologically valid proposals for the development of reinforcing tools or systems. Their content analysis differentiated eight constituent categories of the messages: (1) Problem; (2) Explicit requests for help; (3) Personal work; (4) Openings; (5) Closings; (6) Student’s identity; (7) Context; and (8) Politeness markers. Findings rightly show variation by age, that indeed ninth graders wrote messages containing more constituent categories than sixth graders, and that in general, younger students’ messages contained less explicit help requests and contextual information than older students’ messages. The study’s specific outcomes that not all students ask for help in the same way, in this case due to the development of age-related metacognitive capacities, are also a prudent general reminder that student groups are not as homogeneous as researchers and instructors might hope.

5.2.4.5. Effective discussion

Chen & Wang (2009), in one of the few studies in the corpus that focuses on high school students engaging in Computer Supported Collaborative Learning (CSCL), deconstruct the fashion in which simplistic labels, such as “effective” or “productive” discussion are defined and used within the research discipline as a whole. They are especially suspicious of definitions that are too narrow and de-legitimize the social realm and reality of discussion.

Specifically, they examine the role of social talk in online discussion forums. They contest the value of analyzing talk into on and off-task, critiquing the notion that off-task talk, or social talk, is less productive, negative, or even really “off” task. They argue that through their analysis, they find that a substantial quantity of off-task messages served the latent function of guiding group discussion toward making progress in solving collaborative problems in a subtle and indirect manner. As both instructors and students engage in these categories when participating in online discussion, their conclusions are important for teachers and students, peers, and participators. They also contest one of the key assumptions of the paradigm, namely that instructors need to control and filter out “off-topic” discussion.

6. Conclusion

6.1. Summarizing methodology

The authors have attempted to contextualize the literature focusing on forum and AOD published in the years 2008–2012. We conducted a systematic phenomenological literature review (Randolph, 2009) of forum and AOD publications in nine major e-learning education and educational review journals using a keyword search. After collecting and reading through a corpus of 84 articles, the researchers agreed on a set of inclusion and exclusion factors, which resulted in a refined corpus of 43 papers. These papers were first analyzed quantitatively, in order to identify and document current trends in research types, contexts, and platforms for research focusing on forum and AOD in educational contexts. Then, a qualitative analysis, based on the phenomenological method (Smith, Flowers, & Larkin, 2009), was used to identify and contextualize meaning statements and themes.

6.2. Major contribution of the study

The paper provides two aspects that are currently lacking in the literature: a quantitative and phenomenological qualitative snapshot of the state of the literature. First, quantitative analysis of the refined corpus suggests the following. Most forum and AOD-focused research in educational contexts from 2008–2012 was carried out through or on LMS platforms in university settings, likely the result of the proliferation of universities around the world adoption of LMS platforms. Thus we see a connection between the growth of LMS for educational as well as research purposes, specifically, as a tool to collect data. We also find that most research on AOD is still currently being conducted in education or computer technology classes, with blended learning dominating distance-learning contexts. This should be an interesting dynamic to study in the future, as we would expect to see research increasingly conducted in other disciplines, such as Thomas's (2013) recent study on AOD in healthcare education, to have varied philosophies, scopes, goals, and outcomes, as well as further growth in AOD research based in distance settings. Currently, most research locations were based in Asia and Europe, and the journals dominating the field were *Computers & Education*, followed by *Journal of Computer Assisted Learning*, and *Australasian Journal of Educational Technology*.

Subsequent phenomenological analysis and discussion illustrates and critiques the development of a dominant research paradigm, which we argue is constructed through the literature's adoption of a number of assumptions, including prohibitions against un-mediated, uncontrolled, or un-facilitated forum or AOD use, a preference for instructor control, the need for instructors to identify and preference specific definitions of higher learning and effective discussion—in order to achieve them, as well as instructors' responsibility to teach students how to “use” forum and AOD, often through the use of complex scaffolds, models, protocols, and assignment parameters. Rather than focus merely on research types as most previous reviews have done, we have also explored this paradigm through four investigative impulses or approaches: argumentative, comparative, relational, and analytical. Specific representative examples of each investigative impulse are thoroughly discussed and critiqued, and as a result, should be of value to all stakeholders, including researchers, instructors, and students, interested and involved in forum and AOD use in educational contexts. We also expect this study will be of value to future research and researchers; as it documents more precisely the state and scope of the literature published in the years 2008–2012, it should be useful for future comparative studies to gauge how the field has evolved and continues to evolve.

Although some similar general findings are supported in Andersen's (2009) study, Andersen focuses more forcefully on the importance of the instructor, and as a result, neglects to mention research investigating the benefits of prioritizing student/peer autonomy. The present research also spends considerably more critical attention in exploring and critiquing how these emerging themes are related and structured through a research paradigm. Importantly, as opposed to Hammond's earlier (2005) study, we do find a general research preoccupation with analyzing and improving the quality of online interaction and discussion, which argues forcefully that practice, and thus research on practice, is moving to a more advanced state of understanding, refinement, and integration of online discussion and forum use.

6.3. Limitations of the study

More examples could be added to the corpus in order to verify results. In addition, the use of snowball sampling could be used in order to add and explore related articles that fell outside of the original parameters but would still be useful for a more thorough discussion of the paradigm as represented in other high-quality refereed journals.

6.4. Implications for future research for all stakeholders (researchers, teachers, students)/pedagogical research

The area of investigation we see as most important in future research involving forum and AOD is that of the effect of locus-of-control, or who controls learning (Liu & Chen, 2007). We see locus-of-control as an important yet under-applied construct which should be applied to forum and AOD in educational contexts, and argue for a likely correlation between locus-of-control and agency that requires further critical

attention. Specifically, the relationship or balance of prompts, scaffolding structures, and discussion strategies, either through methods or new tools and environments, significantly weights locus-of-control, as well as autonomy (Benson, 1997, 2000, 2001; Holec, 1981), towards the forum system and instructor and away from students, peers, and learners. The authors argue that a model of locus-of-control should be developed in order to better evaluate and understand the effect and ethical implications of locus-of-control on forum and AOD use in educational contexts. We also note the absence of studies dealing with citation and plagiarism issues (Liu, Lo, & Wang, 2013) in forum and AOD. Hence, we expect to see these research topics examined to some extent in future studies.

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Appendix A. Inclusion and exclusion criteria

Inclusion/exclusion criteria	Y/if N, discard
1) Tracking number: 2) Title of article, author: 3) Date: 4) Journal: 5) Forum/Online discussion primary focus of the research? 6) Forum/Online discussion asynchronous and threaded? 7) Empirical-based research? 8) Exclude literature reviews, book chapters, book reviews, and conference papers: 9) Exclude papers on wikis or blogs: INCLUDE or Exclude: 1) I or 2) E 10) Research site/country: 11) Forum platform: 1) Web; 2) LMS, CMS, e-platform; 3) both 12) Academic context: 1) Primary; 2) Secondary; 3) Under graduate 4) Post Graduate 13) Academic Discipline: 14) Delivery method: 1) Distance; 2) Blended; 3) Both 15) Hosting: 1) Public; 2) Private; 3) Both 16) Mobile or Ubiquitous online discussion/forum: 1) Yes; 2) No 17) Assessment mechanism: Made ways to assess failure or success in meeting outcome goals 18) Participation or Content analysis (qualitative or quantitative) of online discussion/forum communication. 19) Focus on Instructor agency: 20) Focus on Student/Peer agency: 21) Comparative chat environments: 22) Other themes	

Appendix B. Corpus of 43 papers organized by investigative impulse; Author, Title, and Year; Academic Level and Discipline; Self-reported Research Goal; and Self-reported Research Outcomes

Author/year/title	Academic Level /Discipline	Self-reported research goal	Self-reported research outcomes
Investigative Impulse: Argumentative; Critical Thinking (3) Cheong and Cheung (2008). <i>Online discussion and critical thinking skills: A case study in a Singapore secondary school</i>	Secondary IS/IT/Computer Science	Investigate lower secondary school students' critical thinking in asynchronous online discussion.	Secondary students show minimal amount of critical thinking. Suggests need for teacher scaffolding.
de Leng et al. (2009). <i>Exploration of an e-learning model to foster critical thinking on basic science concepts during work placements</i>	Undergraduate Healthcare	Design e-learning model for increasing critical thinking in higher education science students.	E-learning model successful in facilitating sustained on-topic discourse involving critical thinking.
Yang (2008). <i>A catalyst for teaching critical thinking in a large university class in Taiwan: asynchronous online discussions with the facilitation of teaching assistants</i>	Undergraduate Engineering	Teach critical thinking in large classes by using forum with teaching assistants.	Instructional intervention in form of smaller discussion groups and use of facilitated Socratic dialogues has positive effect on fostering critical thinking.
Investigative Impulse: Comparative; Environments and Tools (3) Lan et al. (2012). <i>Comparing the social knowledge construction behavioral patterns of problem-based online asynchronous discussion in e/m-learning environments</i>	Undergraduate IS/IT/Computer Science	Compare e and m learning environments and test mobile interactive teaching feedback system (MITFS) to measure interaction in problem-based asynchronous discussion.	Using mobile devices positively influenced students' learning performance.
van der Pol et al. (2008). <i>The nature, reception, and use of online peer feedback in higher education</i>	Undergraduate Healthcare	Investigate online interactive peer feedback in higher education.	Successful uptake of feedback found to be important aspect. More concrete suggestions in annotation system than Blackboard discussion forum.

(continued)

Author/year/title	Academic Level /Discipline	Self-reported research goal	Self-reported research outcomes
Wang and Yang (2012). <i>Using collaborative filtering to support college students' use of online forum for English learning</i>	Undergraduate English	Examine impact of collaborative filtering via recommender function; Compare traditional forum vs. forum with recommender module.	Students using forum recommender read online posts more frequently and outperformed control group in productive language scores; However, no significant difference in learning motivation between two groups.
Investigative Impulse: Comparative; Discussion strategies, Protocols, and Methods (7)			
Darabi, Arrastia, Nelson, Cornille, and Liang (2011). <i>Cognitive presence in asynchronous online learning: a comparison of four discussion strategies</i>	Undergraduate Healthcare	Compare 4 scenario-based online discussion strategies (Structured, Scaffolded, forced debate, and role play) effect on learners' cognitive presence.	Discussion strategies requiring learners to take a perspective in an authentic scenario facilitate cognitive presence, critical thinking, and higher levels of learning.
Hou (2011). <i>A case study of online instructional collaborative discussion activities for problem-solving using situated scenarios: An examination of content and behavior cluster analysis</i>	Undergraduate IS/IT/Business	Empirically explore the learning process of adopting collaborative online instructional discussion activities for problem-solving using situated scenarios.	Study suggests that, when compared to general situated learning activity, discussions are of better quality when they involve a role-playing activity.
Jyothi, McAvinia, and Keating (2012). <i>A visualisation tool to aid exploration of students' interactions in asynchronous online communication</i>	Undergraduate Humanities	Describe and test a visualization tool, entitled Virtual Interaction Mapping System, or VIMS, to aid the analysis of online communication.	Analyzes both the method of visualization and analysis of the online interactions as a pilot for further development of VIMS.
Manca, Delfino, and Mazzone (2009). <i>Coding procedures to analyse interaction patterns in educational web forums</i>	Post-graduate Education & Technology	Develop a coding schema whose aim is to identify the addressees of messages through the help of qualitative analysis of the postings.	Results show new coding schema, if compared with traditional structural coding, detected a greater number of addressees, thus allowing a greater number of postings to be included in an SNA adjacency matrix.
Ng, Cheung, and Hew (2012). <i>Interaction in asynchronous discussion forums: peer facilitation techniques</i>	Post-graduate Education & Technology	Identify through cross-case comparison of two graduate-level blended courses attended by Asian Pacific students, the actual peer facilitation techniques that could encourage online interaction.	Facilitators should re-consider use of certain traditionally recommended strategies such as directing an online message at specific participants to encourage responses. Study suggests that doing so could sometimes backfire and discourage online contributions.
Schworm and Gruber (2012). <i>e-Learning in universities: Supporting help-seeking processes by instructional prompts</i>	Undergraduate Education & Science	Investigate effect of giving prompts on the quantity and quality of academic help-seeking in a blended university learning course.	Compared with students who received no prompts, students with prompts about the relevance of active help-seeking had better learning outcomes, participated more actively in online learning activities, more explicitly referred to learning contents in the forums, and took more initiative in starting discussions.
Zydney, de Noyelles, and Seo (2012). <i>Creating a community of inquiry in online environments: An exploratory study on the effect of a protocol on interactions within asynchronous discussions</i>	Post-graduate Education & Technology	Examine the influence of an online protocol on asynchronous discussions.	Online protocol more evenly distributed the presence of cognitive, social, and teaching elements necessary to create and sustain an online community of inquiry.
Investigative Impulse: Relational (11)			
Bassani (2011). <i>Interpersonal exchanges in discussion forums: A study of learning communities in distance learning settings</i>	Post-graduate IS/IT/Computer Science	Investigate dynamics of conversations in discussion forums in order to understand processes involved in formation of virtual learning communities.	Results indicate relationship between texts of discussion forum messages and continuation of interpersonal exchanges.
Chan and Chan (2011). <i>Students' views of collaboration and online participation in Knowledge Forum</i>	Secondary Education	Examine students' views of collaboration and learning and how these predict students' online participation.	Students who viewed collaboration as more aligned with collaborative knowledge building more likely to employ a deep approach to learning.
Chen and Chiu (2008). <i>Online discussion processes: Effects of earlier messages' evaluations, knowledge content, social cues and personal information on later messages</i>	Undergraduate Math	Examine how earlier messages affected later messages along five dimensions: (1) evaluations; (2) knowledge content; (3) social cues; (4) personal information; and (5) elicitation.	Results support the claims that teachers can use and manage online discussions at the message level to promote critical thinking, facilitate discussion of controversial topics, and reduce status effects.
Cheng, Paré, Collimore, and Joordens (2011). <i>Assessing the effectiveness of a voluntary online discussion forum on improving students' course performance</i>	Undergraduate Psychology/ Psychopharmacology	Evaluate effectiveness of voluntary discussion forums/ intrinsic forum participation relation to course performance.	Students who participated in forum tended to have better performance in course, and furthermore that participating in the discussion forum, particularly reading posts on forum, slightly improved exam performance.

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Author/year/title	Academic Level /Discipline	Self-reported research goal	Self-reported research outcomes
Dringus and Ellis (2010). <i>Temporal transitions in participation flow in an asynchronous discussion forum</i>	Post-graduate IS/IT/Computer Science	Identify how temporal transitions, specifically duration of message flow, affects momentum or wellness of discussion in an asynchronous forum.	Results revealed for open-ended topics (i.e., no specific end date imposed by the instructor), momentum of forum discussion might be short-term, between 21 and 28 days into the topic. Peaks and valleys subsequent to 31 days were not significant to discussion vitality.
Hwang and Arbaugh (2009). <i>Seeking feedback in blended learning: competitive versus cooperative student attitudes and their links to learning outcome</i>	Undergraduate Business	Test effects of cooperative and competitive attitudes on face-to-face and virtual feedback interactions, and their consequent impact on multiple-choice test performance. 1. Measure impact of electronic media usage on measurable knowledge acquisition. 2. Analyze attitudes of competitiveness and cooperation in driving electronic board and forum participation.	Results showed that participation on discussion topics through Blackboard, predicted multiple-choice test performance. In contrast, none of the traditional face-to-face feedback-seeking behaviors, neither with professors in class or out of class, nor among fellow students, had significant influence on test results.
Jeong and Frazier (2008). <i>How day of posting affects level of critical discourse in asynchronous discussions and computer-supported collaborative argumentation</i>	Post-graduate Educational Technology	Examine how day in which messages are posted (early, midweek and weekend) in computer-supported collaborative argumentation affect number of responses elicited by arguments and challenges, and how effects differ across four types of exchanges (argument–challenge, challenge–counterchallenge, challenge–explain, challenge–evidence) that serve as indicators of critical discourse.	Found day of posting had significant effect on number of responses elicited per message, with greatest to smallest effect on argument–challenge, challenge–counterchallenge, challenge–explain and challenge–evidence exchanges respectively.
Naranjo et al. (2012). <i>Participation and cognitive quality profiles in an online discussion forum</i>	Undergraduate Educational Psychology	Analyze the relationships between participation in an online discussion forum and the cognitive quality of the contributions made.	Results suggest that a high level of participation (high level of presence/high level of connectivity) is a necessary but not a sufficient condition for maintaining high-quality contributions throughout discussion.
Ramos and Yudko (2008). <i>"Hits" (not "Discussion Posts") predict student success in online courses: A double cross-validation study</i>	Undergraduate Psychology	Examine how hits and participation are related to exam grades.	Participation in online discussion little to no effect on performance as measured by outcome on exams.
Shaw (2012). <i>A study of the relationships among learning styles, participation types, and performance in programming language learning supported by online forums</i>	Post-graduate IS/IT/Computer Science	Analyze relationships among learning styles, participation types, and learning performance for programming language learning supported by an online forum.	1) Different learning styles associated with significantly different learning scores and 'Accommodator' style associated with superior learning scores; (2) participation types also associated with significantly different learning scores and that 'Replier' type is associated with superior learning scores; (3) learning satisfaction not significantly different among different learning styles or participation types, and (4) no significant association between learning styles and participation types.
Topcu and Ubuz (2008). <i>The Effects of Metacognitive Knowledge on the Pre-service Teachers' Participation in the Asynchronous Online Forum</i>	Undergraduate Education	Analyze effects that students' metacognitive knowledge has on their participation in online forum discussions.	Educators should begin to focus on the MK of the learners and foster the development and use of it when necessary. Study also suggests that instructors should encourage students to send messages explaining or clarifying concepts using examples and/or metaphors.
Investigative Impulse: Analytical (19) Calvani et al. (2010) <i>Visualizing and monitoring effective interactions in online collaborative groups</i>	Post-graduate Education & Technology	Propose methodology for assessing effective collaborative interactions within the add-on module, Forum Plus, for the Moodle (LMS).	Methodology presented successful in supplying early overview of level of effectiveness of the collaborative group; as a result, may provide useful instrument to guide further qualitative observations.
Chan, Hew, and Cheung (2009). <i>Asynchronous online discussion development: examining growth patterns and peer-facilitation techniques</i>	Post-graduate Education & Technology	Extend research on (AOD) by providing perspective on: (1) growth patterns of discussion threads and (2) influence of peer- or student-facilitation techniques on thread development.	Results suggest an online discussion thread grows either one of three patterns: a 'short thread pattern', an 'extended thread pattern' with an elongated structure or a 'split thread pattern' with a broad structure.

(continued)

Author/year/title	Academic Level /Discipline	Self-reported research goal	Self-reported research outcomes
Chen and Wang (2009). <i>Social conversation and effective discussion in online group learning</i>	Secondary Science	Analyzes social talk of high school students in online discussion forums.	Concludes social talk is interwoven with on-task talk. A substantial quantity of off-task messages served latent function of guiding group discussion toward making progress in solving collaborative problems.
Cheung and Hew (2012). <i>Examining facilitators' habits of mind in an asynchronous online discussion environment: A two cases study</i>	Post-graduate IS/IT/Computer Science	Explore student facilitators' influence in promoting learners' participation in terms of their exhibited habits of mind.	Habits of "awareness of own thinking" and "open minded" were found to be exhibited more often by student facilitators in the two cases.
Enriquez (2008). <i>Translating networked learning: un-tying relational ties</i>	Post-graduate Education	Describes and interprets realities of networked learning within a particular post-graduate course in an English university setting.	Argues for a different approach to a network of learning, focusing on the <i>relational effects</i> of multiple technical and social arrangements and engagements beyond the response relations the online environment is able to capture and store. Approach emphasizes network processes rather than network structures.
Gerosa, Filippo, Pimentel, Fuks, and Lucena (2010). <i>Is the unfolding of the group discussion off-pattern? Improving coordination support in educational forums using mobile devices</i>	Undergraduate Education & Technology	Investigate how to improve coordination support in a forum using mobile devices for mitigating mediator's difficulties in following the status of a forum.	Mediators used mobile-based coordination support to keep informed on what is taking place within the forum without the need to log on their desktop computer.
Hew and Cheung (2008). <i>Attracting student participation in asynchronous online discussions: A case study of peer facilitation</i>	Post-graduate Education & Technology	Examine facilitation techniques used by student facilitators to attract course mates to participate in AOD.	Seven facilitation techniques were employed; most frequently used were Socratic questioning and sharing personal opinions or experiences.
Lee (2012). <i>Patterns of Interaction and Participation in a Large Online Course: Strategies for Fostering Sustainable Discussion</i>	Undergraduate Leadership Development	Attempts to explain how discussion question and evaluation criteria influenced nature of discussion focusing on interaction and knowledge construction.	Discussion question and evaluation criteria influenced patterns of interaction and participation, and phase of knowledge construction.
Lin, Hsieh, and Chuang (2009). <i>Discovering genres of online discussion threads via text mining</i>	Secondary Science	Develop framework of genre classification system (GCS) in order to generate classification model to specify genres in discussion forums.	GCS based on the cascade model can perform as an automatic posting coding system.
Liu and Tsai (2008). <i>An analysis of peer interaction patterns as discoursed by on-line small group problem-solving activity</i>	Undergraduate IS/IT/Computer Science	Study analyzed content of peer learning interactions on 57 college computer science students who were randomly assigned into 14 small groups for solving programming problems.	Proposes five peer interaction patterns in terms of peer knowledge exchange: 1) centralized knowledge exchange; 2) distributive knowledge exchange; 3) group development impediment; 4) ability impediment; and 5) partial knowledge exchange.
Nandi, Chang, and Balbo (2012). <i>Evaluating quality in online asynchronous interactions between students and discussion facilitators</i>	Post-graduate IS/IT/Computer Science	Demonstrate a framework or set of criteria for evaluating discussion forum activities.	Students depend highly on instructor's feedback and participation of students can only be evaluated with reference to moderation of the instructors.
Oliveirra, Tinocaa, and Pereirab (2011). <i>Online group work patterns: How to promote a successful collaboration</i>	Post-graduate Education & Technology	Study the different types of collaborative practices in online courses. Focus on exploring questions related to process of knowledge convergence during online group work in Open and Distance Learning.	More and less successful groups, in terms of outcome or product, clearly revealed distinctive patterns of work, characterized by negotiation, research, conception and production.
Patriarcheas and Xenos (2009). <i>Modelling of distance education forum: Formal languages as interpretation methodology of messages in asynchronous text-based discussion</i>	Undergraduate IS/IT/Computer Science	Explore distance learning forum modeling using a formal language. Develop and test a formal language defined in mathematical terms to represent messages in forums.	Language found to represent most common cases of messages. Fulfills need for developing a tool to support a mode of discussion in distance learning forum and, at the same time, take into account factors influencing (forum) effectiveness.
Puustinen, Volckaert-Legrier, Coquin, and Bernicot (2009). <i>An analysis of students' spontaneous computer-mediated help seeking: A step toward the design of ecologically valid supporting tools</i>	Secondary Math	Analyzes middle school students' spontaneous mathematics-related help-seeking behavior, in view of making ecologically valid recommendations for design of supporting tools or "help systems". Aim to investigate content of students' help-seeking messages and explore whether there are there different forms of help-seeking messages and how they evolve with age.	Results showed not all middle school students use the same help-seeking "format". Compared to sixth graders, ninth graders wrote messages containing more constituent categories, i.e., they provided online expert with more kinds of information.

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Author/year/title	Academic Level /Discipline	Self-reported research goal	Self-reported research outcomes
Tan and Seah (2011). <i>Exploring relationship between students' questioning behaviors and inquiry tasks in an online forum through analysis of ideational function of questions</i>	Primary Science	Explore questioning behaviors among elementary students engaging in inquiry science using the Knowledge Forum.	For close-ended task that sought scientific facts from authoritative sources, students tended to ask only scientific questions. For open-ended problem-solving task that demanded epistemic justification from the students, found more even distribution in all three kinds of questions.
Vercellone-Smith, Jablolkow, and Friedel (2012). <i>Characterizing communication networks in a web-based classroom: Cognitive styles and linguistic behavior of self-organizing groups in online discussions</i>	Post-graduate Education	Explore cognitive style profiles and linguistic patterns of self-organizing groups within a web-based graduate education course to determine how cognitive preferences and individual behaviors influence the patterns of information exchange and the formation of communication hierarchies in an online classroom.	Linguistic behaviors of students in the core of the social network, coupled with their more adaptive cognitive style preferences, suggest these students may inherently place greater value on fostering group cohesion than those in the periphery.
Yap and Chia (2010). <i>Knowledge construction and misconception: A case study approach in asynchronous discussion using Knowledge Construction - Message Map (KCMM) and Knowledge Construction - Message Graph (KCMG)</i>	Secondary Science	Introduce a methodology and test/ describe the process of mapping students' electronic discussion to analyze inter-group cognitive development and knowledge construction, as well as misconception, among Secondary 2 (Grade 8) students.	Self-directed learning through AOD has to be monitored by facilitators as learners possessed misconceptions that could potentially mislead other participants.
Yeo and Quek (2008). <i>Investigating design and technology students' participation and learning in a technology mediated learning environment</i>	Secondary Design and Technology	Investigate how 15 Design & Technology (D&T) students (aged 15 years) participated in three stages, <i>Situation, Ideation and Development</i> , of the design process in a technology mediated environment.	Findings showed discussions among students were not evident in the Situation stage but were evident in the Ideation and Development stages.
Yeo and Quek (2011). <i>Investigating design and technology students' peer interactions in a technology-mediated learning environment: A case study</i>	Secondary Design and Technology	Investigates students' peer interactions in the Design and Technology (D&T) environment supported by <i>Knowledge Forum</i> .	Findings showed unequal participation by students throughout weekly online discussion activities. In terms of students' interaction with peers, frequency of students' reading of notes far exceeded frequency of building upon notes.

References

- Andresen, M. A. (2009). Asynchronous discussion forums: success factors, outcomes, assessments, and limitations. *Educational Technology & Society*, 12(1), 249–257.
- Bakhtin, M. (1981). In M. Holquist (Ed.), *Dialogic imagination (C. Emerson & M. Holquist, Trans.)*. Austin: University of Texas Press.
- *Bassani, P. B. S. (2011). Interpersonal exchanges in discussion forums: a study of learning communities in distance learning settings. *Computers & Education*, 56, 931–938.
- Benson, P. (1997). The philosophy and politics of learner autonomy. In P. Benson, & P. Voller (Eds.), *Autonomy and independence in language learning* (pp. 18–34). London: Longman.
- Benson, P. (2000). Autonomy as a learners' and teachers' right. In B. Sinclair, I. McGrath, & T. Lamb (Eds.), *Learner autonomy, teacher autonomy: Future directions* (pp. 111–117). London: Longman.
- Benson, P. (2001). *Teaching and researching autonomy in language learning*. London: Longman.
- Calvani, A., Fini, A., Molino, M., & Ranieri, M. (2010). Visualizing and monitoring effective interactions in online collaborative groups. *British Journal of Educational Technology*, 41, 213–226.
- *Chan, J. C. C., Hew, K. F., & Cheung, W. S. (2009). Asynchronous online discussion development: examining growth patterns and peer-facilitation techniques. *Journal of Computer Assisted Learning*, 25, 438–452.
- *Chan, C. K. K., & Chan, Y.-Y. (2011). Students' views of collaboration and online participation in knowledge forum. *Computers & Education*, 57, 1445–1457.
- Chen, G. W., & Chiu, M. M. (2008). Online discussion processes: effects of earlier messages' evaluations, knowledge content, social cues and personal information on later messages. *Computers & Education*, 50, 678–692.
- Chen, F.-C., & Wang, T. C. (2009). Social conversation and effective discussion in online group learning. *Educational Technology Research and Development*, 57(5), 587–612.
- *Cheng, C. K., Paré, D. E., Collimore, L.-M., & Joordens, S. (2011). Assessing the effectiveness of a voluntary online discussion forum on improving students' course performance. *Computers & Education*, 56, 253–261.
- *Cheong, C. M., & Cheung, W. S. (2008). Online discussion and critical thinking skills: a case study in a Singapore secondary school. *Australasian Journal of Educational Technology*, 24(5), 556–573.
- *Cheung, W. S., & Hew, K. F. (2012). Examining facilitators' habits of mind in an asynchronous online discussion environment: a two cases study. *Australasian Journal of Educational Technology*, 26(1), 123–132.
- *Darabi, A., Arrastia, M. C., Nelson, D. W., Cornille, T., & Liang, X. (2011). Cognitive presence in asynchronous online learning: a comparison of four discussion strategies. *Journal of Computer Assisted Learning*, 27, 216–227.
- Doise, W., & Mugny, G. (1984). *The social development of intellect*. New York: Pergamon Press.
- *Dringus, L. P., & Ellis, T. (2010). Temporal transitions in participation flow in an asynchronous discussion forum. *Computers & Education*, 54, 340–349.
- Duffy, T. M., Dueber, B., & Hawley, C. (1998). Critical thinking in a distributed environment: a pedagogical base for the design of conferencing systems. In C. J. Bonk, & K. S. King (Eds.), *Electronic collaborators: Learner-centered technologies for literacy, apprenticeship, and discourse* (pp. 51–78). Mahwah, NJ: Lawrence Erlbaum Associates.
- Ennis, R. H. (1985). A logical basis for measuring critical thinking skills. *Educational Leadership*, 43(2), 44–48.
- *Enriquez, J. G. (2008). Translating networked learning: un-tying relational ties. *Journal of Computer Assisted Learning*, 24, 116–127.

* Indicates a paper included in Appendix B.

- Gao, F., Zhang, T., & Franklin, T. (2013). Designing asynchronous online discussion environments: recent progress and possible future directions. *British Journal of Educational Technology*, 44(3), 469–483.
- Gao, F., Wang, C. X., & Sun, Y. (2009). A new model of productive online discussion and its implication for research and discussion. *The Journal of Educational Technology Development and Exchange*, 2(1), 65–78.
- Garrison, D. R., Anderson, T., & Archer, W. (2001). Critical thinking, cognitive presence and computer conferencing in distance education. *The American Journal of Distance Education*, 15(1), 7–23.
- Gerosa, M. A., Filippo, D., Pimentel, M., Fuks, H., & Lucena, C. J. P. (2010). Is the unfolding of the group discussion off-pattern? Improving coordination support in educational forums using mobile devices. *Computers & Education*, 54, 528–544.
- Guldberg, K., & Pilkington, R. (2007). Tutor roles in facilitating reflection on practice through online discussion. *Educational Technology & Society*, 10(1), 61–72.
- Hammond, M. (2005). A review of recent papers on online discussion in teaching and learning in higher education. *The Journal of Asynchronous Learning Networks*, 9(3), 9–23.
- Hew, K. F., & Cheung, W. S. (2008). Attracting student participation in asynchronous online discussions: a case study of peer facilitation. *Computers & Education*, 51, 1111–1124.
- Hewitt, J. (2005). Toward an understanding of how threads die in asynchronous computer conferences. *Journal of the Learning Sciences*, 14(4), 567–589.
- Holec, H. (1981). *Autonomy and foreign language learning*. Oxford: Pergamon.
- Hou, H. T. (2011). A case study of online instructional collaborative discussion activities for problem-solving using situated scenarios: an examination of content and behavior cluster analysis. *Computers & Education*, 56, 712–719.
- *Hwang, A., & Arbaugh, J. B. (2009). Seeking feedback in blended learning: competitive versus cooperative student attitudes and their links to learning outcome. *Journal of Computer Assisted Learning*, 25, 280–293.
- Jeong, A., & Frazier, S. (2008). How day of posting affects level of critical discourse in asynchronous discussions and computer-supported collaborative argumentation. *British Journal of Educational Technology*, 39(5), 875–887.
- *Jyothi, S., McAvinia, C., & Keating, J. (2012). A visualization tool to aid exploration of students' interactions in asynchronous online communication. *Computers & Education*, 58(1), 30–42.
- Koschmann, T. (1996). Paradigm shifts and instructional technology. In T. Koschmann (Ed.), *CSCL: Theory and practice of an emerging paradigm* (pp. 1–23). Mahwah, NJ: Lawrence Erlbaum.
- Kunz, W., & Rittel, H. (1970). *Issue as elements of information systems. Working paper 131*. Berkeley, California: Institute of Urban and Regional Development, University of California.
- Lan, F. L., Tsai, P. W., Yang, S. H., & Hung, C. L. (2012). Comparing the social knowledge construction behavioural patterns of problem-based online asynchronous discussion in e/m-learning environments. *Computer & Education*, 59(4), 1122–1135.
- de Leng, B. A., Dolmans, D. H. J. M., Jöbssis, R., Muijtjens, A. M. M., & van der Vleuten, C. P. M. (2009). Exploration of an e-learning model to foster critical thinking on basic science concepts during work placements. *Computers & Education*, 53, 1–13.
- *Lin, F. R., Hsieh, L. H., & Chuang, F. T. (2009). Discovering genres of online discussion threads via text mining. *Computers & Education*, 52, 481–495.
- Liu, C. C., & Tsai, C. C. (2008). An analysis of peer interaction patterns as discoursed by on-line small group problem-solving activity. *Computers & Education*, 50, 627–639.
- *Lee, J. (2012). Patterns of interaction and participation in a large online course: strategies for fostering sustainable discussion. *Educational Technology & Society*, 15(1), 260–272.
- Lee, L. (2008). Focus-on-form through collaborative scaffolding in expert-to- novice online interaction. *Language Learning & Technology*, 12, 53–72.
- Liu, G. Z. (2008). Innovating research topics in learning technology: where are the new blue oceans? *British Journal of Educational Technology*, 39(4), 738–747.
- Liu, G. Z. (2011). The blended language learning course in Taiwan: issues & challenges of instructional design. In J. Macalister, & I. S. P. Nation (Eds.), *Case studies in language curriculum design: Concepts and approaches in action around the world* (pp. 82–100). New York: Routledge.
- Liu, G. Z., & Chen, A. S. W. (2007). A taxonomy of internet-based technologies integrated in language curricula. *British Journal of Educational Technology*, 38(5), 934–938.
- Liu, G. Z., & Hwang, G. J. (2010). A key step to understanding paradigm shifts in e-learning: towards context-aware ubiquitous learning. *British Journal of Educational Technology*, 41(2), E1–E9.
- Liu, G. Z., Hwang, G. J., Kuo, Y. L., & Lee, C. Y. (2013). Designing dynamic English: a creative reading system in a context-aware fitness center using a smart phone and QR-codes. *Digital Creativity*. <http://dx.doi.org/10.1080/14626268.2013.836110>.
- Liu, G. Z., Lo, H. Y., & Wang, H. C. (2013). Design and usability testing of a learning and plagiarism avoidance tutorial system for paraphrasing and citing in English: a case study. *Computers & Education*, 69, 1–14.
- Liu, G. Z., Liu, Z. H., & Hwang, G. J. (2011). Developing multi-dimensional evaluation criteria for English learning websites with university students and professors. *Computers & Education*, 56(1), 65–79. <http://dx.doi.org/10.1016/j.compedu.2010.08.019>.
- *Manca, S., Delfino, M., & Mazzoni, E. (2009). Coding procedures to analyse interaction patterns in educational web forums. *Journal of Computer Assisted Learning*, 25, 189–200.
- Mayadas, A. F., Bourne, J., & Bacsich, P. (2009). Online education today. *Science*, 323, 85–89.
- Nandi, D., Chang, S., & Balbo, S. (2012). Evaluating quality in online asynchronous interactions between students and discussion facilitators. *Australasian Journal of Educational Technology*, 28(4), 684–702.
- Naranjo, M., Onrubia, J., & Segué, M. T. (2012). Participation and cognitive quality profiles in an online discussion forum. *British Journal of Educational Technology*, 43(2), 282–294.
- *Ng, C. S. L., Cheung, W. S., & Hew, K. F. (2012). Interaction in asynchronous discussion forums: peer facilitation techniques. *Journal of Computer Assisted Learning*, 28, 280–294. <http://dx.doi.org/10.1111/j.1365-2729.2011.00454.x>.
- *Oliveira, I., Tinocaa, L., & Pereira, A. (2011). Online group work patterns: how to promote a successful collaboration. *Computers & Education*, 57(1), 1348–1357.
- *Patriarchas, K., & Xenos, M. (2009). Modelling of distance education forum: Formal languages as interpretation methodology of messages in asynchronous text-based discussion. *Computers & Education*, 52, 438–448.
- Puustinen, M., Volckaert-Legrier, O., Coquin, D., & Bernicot, J. (2009). An analysis of students' spontaneous computer-mediated help seeking: a step toward the design of ecologically valid supporting tools. *Computers & Education*, 53, 1040–1047.
- *Ramos, C., & Yudko, E. (2008). "Hits" (not "discussion posts") predict student success in online courses: a double cross-validation study. *Computers & Education*, 50, 1174–1182.
- Randolph, J. (2009). A guide to writing the dissertation literature review. *Practical Assessment, Research & Evaluation*, 14(13). Available online: <http://pareonline.net/getvn.asp?v=14&n=13>.
- Riffe, D., Lacy, S., & Fico, F. G. (1998). *Analyzing media messages: Using quantitative content analysis in research*. Mahwah, NJ: Lawrence Erlbaum.
- Schworm, S., & Gruber, H. (2012). e-Learning in universities: supporting help-seeking processes by instructional prompts. *British Journal of Educational Technology*, 43, 272–281. <http://dx.doi.org/10.1111/j.1467-8535.2011.01176.x>.
- *Shaw, R. S. (2012). A study of the relationships among learning styles, participation types, and performance in programming language learning supported by online forums. *Computers & Education*, 58, 111–120.
- Smith, J. A., Flowers, P., & Larkin, M. (2009). *Interpretative phenomenological analysis: Theory, method and research (rev.ed.)*. London, England: SAGE Publications Ltd.
- So, H. J. (2009). When groups decide to use asynchronous online discussions: collaborative learning and social presence under a voluntary participation structure. *Journal of Computer Assisted Learning*, 25(2), 143–160.
- *Tan, S. C., & Seah, L. H. (2011). Exploring relationship between students' questioning behaviors and inquiry tasks in an online forum through analysis of ideational function of questions. *Computers & Education*, 57, 1675–1685.
- Thomas, J. (2013). Exploring the use of asynchronous online discussion in health care education: a literature review. *Computers & Education*, 69, 199–215.
- Thomson Reuters. (2013). *Journal citation reports*. Available from: <http://thomsonreuters.com/journal-citation-reports/>.
- Topcu, A., & Ubuz, B. (2008). The effects of metacognitive knowledge on the pre-service teachers' participation in the asynchronous online forum. *Educational Technology & Society*, 11(3), 1–12.
- van der Pol, J., Admiraal, W. F., & Simons, P. R. J. (2006). The affordance of anchored discussion for the collaborative processing of academic texts. *International Journal of Computer Supported Collaborative Learning*, 1(3), 339–357.
- van der Pol, J., van den Berg, B. A. M., Admiraal, W. F., & Simons, P. R. J. (2008). Exploration of an e-learning model to foster critical thinking on basic science concepts during work placements. *Computers & Education*, 53, 1–13.
- *Vercellone-Smith, P., Jablowski, K., & Friedel, C. (2012). Characterizing communication networks in a web-based classroom: cognitive styles and linguistic behavior of self-organizing groups in online discussions. *Computers & Education*, 59(2), 222–235.
- *Wang, P.-Y., & Yang, H.-C. (2012). Using collaborative filtering to support college students' use of online forum for English learning. *Computers & Education*, 59, 628–637.
- Wu, W. H., Wu, Y. C. J., Chen, C. Y., Kao, H. Y., Lin, C. H., & Huang, S. H. (2012). Review of trends from mobile learning studies: a meta-analysis. *Computers & Education*, 59, 817–827.

- Yang, D., Richardson, J. L., French, B. F., & Lehman, J. D. (2011). The development of a content analysis model for assessing students' cognitive learning in asynchronous online discussions. *Education Technology Research and Development*, 59, 43–70.
- Yang, Y. T. C. (2008). A catalyst for teaching critical thinking in a large university class in Taiwan: asynchronous online discussions with the facilitation of teaching assistants. *Educational Technology Research and Development*, 56(3), 241–264.
- *Yap, K. C., & Chia, K. P. (2010). Knowledge construction and misconception: a case study approach in asynchronous discussion using Knowledge Construction – Message Map (KCMM) and Knowledge Construction – Message Graph (KCMG). *Computers & Education*, 55, 1589–1613.
- *Yeo, T. M., & Quek, C. L. (2008). Investigating design and technology students' participation and learning in a technology mediated learning environment. *Australasian Journal of Educational Technology*, 24(5), 540–555.
- *Yeo, T. M., & Quek, C. L. (2011). Investigating design and technology students' peer interactions in a technology-mediated learning environment: a case study. *Australasian Journal of Educational Technology*, 27(4), 751–764.
- *Zydney, J. M., de Noyelles, A., & Seo, K. K.-J. (2012). Creating a community of inquiry in online environments: an exploratory study on the effect of a protocol on interactions within asynchronous discussions. *Computers & Education*, 58(1), 77–87.