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A Systematic Review of Small-Group Communication in Post-Secondary Online Courses

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Abstract

This systematic review establishes a comprehensive understanding of research trends and the findings of current studies that focus on small-group communication in post-secondary online courses. The review includes 18 journal articles which are categorised and summarised on the basis of their common themes. This review finds that a majority of the studies focus on understanding or uncovering 'learning processes' by conducting content analysis (CA). Further research is suggested to investigate 'instructional design or methods' to provide instructors with practical knowledge and ideas to enhance and assist the learning processes. Methodological issues are also discussed, including coding reliability in CA, quantitative measures for assessing collaboration, and a need for causal relational experimental studies.

Keywords: systematic review; small group; communication; online course

Introduction

The increasing popularity of online courses has been enabled by the rapid development of communication technology and the internet. Exponentially growing numbers of post-secondary education institutions are delivering online courses worldwide. Subsequently, there have been concerns and issues relating to the quality and effectiveness of teaching and learning in online courses.

Asynchronous communication (posting messages on a discussion board or group forum spaces) is a major method of communication in online distance education courses (Rourke & Kanuka, 2009). The archives of such communication have provided precious data for researchers to examine the dynamics of teaching and learning processes (Mason, 1991). Henri (1992) described the communication transcripts as "a gold mine of information concerning the psycho-social dynamics at work among students" (p. 118) and urged researchers to analyse the communication data so instructors could use the practical results to coach and facilitate learning. In this regard, many researchers have analysed communication transcripts to uncover the teaching and learning processes in online courses (Murphy & Ciszewska-Carr, 2005).

Small-group activity is a popular instructional method to encourage collaboration in online courses along with whole-group discussion activity (Benbunan-Fich, Hiltz, & Harasim, 2005). In the literature, however, small-group collaboration is less well known than whole-group discussion activities. This literature review therefore aims to establish a comprehensive understanding of research trends and findings from empirical studies that focus on investigating

small-group activities by analysing communication in online courses. By using a systematic approach, this literature review will provide researchers with information about the gaps and limitations of existing research on small-group collaboration.

The review questions are:

1. What are the research foci in the studies that analysed small-group communication in online courses?
2. What are the findings of research that analysed communication during small-group activities in online courses?

Method

This review employs a systematic method which is defined by explicit planning and transparent procedures so that other researchers can know what has been reviewed and how (Gough, 2004; Gough & Rees, 2008; Chalmers, 2005). The review method follows precise, comprehensive, and step-by-step procedures for (1) searching for potentially relevant studies; (2) screening the discovered, potentially relevant studies to include only those that meet the criteria for inclusion; (3) coding the included studies; (4) categorising/grouping the studies; (5) conducting an in-depth review; and (6) reporting the findings (Badger, Nursten, Williams, & Woodward, 2000). Details of the procedures for each step are explained in the following sub-sections.

Electronic database searching

Education-related databases were searched (i.e., Education Resources Information Centre [ERIC], Education Index Full Text, Academic Search Premier, and PsycINFO) through the EBSCO Host platform. Keywords for searching the databases were gathered for three domains: data type, course setting, and research focus (Table 1). Keywords were located by querying the thesaurus in each electronic database. The terms were connected with "OR" and each of the domains were connected with "AND". Through this procedure, a total of 1,083 publications were identified and transferred to RefWorks, an online citation management system.

Table 1 Domains and search terms used for electronic databases

Data type	Course setting	Research focus
bulletin board OR message OR post* OR asynchronous communication OR chat* OR computer mediated communication OR CMC OR text OR post*	distan* course* OR distan* learning OR distan* instruction OR distan* education OR distan* program OR online course* OR online learning OR online instruction OR online education OR online program OR web-based course* OR web-based learning OR web-based instruction OR web-based education OR web-based program OR electronic course* OR electronic learning OR electronic instruction OR electronic education OR electronic program OR e-course* OR e-learning OR eLearning	participation OR relationship OR critical thinking OR quality learning OR knowledge building OR achievement OR outcome OR collaboration OR collaborative learning OR interact* OR social presence OR cognitive presence OR community of practice OR membership OR group activity OR content analysis

Screening: First and second inclusion/exclusion

This phase involved four steps: (1) removing any duplicate studies that had been retrieved; (2) screening the remaining articles based on only titles and abstracts; (3) retrieving those articles that were included after the initial screening; and (4) screening the full text of those articles. A total of 301 duplicated publications were deleted from the RefWorks database system, leaving 882 items to be screened in the first inclusion/exclusion. During the initial screening process, inclusion/exclusion criteria were applied to titles and abstracts only. Because this did not constitute a thorough application of the criteria, articles for which there was insufficient

information to exclude with certainty were automatically included for the second screening process. For the second screening stage, full texts of 139 articles were retrieved and screened, resulting in 51 articles about whole-group discussion and small-group discussion. Eighteen articles that analysed small-group communication were the source of the final data for this review.

Table 2 Inclusion/exclusion criteria

Criteria	Inclusion	Exclusion
Publication type	Published articles in English in peer-reviewed journals	Conference papers, book chapters, dissertations, publications in other languages
Publication year	2000–2009 January	Before and after the inclusion period
Academic level	Post-secondary	K-12 students
Course type	Pure online courses as distance education courses delivered via the internet	Mixed-mode courses (e.g., online discussions to support face-to-face courses)
Data type	Students' text communication messages during small-group activity in online courses	Interview scripts, survey/questionnaire, observation, grade/achievement scores
Method	Primary research-quantitative/qualitative analysis of text messages	Reviews of other studies, opinion, or discussion papers that do not include any analysis of text data

As shown in Table 2, the screening process was conducted according to six inclusion criteria. Studies had to meet all of the criteria to be included in the review. The review was limited to a post-secondary level, so studies involving K–12 students were excluded. K–12 online learning is mostly referred to as 'virtual schooling' and is fundamentally different from post-secondary online learning in terms of its theoretical foundation and the instructional methods employed (Cavanaugh, Barbour, & Clark, 2009).

To be included, a study must have also involved analyses of text communication messages. Some studies involved multiple datasets (e.g., surveys, interviews, course marks) and written communication data. These studies were included, but quite a few studies were excluded that analysed students' perceptions, experiences, satisfaction, or achievement scores without directly examining communication data. Many studies were also excluded because the data were not collected from purely online courses but from hybrid/blended courses (i.e., a mixed mode of face-to-face and online learning). However, a few face-to-face meetings for orientation purposes at the initial stages of a course were not considered to contravene the definition of an online course.

Other limits applied to the scope of the review include the publication type (peer-reviewed journal articles), language (English only), and the date of publication (2000–2009). In terms of research methods, the review sought to include only primary research studies; reviews and opinion or discussion papers were therefore excluded.

Coding the data

Coding is the extraction of information from data. Coding guidelines were developed, containing nine categories for 24 variables: administrative information (review name, date); document information (RefWorks ID, author, year, journal name, article title); theoretical framework; sample description (number of subjects, gender breakdown, country); course description (course format, communication tools, course subject area, course name, academic level, assessment

criteria, whole- small-group activity); research focus (purposes, hypotheses, questions); methods (data analysis/synthesis); results (findings/conclusions), and reviewer's comments. The 18 articles were coded by two independent reviewers. The coding agreement rate was 92%. Any discrepancies were resolved by discussion and agreement.

Mapping the coded data

Mapping is the categorisation of the 18 articles according to common themes, based on the extracted data. Four main categories were induced from the research foci (Figure 1). Sub-categories were induced from research questions and findings of individual studies.
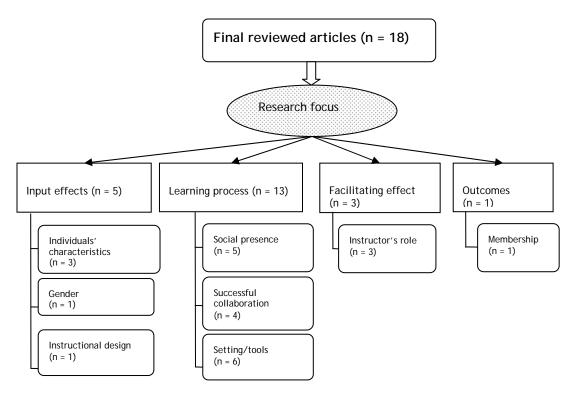

Figure 1 Mapping the studies

Results

As a result of the categorisation process, it was revealed that the majority of the studies (n = 13) investigated the 'learning process' as revealed in communication (Figure 1). Five studies examined the effect of input variables, and three studies investigated the facilitation effect by focusing on the instructor's role or involvement. One study examined outcomes. This section presents the findings reported in the selected studies (Table 3) and provides an overview of methodological approaches employed (Table 4).

Table 3 List of studies in categories of research focus

Research focus (main category)	Research focus (sub-category)	Publication
Input effects	Individuals' characteristics	Liu, Magjuka, & Lee (2008); Sun, Cheng, Lin, & Wang (2008); Wresch, Arbaugh, & Rebstock (2005)
	Gender	Wang, Sierra, & Folger (2003)
	Instructional design	Rose (2004).
Learning process	Social presence	Beuchot & Bullen (2005); Curtis & Lawson (2001); Goertzen & Kristjánsso (2007); Orvis, Wisher, Bonk, & Olson (2002); Wang, Sierra, & Folger (2003)
	Successful collaboration	Curtis, & Lawson (2001); Lee & Gibson (2003); Makitalo-Siegl (2008); Thompson & Ku (2006)
	Setting/tools	Curtis (2004); Maushak & Ou (2007); Mabrito (2006); Schweizer, Paechter, & Weidenmann (2003); Curtis & Lawson (2001); Vonderwell (2003)
Facilitating effect	Instructor role	Painter, Coffin, & Hewings (2003); Rose (2004); Vonderwell (2003)
Outcomes	Membership	Wang, Sierra, & Folger (2003)

Note: Some studies are included in more than one category because they have multiple research foci.

Input effect

Identifying input variables that influence effective collaboration can provide useful information for group-forming methods and facilitating learning processes. Five studies aimed to investigate the effects of inputs on collaboration processes. Rose (2004) found that students in a structured-group design revealed higher levels of dialogue than did those in an open-ended group design. Sun et al. (2008) experimented with a systematic group-forming method for better collaboration. Individuals' cognitive styles (Liu et al., 2008) and gender (Wang et al., 2003) were reported as non-significant factors influencing group collaboration.

Individuals' characteristics

Liu et al. (2008) examined students' cognitive styles (scope: internal, external, or flexible; levels: local, global, or flexible) in relation to their participation with a total of 208 MBA students divided into groups of 4 or 5 members. Their quantitative analysis found cognitive styles did not have a significant effect on the learning achievement or overall class participation. Rather, cognitive styles had predictive power over the students' satisfaction with their teamwork (trust and conflict management).

Sun et al. (2008) suggested a systematic group-forming method by identifying students' attributes; that is, learning time, regions, ages, and value types (theoretical, aesthetic, social, political, and religious). To test the effectiveness and practicality of the method, the researchers compared students' communication in 20 groups in experimental conditions with 20 randomly selected control groups. They found that the experimental groups performed better when measured by the amount of time they spent in the system, the amounts and content bytes of messages, and the rate of successful interaction, defined as "consummated communications through impulse and feedback between the message sender and the message receiver." (p. 673)

Wresch et al. (2005) examined participation trends and how a small online community accepted new participants across the course period. The trend showed a significant decrease in the average number of weekly group comments between the first and second halves of the course. When a new member joined in the middle of the course, the number of comments significantly increased.

Gender

Wang et al. (2003) examined gender differences in participation in synchronous communication. Females in the study tended to continue socialising and to remain connected after the class, while males were inclined to initiate more task-related thoughts and ideas and did not stay long once the chat session was over. Nonetheless, the authors did not find any direct effect of interaction styles on levels or equality of participation, and no significant difference in frequency of postings, although females posted messages more frequently (57% of total exchanges) than the male participants (43%).

Instructional design

Rose (2004) compared two types of small groups: cooperative and collaborative. Cooperative groups were designed in a structured format and had careful and frequent facilitation and monitoring of the group process. The instructor assigned students to specialist roles in each group. Collaborative groups were designed with a more open structure. Group members were not assigned to any specific roles, and the instructor monitored their discussions sporadically. In the initial period of the activity, the cooperative groups had significantly higher levels of dialogue than the collaborative groups. Communication messages were more interconnected in cooperative groups (90.68 %) than collaborative groups (81.34%) in terms of one message referring to another message by subject, topic, or name. Over time, however, the collaborative groups appeared to catch up with the cooperative groups on in-depth cognitive process as well as cohesion of messages. The author interpreted the results as indicating that more structured strategies might be efficient with short-term heterogeneous groups, but similar levels of interaction would be attained if groups have a common history and persist for more than 3 weeks.

Learning process

The quality of learning was evaluated to understand the benefits and effectiveness of small-group activity in terms of students' experiencing self-directed learning (Lee & Gibson, 2003), achieving shared understanding (Makitalo-Siegl, 2008), and realising equal levels of contribution (Curtis & Lawson, 2001). The importance of social factors was emphasised in four studies. Social communication is seen to enhance collaboration (Goertzen & Kristjansson, 2007; Orvis et al., 2002), is associated with cognitive presences (Beuchot & Bullen, 2005), and strengthens supportive group membership (Wang et al., 2003; Curtis & Lawson, 2001). In comparison, students struggled with problems when they collaborated through asynchronous communication because of its ineffectiveness (Thompson & Ku, 2006) and their discomfort while communicating with unfamiliar members (Curtis & Lawson, 2001). Asynchronous and synchronous communication tools support different aspects of collaborative learning and provide different benefits (Mabrito, 2006). To support social interactions that foster a more collaborative environment, online courses should be designed to provide various types of both asynchronous and synchronous communication tools (Curtis, 2004; Mausak & Ou, 2007; Schweizer et al., 2003; Vonderwell, 2003).

Social presence

Beuchot and Bullen (2005) examined Garrison and Anderson's (2003) proposition for the importance of 'social presence' associated with 'cognitive presence'. They assessed the relationship between *interpersonality* (social or personal interaction, or informal communication) and *interactivity* (more engagement and true interaction). They found that interactive messages were more likely to contain self-disclosure, and suggested that encouraging social interaction might lead to increased participation and expand the discussion. Goertzen and Kristjansson (2007) also aimed to understand social presence in collaborative efforts. They examined interpersonality by analysing social interactions in an online Master's programme of Teaching English to Speakers of Other Languages. Their content analysis showed that 76.3% of the social

interactions were expressions of appreciation and 26.6% were affective expressions. The study concluded that an effective collaborative process is closely linked to the nature of interpersonal engagement among participants.

Building a supportive learning community requires respect for other members' ideas. Wang et al. (2003) reported that students frequently used chat functions to establish a pleasant social milieu. The study found that higher performing teams tended to use nicknames to refer to their teams and posted public comments to openly express their positive feelings about one another. Orvis et al. (2002) also looked at social interaction in small groups during synchronous chat sessions in a military training course. Social interactions were higher at the start and end of the course, while on-task discussions peaked in the middle months. The authors asserted that social interactions in this setting were similar to trends often observed in face-to-face settings.

In line with these results, Curtis and Lawson (2001) suggested that online courses should be designed to encourage more social interactions, perhaps through more structured self-introductions. They found that a lack of familiarity among group members constrained successful collaboration.

Successful collaboration

Curtis and Lawson (2001) explored evidence of collaboration during group activities. The authors found that each member made an approximately equal contribution to discussions, suggesting there were no 'lurkers'. While collaboration levels were different for each group, some students were offended when their opinions or ideas were criticised during discussions via email or bulletin boards. Delayed-time and distance constraints were identified as major challenges to online collaboration. The asynchrony of the medium and students' unfamiliarity with the communication tools also constrained group collaboration. Because small-group members felt comfortable using email, they exchanged these more (n = 198) than they posted messages on the discussion board (n = 24). The authors also noted that the asynchronous online interactions lacked 'challenge and explain' cycles of interaction. They suggested using effective real-time tools to support interaction.

Lee and Gibson (2003) explored self-directed learning in three dimensions: control, critical reflection, and responsibility. In the study, students exhibited highly learner-centred characteristics and were interdependent with peers for collaborative learning. They had constructed knowledge by judging diverse opinions and resources based on their own experience and knowledge, while selectively accepting or rejecting others' comments. Similar findings were reported by Makitalo-Siegl (2008), who demonstrated that team members achieved 'shared understanding' by actively exchanging their own perspectives and a variety of resources. During the small-group collaboration, students reflectively compared their own knowledge with personal experiences of interaction and collaboration with other students.

However, problems associated with asynchronous text communication were noted as a major source of challenges during group collaboration. Thompson and Ku (2006) measured the degree of group collaboration in terms of four attributes: *participation* (number of messages), *interdependence* (interaction patterns), *synthesis* (number of statements with new ideas), and *independence* (number of messages sent to the instructor). In their analysis of group discussions, they discovered ineffective communication, conflict among group members, and negative attitudes toward group work.

Communication setting/tools

Mabrito (2006) analysed synchronous and asynchronous communication transcripts of four groups of 16 undergraduate students. The synchronous tool was used more for producing new topics and ideas (69%) than for follow-up comments (31%), while asynchronous tools were

devoted to creating new ideas (47%) and expanding topics (53%). Synchronous sessions were used for team building tasks such as organising group processes, while asynchronous discussions focused on the writing task itself. The study recommended that instructors consider including collaborative time in both synchronous and asynchronous environments.

Schweizer et al. (2003) asserted that using only text-based communication has limitations in that it deprives participants of socially rich communication. In the experimental study, the percentage of correct answers for each type of task and the coherence of the conversations were statistically compared to identify any differences among groups interacting in three pure e-learning settings—synchronous chats, asynchronous forums, and videoconferencing groups— compared with blended learning (a mixed mode of e-learning with face-to-face phases). The study found that learners in the blended setting led a much more coherent discourse than learners in the pure e-learning conditions, or in the face-to-face setting.

Two other studies (Curtis, 2004; Maushak & Ou, 2007) recognised the limitations of asynchronous communication in supporting social interactions, and examined the potential of synchronous communication tools. Curtis used synchronous chat rooms to supplement threaded discussions. The study analysed 86 chat messages collected from 11 students working in four small groups. The study demonstrated the potential of chat rooms. The students enjoyed authentic social interaction, negotiated their own understanding of the course material, and even had fun in the process. These outcomes are similar to those found in face-to-face groups. Maushak and Ou examined how using instant messages (IMs) facilitated collaboration during a group activity. Analysis of IM transcripts revealed that most of the properties of face-to-face collaborative interaction could be identified in terms of mutually constructing knowledge (44%) and facilitating group processes (15% of all IMs). However, challenging each other's reasoning was rarely evident, because students did not know each other well. The authors asserted that IM could be an efficient and productive tool for online project-based collaboration if there is careful design and implementation.

Using only asynchronous communication tools for small-group activities in online courses does not seem to be sufficient to provide students with a safe and comfortable setting for collaboration. Vonderwell's (2003) qualitative case study explored students' perspectives and experiences by analysing asynchronous discussion transcripts and emails exchanged among students, and between students and an instructor during small-group activities. Some students experienced frustration due to the non-cooperation of some of the team members. The study revealed members' discomfort about interacting with the students whom they did not already know.

Facilitating effects

Rose (2004), Painter et al (2003) and Vonderwell (2003) identified instructors' intensive and active monitoring and involvement as an important factor for higher levels of interconnected messages (Rose, 2004) and for higher student participation rates (Vonderwell, 2003; Painter et al., 2003). Painter et al. reported that the least interventionist strategy resulted in the least productive discussion in terms of both interaction and academic development. Vonderwell also reported the importance of the instructor's role in boosting collaboration and interaction. The qualitative case study concluded that instructors should carefully structure and design activities to assist those students who did not participate actively and those who were frustrated in the small-group settings of online courses. The author cautions online instructors that "merely providing discussions or collaborative activities does not mean that students will actively participate". (p. 88)

Outcomes

Wang et al. (2003) examined group membership construction during small-group activity. The authors asserted they found ample evidence of community-forming in terms of active participation, forming a shared identity, and establishing social networks. They measured active participation by the frequency of message exchanges and found a great majority of the students consistently attended webcasts and chat sessions. The remaining two factors were qualitatively examined by describing some incidences that appeared in text. For example, frequent uses of 'we' were identified as a representation of shared identity, and social–emotional expressions were identified as evidence of an established social network.

Methodological approaches employed in the studies

Most of the studies used descriptive research design to explore/examine synchronous and/or asynchronous communication in existing groups without manipulating any conditions or variables for comparison. Only three studies (Mabrito, 2006; Rose, 2004; Sun et al., 2008) used quasi-experimental design to measure the treatment effect of independent variables.

As shown in Table 4, 10 of the 18 studies employed content analysis (n = 9) or discourse analysis (n = 1) methods in terms of dividing communication data into units, coding them into categories, and counting the number of units in the categories. Coding reliability was reported in nine studies: Cohen's K was reported in Orvis et al. (2002), Lee and Gibson (2003), and Beuchot and Bullen (2005); inter-coder agreement rate (%) was reported in Mabrito (2006), Wang et al. (2003); negotiated agreement was used in Thompson and Ku (2006), and Maushak and Ou (2007); Rose (2004) reported inter-coder correlation and Cronbach alpha for intra-coder reliability; Goertzen and Kristjansson (2007) employed one-coder consistency, agreeing with herself over time. Curtis and Lawson (2001) did not report coding reliability. Four studies (Liu et al., 2008; Sun et al., 2008; Schweizer, 2003; Wresch et al., 2005) performed quantitative analysis on the communication data by using the number of postings, logins, or connections. The other four studies (Curtis, 2004; Makitalo-Siegl, 2008; Painter et al., 2003; Vonderwell, 2003) employed qualitative methods.

Table 4 Methods employed in the studies

Publication	Sample	Method	Reliability	Methodological design and analysis
Mabrito (2006)	16	CA	Inter-coder agreement: 87%	Quasi-experimental group comparison (synchronous vs. asynchronous communication), quantitative description (raw scores, %)
Rose (2004)	20	CA	Correlation r = 0.7; Cronbach alpha: 0.74-0.89	Quasi-experimental, group comparison (cooperative vs. collaborative groups), quantitative description (raw scores, %, communication trends)
Orvis et al. (2002)	41	CA	Cohen K = 0.90; agreement: 94%	Difference tests (ANOVA) among communication categories
Thompson & Ku (2006)	12	CA	Negotiated agreement	Assessment of collaboration level, quantitative description (raw scores, %, collaboration rankings)
Maushak & Ou (2007)	30	CA	Negotiated agreement	Quantitative description of synchronous communication (raw scores, %)
Lee & Gibson (2003)	21	CA	Cohen K = 0.89-0.95	Quantitative description of asynchronous communication (raw scores, %)
Wang et al. (2003)	21	CA	Agreement > 80%	Quantitative description of synchronous communication (raw scores, %)
Beuchot & Bullen (2005)	16	CA	Cohen K = 0.64-0.65	Evaluation of the amount and type of interaction and interpersonal content, hypothesis tests (x^2)

Curtis & Lawson (2001)	13	CA	N/S	Quantitative description of asynchronous communication (raw scores, %)
Goertzen & Kristjánsson (2007)	24	DA	One coder agreeing with herself over time	Quantitative and qualitative description of social presence
Liu et al. (2008)	208	QNTA	N/A	Group difference (ANOVA) among cognitive styles
Sun et al. (2008)	415	QNTA	N/A	Quasi-experimental study on grouping methods, difference tests (ANOVA) between experiment vs. control groups
Schweizer (2003)	96	QNTA	N/A	Difference tests (ANOVA) among e-learning groups vs. blended learning groups
Wresch et al. (2005)	60	QNTA	N/A	Difference tests (t-test, x^2) before and after joining new members into groups
Curtis (2004)	11	QLTA	N/A	Qualitative description of synchronous communication
Makitalo-Siegl (2008)	3	QLTA	N/A	Qualitative description of shared understanding
Painter et al. (2003)	15	QLTA	N/A	Qualitative description of three different levels of tutor intervention groups (least-, more-, most-structured groups)
Vonderwell (2003)	22	QLTA	N/A	Qualitative description of asynchronous communication

Note: CA: Content Analysis; DA: Discourse Analysis; QNTA: Quantitative Analysis; QLTA: Qualitative Analysis; N/A: Not applicable; N/S: Not stated

Discussion

This literature review aimed, firstly, to locate empirical studies that examined communication in small groups in online courses; secondly, to categorise and summarise the findings of the individual studies; and, finally, to identify gaps and limitations in the literature that would suggest further research. This section discusses research topics/foci as well as methodological design and approaches for future research. It also recognises some significance and limitations of this review.

Research foci on small-group communication

Some key findings of the included studies confirmed those of the broader existing literature:

- Social communication is a critical element for effective collaboration.
- Although students might struggle with troubles caused by asynchronous communication tools, synchronous communication tools can be used to compensate for the limitations of the former.
- Small-group activities in online courses provide the benefits of both a learner-directed and a learner-centred collaborative environment for learning.
- Instructors should actively monitor and facilitate group collaboration.
- Participation (quantity of communication) is the fundamental element for successful collaboration, and is used as a typical measure to evaluate collaboration in small groups.

The most popular research foci related to examining/understanding the 'learning process' in small online groups. The research issues and questions repeated in the 13 studies were: (a) How does social presence/communication or managerial/coordination communication influence cognitive presence/learning?; and (b) How do online group environment or communication tools relate to the quality of learning and participation in collaboration processes? The findings of the studies confirmed the existing theoretical perspectives and propositions regarding social

presence/communication as a significant factor associated with cognitive presence and a higher quality of learning. However, there is still a lack of research exploring specific instructional strategies and design to encourage and increase social presence/communication. More research is recommended, for example, to explore particular social activities (e.g., ice-breaking activities or games) and any synchronous communication tools (e.g., instant messages or audio/video chats) used to increase social communication. Technology develops quickly and, as more diverse communication and collaboration tools become available, online educators and researchers need to experiment with various technologies to improve communication processes and support collaboration in online groups.

Participation was emphasised as the fundamental component of collaboration. The quantity of communication was frequently used as an indication of successful collaboration. However, communication quantity does not necessarily ensure the quality of collaboration, in spite of many researchers arguing such in the literature. Because few researchers recognised the aspects of groups' communication structure and relationships during collaboration, their studies often ignored factors such as democratic contribution to the group tasks through more equalised participation or open communication networks. Only a few studies looked at aspects of participation such as equal contribution (Curtis & Lawson, 2001); shared understanding (Makitalo-Siegl, 2008); and interdependence, synthesis of information, and independence (Thompson & Ku, 2006). It is suggested that researchers assessing collaboration in small groups devise indices or measures that are more diverse than the quantity of communication.

Group collaboration was not evaluated according to individual groups. Most studies compiled all the communication messages and analysed the overall quality of collaboration without comparing or assessing the collaboration levels of each group. Evaluating collaboration processes in individual groups (e.g., Thompson & Ku, 2006) would allow researchers to identify hindering or facilitating factors by comparing the higher and lower levels of collaborative groups. Thus, more research is suggested to identify indicators and factors for more or less collaboration in small groups in order to provide practical guidelines and strategies for online educators.

Looking at the findings from the studies that investigated input effects on group collaboration (e.g., effectiveness of open-ended/less structured design, group-forming methods, gender and individual characteristics), instructors may better facilitate and prepare the groups in consideration of the input variables. Rose (2004) reported that open-ended/less structured design can be effective if the students are a homogeneous group—that is, they have similar levels of knowledge and have established friendships, often because they have taken courses together in a long-term programme. With regard to group-forming methods, an issue remains as to how to best mix and match students in small groups with variables such as gender, learning styles, geographical regions, and time zones. More research is needed to experiment with different group-forming methods in diverse environments with different techniques (e.g., learner-self allocation or instructor allocation). For example, although Wang et al. (2003) reported no significant gender effect on participation, the dynamics and patterns of communication in a homogeneous gender group (such as female-only or male-only groups) could be significantly different from mixed gender groups.

The teacher's role was confirmed as being the key to more effective and higher quality collaboration in small groups. Certainly, instructors' careful monitoring and intensive facilitation would be beneficial to group collaboration. In practice, however, the issue is the instructors' workload and time commitment. There can sometimes be too many messages to read and thus too little time to provide timely intervention for problems that might be hindering collaboration processes in individual groups. Most current course management systems show students' participation in terms of quantity. More complete indicators for critical problems in groups

would help instructors to provide prompt and proper assistance to at-risk groups in collaboration processes (Jahng, Nielsen, & Chan, 2010). More research is suggested to identify or develop instructional methods, and theoretical concepts and models that can be used to support instructors in practice.

Research design and methodological issues in the included studies

This review found some limitations in the research methods employed in the studies that were included. While over 50% of the studies in this review used content analysis methods, all but one of the authors recognised the importance of coding reliability to make their study replicable, and reported inter-coder and/or intra-coder reliabilities. However, the researchers used diverse indices (agreement percentage, Cohen's kappa, negotiated agreement, one-coder consistency) without justifying their choice of index. Percentage agreement is not a recommended index, and should be used with a second index that accounts for agreement expected by chance (Lombard, Snyder-Duch, & Bracken, 2002). Nevertheless, two studies reported only agreement percentages. A negotiated agreement approach, which can be useful in exploratory research (Garrison et al., 2006), was recommended. In order to make the reliability transparent, the initial agreement rate had to be recorded before the negotiation was performed and reported. Researchers conducting content analysis should properly assess and clearly report inter-coder reliability as well as intra-coder reliability because "without the establishment of reliability, content analysis measures are useless". (Neuendorf, 2002, p. 141)

This review identified a lack of experimental or quasi-experimental methods. There were no experimental studies and only three quasi-experimental studies included in the data. In educational research, experimentation controlling interested variables for group comparisons is regarded as a difficult approach. Nevertheless, experimentation provides a way to determine causal relationships between variables. To provide online educators with practical insights for specific instructional methods, designs, and communication tools that can be used in diverse contexts, researchers are encouraged to conduct a range of substantial experiments that go beyond describing existing strategies and methods.

Significance and limitations of the systematic review

A systematic review is a powerful method for reviewing literature – it provides an overview of primary studies that use explicit and reproducible procedures (Greenhalgh, 1997). The objective criteria for including and excluding studies leads to an unbiased identification of relevant studies by limiting favouritism and judgements based on the reputation of the author(s). However, this review recognises that this advantage also poses a potential risk for missing some renowned and relevant studies. For example, some relevant studies might not be included in the review because they were not indexed with the keywords that were selected, or the published journals were not included in the databases that were searched.

Categorisation of studies was done by inductive coding methods instead of using an a priori (up-front) coding scheme. Common themes emerging from the results of the coding were used to group the studies. The author acknowledges that different categorisations would be possible, depending on the review questions and purposes of future studies.

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