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ARTICLE

A comparative study of computer and mobile phone-mediated collaboration: the case of university students in Japan

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Abstract

Web-based forums are the major form of asynchronous communication in online courses. They are considered suitable collaborative learning environments to conduct discussions among groups of learners (Lieblein, as cited in Lamb, 2004; Zhu, 2006; Swan, 2001; Palloff & Pratt, 2005). However, despite their relevance, web-based forums have been reported to be lacking when measuring the productivity of participants' interaction. Although previous studies have suggested the use of Short Message Service in supporting online collaboration, little research has been conducted to understand whether mobile phones increase interaction in online discussions and how interacting via mobile phones differs from desktop computers. Thus, this exploratory case study examines online collaboration through Moodle forums on desktop computers and the LINE chat application on smartphones.

First, this paper compares how these two types of media influence the participation, interaction and collaboration of students. Second, it inquires into the students' collaboration experiences, opinions, and difficulties they encountered during the online discussions. Finally, it explores the impact that these two types of media had on the students' final outcome. Based on a literature review, the results of the content analysis of the posts and the experiences shared by the participants, this study concludes that mobile phones have great potential to enhance interaction in online collaboration.

Keywords

participation, interaction, online collaboration, LINE, Moodle, mobile phones, desktop computers

Estudio comparativo sobre la colaboración mediante teléfono móvil y ordenador: el caso de los estudiantes universitarios en Japón

Resumen

Los foros basados en web son la principal forma de comunicación asincrónica en los cursos en línea. Se consideran entornos de aprendizaje colaborativo adecuados para llevar a cabo debates entre grupos de alumnos (Lieblein, citado en Lamb, 2004; Zhu, 2006; Swan, 2001; Palloff y Pratt, 2005). Aun así, a pesar de su relevancia, se ha documentado que los foros basados en web son insuficientes para medir la productividad de la interacción de los participantes. A pesar de que estudios anteriores han sugerido el uso de SMS para apoyar a la colaboración en línea, se han realizado pocas investigaciones para entender si los teléfonos móviles incrementan la interacción en los debates en línea y para saber qué diferencias hay entre la interacción a través de móvil y ordenador. Así, este *estudio preliminar examina la colaboración en línea a través de foros de Moodle en ordenadores y la aplicación del chat LINE en teléfonos inteligentes.*

En primer lugar, esta investigación compara de qué manera ambos dispositivos influyen en la participación, la interacción y la colaboración de los estudiantes. En segundo lugar, indaga en las experiencias de colaboración de los estudiantes, sus opiniones y las dificultades con que se han enfrentado en los debates en línea. Finalmente, explora el impacto de ambos medios en el resultado final obtenido por los estudiantes. Basándose en una revisión de la bibliografía existente, el resultado del análisis de contenidos de los mensajes y las experiencias compartidas por los participantes, este estudio llega a la conclusión de que los teléfonos móviles tienen un gran potencial para incrementar la interacción en la colaboración en línea.

Palabras clave

participación, interacción, colaboración en línea, LINE, Moodle, teléfonos móviles, ordenadores

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Introduction

Background

Web-based discussion forums are considered to "create a suitable environment for peer and collaborative learning as they eliminate the apprehension, embarrassment and pressure that students usually feel when participating in live class discussions" (Lieblein, as cited in Lamb, 2004, p. 345). Owing to their asynchronous characteristics, web-based forums allow students to reflect on their own learning (Zhu, 2006) and their classmates' contributions while creating their own posts (Swan, 2001). Further, these forums let students test out new ideas and receive critical and constructive feedback (Palloff & Pratt, 2005) from their peers and instructors. Unfortunately, active interaction from students has been reported to be scarce in some contexts. This problem has been attributed to unusable software, interface design (Vonderwell & Zachariah, 2005), organizational readiness and communication values of the individuals (Fichter, 2005).

Interaction is an important factor for students to interrelate with an online group or community. It creates an impact on students' achievement (Zirkin & Sumler, 1995), satisfaction (Burnett et al., 2007) and perception of learning (Swan, 2001). It is also a crucial element for a discussion to move from simple participation to real collaboration (Ingram & Hathorn, 2004). Jung et al. (2002) argue that social interactions could enhance students' participation in discussions. Further, Beuchot and Bullen (2005) claim that interaction is related to sociability. Similarly, Wilson (2006) considers *social presence*, defined as the extent to which technology makes people feel personal connections with others, as a crucial element in interaction. Therefore, it can be assumed that if there is an increase in social presence on web-based forums, there may be a significant increase on the level of interaction among participants.

Although most formal web-based conferencing takes place via desktop or laptop computers, there is a growing interest in the use of portable devices to access forums. Roschelle (2003) argues that the most successful handheld technologies involve rich social practices which are built around rather simple and reliable technology, and instant messaging (Short Message Service, SMS) on mobile phones has been seen as one of the most used and context rich means of social interaction (Sorensen & Gibson, 2004). The use of SMS in online instruction could increase students' ease of communication, accelerate the work process because of the near synchronous nature of the medium (Beurer-Zuellig & Meckel, 2008) and contextualize interactions, giving users a sense of "be[ing] part of the action" (Asi et al., 2011, p. 15). Thus, if there is an improvement in social interactions and acceleration of the work process, the use of SMS could have a great impact on individual and group-level performance.

Statement of the problem

Previous studies have contrasted Computer-Mediated Collaboration (CMC) on web-based forums with face-to-face environments (Beuchot & Bullen, 2005; Burnett et al., 2007; McCrory, Putnam, & Jansen, 2008; Swan, 2001; Zhu, 2006) and have considered them different in attributions (Ingram

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& Hathorn, 2004). Although some of these studies already suggested the use of SMS in supporting online collaboration (Savenye, 2005; Wuensch et al., 2008), there is a lack of further research on how interactions via mobile phones differ from those of desktop computers. If patterns of collaboration between CMC and face-to-face are treated differently, it is obvious that collaboration through mobile phones should also be treated differently since the interaction occurs via different media. Therefore, there is a need for a deeper understanding on how students' collaboration through mobile phones differs from those of desktop computers and how this use of mobile media affects the groups' outcome.

Research questions

The study aimed to answer three main research questions:

1. Are there differences in participation and interaction between computer and mobile phone-mediated collaborative learning groups?

2. How different are the collaboration experiences between mobile phone and computer-mediated collaborative learning groups?

3. What is the impact on the groups' final written reports when interacting through mobile phones instead of computers?

Methodology

This study aimed to compare the participation, interaction and collaboration between two groups of students. One group used CMC via Moodle forums, a virtual learning system on desktop computers. The other used Mobile Phone-Mediated Collaboration (MMC) via LINE, an instant message application on smartphones. The study considered students' personal experiences, opinions and attitudes towards interaction and discussion, and examined the quality of the final group report. Although a qualitative approach was considered in principle, quantitative data was also collected.

Participants

A total of 26 students ranging in age from 19 to 23 years became the sample of the study. They were attending a course on instructional design and technology at a private university in Tokyo, Japan. Two main groups were formed for the online discussion. The group engaged in the CMC or Moodle group (14 participants: 10 female and 4 male), and the group engaged in the MMC or LINE group (12 participants: 7 female and 5 male). Owing to the students' concerns about exchanging personal contact information, the LINE groups were formed on the basis of the number of participants who

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voluntarily wished to use their smartphones for this task. The rest of the students were assigned to the Moodle group. The Moodle and LINE groups were subsequently divided into two each, resulting in the formation of four small groups. This decision was made taking into consideration previous research by Jahng et al. (2010), which suggested that students might be more participative in small group discussions than in whole group discussions.

Procedures

First, a face-to-face session was organized for students to gather with their respective team members. During this session, two ice-breaker activities were held so that the students could get to know their team-mates better before interacting online. Afterwards, both the LINE and Moodle groups were given ten days to discuss their views of learning. After the end of the discussion period, all the groups were allotted four days to summarize their group discussions and write group reports. Once each group had submitted its group report, all the students were asked to submit an individual reflection note regarding their experience with the online collaborative activity. The tasks designed for this study formed part of the course activities and accounted for 30% of the students' final course grades.

Data collection

The data was obtained from three different sources: a) a content analysis of the messages posted by students to the Moodle web-based forums and LINE application chat rooms during the online discussion; b) the participants' individual self-reflection notes on the online activity, written by the students based on their experience, satisfaction, members' contributions, feelings and thoughts during the online collaboration activity; and c) focus group interviews of seven active members from each Moodle and LINE group. For this, a short interview guide was designed based on the self-reflection notes to collect further details on the participants' experiences of the discussion.

Analysis

Analysis of participation

Participation in online discussions can usually be perceived when a comment is posted on a web forum to be read by others. However, in this study, participation was measured by counting the statements in the students' comments. First, all comments made by the students and the moderator were ordered chronologically, based on the date and time they were posted. Later, these comments were divided into complete statements. The importance of breaking down a message into statements is that even when some groups post more messages, they do not necessarily post the same amount of statements (Ingram & Hathorn, 2004). Therefore, statements are considered to measure participation more accurately since they can vary in number, size and intellectual content.

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Analysis of statements

This case study employed Content Analysis based on the Asynchronous Computer-Mediated Collaboration Model designed by Ingram and Hathorn (2004) and the model by Jahng, Nielsen, and Chan (2010). It focused on three main genres of student interactions: student-entire group, student-student and student-moderator. To analyze the interaction on the content of the problem, the statements were divided into three broad categories: *on-task, off-task* and *independent statements*.

On-task statements were content-related statements. They helped to set the environment for the discussion and build the community. They were later sub-divided into:

a) *Social statements* referring to the assignment, such as positive supportive statements (e.g., "well done", "good job", etc.), complaints about the task or negative comments about the discussion topic.

b) *Group management statements* were those that did not contribute directly to solving the problem; however, they included allocating tasks and deciding on the procedure for the discussion (e.g., "Let's start the discussion", "Are there any other ideas?", "Please, don't forget to…").

c) *Direct discussion of the scenario statements* were sentences that contributed directly to the topic of the discussion (e.g., "I think changing the way of learning is effective"; "for me, learning is more like memorizing", etc.).

Off-task statements were ideas unrelated to the assignment or discussion (e.g., talking about the weather, self-introductions, ice-breakers, etc.).

Independent statements were stand-alone comments that did not lead to any further discussion.

Analysis of patterns of interaction threads

The patterns of interaction were threads in which different participants or the moderator referred explicitly or implicitly to one another's comments. They were classified into:

a) *Simple interaction threads*: They comprised a single comment and response to that comment (e.g., a: comment – b: response).

b) *Collaborative threads*: They included a third response that synthesized all the responses. They included an initial comment, a response to that comment and a synthesizing or further response (e.g., a: comment – b: response – c: synthesis/ further response)

When more threads appeared across the discussion in longer forms, there was an expected increase in interaction and collaboration.

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Coding rubrics for the content analysis

Coding rubrics were designed to categorize the statements as either on-task or off-task (see Table 1) and their type of interaction. Once all the statements had been classified, those that exclusively fell into the on-task category were further classified into *social, group management* and *direct discussion of the scenario* (see Table 2).

Table 1. Coding rubrics for the content analysis

Participant	*Code*	*Type of statement*	*Code*	*On-task interaction*	*Code*	*Type of interaction*	*Code*
Yukiko Sato Tomoko Hato Moderator	**YS** **TH** **M**	On-task (Discussion-related statements)	**:On-task**	Social Group management Direct discussion of the scenario	/Social /Management /Direct	Student to Student Student to Moderator Student to Group	**/tS** **/tM** **/tG**
		Off-task (Non discussion-related statements)	**:Off-task**				
Example Yukiko Sato sent an on-task message on the discussion of the scenario to the whole group **YS:On-task/Direct/tG**							

Table 2. Coding rubrics for the subdivision of on-task statements

On-task interaction	*Code*	*Examples*
Social	/Social	*"There are many ideas in our discussion!! All of them are very interesting."*
Group management	/Management	*"First, post your FIRST opinion as 'A new discussion topic.'"*
Direct discussion of the scenario	/Direct	*"In my opinion, learning happens when the topic is relevant to my own life. If the topic is not relevant to my life, it's really easy to forget."*

Analysis of the groups' final written reports

Real collaboration should result in a synthesis of the contributions of all members. Therefore, it was necessary to know whether the final group reports combined the ideas of all members in each group. This was done by comparing and examining the transcripts of the online discussions with the final group reports. To do that, the "Compare documents" tool provided by Microsoft Word® was used.

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This feature allowed the researcher to see how much information from the online discussions was actually included in the final draft and which students provided the information.

Validity

Multiple sources were used to triangulate the data and to validate the results: the content analysis of the asynchronous discussion transcripts, the students' self-reflection notes and the students' comments from the focus group interviews. Furthermore, two discussion transcripts (one from a Moodle group and another from a LINE group) were coded by two more coders. These coders were instructors from an open university in the Philippines who had experience in the design and management of online courses. Agreements and disagreements during the coding process were debated between the researcher and the two coders via Skype® (a Voice-over-Internet-Protocol service). In the end, approximately 80% of the statements coded matched. The other two discussion transcripts were coded by the researcher himself, taking into consideration the two other coders' suggestions. Finally, the results and findings from the content analysis were compared with the results of previous published research on similar settings.

Results

Differences in participation, interaction and collaboration

The study showed that the LINE groups made a larger number of posts containing a small number of statements, whereas the Moodle groups made a smaller number of posts containing a larger number of statements. The students from Moodle Group 1 posted a total of 220 statements (3,530 words) and those from Moodle Group 2 posted 442 statements (6,982 words), while those from LINE Group 1 posted a total of 202 statements (2,718 words) and those from LINE Group 2 posted 237 statements (2,483 words). Regardless of the differences in the number of statements posted, similar types of statements on the content of the discussion were found in both types of groups. The largest exchange of on-task statements was in the form of *student-group*, followed by *student-student*, and the lowest was in the form of *student-moderator* (see Figure 1). Nevertheless, the LINE groups exchanged a larger number of *social* and *group management* statements, as well as a larger number of off-task statements, in contrast to the Moodle groups (see Figure 2). Furthermore, they exchanged more statements with the moderator in comparison to the Moodle groups.

A common pattern of interaction thread of the *a-b* form (containing a question or a comment and a reply) was found in both the Moodle and the LINE groups. However, the Moodle groups showed few varieties of interaction threads of the *a-b-a* and *a-b-c* only forms, whereas the LINE groups showed a larger variety of interaction threads of the *a-b, a-b-a, a-b-c, a-b-c-a, a-b-c-b* and *a-b-c-d* forms. In addition, two of the interaction threads from the LINE groups were considered collaborative interactions.

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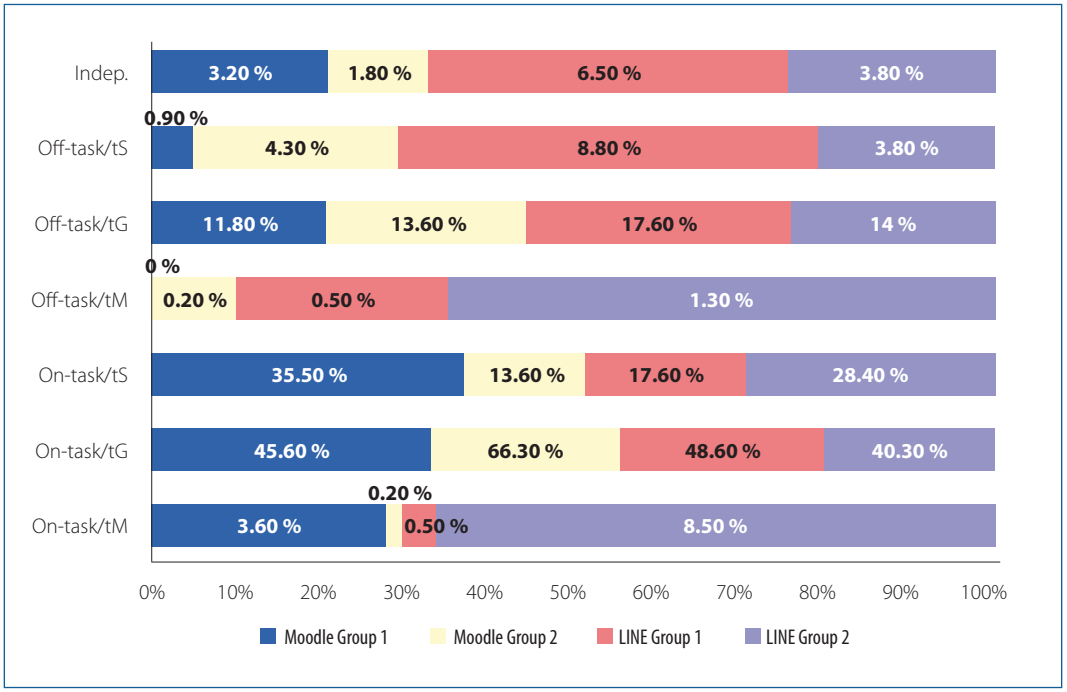

Figure 1. Percentage of on-task and off-task statements in the Moodle and LINE groups

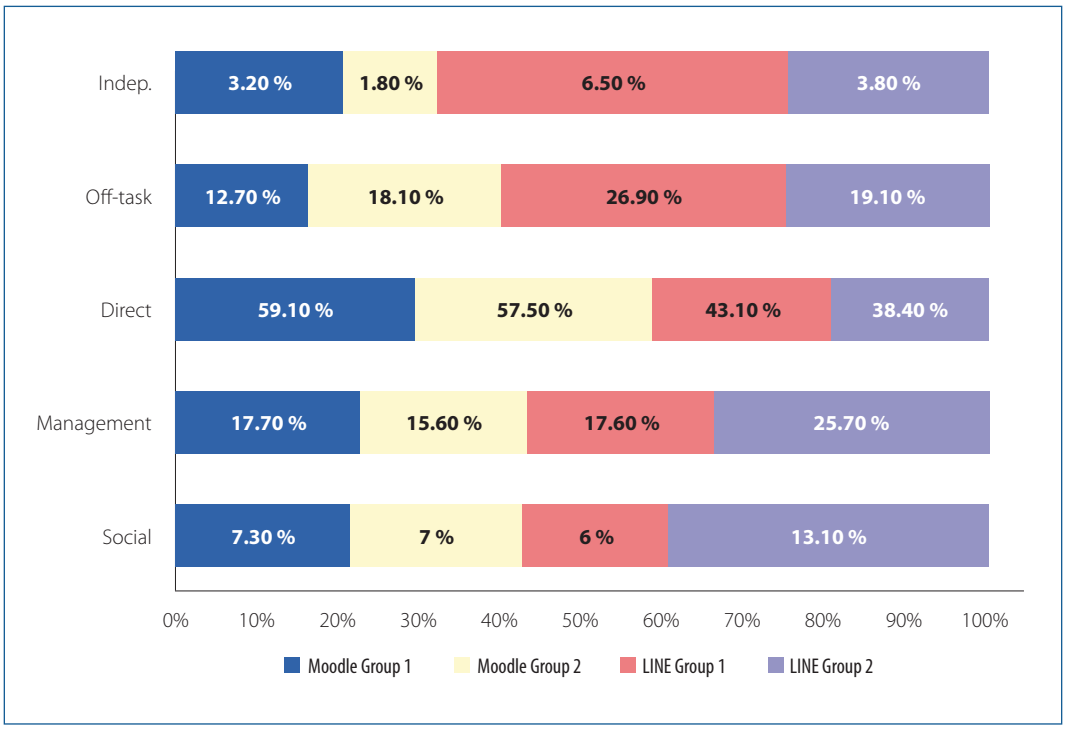

Figure 2. Percentage of social, management and direct statements in the Moodle and LINE groups

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Differences in collaboration experiences

Moodle Group 1 members expressed their unease with the slow response and lack of participation from their peers. The lack of ideas to enhance the online discussion was also considered a problem. In addition, there was also a tendency for online discussion to be dominated by only two members of the entire group. In Moodle Group 2, the majority of students expressed their satisfaction with the activity and its usefulness in making them rethink the concepts previously taught in class. Most of the participants felt very satisfied with the participation and contribution of all the members. The participants who were interviewed attributed it to well executed planning and distribution of responsibilities among all members before the online discussion. Both the Moodle groups considered the time-lags in the responses, the requirement of logging in on the website to make a post, and the broadness of the topic of discussion as main factors that affected the discussion.

LINE Groups 1 and 2 reported having enjoyed the activity. Both groups highlighted the convenience of receiving notifications and messages directly to their mobile phones. They also considered the "Read" notification very useful for encouraging participation from other members. Further, they considered the "chat style" relaxing and enjoyable. Although both groups reported being satisfied with the participation and contribution of their peers, some of the participants felt pressured as LINE demanded quicker responses. Furthermore, they faced problems with the device. The size of the display and keyboard made reading and typing long sentences "a hard thing to do" (female participant, LINE 2 group). Finally, both groups shared the problem of not being able to exchange Word files via their mobile phones to edit and proofread their final report.

Impact on the groups' final written reports

Moodle Group 1's report was not considered to synthesize all of the group members' opinions. Three unedited comments from two students became visible after comparing the final product with the transcripts of the online discussion. However, Moodle Group 2's report was considered closer to a synthesis of the group's ideas, even though it contained a brief summary made by one of its members during the online discussion. As for LINE Group 1's report, it was considered to be close to a synthesis of the entire group's ideas. Nevertheless, it contained a short summary previously posted by a single member. In contrast, in LINE Group 2's report, no comments or summaries previously made by a single member were found. It proved to contain a synthesis of all the group members' ideas.

Discussion

Time-lags between posts and the variance in interaction threads

Burr and Dawson (2003) argued that online interaction is not only mediated by the technology, but also restricted by the main input device. The students from the LINE groups reported having

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difficulties when typing with a small keyboard. Therefore, many messages posted in LINE discussions were kept short. The larger number of posts made by the LINE groups could be explained by the short time-lags that existed between each reply. The time-lags and distribution of the posts between replies of the LINE groups were shorter (e.g., 8:40pm, 9:54pm, 10:23pm, and 10:39pm) compared to those of the Moodle groups (e.g., 3:10am, 1:14pm, 4:08pm, and 6:32pm). Although the portability of the device and the ease with which members could join the discussion anytime-anywhere may have been some of the reasons, the short time-lag in replying using LINE was likely to have been enhanced by the "Read" notification. Whenever the students checked a new post to the LINE forum, the "Read" notification automatically appeared on the sender's screen, confirming that the message had been seen. This notification created a sense of group pressure on the receivers, which encouraged them to post a prompt reply. Thus, the combination of the short statements due to 1) the input limitation of the device and 2) the quick responses from peer members encouraged by the "Read" notification led to more alternations in the posts. As a result, more complex interaction threads were generated in the LINE group discussions.

In contrast, the long time-lags between each reply in the Moodle forums made students address different opinions in a single message. In addition, the average number of students who posted per day was limited. Therefore, the slow response time and the minimal participation in a day resulted in less variance of patterns of interaction threads. This could explain why the dominant interaction threads found in the Moodle groups were *a-b* forms. This finding corresponds with the ideas of Hara, Bonk, and Angeli (2000), who argued that long time-lags between participation create a one-way pattern and not a two-way interaction. That is because the student who initiates the discussion seldom participates a second or third time. Even those students who had been very active in the discussion referred to a different idea when posting their second or third message.

Similarities in on-task statements

The content analysis results showed that in each Moodle and LINE group, the largest on-task statements exchange occurred between a student and the whole group. Greetings included at the beginning of the messages (e.g., "Dear Shinagawa san", "Hi, yuki!!, "Hi everyone!") facilitated the identification of the addressee(s). Yet, some messages did not include a greeting, which made it unclear whether the addressee was a single student or the whole group. Therefore, the content of these messages was re-read and discussed among the coders before classifying them into "student-student" or "student-group".

The majority of on-task statements were *direct* followed by *management* and *social*. Nevertheless, the LINE groups posted more *social* and *management* statements, and a larger number of off-task statements in comparison to the Moodle groups. Although the off-task statements were comments unrelated to the discussion (e.g., greetings, jokes, etc.), they did increase sociability in the community (Bishop, 2006). These results might indicate that although mobile phones promote more *social* and *management* on-task statements than desktop computers, they still encourage students to post a larger number of *direct* statements. In other words, it is possible to keep students discussing on-task, but within a more social and managerial environment.

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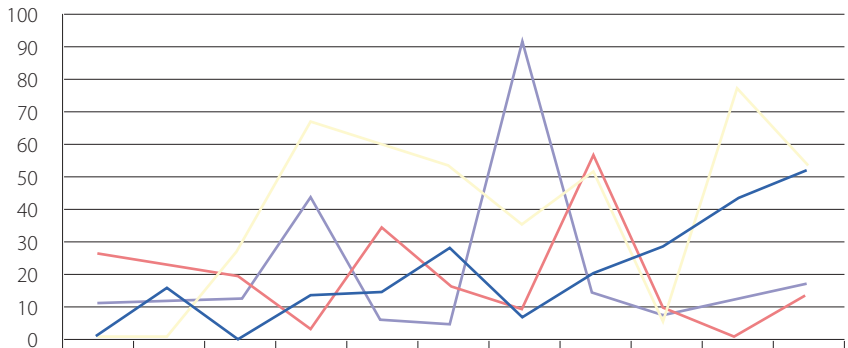
Impact on the groups' performance

The transcripts of the discussion provided insights into the fact that students in the LINE groups had completed the assignment ahead of schedule. In addition, the number of exchanged statements peaked much earlier in the LINE groups than in the Moodle groups.



	20th	21st	22nd	23rd	24th	25th	26th	27th	28th	29th	30th
Moodle Group 1	0	14	0	12	15	28	6	20	28	43	54
Moodle Group 2	0	0	29	68	62	54	36	53	7	78	55
LINE Group 1	27	23	20	4	35	17	9	57	9	1	14
LINE Group 2	11	12	13	44	7	5	92	14	8	13	18

Figure 3. Number of statements distributed along the discussion period

These indications made the researcher infer that the LINE groups had completed their assignment before the Moodle groups. This inference was supported by a self-reflection note from one of the leading members in LINE Group 2, who mentioned that "everyone got an early start on their work" (female participant). Consequently, they had more time to work on editing and proofreading the final draft. The acceleration in the flow of the discussion led the LINE group members to come to a quicker conclusion. This provided the students with more time to work on their written assignment, thus having a positive impact on the final product. This was clearly observed in the group report from LINE Group 2, which proved to be a real synthesis of the whole group's ideas. The positive impact on performance was also reflected in the students' self-reflection notes and comments made during the focus group interviews. They expressed their satisfaction with the participation and contribution of the whole group. These results support the idea that mobile phones can have a major impact on performance by improving interaction and management, accelerating the work process as stated by Beurer-Zuellig and Meckel, (2008). However, the transcripts of the discussions showed that the two LINE groups had arranged an offline meeting at the end of the discussion period, which could have affected the study outcomes. If this is indeed the case, this may have enhanced reachability, personal contact and faster decision-making, which highlights the need to further examine the usage of mobile phones and to take this extra interaction into consideration when repeating or interpreting this research.

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Difference in the content of the discussions

The LINE groups' discussions were mainly based on personal experiences. The students shared several personal episodes of their lives, which were used as examples during the discussion. Further, the LINE group students' performance was less scholarly. They did not cite any fragments from authors or share links to support their thoughts in the same way as the Moodle groups did. This may be due to the laborious action of copying and pasting text on smartphones. Also, being on the move avoided plagiarism. In fact, a student argued that the mobility made her rely more on her personal experience since she was not carrying all her reference material with her when writing comments. Therefore, she considered that by using Moodle on desktop computers, people tended to think more deeply about the topic of discussion. These thought support findings from an interview-based study by Perry and Brodie (2006), who argued that mobile workers referred to mobile technologies as potentially supportive of more effective communication; however, they are not very suitable for more cognitively demanding work.

Conclusions

Based on a literature review and results of this case study, it can be concluded that mobile phones have a great potential for enhancing interaction in online collaboration. The times of posting and replying, and of accessing the forum become a crucial factor in the interaction and patterns of interaction threads. The short messages and limited time in posting responses generated multiple interaction threads among the LINE users, which were not registered in the Moodle groups. Although the content analysis results showed a higher percentage of social and off-task statements in the LINE group discussions than in the Moodle groups, the number of direct statements on the discussion topic was not surpassed. This suggests a potential for students to maintain real-time discussions via a mobile phone in the same way as with a desktop computer, but within a more social and managerial environment. Further, mobile phones enhanced information exchange and kept the flow of the discussion active, which made students in the LINE groups reach an agreement earlier than those in the Moodle groups. As a result, the LINE group members had more time to work on editing their group reports. These characteristics of collaborating via a mobile phone, which had a positive impact on performance and on the quality of their final products, were reflected in the students' satisfaction.

Nevertheless, the outcomes from the participants in this study demonstrated that the Moodle and LINE discussions tended to be different in content. While the Moodle groups' discussions were primarily based on the students' experiences, handouts provided in the course, and other sources from websites, the LINE groups' discussions were mostly experience based. The larger exchange of social information through a mobile phone created a more suitable environment for sharing personal experiences and opinions. These differences in discussion content, brought about by these two programs, should be considered in order to plan suitable activities for each medium.

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While more cognitive activities for problem-solving might be more appropriate for desktop computers, brainstorming activities that promote creative thinking might be more suitable for mobile phones.

Although this study took a somewhat quantitative approach when measuring the participation and interaction within each group, statistical analyses are still required. Analysis such as Chi-square should be done to test the level and uniformity of the members' participation within each Moodle and LINE group. In addition, correlation analyses among direct, social and management messages should be considered to explore individuals' communication and interaction behaviour. The coding used for this study followed the rubrics established by Ingram and Hathorn (2004) and Jahng et al. (2010); nevertheless, content analysis is still considered an umbrella term which has a variety of methods. Therefore, other methods of content analysis should be employed to re-analyze the students' discussions and see if they are consistent with the results of this study. Further research is also required to explore how the use of a mobile device could influence the pedagogical approaches of teachers and the organization of their class activities. Moreover, it is important to study the way students represent and process information through online collaboration and how this affects their learning.

References

Asi, D., Geoff, M., Geoff, S., & Frances, W. (2010). *Mobile learning shareable content object reference model (m-scorm) limitations and challenges*. Cambridge, United Kingdom: Tribal.

Beuchot, A., & Bullen, M. (2005). Interactions and interpersonality in online discussion forums. *Distance Education, 26*(1), 67-87. doi http://dx.doi.org/10.1080/01587910500081285

Beurer-Zuellig, B., & Meckel, M. (2008). Smartphones Enabling Mobile Collaboration. Paper presented at the 41st Annual Hawaii International Conference on System Sciences. doi http://dx.doi.org/10.1109/HICSS.2008.399

Bishop, J. (2006). Increasing participation in online communities: A framework for human computer interaction. *Computers in Human Behavior, 23,* 1881-1893. doi http://dx.doi.org/10.1016/j.chb.2005.11.004

Burnett, K., Bonnici, J. L., Miksa, S. D., & Kim, J. (2007). Frequency, intensity and topicality in online learning: An exploration of the interaction dimensions that contribute to students' satisfaction in online learning. *Journal of Education for Library and Information Science, 48*(1), 21-35.

Burr, L., & Dawson, S. (2003). Codification of interaction within a large scale online forum environment. Paper presented at Educause 2003, University of Adelaide.

Fichter, D. (2005). The many forms of e-collaboration: Blogs, wikis, groupware, discussion boards, and instant messaging. *Online, 29*(4), 48-50.

Hara, N., Bonk, C. J., & Angeli, C. (2000). Content analyses of on-line discussion in an applied educational psychology course. *Instructional Science, 28*(2), 115-152. doi http://dx.doi.org/10.1023/A:1003764722829

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Ingram, A. L., & Hathorn, L. G. (2004). Methods for analyzing collaboration in online communications. In T. S. Roberts (Ed.), *Online Collaborative Learning: Theory and Practice* (pp. 215-241). Hershey, PA: Information Science Publishing.

Jahng, N., Nielsen, W. S., & Chan, K. H. E. (2010). Collaborative learning in an online course: A comparison of communication patterns in small and whole group activities. *Journal of Distance Education, 24*(2), 39-58.

Jung, I., Choi, S., Lim, C., & Leem, J. (2002). Effects of different types of interaction on learning achievement, satisfaction and participation in web-based instruction. *Innovations in Education and Teaching International, 39*(2), 153-162. doi http://dx.doi.org/10.1080/14703290252934603

Lamb, A., & Johnson, L. (2006). Want to be my "friend"? What you need to know about social technologies. *Teachers Librarian, 34*(1). 55- 66.

McCrory, R., Putnam, R., & Jansen, A. (2008). Interaction in online courses for teacher education: Subject matter and pedagogy. *Journal of Technology and Teacher Education, 16* (2), 155-180.

Palloff, R. M., & Pratt, K. (2005). *Collaborating online*. San Francisco, CA: Jossey-Bass.

Perry, M., & Brodie, J. (2006). Virtually connected, practically mobile. In J. H. E. Andriessen & M. Vartiainen (Eds.), *Mobile virtual work: A new paradigm?* (pp. 97-127). Heidelberg, Berlin: Springer. doi http://dx.doi.org/10.1007/3-540-28365-X_5

Roschelle, J. (2003). Unlocking the learning value of wireless mobile devices. *Journal of Computer Assisted Learning, 19*(3), 260-272. doi http://dx.doi.org/10.1046/j.0266-4909.2003.00028.x

Savenye, W. C. (2005). Improving online courses: What is interaction and why use it? *Distance Learning, 2*(6) 22-28.

Sorensen, C., & D. Gibson (2004). Ubiquitous Visions and Opaque Realities: Professionals Talking About Mobile Technologies. *The Journal of Policy, Regulation and Strategy for Telecommunication, Information and Media, 6*(3), 188-196. doi http://dx.doi.org/10.1108/14636690410549516

Swan, K. (2001). Designing factors affecting students satisfaction and perceived learning in asynchronous online courses. *Distance Education, 22*(2), 306-331. doi http://dx.doi.org/10.1080/0158791010220208

Vonderwell, S., & Zachariah, S. (2005). Factors that influence participation in online learning. *Journal of Research on Technology in Education, 38*(2), 213-230.

Wilson, J. R. (2006). Collaboration in mobile virtual work: A human factor view. In J. H. E. Andriessen & M. Vartiainen (Eds.), *Mobile virtual work: A new paradigm?* (pp. 129-151). Heidelberg, Berlin: Springer. doi http://dx.doi.org/10.1007/3-540-28365-X_6

Wuensch, K. L., Aziz, S., Ozan, E. Kishore, M., & Tabrizi, H. N. (2008). Pedagogical characteristics of online and face-to-face classes. *International Journal on E-learning, 7*(3), 523-532.

Zhu, E. (2006). Interaction and cognitive engagement: An analysis of four asynchronous online discussions. *Instructional Science, 34*, 451-480. doi http://dx.doi.org/10.1007/s11251-006-0004-0

Zirkin, B., & Sumler, D. (1995). Interactive or non-interactive? That is the question!!! *Journal of Distance Education, 10*(1),1-10. Retrieved from http://www.jofde.ca/index.php/jde/article/view/230/605

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