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Exploring Group Forming Strategies by Examining Participation Behaviours during Whole Class Discussions

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Abstract

The purpose of this study was to explore group forming strategies by examining participation behaviours during whole class discussions associated with active participation in a following small group activity. Written communication data, posted in class discussion forums (843 messages/70,432 words) and small group forums (732 messages/59,394 words), were analyzed quantitatively. The result indicated that individuals' participation quantity in small groups was significantly correlated with their own participation behaviour in whole class discussions. Also, a significant portion of small group participation was explained by their group members' participation (i.e., group member effect). Based on the results, we suggest instructors use the information of participation behaviours during the initial period of whole class activities for allocating students into small groups heterogeneously.

Keywords: participation, small groups, whole class discussions, grouping method, instructional design, quantitative analysis

List of Topics

Introduction

Small group activity is a popular instructional method in online courses based on the confirmed benefits of collaborative learning in terms of higher achievement and more positive attitudes toward learning (Alavi & Dufner, 2005; Johnson, Johnson, & Stanne, 2000; Persico, Pozzi, & Sarti, 2010; Zhang, Peng, & Hung, 2009). During a project-based small group activity, in particular, members are expected to participate actively as they share information and ideas, compare their perspectives, identify knowledge gaps, and resolve disagreements to work as a group toward a common goal (Palloff & Pratt, 1999; Tuckman, 1965). Students are responsible for planning and implementing their ideas, and finding solutions as a team, which has long been advocated by constructivist and social learning theories (Gomez, Wu, & Passerini, 2010) as well as highly valued in today's workplace (Koh, Herring, & Hew, 2010; Wang, 2010). However, members' inactive participation leads to difficulties in achieving successful collaboration (Jahng, Nielsen, & Chan, 2010). In this respect, an instructional strategy of grouping methods to encourage students' more active participation has been one of major concerns of practitioners and researchers.

This article recommends a practical and effective grouping strategy for allocating students into small groups. The study, however, is not an experiment of any specific grouping methods in terms of how to mix and distribute students into small groups, but an examination of an assumption that students' participation behaviours in whole class setting might be related to their participation behaviours in the following small group setting. Thus, if students' participation behaviours are uncovered and if any variables associated with their behaviours in a small group are identified in a predictable way over time, the findings will help educators develop practical strategies for designing and facilitating. As Reeves (2002) argued, "instructional technology research has too often ignored issues that are important in current practice and has generally made little or no impact on practitioners" (as cited in Thorpe, 2008, p. 58). We believe this research might have 'increased value' because it provides information and suggestions about the design and strategies for teaching and learning based on its findings (ibid).

Many researchers have investigated participation in online courses by analyzing written communication in

whole class discussions and in small group activities. Most have focused on participation in either of the settings (a whole class or a small group), but few have explored the relationship between participation behaviours in the two settings across a course delivery. This research explores student participation behaviours during whole class discussions (weeks 1-4) in relationship to quantitative participation in a small group (weeks 5-8). Asynchronous communication data archived in course discussion forums and group forums of a graduate online course were retrieved and analyzed quantitatively.

Literature Review

Effective Instructional Strategies & Grouping Methods

Research has shown that successful group collaboration with high satisfaction and perceived learning is not accomplished easily in online courses (see Haythonthwaite, 1998; Jahng, et al., 2010; Richardson & Swan, 2003; Thompson & Ku, 2006; Wang, Sierra, & Folger, 2003). Group members often face technical problems and emotional frustrations caused from diverse personalities, different levels of expertise, and different geographical areas or time zones. In addition, asynchronous text-based communication, which is the dominant method of communication in current online courses, has limitations that can cause anxiety and misunderstandings, including late responses and an absence of social cues and facial expressions. When group members fail to overcome these problems and frustrations, they may forego sophisticated discussions and avoid deep engagement in collaboration processes (Curtis & Lawson, 2001). This affects the quality of collaboration and learning and creates negative attitudes towards group collaboration (Francescato, Porcelli, Mebane, Cuddetta, Klobas, & Renzi, 2006; Thompson & Ku, 2006).

Investigating instructional strategies for effective small group collaboration has been a research issue in literature of online education. A group forming method, in particular, has been identified as an important factor to enhance members' participation in small groups (Dillenbourg, Baker, Blaye, & O'Malley, 1996; Felder & Brent, 1994; Ingram & Hathorn, 2004; Sun, Cheng, Lin, & Wang, 2008). The three most common types of group forming methods are: self-selection, random-assignment, and instructor-assignment (Decker, 1995). Self-selection and random-assignment are frequently used because they are simple and convenient methods. Self-selection allows students to choose their group members, which usually results in homogeneous groups because students tend to get together with those students with similar interest, background, and achievement levels (Buckenmyer, 2000). Inactive participants in whole class discussions often end up together in a 'leftover group' because they are too shy to approach some active students. Felder and Brent (1994) assert that the drawbacks of a homogeneous group with only weak students are obvious. They also argue that a group with only strong students could be equally undesirable since the strong group tends to divide up a group work, omitting the dynamic interactions that lead to most of the proven benefits of collaborative learning.

Distributing students properly to form heterogeneous groups in consideration of their diverse academic and social attributes would foster more and deeper collaboration with members helping each other construct knowledge and understanding. For instance, less knowledgeable students gain from seeing how their peers approach problems, and more knowledgeable students gain a deeper understanding of the subject by teaching it to others (Felder & Brent, 1994). Random-assignment is recommended widely as a way of forming heterogeneous groups. This approach, however, may not always generate heterogeneous groups (Donald, Bacon, & Stewart, 1999): "... some randomly assigned teams would, by chance, end up with a desirable combination of students, others would certainly not..." (p. 469). In this regards, some researchers suggest mixing and matching students deliberately based on, for example, students' attributes (i.e., time zone, region, age, personal value types) (Sun, et al., 2008), individuals' cognitive styles (i.e., scopes - internal, external, or flexible; levels - local, global, or flexible) (Liu, Magjuka, & Lee, 2008), and gender (Wang, et al., 2003). However, these methods may not be feasible for an instructor to use in practice with some limitations. Using an algorithm or a formula with diverse variables of students' social and academic attributes as experimented by Sun and colleagues seems to be too complex and time consuming to measure such characteristics prior to assigning students into teams at the beginning of a course. Furthermore, the variables (cognitive styles and gender) tested in the latter studies were not significant factors influencing more participation/interaction in small groups. So, which methods can be practical and feasible for allocating students into a more collaborative group? What variables should be considered for forming heterogeneous groups to encourage more active communication for collaboration? Does an instructor need to mix inactive students, so call 'lurkers' (Beaudoin, 2003), with more active participants in a small group? With regards to these questions and issues, we examine students' participation behaviours during whole class discussions prior to a small group activity. We aim to identify students' participation behaviour variables in whole class discussions that are related to active participation in their small groups. We also investigate inactive students' participation in whole class activities and their association with behaviours in small groups. Based on the results, we make recommendations for heterogeneous grouping strategies that can be used by educators.

Project-Based Small Group Collaboration

According to the Input-Process-Outcome (IPO) model of group collaboration (Hackman, 1987; McGrath,

1984), *process* transforms the *inputs* into *outcomes*. The IPO framework helps researchers identify the relationships among variables (Benbunan-Fich, Hiltz, & Harasim, 2005). Process is like a black box in which individuals bring diverse attributes (inputs) to work with group members to produce outcomes. A genuine outcome of collaborative learning can be members' constructed knowledge generated through the collaboration process to complete a group task/project, i.e., catalyst: major input variable (Jahng, et al., 2010). Other input variables can be different levels of prior knowledge, experiences, personalities, and learning styles, and attributes (age, gender, geographical location, etc.). These variables are presumably exposed in written communication of individuals' participation in collaboration process.

The instructor in an online course plays a role of a facilitator/moderator across collaboration processes. S/he cannot change most of the input variables mentioned above, but can use the information by monitoring participation behaviour to better plan and assist the learners. A project-based small group activity occurs nested within a whole class setting. When a small group activity is designed to take place in later in the course, friendship/social relationship established during the whole class discussions can be input variables of small group collaboration process. Instructors may examine students' participation behaviour during the initial whole class discussions to allocate students into groups.

Makitalo-Siegl (2008) noted that there have been few studies that look at "the collaboration process extending from the beginning to the end of an online learning course" (p. 79). Brindley, Blaschke, & Walti (2009) recommended designing group activity at a later time of a course to allow students some time to acquire skills for group collaboration and develop relationships with classmates and comfort with the technological environment. However, the recommendation was not based on any evidence related to the kinds of relationships in whole class discussions that were developed in association with small group participation.

The purpose of this research is to investigate how students' participation in a small group activity is related to their whole class participation, and thus to provide practical recommendations for how instructors and instructional designers can use the information gained through monitoring/observing participation behaviour and interaction relationships to help them form groups.

Three research questions are investigated in this article:

1. Is inactive students' participation in a small group activity different than their participation in whole class discussions?
2. Which participation behaviours in whole class activities are related to participation behaviours in a small group?
3. How much of small group participation is explained by individual's participation in whole class discussions?

Methods

Data were collected from a graduate online course in an educational technology program. The course was delivered for 13 weeks from January 2008 through the WebCT Vista course management system. A total of 24 graduate students (12 females and 12 males) were enrolled. Individual students were identified by anonymous codes made up of three characters: *A1m*, for example, represents *a male member of Group A*. The course was designed to include two major learning activities: whole class activities and a small group activity. For the whole class activities there were four units of discussions: Unit 1 (self-introduction, Bio activity) and Units 2, 3, and 4 (topic discussions). For the small group project, i.e., writing a group paper, students were allowed to assign themselves into one of six groups and they used own group forum space to work for the project. Data analyzed for this study includes whole class activity data (843 messages/70,432 words) and small group data (732 messages/59,394 words).

Quantitative methodological techniques (z-score, correlation, and regression) were employed to analyze the asynchronous communication data. Participation quantity, i.e., amount of communication, was used to identify active or inactive students. Inactive participants were determined comparatively by calculating z-scores of participation (amount of posted words) in whole class discussions. Eight out of 24 students whose z-scores belonged to bottom 30% were identified as inactive students. Z-scores were used because they can show relative participation above or below the mean. Positive z-scores indicate that the raw scores (amount of posted words) were above the mean (z-score=0); negative z-scores indicate that the raw scores were below the mean.

A correlation analysis was performed with the variables of individuals' participation behaviour in whole class discussions to examine the association with small group participation. With the variables, step-wise regressions were run to reveal the potential predictive power for small group participation.

The examined variables were defined and measured as below:

Participation: was defined and measured in terms of quantity of communication by number of words.

Although participation has been defined in various conceptual frameworks in the literature (Hrastinski, 2008), the quantitative amount of communication should be regarded as 'a prerequisite' of qualitative contribution to accomplish benefits of collaborative learning (Nistor & Neubauer, 2010). Without communication among members, collaboration cannot occur.

Participation behaviours: were examined by employing social network analysis concept to investigate communication relations and structure of interaction (Wasserman & Faust, 1994).

- *Ego Network Size*: number of students connected/communicated directly during whole class activities by responding each others' postings
- *Ego Net Ties*: number of connections
- *Posting Habit*: posting day to look at whether a student is early/late poster
    - posting day for self induction activity (Unit 1 whole class activity)
    - posting day of first message for topic discussion (Unit 2 whole class activity)
- *Centrality (influence)*: Number of words sent out during whole class discussions

Forum types: Four forum spaces for whole class discussions and communication were designed in the course. The purposes of the spaces were different. Thus, it was assumed that student participation in the different forums might reveal different association with participation in small groups.

- *Bio* forum: was a space for self-introduction which was an activity for the week 1 of the course.
- *Main* forum: was a space for general questions and answers such as technological problems.
- *Topic* discussion: is so-called course discussion board which was used for topic discussions. Unit 2 data were used for the variable.
- *Café* forum: was a space for socializing purpose.

Results

Is inactive students participation in a small group activity different from their in whole class discussions?

Eight inactive students were identified by their participation in whole class discussions from week 1 to week 4 before entering a small group activity. Table 1 presents z-scores of the students' participation during whole class discussions to compare with their participation during their small group activity.

Looking at the participation behaviours in whole class and small group, three students belonged to Group F, two to Group A, and one to Groups C, E, and D each. It is noted that all the eight students' z-scores in whole class discussions are negative, below the class average and seven students' z-scores in small groups are also negative, i.e., below their groups' average (Table 1). Only one student (D4f) in Group D shows a big improvement during small group activity (see Figure 1). The student was the least active participant during whole class discussions, but became much more active (above average of the z-score) in her small group participation. Another student (C3m) who was the second least active participant also showed some improvement in his small group. The rest of the students revealed similar levels of participation during their small group activity. F2m became even less participative in his small group activity than whole class discussions.

Table 1: Inactive students' participation in whole class discussion and their participation in a small group activity (z-scores)

*Student ID	Whole class	Small group
E2f	-0.51	-0.41
A2f	-0.6	-0.75
F2m	-0.66	-1.09
A1m	-0.83	-0.89
F4f	-0.84	-0.82
F3m	-0.9	-0.78

C3m	-1.24	-0.51
D4f	-1.31	0.31

* Student ID: E2f represents a female member of Group E.

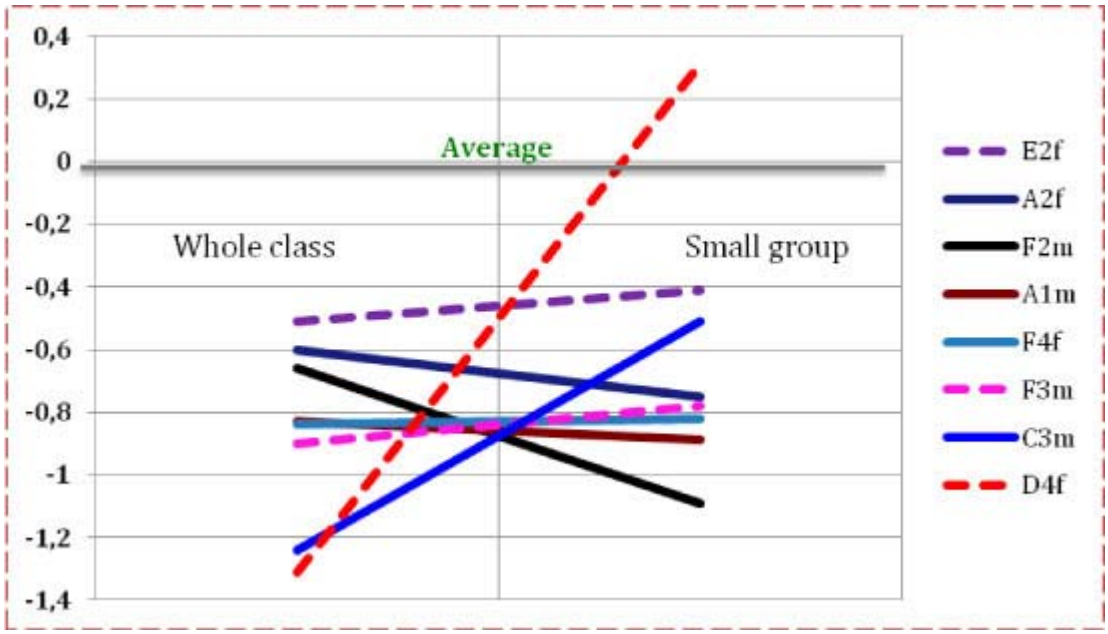

Figure 1. Inactive students' participation in whole class and small groups

Which participation behaviours in whole class activities are related to participation in a small group?

Correlation analysis on individual students' participation in small group was performed to examine the association with their own participation variables during initial period of whole class activities and other members' participation during small group activity (Table 2). Overall, individuals' small group participation was significantly correlated with their own participation in whole class activity ($r = .53$, $p < .01$). This means that more active students during the initial period of whole class activities actively participated in small group project as well. Main forum participation, in particular, revealed very high correlation to the small group participation ($r = .62$, $p < 0.1$). The Main forum was for seeking/providing help by asking/answering questions. Participation in the Main forum was 'voluntary' while posting messages in Units 1 and 2 were required. This result can be interpreted that more voluntary participants are more communicative in small group setting. Interestingly, participation in Unit 2 topic discussion was not significantly correlated with small group participation ($r = .37$, $p>.05$).

The individuals' communication network variables, i.e., ego net size and ego net ties, showed positive correlations with small group participation ($r = .34$, $r = .40$, respectively), but the associations were not statistically significant. In terms of posing habits, posting times (earlier or later postings) in the Bio and Unit 2 reveal negative correlations ($r = -.30$, $r = .07$, respectively). The negative values indicate that earlier posters participated more actively (more amount of communication) in small groups. However, the correlations are not statistically significant, either.

Table 2: Variables associated with individuals' participation in small group activity

Variables	Correlation (r)
Participation in Whole Class (weeks 1-4)	
Overall Whole Class	.53**
Unit 1 Bio forum	.57**
Unit 2 Topic discussion forum	.37
Main forum (General Q & A)	.62**

Cafe forum (Social space)	.48*
Posting time in Whole Class (weeks 1-4)	
Bio Posting Day	-.30
Unit 2 First Posting Day	-.07
Communication network in Whole Class (weeks 1-4)	
Ego Net Size: Size of direct connections	.34
Ego Net Ties: Number of connections	.40*
Other members' participation in Small Group (weeks 5-8)	
Other Members' Participation in small groups	.64**

*p<.05, **p<.01

Other group members' participation during small group activity was a significant variable related to individual members' participation ($r = .67$, $p < .01$). This means that a member's participation was strongly associated with his/her group members' participation: A student would be more communicative when he/she was grouped with active participants. This implies importance of member allocation by mixing students in consideration of their participation behaviour.

How much portion of small group participation is explained by individual's participation in whole class discussions?

Stepwise regression analysis was used to investigate how much of individuals' small group participation is explained by their early participation behaviour in whole class and by their group members' participation during small group activity (Table 3). The result shows that 66.6 % of small group participations was explained by other members' participation (OMP) and own participation in Main forum. OMP and variables in whole class activities together explained 61.3 % of individuals' small group participation. It can be interpreted that about two-thirds of individuals' small group participation would be determined by other members' participation in a small group and own participation in initial whole class activity.

Table 3: Regression on small group participation

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
OMP & Main	.816	.666	.634	209.057	.261	16.378	1	21	.001
OMP & Bio	.772	.596	.557	329.332	.191	9.920	1	21	.005
OMP & Overall WCD	.783	.613	.576	301.043	.208	11.280	1	21	.003

Note: OMP (Other Members' Participation in small groups)
Main: amount of words posted in Main forum;
Bio: amount of words sent in Bio forum for self- introduction;
Overall WCD (whole class discussions): amount of words during weeks 1-4 posted in whole class forums

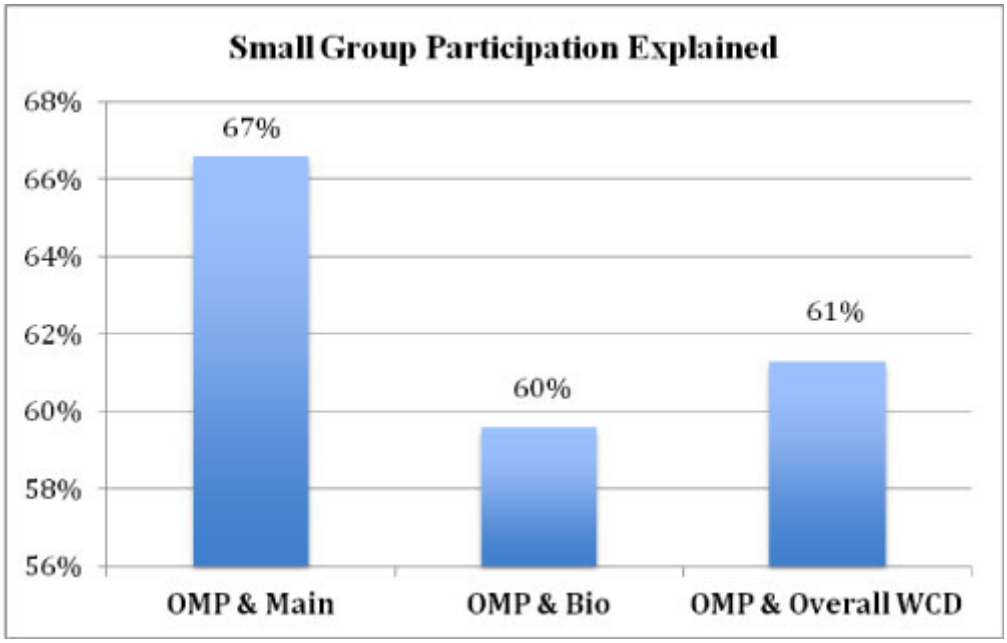

Figure 2. Small group participation explained by group members' participation and self-participation

When regressions were performed with single variables, other members' participation was the most significant variable explaining about 40 % of individuals' participation in small groups (Table 4). Again, this result leads to the assertion stressing the importance of group members' influence during small group collaboration.

Table 4: Regression on small group participation by a single variable

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
OMP	.636	.405	.378	575.958	.405	14.970	1	22	.001
Main	.616	.379	.351	609.487	.379	13.446	1	22	.001
Bio	.575	.330	.300	672.098	.330	10.841	1	22	.003
Overall WCD	.528	.278	.246	735.370	.278	8.490	1	22	.008

Note: OMP (Other Members' Participation in small groups)
Main: amount of words posted in Main forum;
Bio: amount of words sent in Bio forum for self- introduction;
Overall WCD (whole class discussions): amount of words during weeks 1-4 posted in whole class forums

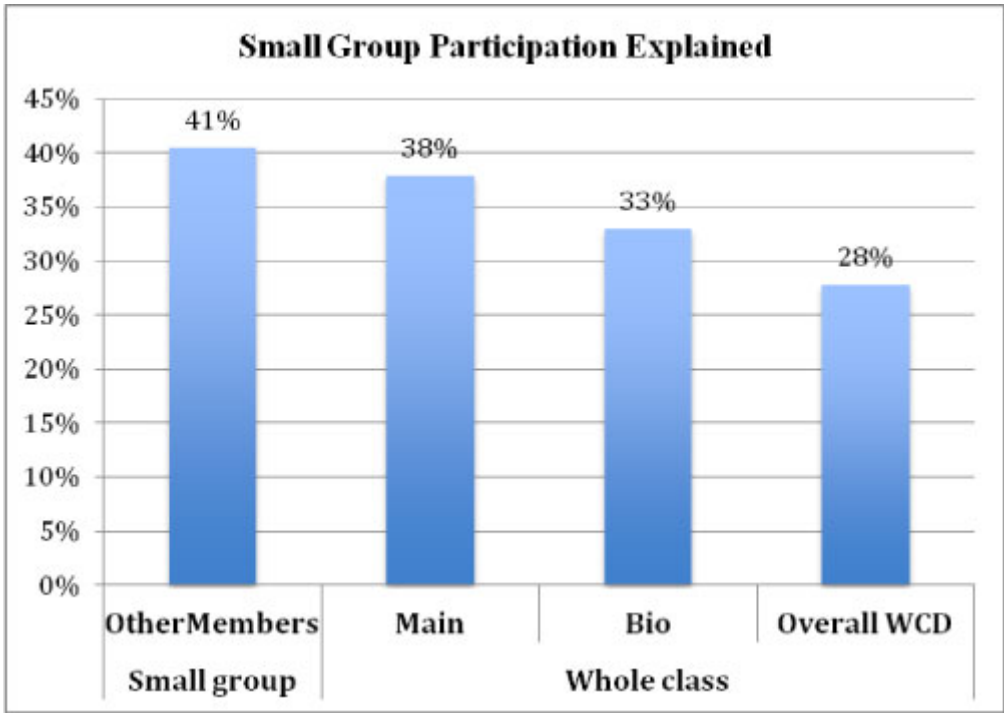

Figure 3. Small group participation explained by single variable

Conclusion & Discussion

The purpose of the research was to investigate students' participation behaviour across collaborative learning activities of an online course and to determine if there is any relationship between whole class and small group behaviour. The purpose of the study was to develop evidence-based instructional strategies for forming small groups where members actively interact to accomplish collaborative task. In order to achieve the aim, we developed research questions based on assumptions:

1. Inactive participants in whole class discussion would remain quiet in a small group if they were grouped with inactive members. On the other hand, a lurker/witness learner would tend to be more participative when grouped with more active participants.
2. Individual participation behaviour in whole class activity (e.g., posting habits, communication relationships) may be associated closely with their participation in later small group activity.
3. Individual participation in small group activity may be influenced by their group members' participation.

For the research question1, we reported that the inactive participants during whole class discussions mostly remained quiet or even quieter during their small group activity. Only one student revealed above average participation in a small group and another student made some improved participation in his group. We found that these students were not grouped with any other inactive students in the same group while the other inactive students those who were quiet/quieter in a small group were grouped with one or more inactive members in their groups.

Not only the inactive students' participation but also the overall individual students' small group participation was significantly correlated with their own participation behaviour in whole class activity ($p<.01$). In particular, Main forum and Bio forum revealed high correlation to small group participation. Regression analysis for the question 3, we found about 70 % of an individual's participation in a small group was explained by two factors: his/her participation in quantity in whole class discussions before entering small group activity (about 30 %), and other members' participation in quantity during the small group activity (about 40 %).

The findings are consistent with findings from other research. For example, Brindley et al. (2009) reported that 'witness learners', those who never appear in module conference discussions, *almost always* actively participate in study group activities and interpreted the result to conclude "some students prefer small group interaction to interaction within larger class conferences" (p.9). They did not report whether the witness learners' active participation in small groups was actually more active than the other classmates. We also found some students showed improvement in participating in small groups but most of the inactive students were still below average compared with classmates. Jahng et al. (2010) reported some students participated more actively in small group discussions than in whole class discussions. They did not report why some did participate more but others did not. We identified the potential reasons as group members' effect and individual's own participation behaviour in whole class discussions.

The findings highlight the value of using proper grouping methods to increase participation and collaboration. We recommend an instructor-lead careful and systematic group formation process instead of self-allocation or random assignment as suggested in the literature (e.g., Buckenmyer, 2000; Felder & Brent, 1994). The students involved in this research were allowed to allocate themselves into small groups. That might result in homogeneous groups where inactive students end up in the same group resulting in these students participating even less during the small group activity. On the other hand if inactive students who were mixed with more active communicators they might become much more active in their small group.

Kozar (2009) emphasized the importance of pre-collaboration period to motivate students to participate in and understand the rules for collaboration in a small group. The findings of our research support the suggestion for scheduling a small group activity later course. This would allow the instructor time to understand students' participation behaviours so he/she could mix and match the students properly into small groups. Instructors will need to monitor/observe participation behaviour and interaction relationships among students during whole class discussions and use this information to allocate students into small groups heterogeneously. To assist the instructors, more sophisticated monitoring systems should be developed in course management system.

There are several limitations to this research that affect the generalizability of the findings. The data involved in this study are collected from a single graduate online course with 24 students. Both whole class and small group activities were designed as less structured where students were allowed maximum freedom to preside their own learning. The participation patterns and behaviours can be different if the research was conducted in a course designed to have more structured activities with hundreds of students (e.g., Thorpe, 2008). Further research is suggested in different course types and settings.

Another limitation of the research is related to interpretation of results based on correlational analyses. We are aware that correlation does not necessarily mean causation: The high correlations of participation behaviours between whole class and small group settings are not necessarily a 'cause-effect' relationship. However, a preceding variable in a time sequential settings does strongly suggest a predicting factor for a following variable.

Lastly, this was not an experimental study. In order to confirm and validate our findings, we recommend future researchers conduct experiments testing different grouping methods based on students' participation behaviours and relationships in whole class discussions in a variety of different online courses contexts.

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