The effects of instructor participation and class size on student participation in an online class discussion forum

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Abstract

Student participation in online discussion forums is associated with positive outcomes for student achievement and satisfaction, but research findings on the impact of class size and instructors’ participation on student participation have been mixed. The present study analyzed the frequency of instructor and student posts in asynchronous discussion forums in 500 online courses to examine factors contributing to student participation. Results showed significant effects of both class size and amount of instructor participation, with a significant interaction between the two. In medium class sizes (with 15–30 students), amount of instructor participation did not predict the number of posts per student, but in smaller classes, significant differences in student participation were found depending on amount of instructor participation. Implications for fostering student participation in online discussion forums and interpreting research in this area are discussed.

In online classes, discussion forums allow students to actively engage in the learning process. Discussion has been recognized as a key part of active, experiential learning (Baker, Jensen, & Kolb, 2005). Participation and peer-to-peer interaction contribute to critical thinking (Frijters, ten Dam, & Rijlaarsdam, 2008; Smith, 1977), reflection (Hara, Bonk, & Angeli, 2000), and higher-order thinking (Meyer, 2003).

Asynchronous online discussion forums have the additional benefit that student participation is not limited by time (Althaus, 1997; Meyer, 2003). Students can respond to a discussion prompt no matter how many students have already responded, and the discussion can continue as long as the students are interested in participating (Liu, 2012). There are also lower barriers to entry for individuals normally underrepresented in classroom discussions. Women (Caspi, Chajut, & Saporta, 2006; Wolfe, 2000), students with English as their second language (Rainsbury & Malcolm, 2003), and more introverted (Amichai-Hamburger, Winapel, & Fox, 2002; Caspi, Chajut, Saporta, & Beyth-Marom, 2006) or nervous (Majid, Yang, Lei, & Haoran, 2014) students may feel more comfortable communicating in an online discussion than in traditional classrooms. Students who prefer more time to formulate their thoughts also benefit from online discussions (Andersen, 2009; Majid et al., 2014).
However, simply offering students an online discussion forum is not enough to improve learning outcomes. Palmer, Holt, and Bray (2008) found that whereas reading others’ posts in the forum was not associated with academic outcomes, the number of new posts students contributed to the forums predicted their final grades, suggesting that actively engaging with the material by writing a discussion post was beneficial for their learning. Note that the content of the posts was not considered in this research; only the number of posts students contributed. A relationship between the number of posts in an online discussion forum and improvement in test scores has also been found with fifth grade language learners (Zheng & Warschauer, 2015), group projects and exam scores (Wei, Pen & Chou, 2015), and when controlling for mid-term exam scores before the discussion forum was introduced (Cheng, Paré, Collimore, & Joordens, 2011). Discussion forums with more posts perform at a significantly higher cognitive level in terms of the quality of knowledge construction (Schellens & Valcke, 2005). Given these reported benefits of active participation for students, researchers interested in increasing student engagement have examined various predictors of student participation, including instructor participation and class size.

Instructor participation
Students perceive the role of the instructor as a facilitator of discussion to be particularly important for online courses (Hung & Chou, 2015) and they find instructor-moderated discussions more appealing (Wise, Hamman & Thorson, 2006). However, the evidence concerning the impact of instructor participation on student engagement in discussions has been mixed. Whereas some studies have found a positive relationship between the number of instructor posts and student posts (Jiang & Ting, 2000), others have found no relationship (Mazzolini & Maddison, 2003). Some studies have even reported a negative effect of instructor presence in online discussions. Using an experimental design that varied whether instructors posted in a discussion in a blended classroom, Murphy and Fortner (2014) found that students posted

Practitioner Notes
What is already known about this topic:
• Active student participation in online discussion forums is important for student learning.
• Past research has returned conflicting results for the impact of instructor participation on student participation.
• Instructors fear hampering discussion with their participation.
What this paper adds:
• Class size is found to be a moderator of the relationship between instructor and student participation.
• In small classes (less than 15 students), instructor participation increases student participation.
• In medium classes (15–30), instructor participation does not impact student participation.
• Class size explains conflicting findings in past research about instructor participation.
Implications for practice and/or policy:
• Medium sized discussion forums are most engaging for students.
• Greater instructor participation does not reduce student participation at any level.
• Instructors’ participation is particularly needed in small classes to foster discussion.
significantly more when instructors did not participate at all, suggesting a negative effect of instructor participation in the online portion of this course. Park et al. (2015) compared the number of student posts when the teacher was part of the discussion or not. Eleven out of the 15 students posted less when the instructor was present, again signaling a negative effect of instructor presence in asynchronous discussions in terms of the number of student posts.

Accordingly, prescriptions for instructors differ widely (Jinhong & Gilson, 2014; Meyers & Jones, 1993). Some suggest a moderate level of participation by instructors is important (Dennen, 2005), with the argument that “too much” participation by the instructor can reduce student participation (Andresen, 2009; Palloff & Pratt, 2011). The suggestion that instructors’ posts reduce the number of student posts (Mazzolini & Maddison, 2007) can leave instructors fearful of squashing discussion with their participation (Seaton & Schwier, 2014).

Class size

Another factor that may contribute to student participation in online discussions is class size. “Large” classes (greater than 34 students according to established categories that define “small” as less than 15 and medium as 15–34; Benton, Li, Brown, Guo, & Sullivan, 2015; Hoyt & Lee, 2002) lead to less participation than medium (Kim, 2013) or small-sized groups (Shaw, 2013), but the ideal class size within the small-to-medium range has been debated. On the one hand, larger groups allow for more interactions between students and more potential points to discuss (Caspi, Gorsky, & Chajut, 2003). Class size was positively associated with the number of posts displaying higher-level knowledge in small groups ranging from 2 to 10 (Hew & Cheung, 2011). Orellana (2006) reported that faculty members with less than 15 students in an online class believed more students were needed to achieve the optimal level of interaction, and students in Vrasidas and McIsaac’s (1999) case study felt four participants were insufficient for an asynchronous discussion. On the other hand, larger online discussions may lead to “information overload” (Jones, Ravid, & Rafaeli, 2004), a reduction in instructor-student interaction (Caspi et al., 2003), or a mirroring of psychological barriers to participation in traditional classes (e.g., shyness; Hyde & Ruth, 2002). Some argue that larger classes decrease the quality of instructor feedback resulting in an overall decrease in course quality (Sorensen, 2015). Conflicting with the above recommendations for larger groups, classes of 8–10 students have been recommended to maximize group interaction (Schellens, Van Keer, Valcke, & De Wever, 2007).

Research questions

Based on these conflicting findings in the literature concerning the impact of instructor presence and class size on student participation, the following questions were examined at the class level with discussion forum participation data for 500 online courses:

1. Does instructor participation predict student participation?
2. Does class size predict student participation?
3. Is the effect of instructor participation moderated by class size?

Method

Class-level data from 500 online courses, containing a total of 7,477 students, was compiled between January and December 2014 from the university-wide Learning Management System of a single university in the Southwestern United States. The total sample included 250 undergraduate courses and 250 graduate courses (189 master level, 61 doctoral), which ranged from four to eight weeks in length. Courses included education, business, social sciences, nursing, language, and mathematics, among others. Class sizes ranged from 2 to 30 students, with a median of 15 students per class (Mean = 14.89, SD = 6.49), which corresponds with the established cutoff between “small” and “medium” class sizes in the literature (Benton et al., 2015; Hoyt & Lee,
The dataset included weekly discussion forum participation frequency, including 414,645 student posts and 59,386 instructor posts. Discussion participation was mandatory and contributed to a weekly participation grade. All online courses were provided with two discussion forum questions each week, which corresponded to weekly learning objectives. The weekly count of instructor and student posts, but not the content, was recorded by the Learning Management System.

The per student measure of participation in the discussion forum ($M = 7.76, SD = 1.90$) was calculated by dividing the average number of weekly posts by the number of students in the class. Weekly instructor participation was calculated for classes ranging from four to eight weeks ($M = 16.67, SD = 9.50$) by dividing the number of posts by the number of weeks of the course. Instructor participation was highly skewed (excess kurtosis = 2.53) so classes with instructors whose participation was greater than two SDs from the mean ($N = 25$) were excluded from the regression analysis and ANOVA and examined separately as an “extremely high instructor participation” group. The remaining sample contained 475 classes with 6,954 students.

Results

Instructor participation and class size as continuous variables

To examine the first research question, we first regressed weekly participation per student on instructor participation. As expected, instructor participation predicted student participation ($\beta = .34, p < .001; f^2 = .12$). Addressing our second research question, class size also positively predicted student participation ($\beta = .28, p < .001; f^2 = .09$). As predicted, the effect of instructor participation on student participation was significantly moderated by class size ($\beta = -.18, p < .001, f^2 = .22$). This negative interaction term means that as class size increased, the impact of instructor participation on student participation decreased. See Figure 1. These two variables and their interaction explained 18% of the variance in student participation.

The critical interaction between instructor participation and class size was found in both undergraduate classes ($\beta = -.19, p = .003$) and graduate classes ($\beta = -.13, p = .026$), analyzed in separate regressions with each predictor variable centered within program. See Table 1. Including course length (number of weeks) as a covariate in these models did not affect the significance of the interaction for either undergraduate ($\beta = -.21, p = .003$) or graduate classes ($\beta = -.15, p = .019$). Thus, the impact of instructor participation on student participation decreased as class size increased, and the strength of this moderation was not affected by undergraduate versus graduate course level or course length.

Categorical comparisons

To examine this significant interaction between instructor participation and class size using recognizable categories, an Analysis of Variance (ANOVA) was conducted on instructor participation below or above the mean ($M = 15.25, SD = 7.23$; low vs. high instructor participation), and classroom size below or above 15 students ($M = 14.64, SD = 6.49$; small vs. medium class size; Benton et al., 2015). This second analysis using binary categories allows a clear picture of the effect of instructor participation in small and medium sized classes. In response to the first two research questions, significant main effects were found for both instructor participation, $F(1, 471) = 22.01, p < .001, \eta^2 = .045$, and class size, $F(1, 471) = 14.47, p < .001, \eta^2 = .030$, showing that students participated more in classes with above-average instructor participation and 15 or more students. These main effects were moderated by a significant interaction, $F(1, 471) = 10.96, p = .001, \eta^2 = .023$. In small class sizes, there were significant differences in student participation depending on level of instructor participation (high instructor participation: $M = 8.14, SD = 1.64$ vs. low instructor participation: $M = 6.78, SD = 2.09$), $t(225) = 5.14, p < .001, d = .72$. However, in medium class sizes student participation did not differ based on
instructor participation (high instructor participation: $M = 8.22, SD = 1.43$ vs. low instructor participation: $M = 7.99, SD = 1.99$), $t(246) = 1.08, p = .28$. Planned contrasts showed that participation per student in small class sizes with high instructor participation did not differ from the medium class size groups, $t(331) = .14, p = .89$. Student participation in the small class sizes with low instructor participation was significantly lower than the other three, $t(471) = 7.31, p < .001$. See Table 2.

**Extremely high instructor participation**
A regression analysis was then conducted on the small subsample of classes excluded from the earlier analyses because of extremely high instructor participation ($N = 25$). Within these classes, there was no relationship between the number of instructor posts and average student participation ($\beta = -.03, p > .92$). The effect of class size ($\beta = -.15, p > .58$) and the interaction between class size and instructor participation ($\beta = -.23, p > .39$) were also not significant, although the small number of classes in this sample reduced our power. Students in these classes showed a universally high level of weekly participation ($M = 8.46, SD = 1.60$) as compared to the rest of the sample ($M = 7.73, SD = 1.91$). These findings suggest that after a certain point, instructor participation does not impact student participation.

**Discussion**
The present study aimed to reconcile conflicting findings about the impact of instructor participation and class size on student participation using a diverse sample of 500 online courses. With the average post per student per week as the criterion variable, the number of posts by the instructor significantly predicted student participation. Class size also significantly predicted student participation, with larger class sizes associated with more posts per student. Most importantly, we found a significant interaction, in which the impact of instructor participation on student participation decreased as class size increased. To illustrate the implications of this interaction, we then conducted an analysis with meaningful categorical variables. In small
classes (<15), students posted more in classes with high-participating instructors. Students in online classrooms with these above-average instructors participated as much as students in medium-sized classes. However, in medium-sized classes (15-30 students), per student participation remained high regardless of instructor participation. The present study thus replicates and explains seemingly conflicting findings in past research and provides actionable data for instructors, administrators, and policymakers determining ideal class sizes for students and guidelines for instructor engagement in online discussion forums.

**Implications for research**

Taking class size into account can help reconcile conflicting findings in the literature about the relationship between instructor and student participation. Mazzolini and Maddison (2003), who found no effect of instructor participation, reported an instructor to student ratio of approximately 30:1. For these medium class sizes, instructor participation was also nonsignificant in the present study. Murphy and Fortner (2014) and Park et al. (2015), who each found a negative effect of instructor presence on student postings, also had medium class sizes (18-20 students in Murphy & Fortner, 2014; 15 students in Park et al., 2015). On the other hand, the classes analyzed by Jiang and Ting (2000), who found a positive effect of instructor participation on student participation, averaged less than 11 students per class. We also found a significant positive effect of

**Table 1: Multiple linear regression of student participation on instructor participation, class size, and their interaction, both overall and within undergraduate and graduate courses**

<table>
<thead>
<tr>
<th>Sample</th>
<th>N</th>
<th>R²</th>
<th>Predictor</th>
<th>B</th>
<th>SE(B)</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td>All classes</td>
<td>475</td>
<td>.18</td>
<td>Instructor participation</td>
<td>.076</td>
<td>.012</td>
<td>.287***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Class size</td>
<td>.048</td>
<td>.013</td>
<td>.163***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Participation x size</td>
<td>-0.008</td>
<td>.002</td>
<td>-1.181***</td>
</tr>
<tr>
<td>Undergraduate</td>
<td>236</td>
<td>.07</td>
<td>Instructor participation</td>
<td>.034</td>
<td>.015</td>
<td>.143*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Class size</td>
<td>.018</td>
<td>.017</td>
<td>.068</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Participation x size</td>
<td>-0.008</td>
<td>.003</td>
<td>-0.193**</td>
</tr>
<tr>
<td>Graduate</td>
<td>239</td>
<td>.20</td>
<td>Instructor participation</td>
<td>.110</td>
<td>.015</td>
<td>.469***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Class size</td>
<td>-0.013</td>
<td>.019</td>
<td>-0.044</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Participation x size</td>
<td>-0.005</td>
<td>.002</td>
<td>-0.134*</td>
</tr>
</tbody>
</table>

Note: Instructor participation and class size centered within each sample.
*p < .05, **p < .005, ***p < .001.

**Table 2: The effect of instructor participation (below or above the mean) on student participation in small and medium classes measured in posts per student per week**

<table>
<thead>
<tr>
<th>Class size</th>
<th>Low participating instructors</th>
<th>High participating instructors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>M</td>
</tr>
<tr>
<td>Small (&lt;15)</td>
<td>141</td>
<td>6.78ab</td>
</tr>
<tr>
<td>Medium (15–30)</td>
<td>108</td>
<td>7.99b</td>
</tr>
</tbody>
</table>

*a(t(225)) = 5.14, p < .001, d = .72.
*b(t(247)) = 4.63, p < .001, d = .59.
instructor participation in classes with less than 15 participants. Thus, these past studies provide additional support for the idea that class size is an important moderator in the relationship between instructor and student participation, explaining both conflicting findings in the published literature and variability in student participation across classes. The implication of this study is that the impact of instructor participation on student discussion depends on the size of the class.

Implications for administrators and instructors
The present findings have important implications for determining the ideal size for an online asynchronous discussion forum. In contrast to the idea that smaller classes are better for discussion, we found the number of students in a class had a significant positive relationship with the number of posts per student. We suggest the greater number of students in the online discussion provides more opportunities for students to jump in to the discussion, in the form of responses to other students’ questions and reactions to peers’ posts (Caspi et al., 2003), providing more active learner-centered ways for students to engage and learn through peer-to-peer discussion (Andresen, 2009). Importantly, the present study shows that the negative impact of small class sizes on student participation can be remedied by instructors who are more active in the discussion. We found no differences in the per student participation of students in small classes when their instructor showed a high level of participation compared to medium-sized classes.

The present findings also have important implications for instructors of online classes. According to Seaton and Schwier (2014), a common concern among instructors is that their comments might inhibit students’ ongoing discussion. Instead, this data suggests that instructors’ participation positively predicts student participation, particularly in small classes where students may be struggling to find relevant points to discuss. We found no evidence for the assertion that “too much” participation can hamper discussion; even at the most extreme, the number of instructor posts did not reduce student participation. It is possible that students are interacting more with the instructor than with each other (Dennen, 2005), but it is not clear this would be negative as interaction with the instructor is a significant contributor to perceived learning (Fredericksen, Pickett, Shea, Pelz, & Swan, 2000).

Our data can also be used to address the question of faculty workload for online courses (Artz, 2011; DiBiase, 2000), a subject that researchers have argued has been affected by subjective bias, misconceptions, and wide variability in estimates (DiBiase, 2004; Mupinga & Maughan, 2008; Sieber, 2005). The present research suggests that more instructor participation is necessary in smaller classes to achieve equivalent levels of student engagement; thus, within discussion forums the faculty workload per student increases in smaller courses.

Limitations and future directions
This study looked at online classes offered by a single university in the southwestern United States with graded online discussion participation. Different universities have different posting requirements (e.g., voluntary discussion forums, Caspi et al., 2003) and norms surrounding participation. However, by including a wide range of online courses, the current findings have much more generalizability than often found in published research examining a single online course or program.

A second limitation of the present study is that the content of the discussion posts, both for the instructors and the students, were unavailable. What types of instructor posts most impacted student participation? Instructor posts that include course-related self-disclosure and humor, for example, may increase students’ engagement with the course (Imlawi, Gregg, & Karimi, 2015). Although some have argued the quality of instructors’ posts can be more important than the quantity (Arend, 2009; Clarke & Bartholomew, 2014), student participation, in terms of quantity, has been shown to be associated with student learning, as measured by final grades (Cheng...
et al., 2011; Palmer et al., 2008; Wei et al., 2015; Zheng & Warschauer, 2015) and cognitive level (Schellens & Valcke, 2005). Future research could examine whether high quality posts by students (eg, on-task, Schellens & Valcke, 2006 or cognitively deep, Hara et al., 2000) also follow this interaction, or whether increases in the number of posts students contribute is unrelated to quality.

Finally, the direction of causation cannot be determined from the present data. We find a strong positive relationship between instructor and student participation, which could reflect an influence of the instructors on students, or the influence of students on instructors. Similarly, we can only propose mechanisms, to be explored with future research, to explain why this relationship is reduced as class size increases. We suggest that less instructor guidance and input is required by medium-sized discussion groups, who are able to operate more independently (eg, providing new directions for discussion, asking questions; Caspi et al., 2003); future research could examine the content of student posts in small- and medium-sized classes to test this idea.

Conclusion
The present study examined participation data from the discussion forums of 500 online courses. Instructor participation and class size both significantly predicted weekly per student participation. Most critically, the present study introduced class size as an important moderator of the relationship between instructor and student participation in asynchronous online discussion forums. Considering class size can help reconcile conflicting findings in the literature about the impact of teacher participation on student participation, inform institutions’ and accrediting agencies’ decision-making about optimal class size, and provide instructors with guidance about when their participation is most necessary to encourage active learning in online discussions.

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Statements on open data, ethics and conflict of interest
The present data were obtained in an anonymous format after completing a site authorization request and following the approval of the Grand Canyon University Institutional Review Board. The authors have no conflict of interest.

References

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