All It Takes Is One: Evidence for a Strategy for Seeding Large Scale Peer Learning Interactions

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Abstract
The results of a study of online peer learning suggests that it may be advantageous to automatically assign students to small peer learning groups based on how many students initially get answers to questions correct.

ACM Classification Keywords
H.5.m [Information interfaces and presentation (HCI)]: Miscellaneous.

Introduction
We investigated [1] how to introduce synchronous interactive peer learning into an online setting appropriate for students in massive online courses. Motivated by the literature of peer learning [4, 6, 2, 5, 3] and by a goal of making the experience of online learning more social, we conducted studies in which groups of three participants are formed and answer multiple choice questions via synchronous discussions. In those studies, participants first answered a multiple choice question on their own and then saw the answers proposed by the others in the group. They were then encouraged to discuss the answers and try to help each other figure out the correct answer. They each had an opportunity to revise their response based on the discussion. Questions were selected from a set of 20 GMAT practice questions on critical reasoning.

This paper provides a more detailed analysis of the group breakdown than described in [1]. In particular, we found that more participants will change from an incorrect to a correct response if *at least one* participant in the group initially makes a correct response than if there is no such initially correct response. (Fishers test, $p < 0.05$). Figure 1 illustrates the data in detail. For the 21 peer learning chat groups in which one person started with the correct answer, in only 4 cases did the group degenerate into fewer correct answers by the end of the exercise, and in 12 cases the scores improved. Similarly, for the 26 chat groups in which two participants began with the correct answer, in only 3 cases did the results get worse, and in 12 cases the results improved with the third participant moving to the correct answer.

Num initial choice correct	Num Final Choice Correct			
	0	1	2	3
0	10	1	1	
1	4	5	5	7
2	2	1	11	12
3			1	13

Figure 1: Number of correct answers to a multiple choice question in a group of three participants before and after a discussion takes place. Red signifies a decrease in the number correct, green an increase in the number correct, and the neutral color signifies no change in the number correct after the discussion takes place.

Another interesting observation from this data is that when everyone in the group started with the correct answer, the group as a whole was very unlikely to move away from that correct answer. However, the converse was also true: if no one in the group had the correct answer, then the group was very likely to stay in that state of everyone remaining wrong.

A New Strategy For Assigning Peer Learning Groups

This observation suggests intriguing new strategies for large scale online learning that are not feasible in in-person classrooms or in small-scale online learning environments.

One idea is to develop a software platform that first serves a question to a set of students, and after determining their initial answers, automatically groups the students with others based on what has been determined in advance to lead to a pedagogically fruitful conversation. This can cascade still further: if a student gets the answer wrong a second time, that student could be given a hint as to why their choice is wrong, and grouped again with other students who had a similar misconception. Thus another option is to experiment whether certain prompts or hints will further improve the performance of the groups.

In our study there was no evidence that more participants will improve from an incorrect to a correct response if two students are correct, rather than only one (Fisher's test, $p > 0.5$). The parameters of how to group students may vary depending on the kind of material being learned and question being asked. Further study may show empirically that certain types of problems work better when only one of several students is well-informed, whereas for other kinds of problems it may be best to have a majority of knowledgable students.

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References

[1] Coetzee, D., Lim, S., Fox, A., Hartmann, B., and Hearst, M. A. Structuring interactions for large-scale synchronous peer learning. In *CSCW: ACM Conference on Computer Supported Collaborative Work* (2015).

[2] Crouch, C. H., and Mazur, E. Peer instruction: Ten years of experience and results. *American Journal of Physics 69*, 9 (2001), 970–977.

[3] Deslauriers, L., Schelew, E., and Wieman, C. Improved learning in a large-enrollment physics class. *Science 332*, 6031 (2011), 862–864.

[4] Millis, B. *Cooperative Learning in Higher Education: Across the Disciplines, Across the Academy*. Stylus Publishing, LLC., 2012.

[5] Smith, M. K., Wood, W. B., Adams, W. K., Wieman, C., Knight, J. K., Guild, N., and Su, T. T. Why peer discussion improves student performance on in-class concept questions. *Science 323*, 5910 (2009), 122–124.

[6] Springer, L., Stanne, M. E., and Donovan, S. S. Effects of small-group learning on undergraduates in science, mathematics, engineering, and technology: A meta-analysis. *Review of Educational Research 69*, 1 (1999), 21–51.