Journal of the Scholarship of Teaching and Learning, Vol. 11, No. 1, January 2011, pp. 53 – 61.

Is active learning like broccoli? Student perceptions of active learning in large lecture classes

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Abstract: Although research suggests that active learning is associated with positive outcomes (e.g., memory, test performance), use of such techniques can be difficult to implement in large lecture-based classes. In the current study, 1,091 students completed out-of-class group exercises to complement course material in an Introductory Psychology class. Students were assigned either active learning or content review activities. Students in the active learning condition reported greater retention of and engagement with the course material but not greater enjoyment when compared to students in the content review condition. The importance of choosing pedagogical methods that promote the construction of knowledge rather than just behavioral activity is discussed.

Keywords: active learning, student perceptions, instructional techniques, large lecture

I. Introduction.

The lecture is a traditional approach to learning and instruction found across academic levels and disciplines. It is an efficient means of transferring knowledge from instructor to student, especially given institutional pressures for large classroom environments. However, instructors have begun to question the effectiveness of this approach:

> ….we want to teach our students as much as possible in the limited amount of time we've been given. So we in effect load our pedagogical dump truck as full as we can, back it up to the classroom, and unload it onto our students, burying them in teaching…When we use the dump truck method, we overwhelm our students with more skills and strategies than they can possibly absorb in an hour. That's our first mistake. Then we fail to give students the opportunity to practice any of the strategies and skills, virtually guaranteeing that they won't be internalized. (Gremmels, 1995, p. 89)

Gremmels's metaphor cleverly captures the drawbacks of what is often seen in classrooms. Although constraints such as large class sizes and theatre-style classrooms can prohibit the use of newer pedagogical methods, ways of combining active learning with the traditional lecture should be explored.

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A. What is active learning?

Active learning is generally defined as any instructional method that engages students in the learning process (Prince, 2004). In contrast to "passive-learning" methods where the responsibility of instruction falls on the teacher, active learning is a student-centered inductive learning process. It engages students by requiring them to *do* meaningful activities and *think* about what they are doing (Bonwell and Eison, 1991). Thus, active learning does not involve just doing activities; there must be opportunity for students to reflect, evaluate, analyze, synthesize, and communicate on or about information (Fink, 2003). Research suggests that active learning leads to a variety of positive outcomes including better student attitudes (Bleske-Rechek, 2002), greater motivation (Waston, Kessler, Kalla, Kam, and Ueki, 1996), improvements in students' thinking and writing (Bonwell and Eison), memory for information taught (Cherney, 2008), and improved exam performance (Yoder and Hochevar, 2005).

B. The pitfalls of lectures and large class sizes.

Even though active learning is associated with positive outcomes, lectures should not be abandoned, given their potential to organize material and present information unavailable elsewhere (Nasmith and Steinert, 2001). However, lectures reinforce students' roles as passive learners and depersonalize students' experiences. Further, even though large lectures are the typical format for Introductory Psychology courses, many students do not have established memory structures on which to encode and build course material (Cherney, 2008). This, combined with exam formats that reinforce memorization, can thwart conceptual learning.

Incorporating active learning methods into lectures may address these limitations by engaging students with course content. Bleske-Rechek (2002) designed an in-class small-group activity to demonstrate obedience, conformity, and social roles in a real-life context in her 65-student introductory psychology class; students reported preferring the activity to a lecture. However, instructors at other universities may be faced with obstacles related to much larger class sizes and auditoriums of tiered seating (Michael, 2007). One alternative is assigning active learning activities that occur outside of class time and dividing students into groups, addressing complaints that large lectures are impersonal and intimidating (Barbour, 1989). This is consistent with the physical sciences that connect lecture with active learning in the laboratory. For example, students in an introductory physics class worked in groups outside of class on tutorials to help build qualitative reasoning on a fundamental concept (Redish, Saul, and Steinberg, 1997).

II. The current study.

To capitalize on the strengths of both teaching strategies while working within the pressures and constraints of higher education, the current study assigned group exercises to reinforce content taught in large Introductory Psychology lectures. Half of the students completed "active learning" exercises and half completed "content review" exercises similar to those found in a textbook study guide, selected because many students perceive study guides as helpful (Dickson, Miller and Devoley, 2005). We hypothesized that students in the active learning condition would 1) report greater retention of course material, 2) report more engagement with course material, and 3) have more positive attitudes about the course. Even though a limitation of the current study is the use of self-report, research has shown that students can report accurately on their

own learning (Chesebro and McCroskey, 2000), and that their perceptions can influence learning outcomes (Lizzo, Wilson, and Simons, 2002).

A. Sample.

Participants were 1,091students enrolled in one of four large Introductory Psychology classes at a large state university. The sample was comprised of 423 males and 640 females (28 students did not provide this information). The classes were predominantly freshman (71.3%). Two faculty members (the authors of this paper) each taught two classes. Both faculty members had previously taught Introductory Psychology.

C. Measures.

All participants completed an anonymous end-of-the-semester survey immediately following their final exam. All items were rated on a 5-point scale (1 = *strongly disagree*; 5 = *strongly agree*) except where noted below.

Retention. Self-report of general retention was measured with three questions: "The group activities helped me better remember class material;" "I gained a better understanding of class material after completing group activities;" "The group activities were a good way to learn about the specific topics." A composite measure of general retention was created by averaging all three items (α = 0.88). Self-report of retention for the topic of each group activity was measured with a single item using the stem, "The group activities increased and/or clarified my knowledge about [topic]."

Engagement. Self-report of engagement with course material was measured with three questions: "The group activities helped me to think about what I was learning in a different way;" "The group activities stimulated my interest in psychology;" "The group activities challenged me intellectually." A composite measure of general engagement was created by averaging the three items (α = 0.80).

Course Attitudes. Enjoyment of the class was measured with a single question that asked students to rate their agreement with the statement, "I enjoyed this class." Overall evaluation of the course was rated on a 5-point scale (1 = *poor*; 5 = *excellent*) with one statement: "The course, on the whole, was…" To aid in interpretation, this item was reverse-scored such that higher scores indicate a more positive evaluation of the course.

C. Procedure.

Each instructor taught one active learning condition class and one content review condition class which were scheduled back-to-back, and the order of class condition was counterbalanced. There were 541 students in the content review condition (CRC) and 550 students in the active learning condition (ALC); there were no significant differences in sex or class year.

Students within the same class were randomly assigned to groups of 6 and were required to purchase a manual containing instructions for each activity. Nine group activities were created by the authors for both conditions. CRC activities were designed to be engaging but passive (e.g., crossword puzzles and word scrambles of key terms, true-false games). ALC activities were designed to have students discover and apply the information themselves. For example, in the sensation and perception activity, students created different sugar-water solutions to test

absolute thresholds and just noticeable differences in taste. In the emotion activity, students were given specific instructions on how to pose their faces to demonstrate particular emotions and evaluated how good people are at identifying so-called "universal emotions." Students completed the activities in their assigned groups outside of class, and activities were due one week after the material was covered in class. Refer to Appendix 1 for details about these exercises.

III. Results.

A series of factorial ANOVAs were conducted to test the hypotheses that students in the active learning condition, compared to the content review condition would report greater retention of (Hypothesis 1) and engagement with (Hypothesis 2) course material. In addition to activity type, instructor and participant sex were entered as fixed factors in each analysis to control for differences (i.e., research has found sex differences in preferences for group work, Honigsfeld and Dunn, 2003). (Because the proposed hypotheses were not related to the variables of instructor or sex of the student, main effects for these variables and interactions between these two variables are not discussed below unless they interact with the type of group activity.) No significant interactions between type of group activity and either instructor or participant sex were found. In addition, the three-way interaction was not significant. Concerning Hypothesis 1, participants assigned to the ALC reported greater overall retention (M = 2.96, SD = 0.97) compared to the CRC (M = 2.78, SD = 0.95), F (1, 1050) = 6.60, p = 0.01, d = 0.19. Evaluation of students' retention of the specific topics revealed that for seven of the activities, participants in the ALC reported greater retention. Table 1 summarizes these results. For Hypothesis 2, a significant main effect was found for engagement with the material, F (1, 969) = 33.05, p <0.001, d = 0.37, with the ALC showing greater engagement (M = 2.85, SD = 0.86) compared to the CRC (M = 2.53, SD = 0.85).

Regarding Hypothesis 3, a second set of factorial ANOVAs were conducted to determine if participants who completed active learning group activities enjoyed the class more and held a more positive evaluation of the course. As with the earlier analyses, instructor and sex of participant were added to the model but there were no significant interactions with class type. A significant main effect was found for enjoyment of the class (F (1, 1053) = 13.79, $p < 0.001$, d = 0.22); however, it was the CRC (M = 3.60, SD = 1.04) that showed more enjoyment of the class compared to the ALC (M = 3.37, SD = 1.05). A significant main effect in the same direction was also found for overall evaluation of the course (F (1, 1055) = 13.81, $p < 0.001$, d = 0.20), with CRC participants (M = 3.30, SD = 0.96) showing a more positive overall evaluation toward the course compared to ALC (M = 3.11, SD = 0.98).

A final set of analyses was conducted to determine if participants' perceptions of greater retention and engagement with the material were predictive of more positive attitudes toward the class. Retention, engagement, and activity type (contrast coded with ALC coded as 1, and CRC coded as -1) were regressed on enjoyment and evaluation of the class. Only engagement (β = 0.29, t = 6.09, $p < 0.001$) and activity type (β = -0.16, t = -5.19, $p < 0.001$) predicted increased enjoyment of the class. Similar results were also found in the prediction of overall class evaluation (engagement:β = 0.23, t = 4.65, $p < 0.001$; activity type:β = -.14, t = -4.54, $p < 0.001$).

Table 1. Retention of material for each course topic.

	Active Learning		Content Review			
Topic	*M*	*SD*	*M*	*SD*	*F*	*d*
Research Methods	2.97	0.97	2.74	0.99	10.64***	0.23
Brain & Behavior	3.09	1.02	3.15	1.01	0.63	
Sensation & Perception	3.03	0.96	2.87	1.01	6.26**	0.06
Learning	3.14	1.00	3.07	1.02	1.35	
Memory	3.32	1.04	2.98	1.00	25.43***	0.33
Intelligence	3.06	0.98	2.92	1.00	4.53*	0.14
Emotion	3.07	1.04	2.89	0.97	6.38**	0.18
Social Psychology	3.02	1.02	2.85	0.97	6.04**	0.17
Abnormal Psychology	3.19	1.02	2.92	1.02	14.48***	0.27

*$p < 0.05$. **$p < 0.01$, ***$p < 0.001$

IV. Conclusion.

This study examined the difference between active learning group work and content review group work that complimented large Introductory Psychology lectures. As predicted, students in the active learning condition reported greater retention of course material for the majority of topics as well as the course material as a whole. Differences in self-reported retention were not found between both conditions for the "Brain and Behavior" and "Learning" modules. This may be due to the fact that these content review activities were more similar to active learning activities, requiring students to think about what they were doing. For example, in the content review activity for the "Brain and Behavior" chapter, students were asked to label brain structure and define its function and purpose *in their own words*.

Consistent with the second hypothesis, students in the active learning condition also reported greater engagement with the class material. These findings add to the literature demonstrating positive outcomes associated with active learning. In the current study, although the content review condition generally required students to "do" something, students did not have opportunity to select and apply their knowledge in novel ways. This is consistent with research on the generation effect (Slamecka and Graf, 1978), which suggests that people are more likely to remember information that they generate themselves (when compared with information that people simply try to remember). Explanation for the generation effect can be found in the levels-of-processing theory, which proposes that deeper and more elaborate processing is associated with enhanced recall (Slamecka and Graf, 1978).

The third hypothesis, that students in the active learning condition would report more positive attitudes about the class, was not supported. It is possible that students in the active learning condition resented the "intellectual effort" necessary for successful completion of the activities. A meta-analysis by Alliger and colleagues (1997) showed that utility reactions are more predictive of on-the-job performance. Thus, even though students in the active learning condition held less favorable affective reactions, their lack of satisfaction may not impact their learning. Further, our subsequent analyses indicated that both activity type and levels of engagement were independent predictors of overall course evaluation, suggesting that instructors should find ways of engaging students in course material regardless of how it is learned. It appears that active learning may indeed be like broccoli: Although it is good for students intellectually, their overall impression of it may not be completely positive.

One limitation of the current study is that the relationship between active learning and academic performance was not examined. Due to the anonymous nature of the questionnaire and the administration of different exams by the instructors, using grades as data was not possible. Although reactions have been found to be predictive of learning outcomes, the relationship is not strong enough to suggest that reactions be used as indicators of learning (Stizmann, Brown, Casper, Ely, and Zimmerman, 2008). Therefore, future research should examine whether the specific active learning exercises result in learning outcomes.

The current study examined the feasibility and benefit of assigning active learning exercises as a course requirement in large lecture-style classes to increase engagement with course material and the likelihood of conceptual learning. This concept may be applied to other types of classroom settings. For example, the online learning environment may be enhanced through the use of meaningful, hands-on activities that require students to synthesize and analyze information. This is consistent with calls to foster active learning in online courses (e.g., Brown, 1997).

Although active learning is a pedagogical method, it does not prescribe how to teach. Since hands-on activities are not necessarily methods that aid the process of learning, instructors should carefully choose pedagogical methods, focusing on those that promote selecting, organizing, and integrating knowledge, rather than just behavioral activity.

Acknowledgements

Allyn & Bacon Publishers provided financial support for this project. This research was conducted at the University of Delaware, Newark, Delaware, 19716. The authors would like to thank Matthew J. Shaffer and Jocelyn Jones for their assistance with the data management portion of this project.

Appendix 1. Brief Descriptions of Active Learning Group Assignments.

Topic	Introductory Instructions
Research Methods	You will be conducting a study, using the guidelines of good psychological research. You will generate a hypothesis and collect data to see whether the data support it. You will also be asked to consider how well you did in designing a study based on what you have read and learned in class about what makes for good psychological research.
Brain and Behavior	During this exercise, you will be able to get some "hands-on" experience with the brain, its various structures, and how these structures function. You will also get some experience with how the brain works and how it can malfunction.
Sensation & Perception	You will examine both how you sense things as well as how you perceive things. The first half will involve viewing art and figuring out which visual cue is necessary to see the picture. During the second part, you will be able to test your perceptive skills using your sense of taste.
Learning	You will apply principles of learning to a real-life scenario. You will identify maladaptive behavior and recommend ways of changing that behavior in a classroom by applying the learning principles discussed in class and in your text.
Memory	You will examine how different memory strategies discussed in lecture and in your text can improve or hinder your memory for a grocery list.
Intelligence	You will examine the relationship between intelligence, scholastic aptitude/ability, and creativity by collecting data on these variables.
Emotion	You will participate in a demonstration on the subjective experience of emotion. You will also get an opportunity to try your hand at interpreting the facial expressions of other people.
Social Psychology	You will be using the principles of social psychology to solve a real-world problem. Keep in mind, there is no one correct answer to the problem. However, you will need to demonstrate that you understand concepts like social facilitation, groupthink, etc. and have considered them sufficiently.
Abnormal Psychology	You will read case studies of people who are suffering from a mental disorder. In addition to simply diagnosing them, you will be asked to perform a full assessment of their symptoms and possible treatment alternatives.

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