

An ‘interteaching’ informed approach to instructing large undergraduate classes

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Abstract: A novel approach to teaching large undergraduate courses using methods derived from ‘interteaching’ was investigated. Students in two large sections of undergraduate abnormal psychology received preparation guides, and took part in in-class discussion sessions during which instructors circulated to answer questions. Following discussion, students completed interteaching reports, based upon which instructors prepared clarifying lectures. Regression analyses revealed significant positive associations between attendance at discussion sessions and course performance, after controlling for academic average and student motivation. Performance for writing assignments involving critical and analytical thinking was significantly higher than in prior offerings of the course. A majority of students expressed a preference for the instructional methods. This instructional approach thus facilitated effective learning and may be more effective than traditional lecture based practices.

Keywords: interteaching, college instruction, large course instruction, teaching methodology, student engagement, active learning, student success.

I. Introduction.

In this paper we report upon a novel teaching method developed for large undergraduate courses. We developed this approach based on *Interteaching* (Boyce and Hineline, 2002), an educational method that shifts student responsibility for learning from one of passive reception to active engagement, and shifts the instructor’s role from imparting knowledge to structuring and guiding learning (Saville, 2006). Interteaching is an integrative teaching approach, derived from a wedding of educational methods drawn from behavioural instruction (Keller, 1968), cooperative learning (Halpern, 2004), and reciprocal peer tutoring (Griffin and Griffin, 1998).

In the traditional lecture format students are typically assigned readings in advance of class, however comprehensive reading prior to attendance is infrequent and comprehension is usually less than ideal. Such approaches promote passive listening during lecture, and realization of the extent of understanding (or lack thereof) only upon examination (McKeachie, 2002). In contrast, research on learning and memory demonstrates that factors such as desire to learn, frequent and deep processing of material, awareness of progress in learning, and monitoring of learning effectiveness are associated with better learning outcomes (Pintrich, Brown and Weinstein, 1994). Thus, it is advantageous for students to have multiple, higher quality exposures to the material over the course of studying.

To achieve this end, interteaching shifts the responsibility for initial exposure to materials from instructors to students, by providing a framework which emphasizes reading and preparation before the topics are encountered during class sessions. Furthermore, by grappling

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with the material, students are likely to be more invested in learning, and increasingly able to monitor their own understanding. Students so engaged develop their skills for acquiring and monitoring the quality of their knowledge. This is to say, they will better understand what they do know, and more importantly, what they do not yet know (see Dunning, Johnson, Erhlinger, and Kruger, 2003; Thiede, Anderson, and Therriault, 2003; Young and Fry, 2008, for discussion related to metacognitive competence and skill acquisition).

The procedures in an interteaching class session are as follows. Instructors prepare preparation guides in advance of class sessions. These guides consist of a series of factual and conceptual questions (i.e. 8-12) which assist students in engaging with and comprehending course material for the upcoming class. Students complete preparation guides (study guides) before class. In class, they form groups and discuss the questions, while the instructor circulates to answer questions and facilitate discussion. After discussion, students complete information sheets that the instructor subsequently uses to construct a clarifying lecture that focuses on only the most requested prep guide items. The clarifying lecture occurs at the start of the next class period and precedes student discussion on the next guide. Finally, exams are frequent and closely linked to preparatory material. See Boyce and Hinline (2002) and Saville et al. (2005) for further discussion of the conceptual framework and procedural details of the model.

The approach emphasizes student engagement with knowledge and ownership of the learning process, views advocated by proponents of active learning (Benjamin, 1991; Miserandino, 1999; Qualters, 2001). To accomplish these goals, the interteaching framework stresses preparation, as well as student-to-student and student-to-instructor discussion of material in class. Furthermore, by interacting with students in the moment, instructors are able to correct errors and address challenging concepts as they arise.

Initial outcome evidence for interteaching is promising. Research with small samples has provided evidence supportive of the method. In an experimental study (Saville, Zinn and Elliott, 2005), participants took part in a laboratory session and were randomized to learn about a short article via interteaching, lecture, reading, or served as controls (no exposure to the article). At testing one week later, participants in the interteaching group answered more questions correctly (74%) than the remaining groups, which did not differ from one another (from 51% to 60%).

Another study (Saville, Zinn, Neef, Norma, and Ferreri, 2006, Study 2) examined interteaching in the undergraduate classroom. In two sections of an undergraduate psychology research methods course (N = 12 and 19), half of the class sessions were delivered using interteaching, and the other half using lecture. Quizzes were administered at the start of each class, related to material from the preceding class. Across units, interteaching consistently outperformed lecture, with 81% of participants scoring higher following interteaching than lecture. On a final examination, 76% of interteaching based questions were answered correctly, as compared with 69.5% of lecture based questions. Another study (Saville, 2006) used a dismantling design demonstrated that preparation coupled with in-class discussion is a key component in these performance gains. Students who were provided only with prep guides did not show performance gains, however, students who completed guides and in-class discussion did show significantly improved performance. Furthermore, although academic performance is only one measure of educational success, research has also considered student engagement and enjoyment of the process. Across these published reports (Saville, Zinn and Elliott, 2005, 2006; Saville, 2006), a majority of students indicated a preference for interteaching over lecture.

Prior studies report upon the use of interteaching in relatively small classes. How well the effectiveness of the model will translate to larger classrooms, however, has not yet been

explored. This paper presents findings which examine the association between academic performance, student engagement, and participation in the variant of interteaching which we employed in two large abnormal psychology courses. Per the interteaching model, in our courses students received preparation guides in advance of class. In class, they engaged in discussion about the guides in small groups, during which the instructor circulated to answer questions and stimulate discussion. After discussion, students completed interteaching reports following which the instructor provided a clarifying lecture regarding topics of difficulty.

However, we also altered the teaching model. To accommodate the unique goals of our courses, we opted to retain a somewhat greater role for lecture than Boyce and Hineline (2002) recommend. Instead of using two-thirds of class time for discussion, we chose to dedicate half of the time to discussion and the other half to clarifying lectures. The interteaching model also suggests that the guides be tied to exam materials. We thought it interesting to examine how the method might work if the linkages were not as explicit for some of the evaluation. Thus, written assignments were more closely tied to guides, whereas we did not emphasize explicit connections between guides and exams. Finally, in one of the courses, students were not required to switch discussion partners every class session.

The first author applied these methods in a large undergraduate course, following which the second author adapted the approach to an even larger course. If the methods used contain the key effective ingredients of interteaching, we anticipated observing performance gains relative to prior offerings of the same course. We anticipated that if attendance in discussions sessions facilitated learning, that attendance would be associated with course performance after controlling for academic performance and motivation. Finally, we anticipated that a majority of students would report preferring the discussion-based teaching approach.

II. Method.

A. Participants.

The University of Windsor Research Ethics Committee reviewed and provided approval for this research. The sample for the first course consisted of 58 students (72.4% female, mean age 22.07 years) who consented (of 61 enrolled). The sample for the second course consisted of 118 students (87.3% female, mean age 22.8 years) who consented (of 124 enrolled). Although they were not the focus of this study and were not suitable as full control groups, two preceding lecture-based versions of the abnormal psychology course ($N_s = 68$ and 47) were used as points of comparison where appropriate.

B. Course Materials.

The first author adapted a 13-week lecture-based abnormal psychology course to incorporate interteaching methods, and developed preparation guides containing about twelve questions for each class session. These provided a mixture of questions directed towards factual recall, critical analysis, and application of material. These preparation guides were used in both of the large courses.

C. Measures.

The number of discussion sessions attended, and grades on examinations, and writing assignments were recorded. A composite course average was also calculated, by averaging examination and written assignment grades; discussion attendance was not included.

We assessed preferences for interteaching versus lecture alone via the question, “Which style of teaching do you prefer?”, using a 7 point Likert-style scale (anchored: 1 = discussion plus lecture; 4 = no preference; 7 = lecture alone). Two additional questions asked about time spent in discussion and lecture (1 = less time for discussion/lecture, 7 = more time for discussion/lecture). As results for the latter questions closely mirrored the first question, responses to the first question are reported below.

To assess motivation (only in the second course), we included two 9-point questions. The first queried general motivation, “How motivated were you to take part in the methods used in this course?” while the second asked, “How motivating were the teaching methods used in this class compared to other lecture-only courses you have taken?” (1 = much less motivating than other classes; 5 = no change; 9 = much more motivating).

D. Procedure.

The first course met twice per week for 80 minutes, and consisted of 11 discussion and 11 corresponding lecture sessions. Students received preparation guides and prepared in advance of class. Verification of preparation is not a component of the interteaching model, hence quality of completion was not recorded. In class, students met in pairs (and in a new pair each week) to discuss the questions on the guide. The instructor and an assistant circulated to stimulate discussion and answer questions, after which students completed interteaching reports to indicate areas of difficulty. The instructor commenced the next class with a clarifying lecture, in which he discussed topics for which students had expressed difficulty understanding, or about which they wanted to learn more. Evaluation consisted of attendance at 10 discussions (as recommended by Saville, 2006), three exams, a clinical case paper, and a self-reflection paper. Exams consisted of multiple choice and fill-in-the blank questions. About 75% of questions came from an exam bank, with the remainder written by the instructor and linked to preparation guides.

The second course was highly similar to the first, with modifications to accommodate the larger class size. First, because the class occurred once weekly for 3 hours, holding alternating discussion and lecture sessions did not translate well to the weekly format. Thus, clarifying lectures followed discussions during the same class period. During a mid-class break, the instructor and assistants surveyed the reports and discussed issues raised by students, which guided the instructor during the ensuing lecture. Second, to facilitate discussion in a larger course, students interacted in groups of 3 to 4. Third, while the instructor encouraged students to switch partners, the class size made this difficult to monitor and students did not always switch from week to week. Finally, while evaluation was similar, exam questions came entirely from an exam bank, and 2 clinical case papers of increasing difficulty comprised the writing assignments.

The case writing assignments in both courses were an exercise in the reasoning and decision making processes involved in making clinical diagnoses. For each, students received a description of a clinical interview. Based upon case summaries, students wrote a 4-6 page diagnostic summary. In the process, we asked students to articulate the reasoning that led them to accept or reject possible diagnoses. Students were expected to engage in a number of practices

which reflected good critical and analytic thinking, including items such as weighing confirmatory and disconfirmatory evidence, avoiding undue inference, making use of language of probability, weighing clinical significance of symptoms, and identifying further information needed to clarify the diagnostic profile. We note that graders were unaware of student attendance rates when grading, thus knowledge of attendance did not impact the grades assigned.

We collected additional data prior to the final exam in both courses. Students provided preference ratings for teaching methods, demographic information, permission to use their course grades, and permission to verify their GPA. Students received a 1% course bonus in compensation for their participation.

III. Results.

Statistical analyses were conducted using SPSS 17.0. To examine the potential association between teaching methods and improvements in learning, we contrasted performance on the diagnostic case writing assignment in the first course ($N = 61$) and two prior lecture-only offerings of the same course taught by the first author ($Ns = 68$ and 47 ; i.e. comparison classes). We thought this to be reasonable, as this writing assignment was largely identical across all three courses, which used the same case and grading rubric. The current average was 75.11% ($SD = 5.98\%$), contrasted with 71.98% ($SD = 9.62\%$) in the prior courses; this difference was statistically significant, $t(2) = 2.26, p < 0.05$. The examinations differed substantially across the courses, so contrasts across courses were deemed inappropriate.

Session attendance and course performance. We next examined the association between course performance and attendance at discussion sessions. Attendance correlated significantly with the course average, writing assignments, and a majority of the individual examinations. in both courses (Table 1).

Table 1. Correlations between attendance, GPA, motivation, and outcome variables.

	Course							
	Attend	GPA	average	Paper 1	Paper 2 ²	Exam 1	Exam 2	Exam 3
Attend	–	0.32*	0.53**	0.47**	0.42**	0.40** ¹	0.36** ¹	0.36** ¹
GPA	0.32**	–	0.73**	0.40**	0.50**	0.64**	0.49**	0.73**
Course average	0.35**	0.70**	–	0.73**	0.68**	0.77**	0.73**	0.90**
Paper 1	0.31**	0.43**	0.66**	–	0.82**	0.19	0.30*	0.67**
Paper 2 ²	0.42** ¹	0.42**	0.77**	0.40**	–	0.26*	0.27*	0.68**
Exam 1	0.18 ¹	0.64**	0.86**	0.45**	0.50**	–	0.60**	0.61**
Exam 2	0.23* ¹	0.64**	0.88**	0.44**	0.53**	0.78**	–	0.47**
Exam 3	0.16	0.66**	0.86**	0.41**	0.49**	0.77**	0.78**	–
Motivation (Course 2 only)	0.17	-0.02	0.16	0.06	0.25**	0.15	0.12	0.01

Notes: Correlations for the first course are above the diagonal; for the second course are below the diagonal. * $p < 0.05$; ** $p < 0.01$; 1 – Correlation is between exam grade and attendance at discussion sessions for that exam; 2 – Paper 2 was a self-reflection paper in the first course, and a second diagnostic case paper in the second course.

To control for differences in academic ability (in both courses) and motivation (in course 2), we conducted hierarchical multiple regression analyses to control for these variables before regressing attendance upon course outcomes. The increase in variance accounted for above that of the control variable(s) is reported ($\Delta R^2 = R^2$ change = increase in variance accounted for).

In the first course ($N = 58$), after controlling for GPA we found significant relationships between performance and attendance for the composite grade ($\Delta R^2 = 0.035$, $p < 0.05$), the case writing assignment ($\Delta R^2 = 0.062$, $p < 0.05$), the self-reflective writing assignment ($\Delta R^2 = 0.060$, $p < 0.05$), and the second exam ($\Delta R^2 = 0.053$, $p < 0.05$); but not the first and third exams.

Table 2. Course 1, Hierarchical multiple regression statistics predicting the effect of discussion attendance upon outcome variables, after controlling for GPA.

<i>Outcome variable</i>	<i>Predictors</i>	<i>B</i>	<i>SE</i>	β	<i>Sig.</i>	<i>Adj. R²</i>
Course average	GPA	0.017	0.005	0.413	< 0.01	0.55
	Discussion attendance	0.008	0.004	0.259	< 0.05	
Exam 1	GPA	0.033	0.006	0.608	< 0.01	0.41
	Discussion attendance	0.014	0.013	0.119	<i>ns</i>	
Exam 2	GPA	0.027	0.007	0.454	< 0.01	0.26
	Discussion attendance	0.021	0.010	0.248	< 0.05	
Exam 3	GPA	0.043	0.006	0.712	< 0.01	0.52
	Discussion attendance	0.008	0.011	0.067	<i>ns</i>	
Paper 1 (Diagnostic)	GPA	0.014	0.005	0.313	< 0.05	0.20
	Discussion attendance	0.010	0.004	0.286	< 0.05	
Paper 2 (Self-reflection)	GPA	0.017	0.005	0.413	< 0.01	0.28
	Discussion attendance	0.008	0.004	0.259	< 0.05	

Note: SE – Standard error; β – Standardized coefficient; Adj. R² – adjusted R squared.

In the second course ($N = 118$), after controlling for both GPA and motivation, we found significant relationships for the composite grade ($\Delta R^2 = 0.017$, $p < 0.05$), and both case writing assignments ($\Delta R^2 = 0.040$, $p < 0.05$, and $\Delta R^2 = 0.076$, $p < 0.01$). Attendance did not uniquely predict exam performance in the second course.

Table 3. Course 2, Hierarchical multiple regression statistics predicting the effect of discussion attendance upon outcome variables, after controlling for GPA and motivation.

<i>Outcome variable</i>	<i>Predictors</i>	<i>B</i>	<i>SE</i>	β	<i>Sig.</i>	<i>Adj. R²</i>
Course average	GPA	0.032	0.004	0.670	< 0.05	0.44
	Motivation	0.002	0.004	0.032	<i>ns</i>	
	Discussion attendance	0.008	0.003	0.140	< 0.05	
Exam 1	GPA	0.035	0.004	0.659	< 0.05	0.40
	Motivation	0.006	0.005	0.096	<i>ns</i>	
	Discussion attendance	-0.002	0.013	-0.008	<i>ns</i>	
Exam 2	GPA	0.047	0.005	0.626	< 0.05	0.40
	Motivation	0.003	0.005	0.047	<i>ns</i>	
	Discussion attendance	0.006	0.007	0.063	<i>ns</i>	
Exam 3	GPA	0.040	0.004	0.691	< 0.05	0.43
	Motivation	-0.003	0.005	-0.049	<i>ns</i>	
	Discussion attendance	-0.002	0.010	-0.050	<i>ns</i>	
Paper 1 (Diagnostic)	GPA	0.019	0.004	0.364	< 0.01	0.22
	Motivation	0.003	0.005	0.057	<i>ns</i>	
	Discussion attendance	0.017	0.007	0.209	< 0.05	
Paper 2 (Diagnostic)	GPA	0.025	0.006	0.346	< 0.05	0.26
	Motivation	0.006	0.007	0.074	<i>ns</i>	
	Discussion attendance	0.020	0.006	0.295	< 0.01	

Note: SE – Standard error; β – Standardized coefficient; Adj. R² – adjusted R squared.

Preference for teaching methods. To simplify reporting, we collapsed the preference scale to reflect students who expressed a preference for more interteaching (1, 2 or 3 on the scale), no preference (4 on the scale), or a preference for more lecture (5, 6 or 7 on the scale). In the first course, a majority of students preferred the interteaching format: 60.3% of students expressed preference for more interteaching, 6.9% indicated no preference, and 29.3% indicated a preference for more lecture-only. In the second course, preference was about equally split; 46.6% expressed interest in more discussion, 2.6% were neutral, and 50.4% expressed interest in more lecture.

Motivation for teaching methods. Amongst the students in the second course, 81% reported finding themselves equally motivated compared to other courses, and 52% indicated being more motivated than in other courses. The average motivation rating for those indicating greater motivation was 6.9 on the 9 point scale, indicating a moderate increase in motivation.

We also examined associations between motivation and the other variables in the second course. Motivation correlated positively with performance on the second writing assignment ($r = 0.25, p < 0.01$), preference for discussion ($r = 0.62, p < 0.01$), interest in more discussion ($r = 0.45, p < 0.01$) and interest in less lecture ($r = -0.40, p < 0.01$). Motivation did not correlated significantly with attendance or overall course performance.

IV. Discussion.

These results suggest that the participation in the interteaching-inspired methods employed in these large undergraduate abnormal psychology courses promoted effective learning. Quality of performance for written assignments increased as attendance at discussions increased, and one paper showed improved grades relative to prior lecture-based offerings of the course. Attendance at discussion sessions was associated with course performance, after controlling for GPA (in both courses) and student motivation (in one course).

The positive relationship between attendance and grades on written assignments was evident in both courses, despite differences in course size, frequency of meetings, and several other procedural specifics. We speculate that preparation and discussion may promote deeper processing of course material, which thereby influences writing. While quality of preparation was not formally observed in these courses, many students appeared to the instructors to be quite actively involved. The relationships between motivation and writing outcomes in the second course are consistent with this observation. The methods likely motivated at least some students to become more engaged in learning, perhaps due to a greater sense of personal involvement in the course, which subsequently impacted writing performance.

We would like to acknowledge several limitations of this work. The examination of attendance indicates that the teaching methods promoted learning. What these particular findings do not indicate is whether the approach, which incorporates discussions and lectures, produced better learning outcomes than lecture alone. Indeed, attendance alone is known to influence learning (Newman-Ford, Fitzgibbon, Lloyd, and Thomas, 2008). Additional work is needed to clarify if these methods hold advantages over lecture in large classes. It is possible that GPA and motivation are not sufficient controls, and students who attend simply do better. While future work is clearly needed to make definitive statements, showing gains over a prior lecture-based course and advantages above general academic ability and motivation for teaching methods is certainly suggestive. Furthermore, even if the interteaching based and lecture methods results in equivalent learning outcome, the fact that most students indicated that these interteaching

informed teaching methods were equally or more motivating and enjoyable are a notable strength of the approach.

The majority of exam questions were not linked to the study guides in either course (the first course had 25% linked; the second had none). The first course did show a significant relationship between attendance and one exam. The fact that no relationship between attendance and exams was found in the second course suggests that at least some link between guides and exams is important, as recommended by the interteaching model.

The work described herein demonstrates that the teaching methods used resulted in effective learning in large undergraduate abnormal psychology courses. As such, this method stands as a novel alternative to lecture when teaching abnormal psychology. The approach has conceptual advantages over lecture, is more interactive, and appears to be more enjoyable and motivating for a majority of students. Based upon these observations, instructors are encouraged to consider the use of these and similar teaching methods in their courses. Regarding future research, work which rigorously tests interteaching can examine the benefits of specific components of the model, while other work should continue to examine variations of the interteaching method that instructors devise to meet the unique needs of their courses.

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