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Comparison of Teaching Styles: Traditional Lecture versus a Modified Interteach

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Comparison of Teaching Styles: Traditional Lecture versus a Modified Interteach

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Abstract

Interteaching is an evidence-based instructional practice built on behavioral treatments, such as errorless teaching, to help students reach academic goals in higher education. This study presents a modified interteach session as an extension of research done with standard interteaching. In modified interteaching, sessions are divided into two classes per week, where the first class consists of the instructor giving an introductory lecture to material that will be assigned for students to read. On the second day of class, students work in small groups to first "drill" each other on fluency-based targets then complete comprehensive study guides derived from information in the assigned weekly readings. The instructor(s) travel from group to group to provide immediate clarification on confusing or difficult problems. We examine 28 point evaluation packet scores across modified interteach, traditional lecture, and online-only methods of teaching a higher education course. Results from this study showed that students in the modified interteach sections outperformed students in the traditional lecture and online-only courses. Modified interteach mean scores 24.86 and 24.39 while the mean score for the online only and traditional lecture courses were 13.20 and 13.21 respectively. These results suggest a needed shift in teaching methods in higher education from traditional lecture to alternatives such as our modified interteach method to increase student success.

Keywords: interteach, lecture, higher education, teaching styles

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Chapter I: Introduction

Historically, teachers have taught courses as they have been taught, and emphasize material based on his/her expertise and perception of student need (U.S. Department of Health, Education & Welfare Office of Education, 1996). Variation in how material is presented to students can influence student retention. Studies have shown that curriculum should be developed to promote student participation and increase interaction with the material in a while systematically introducing new material (i.e., a change in how teachers teach; Buskist, Cush, & DeFrandpre, 1991; U.S. Department of Health, Education & Welfare Office of Education, 1996).

Instructional Methods

For some time, behavior analysts have been interested in improving teaching methods and have offered some programs and procedures created to benefit the learner. Keller (1968) promoted the use of Personalized System of Instruction (PSI) as a new method of instruction in which the learner proceeds to new material at his/her own pace and can only do so once he/she has mastered the previous material. This method of instruction promotes learning through repeated contact with the material, repeated testing, and immediate scoring. In a typical PSI lesson, the learner will contact material first through reading passages about the topic, then they will contact the material repeatedly through different modules. Examples of modules include visual prompts such as films, diagrams, and quiz questions with extra-stimulus prompts. PSI emphasizes that the "proctor" (typically a teacher's assistant) enhances the social aspect of learning and can relate to the students in a way that increases student participation (Buskist, et al., 1991; Keller, 1968). Other forms of teaching that have been compared to traditional lecture include Programmed Instruction (PI), Precision Teaching, Direct Instruction (DI), Reciprocal

Peer Tutoring (RPT), Problem Based Learning (PBL), and Cooperative Learning. Querol, Rosales, and Soldner (2015) described each of these methods in a comprehensive review. PI, much like PSI, focuses on visual prompts (e.g., quiz questions with extra-stimulus prompts) to promote mastery of information before moving on to more complex material. Precision Teaching is considered a branch of PI that emphasizes errorless learning through fluency trials. The focus on fluency allows for the teacher to adjust criteria for each student based on his/her own performance. DI is a teacher-driven, fast-paced method of instruction that is scripted and highly structured. DI is primarily used in early education. RPT is a student-driven method of instruction. In an RPT lesson, students are paired such that one student takes on the role of a tutor (i.e., presenting information and delivering quizzes) while the other student in the dyad takes on the role of the tutee (i.e., answering questions and completing quizzes). Boyce and Hineline (2002) claim that learning is something that a person does and that the best way to learn is to teach. RPT has shown that students who act as tutors achieve higher scores on tests. PBL focuses on the ability of a small group of learners to use material to solve some problem. Alternatively, Cooperative Learning calls for the entire class to contribute to a discussion in effort to solve some problem. The principles behind RPT, PBL, and Cooperative Learning are all included in interteach methods of teaching.

Interteach Components

Interteach was developed as a method of teaching that combines behavioral technologies such as contingency management, focused discussion, precision teaching, reciprocal peer teaching, probes, and errorless teaching to enhance student performance on academic goals in higher education (Boyce & Hineline, 2002). Teachers resist the use of interteach primarily because of the time it takes to create all of the components used in an interteach method of

instruction. Components of interteach include; student prep guides, interteach sessions, record evaluations, and clarifying lectures (Brown, Killingsworth, & Alavosious, 2014; Sirios, Windsor, & Pascual-Leone, 2009). Student prep guides are packets of worksheets correlated with each unit of material that the student is typically expected to complete as homework. Interteach sessions take place in the classroom, where students form groups and discuss the prep guide material while the instructor wanders from one group to the next to answer questions (Brown et al., 2014). Interteach record evaluations are the student's opportunity to fill out a form that informs the instructor of specific material the students would like to have reviewed. Finally, clarifying lectures are the instructor's opportunity to review the student record evaluations and deliver a lecture to clarify any information the students requested.

Querol et al., (2015) conducted a comprehensive review of interteach. They noted five major themes throughout the literature. First, interteach consistently increased academic performance when compared to traditional lecture across multiple disciplines including computer programming, political science, special education, nutrition, social welfare, sociology, and psychology. Second, interteach was successful at increasing academic performance across small (1-30), medium (31-75) and large (75-117) class sizes. Third, the use of a quality point contingency increases average quiz scores. Fourth, clarifying lectures consistently increased average quiz scores despite length of delay. Finally, frequent test scores generally increased scores on final examinations.

Prep Guides

Types of prep guide questions were examined by Bethke (2016) such that retention of information taught with high and low level prep guide questions was compared through a follow-up quiz. Participants in both conditions in this study were exposed to an interteach method of

teaching. Results showed that higher level prep guide questions took longer to complete than lower level prep guide questions, but there was no significant difference between the percentages of correct responses between the two conditions. This showed that prep guides contribute to the efficacy of interteach because it caused the students to interact with the material in multiple ways, but the difficulty of the questions included did not affect the overall retention of material (Bethke, 2016).

Canella-Malone, Axe, and Parker (2009) examined the effect of answering prep guide questions created by the instructor versus students generating their own prep guide questions. Students in condition 1 answered prep guide questions created by the instructor prior to each class then discussed answers in class. Students in condition 2 created their own prep guide questions including answers, then discussed answers in class. Results from this study indicated no significant difference on quiz scores between conditions, even though students reported a preference to answering already prepared questions because they felt those questions would be on the quizzes (Canella-Melone et al., 2009).

Group Size

Studies have shown that the size of groups has no significand difference on the scores of quizzes or exams, although students did note that they prefer to work in smaller groups (2-3 individuals) because they felt all students had opportunity to participate (Leidt, 2017; Truelove, Saville, & Van Patten, 2013). Saville, Cox, O'Brien, & Vanderveldt, (2011) examined the effect of delaying the clarifying lecture by providing the clarifying lecture two to five days after the interteach session, five minutes after the interteach session, and no clarifying lecture. Results from a final exam showed that although both groups that received a lecture performed

significantly better than the no-lecture control, there was no difference between the scores of the immediate lecture and the delayed lecture.

Testing Frequency

Multiple studies have examined the effect of frequent testing on final exam scores in an interteach model (Fielderman, 2014; Lambert & Sasville, 20012; Saville, Pope, Lovaas, & Williams, 2012). Both Lambert and Saville (2012) and Saville et al. (2012) found little effect in frequent testing of material when the tests come before the clarifying lecture. These studies concluded that the clarifying lecture should function as a reinforcer because the students have the opportunity to specify what information they need clarification on in order to perform better on the quiz.

Fielderman (2014) studied the frequency of examinations throughout a semester during the interteaching process. Condition 1 had six examinations throughout the semester and condition 2 had twelve examinations throughout the semester. Results from Fielderman's study showed that students in condition 2 scored better than or equal to students in condition 1. Students in condition in condition 2 also showed a larger increase in scores from pre-test to post-test indicating a possible increase in retention when students are tested more frequently.

Social Validity

Although student academic performance is a highly sought after indication of the effect of teaching methods, a generally overlooked component of teaching methods is the social validity. Goto and Schneider (2010) used a survey to assess the social validity of interteach. Results showed that students generally rated their perceived learning outcomes highly and also rated their perceptions of interteach as an educational method highly. Studnts and that interteach fostered a sense of critical thinking as well as a sense of responsibility to know the material

taught in class. Students also indicated that they felt more focused during the clarifying lecture because they had been previously exposed to the material.

Considerations for Implementation

Saville (2013) and Querol et al. (2015) give a list of considerations for instructors planning on implementing interteach in their classroom. To begin, Saville recommends sticking to the original material, explain why interteach is used, and give it time. Next, Saville recommends to write quality prep guide questions and make the prep guides a reasonable length such that they can be completed in one class period. Finally, Saville states to constantly take steps to improve your method, connect the prep guide questions with exam questions, explain to students what a quality discussion is, and try to avoid lecturing over the prep guide items. Additionally Querol (2015) recommends taking time to plan the course before beginning the semester and not to let the class size interfere with the decision to implement interteach as a method of instruction.

Analysis of Interteach Versus Traditional Lecture

Many studies have compared interteach methods of teaching to traditional lecture methods in both contrived settings (Saville, Zinn, & Elliott, 2005; Saville et al., 2014) and in natural, higher education settings (Arntzen & Hoium, 2010; Chester, Kienhuis, & Wilson, 2013; Saville, Zinn, Neef, Van Norman, & Ferreri, 2006; Scobria & Pascual-Leone, 2009). Saville et al. (2005) conducted a study in a contrived setting with four conditions: interteach, lecture, reading, and control. Participants in the interteach condition spent 15 minutes reading an article and answering questions on a handout. Next, participants formed pairs and discussed the handout questions for 15 minutes. During this time the instructor walked from pair to pair, answering questions the participants had about the material. While discussing questions, participants filled

out an interteach report which indicated to the instructor what material needed clarification. The instructor then reviewed material from the interteach reports for 15 minutes. Participants in the lecture condition listened to a 45 minute lecture on the same material as the interteach condition. Participants in the reading condition spent 45 minutes reading the article containing the same material as the other conditions. Participants in the control condition received no exposure to the material, participants in this condition only took the follow up quiz All participants in the interteach, lecture, and control conditions returned one week later for a follow up quiz. Saville et al. (2005) concluded that interteach was more effective in teaching material to students because the participants in the interteach condition answered significantly more questions correctly, while there was no significant difference between the other three groups. Interteach could be more effective due to the interactive nature of the classroom design, social reinforcement from peers in groups, the cooperative learning environment, and the increased retention due to the clear relation between study materials and quiz questions (Saville et al., 2005).

Saville et al. (2014) conducted an extension of the 2005 study focusing on long term retention. For this study, researchers followed the same procedure as the Saville et al. 2005 study such that session 1 involved participants either participating in an interteach session, listening to a lecture, reading an article, or control (completing anagrams). At the end of session 1 participants took a ten item, multiple choice quiz. One week later participants took a modified version of the same quiz, and took another modified quiz at the 3 week follow up. Results from this follow up study further confirmed the results from the Saville et al. 2005 study: participants in the interteach condition answered more questions correctly than all other conditions. Furthermore, participant attrition was lowest in the interteach condition (Saville et al., 2014). Both studies noted that interteach is more applicable to a college classroom because of its self-

paced nature within one class period, and it is more student directed due to the interteach reviews narrowing decisions for instructors on what to include in lectures (Saville et al., 2005; Saville et al., 2014).

In 2010, Arnten and Hoium conducted a study comparing interteach to a traditional lecture method of teaching in a higher education classroom using a pretest, posttest design. Students in the traditional lecture condition listened to approximately four lectures, each one hour in length and were given the recommended text. Students in the interteach condition first listened to a short introduction lecture (45 minutes), then students read a short article relating to the material and formed pairs to discuss questions while the instructor traveled from one group to the next, answering questions. The class period concluded with a clarifying lecture (45 minutes) based on information that the students indicated as difficult or needing clarification. Results from this study showed that not only did interteach yield higher test results, but interteaching was preferred by both instructors and students, and was more effective in giving students more knowledge, as reported on a self-rated scale (Arntzen & Hoium, 2010).

In 2006, Saville et al. conducted a two part study, first examining the effect of interteach versus traditional lecture on pretest, posttest scores with extra credit opportunities for participation, then examining interteach versus traditional lecture where the instructor dispersed participation points. In the first study, the lecture condition consisted of a lecture with a PowerPoint presentation (approximately 40-60 minutes) with encouraged participation for the last 10 minutes to earn extra credit points. The participants in the interteach condition worked in groups of two or three to review and discuss prep guides that were completed prior to class. The graduate assistant and instructor would travel from one group to another answering questions and gave extra credit points to groups that remained on-task. Data collected from quiz scores showed

that interteach classes had higher average correct answers and a satisfaction survey showed that students preferred the interteach days.

The second study conducted by Saville et al. (2006) counterbalanced interteach and lecture classes across two sections of an undergrad course. Researchers used the same methods of lecture and interteach as the first study with the exception that participation points on interteach days were allocated to students when the instructor facilitated discussions. Data collection consisted of a cumulative final including 20 interteach-based questions and 20 lecture-based questions. Results from this study showed that interteach days had consistently higher unit test scores as well as higher percentage correct on the cumulative final when compared to traditional lecture. Students reported increased satisfaction with interteaching rating those days higher than lecture days (Saville et al. 2006).

Hesitation to implement interteach in a higher education setting, in part, stems from the fact that sections of courses are not identical such that some sections may meet more frequently than others. Scobria and Pascual-Leone (2009) compared interteach methods by measuring the number of discussion sessions attended, grades on exams, and grades on writing assignments across two sections of an undergraduate course. Course 1 met twice a week for 80 minutes. The structure for course 1 was as follows: students completed prep guides prior to class, students paired into small discussion groups to review the prep guide while the instructor traveled the room answering questions At the end of class, the students filled out an interteach report which the instructor used to create a clarifying lecture for the beginning of the next class. Course 2 met once a week for three hours. The first half of the class was the same as the first class in course 1; students completed the prep guide before class, met in groups to discuss while the instructor answered questions. Then the class took a short break during which the instructor reviewed the

interteach records and created a clarifying lecture to deliver for the remainder of class. There was no significant difference in number of discussion sessions attended, grades on exams, or grades on writing assignments between the two methods of interteach. Student satisfaction questionnaires showed that students expressed preference for interteach compared to other courses that they have taken, and students felt equally motivated for their interteach course as other courses. Results show that interteach is equally effective despite different course schedules.

As previously discussed, instructors resist implementing interteaching due to the time consuming nature or course preparation and the unfamiliarity of the teaching style (Boyce & Hineline, 2002). To investigate this, an analysis was conducted through interviews of instructors who used interteach methods for the first time (Chester et al. 2013). Results from these interviews contained five main themes. The first theme stated that instructors noticed an increased workload for course preparation. Second, instructors felt an enhanced confidence, knowing that the material they prepared would be appropriate for the student's level due to the interteach record giving specific requests on what to focus on for material development. Third, instructors felt that they had positive perceptions of the lectures they delivered as there was an expressed sense that they were meeting the learning needs of the students because their lecture preparation was guided by the students' expressed needs for clarification. Fourth, instructors noted that the implementation of a new method of teaching allowed for an opportunity to revise the course and refresh content and materials. Last, lecturers noted that they would continue to use interteach methods of instruction in their future courses. Results from this study indicated that while resistance to interteach may be high, the effect of integrating interteach into a classroom offers more advantages than detriments.

The purpose of this study is to compare the effects a modified method of interteach to a traditional lecture method of teaching across sections of an introduction to behavior analysis course.

Chapter II: Method

Participants and Settings

All participants were undergraduate students enrolled in a Community Psychology program at a Midwestern university. Participants were divided into groups by sections of an introduction-level behavior analysis class across three semesters. Group 1 was taught by Instructor A, a BCBA-D faculty member with multiple years teaching experience at the time of the study. Group 1 was taught via an online lecture method in the Summer Semester of 2017 (n = 6 out of 18 total students). Group 2 was taught by Instructor B with a modified interteach method of teaching in the Spring Semester of 2017 (n = 39). Group 3 was taught by Instructors B and C. Instructor C was a graduate student in the Applied Behavior Analysis Masters of Science program at the university. Group 3 was taught via a modified interteach method of teaching in the Fall Semester of 2017 (n = 43). Finally, Group 4 was taught by instructor D, an adjunct instructor with multiple years teaching experience in higher education and a M.S. in Applied Behavior Analysis. Group 4 was taught via a traditional lecture method of teaching in the Fall Semester of 2017 (n = 13). Instructors for all groups created materials prior to knowing of the study. Group 1 took place across a 5 week, Summer Semester while Groups 2, 3, and 4 took place across 15 week semesters.

Online Summer Class Structure

Group 1 was taught online, over a five week summer semester, consisting of four units. Each unit covered five chapters from Malott and Shane's (2016) *Principles of Behavior* (7th Ed.). Units also included three or four class activities and multiple video lectures. The course concluded with a cumulative, proctored exam. Students in Group 1 completed the entire course via an online classroom management system with the exception of proctored exams.

Traditional Lecture Class Structure

Group 4 was taught through traditional lecture method of teaching. This course held one, 3 hour night class each week to cover one unit. Each unit covered 4 chapters of Miltenberger's (2016) *Behavior Modification: Principles and Procedures* (6th ed). Supplemental chapter PowerPoints were added to the lectures, and were available for students to access outside of class. Each unit was concluded with a non-cumulative unit exam. The semester was concluded with a cumulative final exam.

Interteach Class Structure

Groups 2 and 3 were taught via a modified interteach method of teaching, and had identical class structures with the exception of slightly updated materials for Group 3. Both Groups 2 and 3 used a book created by Instructor B for the purpose of teaching with a modified interteach method. Considering that students in Groups 2 and 3 were not required to complete the prep guide material prior to class periods, the method of interteach used in this study was described as a modified interteach. Groups 2 and 3 met twice each week for 75 minutes each day. Day 1 began with a 9 question, multiple choice quiz on key components from previous week's unit. Students had 90 seconds to write their answer to each question. After collecting all quizzes, the instructor reviewed all quiz answers with the students giving elaboration feedback. Next the instructor delivered a clarifying lecture (approximately 10 minutes) which lead to a lecture on new material (approximately 50 minutes).

Students were required to read the text unit and create flashcards with the vocabulary words provided in the text. Then students were expected to review the vocabulary flashcards using the Say All Fast Minute Every Day Shuffled (SAFMEDS) technique. The purpose of using the SAFMEDS technique is to increase speed and accuracy of vocabulary review. Vocabulary

fluency probes, referred to as “drills,” were tested on the second day of class each week. Drills consisted of students working in small groups (2-3) to quiz or “drill” one another on vocabulary flashcards for 20 second intervals to measure fluency. Each student was drilled three times for 20 seconds each. After students completed the Drills, they continued to work in the small groups to complete the equivalent of prep guide questions, referred to as Class Review Packets.

Class Review Packets contained a variety of questions designed to challenge students’ critical thinking while developing an understanding of the material. Students were not allowed to use any course material to answer questions on the Class Review Packets. While the students worked in small groups, the instructor and the instructor’s assistant wandered the classroom to provide feedback to students and clarify questions. The instructor and assistant used the Class Review Packets as the interteach record to develop the clarifying lecture.

Materials

Data for this study were collected using and evaluation packet consisting of questions regarding key points from the course. The evaluation packet was created by reviewing the final exams from previous semesters of the course. Questions in which 32 (82%) or more students in Group 2 responded correctly were included in the evaluation packet (28 questions total). The evaluation packet concluded with a satisfaction survey to measure social validity (see appendix A).

Procedures

Students in Group 1 were contacted when the primary researcher attended one class period of the advanced behavior analysis course (the next course in the university’s behavior analysis course sequence) at the end of the semester. Data were only included from students who took the introductory course taught by Instructor A in in the Summer Semester of 2017. Students

in Group 1 completed the evaluation packet about 5 months after completing the introductory level course. Students in Groups 2 and 3 had the evaluation packet integrated into their final exam. Finally, students in Group 4 who chose to participate completed the evaluation packet after completing their final exam. Retention data from Group 2 were gathered when the researcher attended one class period of the advanced behavior analysis course (the next course in the university's behavior analysis course sequence) in the Fall Semester of 2017.

Chapter III: Results

Aggregate scores for each Group were recorded. Mean scores showed that students in the modified interteach groups outperformed students in the traditional lecture groups (Group 1 M = 12.5; Group 2 M = 24.86; Group 3 M = 24.39; Group 4 M = 13.21). ANOVA, Tukey HSD Post Hoc, and Hedge's G[1] tests were run to test differences in group means and effect size. A paired samples t-test compared score 1 and score 2 for Group 2. Results from the ANOVA showed a significant difference in group means (F (3, 92) = 46.06; $p < .001$). A Tukey HSD Post Hoc analysis was conducted to compare means between groups. Results indicated no statistical significant difference between Groups 1 and 4 (p = .982; g = .0027; 95% CI [-5.73. 4.31]), suggesting students in the Groups 1 and 4 preformed similarly on the evaluation packet. Results also showed no statistically significant difference between Groups 2 and 3 (p = .955; g = .1164; 95% CI [-1.90, 2.83]), indicating students in the modified interteach groups preformed similarly on the evaluation packet.

Significant differences in mean scores were found between Groups 1 and 2 ($p < .001$; g = 2.90; 95% CI -16.91, -7.81]), Groups 1 and 3 ($p < .001$; g = 2.85; 95% CI [-16.39, -7.39]), Groups 2 and 4 ($p < .001$; g = 2.90; 95% CI [8.38, 14.89]), and Groups 3 and 4 ($p < .001$; g = 2.84; 95% CI [7.98,14.36]). These results indicate a significant difference in mean scores between the traditional lecture and interteach groups while there was no significant difference between both modified interteach groups or between both traditional lecture groups. These data also show that there were large effect sizes for modified interteach groups as compared to other groups.

[1] Hedge's G is useful for analyses with small sample sizes (i.e., $n < 20$) and is interpreted as being a small effect (<.20), medium (~.50), or large (>.80)

Retention data were collected from 11 participants in Group 2. A *t* -Test showed that mean scores from Group 2 excluding the subgroup (n = 28; M = 24.86; SD = 3.98) were significantly higher than the scores for the subgroup of participants from Group 2 (n = 11; M = 20.36; SD = 2.92; t = 3.13; $p < .01$). A Paired Samples *t*-test was then conducted to compare the subgroup's mean scores on the evaluation packet. Results from the Paired Samples *t*-test showed a statistically significant difference between mean scores from score 1 (M = 25.54; SD = 2.01) to score 2 (M = 20.36; SD = 6.65; t = 2.93; $p < .015$). This indicates that retention declined over time for the subgroup of students from Group 2 who completed the evaluation packet a second time.

An additional *t*-Test was conducted to analyze the differences in scores between Group 1 and the subgroup of Group 2 because both groups had some delay in time from the conclusion of the course to completing the evaluation packet. Group 1(M = 12.5; SD = 3.14) had an approximate 5 month delay, and the subgroup of Group 2 (M =20.36; SD = 6.34) had an approximate 7 month delay. Analysis from this *t*-Test showed significance between group means (t = -2.67; $p < .01$).

Social Validity

Students in Groups 2 and 3 were asked to complete an additional portion of the evaluation packet specifically regarding their satisfaction of the different components of interteach. Aggregate scores of each question on the satisfaction survey showed that students reflected on the course with high satisfaction when asked to compare the course to other courses they have taken in the same field (see Table 2).

Chapter IV: Discussion

Results from this study support previous research that students taught with modified methods of teaching outperformed students taught with traditional lecture methods of teaching and that students reflected on Interteach with high satisfaction. Data analyses suggest that modified interteach was a superior method of teaching when compared to a traditional lecture format, this could be the result of many factors.

Strengths

One main component of interteach is that the teacher perpetually updates materials such that students are always receiving the most recent information and examples regarding the specific topic which could lead to improved scores. The material used in the modified interteach groups were slightly updated from Group 2 to Group 3 to make certain that students were contacting the best possible information. Another fundamental component of interteach is that students interact with the material in many ways which could also lead to improved scores due to repetition of content. The modified interteach groups met for class twice per week, contacting the material cumulatively throughout the semester increasing repetition of content learned in the course.

This study compared three different teaching methods; modified interteach, online summer course, and a traditional lecture night course. Each group in the study used different materials Group 1 used Malott and Shane's (2016) *Principles of Behavior* (7th Ed.), Groups 2 and 3 used a book created by instructor B, and Group 4 used Miltenberger's (2016) *Behavior Modification: Principles and Procedures* (6^{th} ed). All Groups were expected to learn the same information by the end of the semester. Across all methods, the students in the interteach section

outperformed the students in both the online summer course and the traditional lecture night course on the evaluation packet.

Limitations

Although many results from this research were statistically significant, several limitations should be acknowledged. First, group sizes for the modified interteach Groups (2 and 3) were much larger than the group sizes for the traditional lecture Groups (1 and 4). The Tukey HSD analysis used a Harmonic mean (M = 13.74) which could increase the possibility of a type I error. Second, general differences in teaching styles should be noted; specifically, the course for group 1 was taught online and over a 5-week summer semester while courses for Groups 2, 3, and 4 were taught over a 15 week semester with the expectation that the same material would be covered. The fast-paced requirement of the 5 week course may limit the exposure to the material that the other courses had more time to cover. Third, Groups 2, 3, and 4 completed the evaluation packet at the end of the semester while enrolled in the introductory course. Participants in Group 1 completed the evaluation packet approximately 5 months after completing the course. This lapse in time may have an effect on retention for those students resulting in lower scores, especially given the decrease in scores for students in Group 2 during their retention check. Finally, the initial evaluation packet was not created for the purpose of research, but as the final exam for Group 2 and Group 3. The questions included in the packet were not equally inclusive of the content that was expected to be learned throughout the course. The interteach courses were created such that each chapter was cumulative and material learned in the beginning of the course would continuously be repeated throughout the remainder of the course. The evaluation packet reflected this component of interteach because the majority of the content in the packet was learned in the first half of the course.

Future Research

This study poses many implications for future research. The evaluation packet was not created for the purpose of research, nor was it equally inclusive of each chapter covered throughout the semester. Future researchers should compose an evaluation packet that is equally inclusive of all information that learners are expected to know at the completion of an introductory behavior analysis course. Although standardized tests are beneficial for research purposes, the utility may not be applicable for typical teaching purposes. Future research should be conducted regarding the use of standardized testing for the purpose of introductory higher education courses as well as the utility of standardized tests driving the method of teaching used in a higher education setting.

Traditional interteach typically requires students to complete prep-guides or course materials prior to attending class this could allow opportunity for students to make errors when completing course materials. The modified interteach method used in this research did not allow students to complete the class reviews prior to class to avoid opportunity for students to make errors and encourage errorless learning when completing the review packets in class. Consequently, research should be conducted regarding the modified method of interteach to a traditional method of interteach. Likewise, other components of teaching methods should be examined in addition to interteach as a comprehensive teaching model. Other methods of teaching such as PI and PSI use go-at-your-own-pace components integrated into the teaching method. The use of additional components to encourage students to come in contact with course material through various methods could benefit student scores, and retention. Although teaching methods have been improving for many years, more research is required to identify the best teaching practices.

References

Arntzen, E., & Hoium, K., (2010). On the effects of interteaching. *The Behavior Analyst Today*. 11(3), 155-160. Doi: 10.1037/h0100698

Bethke, V. S., (2016). Interteaching: Types of prep guide questions and their effects on student quiz performance. (Master's thesis). Retrieved from http://commons.lib.jmu.edu/master201019/84/

Boyce, T. E., & Hineline, P. N., (2002). Interteaching: A strategy for enhancing the user-friendliness of behavioral arrangements in the college classroom. *The Behavior Analyst*. 25 (2). 215-226. doi: 0.1007/BF03392059

Brown, T. W., Killingsworth, K., & Alavosious M. P., (2014). Interteaching: An evidence-based approach to instruction. *International Journal of Teaching in Higher Education.* 26(1). 132-139. Retrieved from https://eric.ed.gov/?id=EJ1043034

Buskist, W., Cush, D., & DeFrandpre, R. T., (1991). The life and times of psi. *Journal of Behavioral Education.*1 (2). 215-234. Retrieved from https://link.springer.com/article/10.1007%2FBF00957005?LI=true

Cannella-Malone, H. I., Axe, J. B., & Parker, E. D., (2009). Interteach preparation: A comparison of the effects of answering versus generating study guide questions on quiz scores. *Journal of the Scholarship of Teaching and Learning.* 9(2). 22-35. Retrieved from https://eric.ed.gov/?id=EJ854891

Chester, A., Kienhuis, M., & Wilson, P., (2013). Implementation of the interteaching model: Implications for staff. *Innovations in Education and Teaching International*. 52(3). 300-309. doi: 10.1080/1473297.2013.845536

Fernald, P. S., & Jordan, E. A., (1991). Programmed instruction versus standard text in introductory psychology. *Teaching of Psychology.* 18(4). 205-211. Retrieved from http://web.a.ebscohost.com/ehost/detail/detail?vid=0&sid=989c12f7-28e7-49ef8a819c650a8039e2%40sessionmgr4010&bdata=JnNpdGU9ZWhvc3QtbGl2ZSZzY29wZT1zaXRl#db=aph&AN=6382315

Fielderman, T. A., (2014). Preliminary analysis of interteaching's frequent component in the community college classroom. *Journal of College Teaching & Learning.* 11(4). 149-156. Retrieved from https://search.proquest.com/openview/a19c87362aa4e31495933dd4311e1007/1?pq-origsite=gscholar&cbl=2026890

Goto, K., & Schneider, J., (2010). Learning through teaching: Challenges and opportunities in facilitating student learning in food science and nutrition by using the interteaching approach. *Journal of Food Science Education.* 9. 31-35. doi: 10.1111/j.1541-4329.2009.00087.x

Harrington, D., (1999) A comparison of traditional classroom and programmed instruction / distance learning approaches. *Journal of Social Work Education.* 35(3). 343-352. Retrieved from http://www.jstor.org/stable/23043560

Jaehing, W., & Miller, M. L., (2007) Feedback types in programmed instruction: A systematic review. *The Psychological Record.* 57(2). 219-232. Retrieved from http://opensiuc.lib.siu.edu/cgi/viewcontent.cgi?article=1104&context=tpr

Keller, F. S. (1968). "Good-bye, teacher…". *Journal of Applied Behavior Analysis.* (1), 79-89. doi: 10.1901/jaba.1968.1-79.

Lambert, T., & Saville, B. K., (2012) Interteaching and the testing effect: A preliminary analysis. *Teaching of Psychology.* 39(3). 194-198. doi: 10.1177/0098628312450435

Leidt, A. E., (2017). Let's discuss: Group size, course performance, & enjoyability in an interteaching class. (Undergraduate thesis)Retrieved from http://thesis.honors.olemiss.edu/818/

Querol, B. I. D., Rosales, R., & Soldner, J. L., (2015). A comprehensive review of interteaching and its impact on student learning and satisfaction. *Scholarship of Teaching and Learning in Psychology.* 1(4). 390-411. 10.1037/stl000008

Saville, B. K., Zinn, T. E., & Elliott, M. P., (2005). Interteaching versus traditional methods of instruction: A preliminary analysis. *Teaching of Psychology*. 32(3). 161-163. doi:10.1207/s15328023top3203_6

Saville, B. K., Zinn, T. E., Neef, N. A., Van Norman, R., & Ferreri, S. J., (2006). A comparison of interteaching and lecture in the college classroom. *Journal of Applied Behavior Analysis*. 39(1). 49-61. doi: 10.1901/jaba.2006.42-05

Saville, B. K., Cox, T., O'Brien, S., & Vanderveldt, A., (2011). Interteaching: The impact of lectures on student performance. *Journal of Applied Behavior Analysis.* 44(4). 937-941. doi: 10.1901/jaba.2011.44-937

Saville, B. K., Pope, D., Lovaas, P., & Williams, J., (2012). Interteaching and the testing effect: A systematic replication. *Teaching of Psychology.* 39(4). 280-283. doi: 10.1177/0098628312456628

Saville, B. K., (2013) Interteaching: Ten tips for effective implementation. Retrieved from https://www.psychologicalscience.org/observer/interteaching-ten-tips-for-effective-implementation

Saville, B. K., Bureau, B., Eckenrode, C., Fullerton, A., Herbert, R., Maley, M., Porter. A., & Zombakis, J., (2014) Interteaching and lecture: A comparison of long-term recognition memory. *Teaching of Psychology.*41(4). 325-329. doi: 10.1177/0098628314549704

Scoboria, A., & Pascual-Leone, A., (2009). An 'interteaching' informed approach to instructing large undergraduate classes. *Journal of the Scholarship of Teaching and Learning.* 9(3). 29-37. Retrieved from https://josotl.indiana.edu/article/view/2140

Sirois, F. M., Windsor, A., & Pascual-Leone, A., (2009). Deconstructing interteaching: Is the whole greater than the sum of its parts?. In M. Albertson (Eds.), *Developments in higher education* (pp. 53-57) New York: Nova Science Publishers, Inc.

Truelove, J. C., Saville. B. K., & Van Patten, R., (2013). Interteaching: Discussion group size and course performance. *Journal of Scholarship of Teaching and Learning.* 13(2). 23-30. Retrieved from https://eric.ed.gov/?id=EJ1011668

U.S. Department of Health, Education & Welfare Office of Education. (1996). *Teacher verification in concept presentation in bscs curriculum program* (Bureau No. BR-5-0585). Retrieved from: https://eric.ed.gov/?id=ED023206

Appendix A: Tables

Table 1.

Mean Scores

Group	*n*	Mean Score
1	6	13.2
2	39	24.86
3	43	24.39
4	13	13.21

Note: Mean score is the aggregate score of all participants in each group.

Table 2. (next page)

CPSY 330 Satisfaction Survey

	6 Point Likert-type Scale	Group 2	Group 3	Combined
1.	I studied harder for this course than other Community Psychology courses I've taken	4.68	3.82	4.25
2.	If you answered question 2 with 4, 5, or 6:			
	a. I studied harder in this course because I didn't want to let my group down.	4.53	4.29	4.41
	b. I studied harder in this course because I didn't want to be embarrassed in front of my group	4.56	3.5	4.03
	c. I studied harder in this course because I liked the material.	4.5	4.43	4.46
	d. I liked working with partners on the class review worksheets	5.56	3.71	4.63
3.	Class reviews helped me explore the material in new ways	5.24	4.45	4.85
4.	Compared to other Community Psychology courses, this course had more work to do each week	4.62	3.64	4.13
5.	Vocabulary flashcards enhanced my understanding of the material	4.81	4.64	4.72
6.	If you answered question 6 with 4, 5, or 6:			
	a. Making the vocabulary flashcards enhanced my understanding of the material	4.78	4.7	4.74
	b. Reviewing the vocabulary flashcards enhanced my understanding of the material	5	4.91	4.95
7.	Clarifying lectures enhanced my understanding of the material	5.38	4.91	5.14
8.	If you answered question 7 with 4, 5, or 6:			
	a. Clarifying lectures enhanced my understanding of the material because I like to hear the course material explained to me multiple times	5.14	4.7	4.92
	b. Clarifying lectures enhanced my understanding of the material because it answered questions that I had after working on the course review	5.14	4.8	4.97
9.	The information given in lectures helped me understand my weekly readings	5.27	4.91	5.09
10.	I have learned more in this course than other Community Psychology courses I've taken	4.86	4.64	4.75
11.	Because of this class I feel more prepared to deal with behavior change situation in my work and at home	5.08	4.36	4.72
12.	This class was easier than other Community Psychology Classes I've taken	3.14	3.73	3.43
	Open ended questions	Group 2	Group 3	Combined
13.	How many days do you think you missed class?	2.58	1.44	2.01
14.	On average how many hours per week did you study for this class outside of class?	3.64	2.99	3.31
15.	On average, how many days per week did you review your vocabulary flashcards?	3.09	2.59	2.84
16.	On average, how many times did you practice each of the vocabulary flashcards when you did review	3.63	2.85	3.24
	10 point scale1 = "I have to attend class" 10 = "I want to attend class"	Group 2	Group 3	Combined
17.	For question 17, please mark on the scale where you feel you fall. I attend class because:	6.50	5.59	6.05

Note: Mean scores of the satisfaction survey from Groups 2 and 3.

Appendix B: Comparison of Teaching Styles: Traditional Lecture vs Interteach

Consent to Participate

You are invited to participate in a research study about teaching styles in a university setting. This study is being conducted to assess the effectiveness of different teaching styles to student learning and information retention.

If you agree to be part of the research study, you will be asked to answer a list of questions derived from content taught in CPSY 330 Principles of Behavior and potentially to complete a satisfaction survey. If you agree to be a part of the research study you will be asked to grant the researchers permission to access information regarding your enrollment in CPSY 330 (i.e. semester you completed the course and what professor taught the course).

Benefits of the research include a basis for St. Cloud State University to develop the best possible class in regards to student retention of content, and student satisfaction.

There are no foreseeable risks or discomforts associated with participation in this research project.

Data collected will remain confidential, meaning data will be reported and presented in aggregate (group) form or with no more than two descriptors presented together. No identifying information will be reported.

Participating in this study is completely voluntary. Your decision whether or not to participate will not affect your current or future relations with St. Cloud State University, the researcher. Deciding not to participate will not affect your grade in any SCSU course. If you decide to participate, you are free to withdraw at any time without penalty.

If you have questions about this research study, you may contact:
Margaret Murphy at mmurphy3@stcloudstate.edu
Dr. Benjamin Witts at bnwitts@stcloudstate.edu

Results of the study can be requested from the researcher:
Margaret Murphy at mmurphy3@stcloudstate.edu

Your signature indicates that you are at least 18 years of age, you have read the information provided above, and you have consent to participate.

_____
Name (print)

_____ _____
Signature Date

Please Complete the following:

1. I want to measure how often a behavior occurs. I should use:

    a. Latency
    b. Intensity
    c. Duration
    d. Frequency

2. Behavior is best defined as:

    a. Any response to stimuli
    b. Any organismic action that alters the environment
    c. Environmental relations between behavior and consequence
    d. Anything you observe another organism doing

3. Which of the following is not in the 3-term contingency?

    a. Antecedent
    b. Contingency
    c. Consequence
    d. Behavior

4. Lawful behavior can be:
    a. Willful
    b. Influenced
    c. Neglected
    d. Independent

5. Circle the two options that are functionally equivalent

    a. Turning the door knob to open the door
    b. Asking for a break to get out of work
    c. Leaving the office to go meet with a client
    d. Pressing a "door open" button so the door opens

6. What best describes a "reinforcer"

    a. A stimulus that at least once worked as a consequence in a reinforcement contingency
    b. A stimulus that is currently working as a consequence in a reinforcement contingency
    c. A stimulus that will work as a consequence in a reinforcement contingency

7. In negative reinforcement, we remove:

    a. An adverse event
    b. An aversive stimulus
    c. An antecedent condition
    d. An auxiliary context

8. Wareef spends too much time thinking about her ex. Thinking about her ex is:

    a. A behavioral deficit
    b. A behavioral excess
    c. A behavioral contingency
    d. A behavioral consequence

9. In extinction, what consequence is provided after the behavior is produced?

    a. Aversive consequence
    b. Reinforcing consequence
    c. Alternative consequence
    d. No consequence

10. Which of the following is defined by behavior once extinguished coming back because its maintaining reinforcer was presented again?

    a. Extinction burst
    b. Spontaneous recovery
    c. Reinstatement
    d. Resurgence

11. In differential reinforcement you _____ the inappropriate behavior while _____ the appropriate behavior

a. punish; reinforcing
b. reinforce; extinguishing
c. reinforce; punishing
d. extinguish; reinforcing

12. Establishing operations do what?

a. Increase the extinction of behavior
b. Reduces responding
c. Raises the value of a reinforcer
d. Differentially reinforces

13. Teaching a child to complete a set of math problems faster is an example of:

a. Whole-session DRL
b. Spaced-responding DRL
c. Whole-session DRH
d. Spaced-responding DRH

14. You find that you respond aggressively when your significant other gets too clingy (e.g., is over at your house every day for weeks on end). When you respond like this, s/he leaves you alone for a day or two, which is reinforcing. How could you schedule breaks from your significant other so you are not so hostile?

a. Use a FT schedule of breaks (i.e., every 5^{th} day is yours)
b. Use a FR schedule of breaks (i.e. every 5^{th} response earns you a day to yourself)
c. Use a VI schedule of breaks (i.e., only after a few days will the response earn you a day to yourself)

SHORT ANSWER

15. The 3-term contingency consists of **a**_____, **b**_____, and **c**_____

16. For therapy to work, behavior must be viewed as being subjectable to **p**_____ and **i**_____

17. Operants are defined by their **f**_____**n**, not their **t**_____**y**

18. In _____**ive** reinforcement, behavior escapes or avoids a(n) _____**ive** stimulus

19. In a _____ interval 5 schedule, reinforcement is provided contingent upon responding only after at least five minutes has elapsed since the last response.

20. Establishing operations make the reinforcer more _____

21. S^Ds indicate the reinforcer is more _____

22. Abolishing operations make the reinforcer less _____

23. S^Δs indicate the reinforcer is less _____

24. Establishing operations _____ the probability of behavior historically related to the consequence (i.e., related to the EO)

25. Abolishing operations _____ the probability of behavior historically related to the consequence (i.e., related to the AO)

26. What are the four primary dimensions of behavior?

    a. _____ b. _____
    c. _____ d. _____

27. What is the difference between escape and avoidance? _____
_____

28. Define the term: “Reinforcement” _____

If you completed CPSY 330 in Spring 2017 with Dr. Witts please continue to the next page.

If you completed CPSY 330 in a different semester or with a different professor you may turn in your packet.

CPSY 330 Satisfaction Survey

		Strongly Disagree	Somewhat Disagree	Disagree	Agree	Somewhat Agree	Strongly Agree
1.	I studied harder for this course than other Community Psychology courses I've taken	1	2	3	4	5	6
2.	If you answered question 2 with 4, 5, or 6:						
	e. I studied harder in this course because I didn't want to let my group down.	1	2	3	4	5	6
	f. I studied harder in this course because I didn't want to be embarrassed in front of my group	1	2	3	4	5	6
	g. I studied harder in this course because I liked the material.	1	2	3	4	5	6
	h. I liked working with partners on the class review worksheets	1	2	3	4	5	6
3.	Class reviews helped me explore the material in new ways	1	2	3	4	5	6
4.	Compared to other Community Psychology courses, this course had more work to do each week	1	2	3	4	5	6
5.	Vocabulary flashcards enhanced my understanding of the material	1	2	3	4	5	6
6.	If you answered question 6 with 4, 5, or 6:						
	c. Making the vocabulary flashcards enhanced my understanding of the material	1	2	3	4	5	6
	d. Reviewing the vocabulary flashcards enhanced my understanding of the material	1	2	3	4	5	6
7.	Clarifying lectures enhanced my understanding of the material	**1**	2	3	4	5	6
8.	If you answered question 7 with 4, 5, or 6:						
	c. Clarifying lectures enhanced my understanding of the material because I like to hear the course material explained to me multiple times	1	2	3	4	5	6
	d. Clarifying lectures enhanced my understanding of the material because it answered questions that I had after working on the course review	1	2	3	4	5	6
9.	The information given in lectures helped me understand my weekly readings	1	2	3	4	5	6
10.	I have learned more in this course than other Community Psychology courses I've taken	1	2	3	4	5	6
11.	Because of this class I feel more prepared to deal with behavior change situation in my work and at home	1	2	3	4	5	6
12.	This class was easier than other Community Psychology Classes I've taken	1	2	3	4	5	6

13. How many days do you think you missed class? _____

14. On average how many hours per week did you study for this class outside of class? _____

15. On average, how many days per week did you review your vocabulary flashcards? _____

16. On average, how many times did you practice each of the vocabulary flashcards when you did review _____

For question 17, please mark on the scale where you feel you fall.

I attend class because:

I have to I want to

What is one aspect of class that you wish other Community Psychology courses would incorporate?

_____

_____

What is one aspect of class that you would like to remove or change?

_____

_____