

Interteaching: An Evidence-Based Approach to Instruction

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This paper describes *interteaching* as an evidence-based method of instruction. Instructors often rely on more traditional approaches, such as lectures, as means to deliver instruction. Despite high usage, these methods are ineffective at achieving desirable academic outcomes. We discuss an innovative approach to delivering instruction known as *interteaching* that is derived from the behavioral sciences and has empirical support with regard to applications in higher education. In an *interteaching* session, the instructor composes a preparation guide consisting of several questions that outline a required reading and distributes the guide during class. Students form small groups and work collectively on the guide while the instructor goes from group to group to answer questions. Following the session, the instructor gives a short, intensive lecture on problem areas. Previous research has shown that this approach is effective and allows for frequent assessment of instructional materials and timely guidance of student progress. Suggestions for application and areas of future research are presented.

For an instructor in higher education, the need to stay responsive to the evolving educational system is vital. Over the past 20 years, the nature of higher education has gone through extensive change. The number of students seeking higher education is rising (Snyder & Dillow, 2011), but funding for academic institutions has diminished (Tandberg, 2010). Technological advancements have created a paradigm shift in design, delivery, and assessment of instruction, yet methods are variable, and many instructors rely on older technologies and deliveries such as lectures with a midterm/final exam structure (Austin, 2000). Scholars have begun discussions exploring the accountability of higher education and data-driven decision making regarding effective instruction (Halpern & Hakel, 2003; Leveille, 2005; Michael, 1991; Saville, Lambert, & Robertson, 2011). Recent trends to innovate instruction include alternative approaches, such as flipping the classroom (Berrett, 2012) where lectures are posted to the web prior to class, and students complete homework during the allotted class time. Such methods are taking advantage of the technological advancements, but little data are reported on student performance. Innovation, empiricism and practicality all are important, and they should be used to better adapt to the ever-changing collegiate environment.

This paper describes a coherent approach to innovate instructional systems that is easily adaptable to the college classroom. First, a brief history of behavioral methods of instruction is provided followed by a description of an evidence-based approach known as *interteaching* (Boyce & Hineline, 2002). A review of previous literature and empirical evidence that supports *interteaching* is provided. A commentary on the use within higher education, directions for further research and suggestions for adoption and application of other forms of evidence-based instruction conclude this paper.

Behavioral Instruction in Higher Education

Behavior analysis provides a long history of integrating evidence-based approaches to educational methods (Austin, 2000; Boyce & Hineline, 2002; Keller, 1968; Lindsley, 1991; Skinner, 1958; Vargas & Vargas, 1991). Deeply rooted in the experimental analysis of behavior (Skinner, 1966), behavior analysis segments all behavior into objective units and identifies functional relationships for the purpose of prediction and control (Skinner, 1974). The applied implications of behavior analysis are profound and relevant in many disciplines including business, communications, clinical services, community applications, and more (Austin & Carr, 2000).

Behavioral applications in higher education are empirically effective for improving student retention and performance. Techniques such as programmed instruction (Vargas & Vargas, 1991), precision teaching (Lindsley, 1991) and personalized system of instruction (Keller, 1968) are effective through means of reinforcing successive approximations to mastery of course materials as evidenced by demonstration of proficiency on exams or other assessment tools. Within this paradigm, the instructor mainly serves as a designer and facilitator rather than a gatekeeper. It is the task of the instructor to allow for multiple opportunities for student response (frequent testing and assessment) and provide rapid feedback to students. Over the last five decades, several of these methods have been studied extensively (see Austin, 2000 for a review).

Resistance to behavioral methods of instruction has been documented over the years (Boyce & Hineline, 2002; Sherman, 1992). For example, the design and implementation of a behavioral program in a college classroom are labor intensive. Using a behavioral method of instruction also requires flexibility and wide institutional support, which has dwindled since the 1980s (Boyce & Hineline, 2002). An elegant approach

that captures the effectiveness of behavioral methods while also gaining administrative support is warranted.

Interteaching

Interteaching is a method of instruction derived from the empirical history of the behavior sciences (Boyce & Hinline, 2002). Interteaching creates a learning environment that includes guided instruction, study guides, peer-to-peer interactions, and instructor feedback. Lectures are included as a supporting element but are not the centerpiece of instruction. In a typical interteach session, students form small groups (two to three people per group) and work on a preparation guide for 30-45 minutes. As the session progresses, the instructor goes from group-to-group and clarifies questions, provides feedback on student responses, and assesses student performance. The remainder of the class period is used to address common questions raised during the interteach session in addition to addressing other aspects of the text. There are several important components of interteaching. In the following sections, we identify these components and offer standards and recommendations to implement in college classrooms.

Student Prep Guides

The fundamental variable in the delivery of an interteach session is the use of the preparation guide. The prep guide is distributed prior to the start of a class period and is a short series of questions that outline a required reading. Boyce and Hinline (2002) did not indicate how long in advance the prep guide should be distributed, offering that it may be appropriate to distribute the guide either at the start of the class period or a couple of days in advance. In designing the prep guide, it is important to consider the outcome objectives, the discussion topics necessary to adequately assess these objectives, and the time allocation to completion. The Appendix depicts a sample prep guide designed by the first author for an introductory psychology course.

The Interteach Session

Once the class begins, students form groups of two to three people and begin to work on answering the prep guide questions. Students are encouraged to work on answering questions prior to class, but they are expected to be active contributors during the session. Upon the start of the class period, students begin discussing responses on the prep guide and work together to find coherent and collaborative approaches to complex discussion points. While supplemental materials (e.g., notes, textbooks) may

be referred to during the session, Boyce and Hinline (2002) discourage over-utilizing these resources, as it promotes under-preparation on the part of the student.

The formation of the groups is also important. Students do not work with the same individuals throughout the duration of the course, and instead, work with different members of the class. This approach establishes a collectivist learning environment where students feel free to share opinions and thoughts about material and feel less discouraged about public scrutiny.

As the session goes on, the instructor migrates from group to group and clarifies any issues that may arise for the students. Since students are discouraged from utilizing supplemental materials, the instructor may need to shape incorrect student statements or provide guidance on how to investigate given topics. As the instructor discusses the material with different groups, notes are taken as to what problems are arising with respect to the material and questions posed by the preparation guide. If frequent problems arise, the instructor may stop the session, address a problem quickly, and inform the class that more information regarding a particular question will be more adequately discussed during the clarifying lectures following the session.

Record Evaluation and Clarifying Lecture

Once a session is complete, students fill out a short evaluation that outlines the quality of the session, which problems were difficult for the student to address, the quality of assistance provided by their group members, and the quality of the instructor's feedback. The instructor then reviews the feedback provided by the students and prepares a short clarifying lecture that allows for the problems identified by the student to be discussed at the class level. There are numerous variations and approaches to how this part of the instruction can be delivered, all of which are most likely contextually dependent on the conditions under which the course is occurring. For example, a clarifying lecture may be spent on discussing broader applications of a particular phenomenon that may not be adequately addressed in the book during weeks when the material is easy and more intensive on key concepts when the material is complex.

Another important aspect to consider is time allocation. Clarifying lectures do not take longer than one-third of a class period. Boyce and Hinline (2002) called for the clarifying lecture shortly after the interteach session so that materials presented to the class are in close temporal relation to the completion of the session. Others (e.g., Saville et al., 2011) have recommended postponing the lecture until the following class period so the instructor can better review the

written feedback provided by the record evaluation. Either approach, however, does not take an extensive amount of in-class time to administer.

Other Components

A valuable aspect of interteaching is the flexibility it allows instructors to deliver instruction while also keeping a level of engagement (Saville, 2011). Many of the traditional components that accompany instruction (e.g., papers, exams, quizzes) can still be utilized under this design, which may allow for some degree of administrative buy-in (Boyce & Hinline, 2002). It is recommended that frequent examinations and other learning assessments be delivered throughout the course of the semester to capitalize on the impact of interteaching (Boyce & Hinline, 2002; Saville et al., 2011).

Advantages of Interteaching

Interteaching is an advantageous methodology of instruction for several reasons. First, when utilizing interteaching, the instructor is incorporating an evidence-based technique within his/her instructional practices. Second, interteaching is more user-friendly than other behavioral applications of instruction.

Interteaching allows for frequent assessment of student progress because the role of the instructor is to assess student progress and form instructional tactics to promote active learning. Several products are generated by the students and the instructor to capture these assessments. First, record evaluations left by the student allow the instructor to identify areas that need improvement and focus class discussions toward these areas. As more classes go through similar didactic techniques, the instructor can estimate and predict

potential problem areas and generate materials in anticipation of troublesome questions and sections. In addition, the instructor is allowed anecdotal support via the verbal feedback generated by their students. Class discussions are more fluid and encompassing of the entire group as well. Table 1 offers a comparison of interteaching to lectures and highlights key differences in terms of student and instructor behavior and responses. As observed in this depiction, both shape crucial academic skills, but interteaching offers individual interaction with students more frequently and allows for efficient assessment of student progress and aptitude.

Challenges

Adopting interteaching comes with some factors to consider. First, the instructor is tasked with breaking materials and readings into unit outcomes and objectives. Preparation guides must be designed that allow for sufficient contact with required materials and that are also capable of generating discussion among the class. While this may seem elementary, the time associated with converting lecture materials into interteach discussions or preparation guides can be significant. In addition, it is likely that course activities or supplemental instructional demonstrations must be well planned or kept to a minimum to not overlap with scheduled interteaching sessions.

Another challenge to interteaching falls upon general course structures and times. For example, some classes meet twice a week, others three and some once. A systematic investigation has not been conducted searching for the ideal timeframe to conduct interteaching. Some instructors may have more flexibility to make adjustments in their own courses and alter the times in which they meet, while others may be

Table 1

A Comparison of Interteaching to More Conventional Methods of Instruction, Such as Lectures Combined with Exams

	Interteaching	Lectures
Student responses	Active student engagement via peer-peer discussion and rapid instructor feedback (Saville, 2011).	Students passively listen to lecture and encouraged to take notes.
Note taking	Shapes note taking skills by providing preparation guide that outlines material.	Unchecked note taking that is assessed via exams or quizzes (Austin, 2000).
Instructor interaction	Students approached individually.	Groups are addressed. Individual interaction occurs outside of class.
Class sizes	No research on large class sizes.	Can accommodate many students.
Assessment	Frequent opportunities (Boyce & Hinline, 2002).	Exams/papers as only index of learning (Austin, 2000).
Retention	High in classroom and laboratory studies (Saville et al., 2005; Saville et al., 2006).	Historically low (Matheson, 2008).

subject to more stringent requirements. Regardless, instructors interested in applying interteaching to their own courses must consider the time necessary to devote to interteaching.

Empirical Evidence of Interteaching

Since Boyce and Hineline's (2002) original article, systematic investigations into the effectiveness of interteaching offer support for its adoption. Saville, Zinn, and Elliott (2005) showed the effectiveness of interteaching compared to lecturing. In this study, participants were separated into three groups. Students in the first group read an article, returned the following week, and listened to a lecture on the article. A quiz was then given to each student on the contents of the article. Conditions in the second group were identical except instead of a lecture, students participated in an interteach session. In the last control group, students only read the article and took a quiz the following week. Results showed that students in the interteach condition outperformed those in the control condition and the lecture condition (Saville et al., 2005). This study is noteworthy as it integrates practical considerations into a tightly controlled environment and manipulates key variables in order to improve the application of a particular technology.

Saville, Zinn, Neef, Van Norman, and Ferreri (2006) replicated the results from their previous study and integrated interteaching into actual classroom instruction. In their first series of studies, the authors showed that interteaching was effective in two sections of an undergraduate course. In one section, interteaching was used in the first half of the course, while a lecturing technique was implemented during the latter half. The second section was identical, except the section began with lecturing and ended with interteaching. Students in both sections took weekly quizzes. Results of this study depicted that students in the interteaching sessions performed better than students in the lecturing sections. In the second part of this study, an interteaching component in a graduate human development course was investigated. A counterbalanced design was implemented in which the class alternated teaching techniques on a weekly basis (i.e., instruction alternated between interteaching and lecture). Students took weekly quizzes following the end of each phase. Results of this study showed that students performed higher on average during interteaching weeks than lecture weeks (Saville et al., 2006).

In their original description of interteaching, Boyce and Hineline (2002) discussed the use of quality points that are awarded to students if both members of the session respond correctly to a previous interteach question on an exam. Saville and Zinn (2009)

investigated the use of quality points on interteaching sessions. In this study, participants underwent interteaching followed by a unit exam for six units. Students responded to essay questions, which accounted for 5 points on the exam. If both students who participated in the dyad interteach session received a score of 4 or 5 on the exam, students were awarded 3 quality points. If one or both of the students earned less than four, then no students were awarded quality points. The authors note that the addition of quality points did not have any significant effect on the exam performance of students. The authors discussed some potential implications of this finding. First, the addition of quality points might be too delayed to have any lasting impact on the behavior of the students, as students did not typically know if they received quality points until after the exam had been graded (Saville & Zinn, 2009). Further, it is likely that the effective components of interteaching revolve around the formation of small groups, which creates a more immediate contingency where peers can shape the behavior of others to increase learning (Saville & Zinn, 2009).

The previous works described have focused more on small enrollment sizes. While replications with large class enrollments are warranted, few studies have examined the advantages of interteaching in courses with classes sized over 30 students. Scoboria and Pascual-Leone (2009) addressed this concern in their work. The authors applied interteaching in two sections of a large undergraduate course on abnormal psychology. The instructors distributed prep guides and utilized course assistants to aid in answering student questions, assisting students when questions arose. Clarifying lectures were then employed either in the following class period (Group 1: class met twice a week) or following a short class break (Group 2: class only met once a week). The authors report statistically significant results depicting that interteaching groups performed better on written assignments when compared to traditional lecture control groups (Scoboria & Pascual-Leone, 2009). These results show promise, as most published interteaching studies do not exceed *n* sizes of 30 students.

Interteaching has also begun to generate interest outside of the behavior sciences. Goto and Schneider (2009, 2010) incorporated interteaching into courses on nutrition. In their modified approach, the authors generated two separate preparation guides and assigned half of the class to the first and the remaining half to the second. Students assigned to guides served as instructors of the material. In follow-up experiments, preparation guide questions emerged into critical thinking synthesis assignments, during which those involved in the interteaching session worked toward generating a sufficient answer to a complex question.

Self-report metrics generated from these studies indicate that students preferred interteaching sections (Goto & Schneider, 2009, 2010). When asked to identify what the effective components of instruction were, most students suggested that the outline of the preparation guide assisted learners in reading materials and generating notations about the material. Also, students suggested that the review lecture after the interteach session was also helpful in that students had already contacted the material thoroughly and were more readily prepared to interact with the instructor. These studies are provocative for several reasons. First, they readily show the social validity of interteaching, which also allows for discussion and hypothesis forming of the effective components associated with interteaching. Second, these studies show effective modifications of interteaching in another subject discipline outside of psychology, which further increases readership and exposure of this methodology. Unfortunately, little data are shown on student performance in these studies.

Future Research

While interteaching is a promising method of instruction, an in-depth component analysis is warranted to specify which components of the methodology are effective, ineffective, or resilient to changes in schedule and structure. Given that the approach encompasses many social and behavioral components, an investigation into components is necessary to enhance both the effectiveness of interteaching and the advancement of the experimental history that interteaching is based upon. Further, many of the studies cited here used interteaching in a social science course, and little work has ventured out into other fields of study. For example, there has been no published work in using interteaching in math-based instruction or any of the physical sciences. Experimental applications in this field would generate interest on a broader scale. No studies have been organized where interteaching has been evaluated within the context of an elementary or secondary school. This absence alone creates several questions as to whether or not higher education methods can be directly replicated in these environments. Finally, interteaching has solely been used as a classroom technique. No investigation has been proposed that allows for an investigation to occur outside of the educational environment and into the adult training domain.

The scientist-practitioner approach (Hayes, Barlow, & Nelson-Gray, 1999; Shapiro, 2002) advocates for using both laboratory and experimental techniques to answer problems of social importance. Historically, this approach has been correlated with the

practice of providing human service care with the intent of keeping practitioners in contact with research and scholarship, while also providing researchers with examples of problems to address from a scientific level. We propose that similar methods of investigation and scholarship would be beneficial to higher education for several reasons. First, it would directly connect scholars from multiple disciplines to educational initiatives. This would create a network of multi-dimensional resources that would assist several instructors across the world. Second, the quality of instruction would increase as systematic investigation would further allow for pragmatism and functionality within the classroom, creating an outcome oriented approach to education. Lastly, the scientist-practitioner approach allows a mutually influential and beneficial relationship between research and application for equal emphasis on real-world problems. As generations of students change, so do learning preferences. A network that is constantly evaluating the instructional environment and notating anomalies and outcomes of practices would provide support to instructors at multiple levels.

The following framework of research questions is offered as a preliminary guide for a research program exploring interteaching in higher education.

Effective components. The scope and utility of interteaching can only be understood once the effective components of the process have been evaluated. Basic laboratory work in controlled settings that investigate the entire process would allow educators to implement proven methodologies in their instruction, while also providing a more fruitful basis in applied research for replication.

Large class sizes. Typical course sizes of interteaching studies do not exceed 45 students overall. A systematic replication of interteaching protocols within the context of a high enrollment courses would provide a scope of utility for instructors charged with educating a large number of students per semester ($n > 100$).

Interteaching compared to other methods. Recent discussions in higher education have centered on the idea of flipping the classroom to promote active learning during class time and delivery of lectures elsewhere (Berrett, 2012). While some of the foundational components of both interteaching and flipping are similar, there are differences in regards to how students spend their time out of class and the role of the instructor. Conceptual analyses that better define these roles are warranted, as are empirical comparisons. Such an agenda would add to the empirical evidence that flipping lacks, and it would provide wider interdisciplinary support for interteaching that may produce fruitful outcomes.

Interteaching in STEM. The limited research in interteaching has not expanded into the realm of

science, technology, engineering, or math (STEM). The application of these procedures to these content areas creates a provocative and exciting possibility of interdisciplinary work, connecting instructional researchers with subject experts to increase student proficiency within these subjects. Given the recent attention that this area has received (see Organization for Economic Co-Operation and Development, 2009, for their report on developed countries and their proficiencies), any research in this area aimed at improving student acquisition and retention of knowledge is warranted.

Interteaching is not designed for a particular subject matter, and we encourage educators across higher education to evaluate their own methods. Many factors impact the quality of an education, and taking an objective look at how and why our methods are designed, developed, and honed is worthwhile, especially in the context of our students facing over-taxed learning environments. Young instructors charged with building their courses are encouraged to incorporate interteaching into their curriculum and report their results. Senior instructors looking for new ways to innovate with their pedagogy are likewise encouraged to investigate this approach.

Conclusion

A growing body of interdisciplinary work supports interteaching, but much more needs to be done to answer questions of limitations, practical considerations, technological supplementation, and broader application and replication across subject matters. An instructor's selection of any program of instruction relies on a number of variables including the articulation and identification of the pedagogical assumptions of the instructor, predetermined course outcome objectives, modalities accepted at his/her institution, and application of evidence-based practice to influence learning. Evaluating the merits for adopting interteaching assists instructors in identifying these considerations and may alter their perspectives on the functions of instructors. Providing lectures to attentive students may be a satisfying experience, especially for fluent lecturers, but students' active responding during well-designed classroom activities may yield better outcomes and positive course evaluations. Instructional researchers are encouraged to study variations of this method systematically and report findings to advance the practice and notate anomalies and other practical considerations. Interdisciplinary research and application across many disciplines can identify the conditions where interteaching is worthwhile, while also notating potential weaknesses in application. The fundamental purpose of this paper is to encourage instructors to

reconsider their pedagogical assumptions and techniques. Interteaching offers an attractive method for bringing instructors into closer contact with measures of students' learning. Heightened focus on student performance and innovation in creating students' active participation can create more satisfying experiences for instructors while improving learning outcomes for students.

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Appendix
Interteach Assignment: Chapter 1

1. Psychology is currently defined as:
2. What is dualism?
3. Who was denied a PhD degree from Harvard because she was a woman?
4. Explain the difference between Clinical Psychology and Psychiatry.
5. Dr. James proposes that a man's desire for young and healthy women contributes to the survival of the human species. What psychological perspective is this and why??
6. Describe what a hypothesis is.
7. When everybody has an equal chance of being included in a study, this process is called:
8. Which of the following correlation coefficients reflects the *strongest* correlation?
 - A. +.10
 - B. -.64
 - C. +.35
 - D. -.10
9. Consistently we find low self-esteem is often related with high levels of depression. Does this mean that low self-esteem causes depression? Explain.
10. In order to prove a cause-and-effect relationship we must use what?
11. Neither the researcher nor the subjects knows whether or not they received the drug studied or a placebo. What type of study is this?