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Using Response Card Technology to Reduce Disruptive Behavior in the College Classroom

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Using Response Card Technology to Reduce Disruptive Behavior in the College Classroom

A Thesis
By
Meera Aggarwal

Submitted to the Faculty of the Department of Health Professions
at Rollins College in Partial Fulfillment
of the Requirements for the Degree of

MASTER OF ARTS IN APPLIED BEHAVIOR ANALYSIS AND CLINICAL SCIENCE

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Abstract

The purpose of this experiment was to determine if response-card technology would decrease disruptive behavior (e.g., texting, surfing the Internet, sleeping) in the college classroom. Two experiments were conducted. In Experiment 1, a graduate classroom of 14 students from a small liberal arts college in the southeast participated. An alternating-treatments design was implemented comparing baseline (standard lecture) to Nearpod™ (an online question-feedback platform) and response cards. Results indicated neither intervention had a meaningful effect on disruptive behavior; however, the majority of students indicated a preference for Nearpod™. In Experiment 2, three participants were selected from an undergraduate class for observation. An ABA reversal design was implemented with baseline and Nearpod™ conditions. Results indicated Nearpod™ did not have a significant effect on disruptive behavior; however, the majority of students indicated a preference for Nearpod™.

Keywords: Response card, educational technology, disruptive behavior, college classroom, covert

Introduction

Disruptive behavior is a problem that has continuously plagued classrooms. Randolph (2007) defined disruptive behavior in the classroom context as “students having inappropriate interaction with others or attending to stimuli other than instruction” (pg. 117). Thus, disruptive behavior could include getting out of one’s seat, talking over others, throwing items, and playing with desk objects. With personal device (e.g., cell phone, tablet, and personal computer) use on the rise, disruptive behavior is becoming more covert, especially in college classrooms (Seidman, 2005). Compared to smaller, discussion-based classes, lecture-based classes have less engagement and more disruptive behavior from students relative to classes requiring participation (Geski, 1992). When most college classes are lecture-based, the opportunity for students to engage is reduced.

Disruptive behavior in class is problematic for several reasons. Disruptive behavior is inversely correlated to in-class performance, because when students are attending to other stimuli, in-class performance suffers (Seidman, 2005). Additionally, the ways in which teachers typically get feedback on student performance is through engagement and test scores. If those are diminishing, teachers are not contacting the reinforcement of student engagement and test performance, which could then have an abative effect on the teacher’s performance (Darling-Hammond, 2003).

A potential solution for addressing disruptive behavior could be to increase active student responding. Active student responding is “an observable response to an instructional antecedent” (Heward, 1994, pg. 10). One method of increasing active student responding is response cards. Response cards are devices that allow the entire class to respond simultaneously to questions presented by the teacher (Heward et al., 1996).

Several studies have demonstrated the effects of response cards across various student populations, educational settings, teachers, and behaviors. Specifically, these studies have demonstrated the beneficial effects of response cards on active student responding (Gardner, Heward, & Grossi, 1994; Narayan, Heward, Gardner, Courson, & Omness, 1990), test scores (Cavanaugh, Heward, & Donelson, 1996), and disruptive behavior (Armerndariz & Umbreit, 1999; Chirstle & Schuster, 2003; Davis & O'Neil, 2004; Godfrey, Grisham-Brown, Schuster, & Hemmeter, 2003; Lambert, Cartledge, Heward, & Lo, 2006). However, little research has been conducted with response cards in college classrooms to reduce disruptive behavior. Moreover, considering the increased availability of educational technology, response card techniques have become rather outdated. Response cards can require a considerable amount of time, cost, and material to make. Instructors must also deal with other potential issues such as the risk of losing cards or not having enough cards to accommodate all students. Comparatively, online educational resources may not require as much time, cost, and material relative to laminated cards or white boards while serving a similar function. For instance, teachers can create materials online and students can either bring in their own devices or use school computers. By incorporating updated technology into the classroom, students could engage appropriately, rather than disruptively, with their devices. Additionally, it is possible the behavior of engaging with educational technology will be incompatible with technology-related disruptive behavior, thereby decreasing the amount of disruptive behavior observed in the classroom, though this invites empirical support.

Review of Literature

Increasing Desirable Behavior

To the author's knowledge, one of the earliest studies to examine response cards was conducted by Narayan, Heward, Gardner, Courson, and Omness (1990). The authors conducted an ABAB experiment with a fourth-grade classroom, in which the baseline involved student hand raising and the intervention condition involved students using write-on response cards. (Write-on response cards entail students using individual white boards to present their answers to the teacher.) Results indicated an increase in active student responding and an increase on quiz scores during intervention. In addition, a social validity measure indicated students preferred response cards to hand raising.

Gardner, Heward, and Grossi's (1994) study was a systematic replication of Narayan et al. (1990), in which the procedure remained the same but the subject population was a fifth-grade classroom. Their results also indicated an increase in active student responding and an increase on quiz scores during intervention, indicating reliability of the effects of response cards. A reversal design with hand raising and write-on response card conditions has become the predominant procedure of use to examine response card effect because of how often it produces successful results (Randolf, 2007).

Munro and Stephenson (2009) demonstrated similar effects using the same procedure, however the researchers wanted to examine effects specifically on low-participating students. The entire fifth-grade class used the response cards but the researchers only recorded data on five low-participating students. Their results also indicated an increase in active student responding and an increase in test scores for most students. A strength of the study was that the researchers measured the teacher's amount of question asking and feedback. Results indicated feedback

increased during the intervention condition even though the number of questions asked remained relatively the same throughout all conditions. The researchers speculated the increase occurred during response card conditions because the teacher had the opportunity to provide feedback to the entire class, rather than a single person. This study demonstrates response cards can benefit students even when they are engaging in the lowest baseline rate of participation.

The subjects and settings for the previously described studies consisted of typically developing students in elementary schools. Cavanaugh, Heward, and Donelson (1996) took a different approach to examining the effects of response cards by extending previous findings to a different subject population and class format. The researchers examined the effects of non-participatory versus participatory approaches to reviewing information in a high-school science class. They conducted an alternating-treatments design using students with learning disabilities. The non-participatory review consisted of the teacher presenting the information and not having the student participate. The participatory review involved students using write-on response cards throughout the review. Results indicated an increase in test scores following active review sessions. Whereas most of the other researchers incorporated response cards into math or English classes, Cavanaugh, Heward, and Donelson conducted their study in Science class. This demonstrates how response cards can be incorporated into different academic subjects.

Decreasing Disruptive Behavior

The previously discussed articles demonstrate the positive effects of response cards for increasing appropriate behavior, including accurate responding on assessments and student participation. Additional studies have demonstrated how response cards can also have beneficial effects on disruptive behavior. Armerndariz and Umbreit (1999) examined the effects of response cards on disruptive behavior in a third-grade classroom. They did this by conducting an

ABA reversal design in which baseline (A) was hand raising and intervention (B) was write-on response cards. Results indicated a decrease in disruptive behavior during intervention. In a social validity measure, students indicated a preference for response cards to hand raising. Similarly, Lambert, Cartledge, Heward, and Lo (2006) examined the effects of response cards on nine students who engaged in a high rate of disruptive behavior in a fourth-grade classroom. They conducted an ABAB experiment with hand raising and write-on response cards conditions. Results indicated a decrease in disruptive behavior and an increase in correct academic responding during intervention. Both students and teachers approved of using response cards over hand raising, as indicated by social validity questionnaires.

Christle and Schuster (2003) also demonstrated how response cards are effective at decreasing disruptive behavior while also increasing active student responding and test scores. They implemented a reversal design with hand raising and write-on response card conditions and examined five students in a fourth-grade classroom. The students were selected to be representation of the range of student behavior (i.e., from low to high levels of disruption). The researchers informally recorded question asking and noted that the teacher consistently asked more questions during the response card condition. Christle and Schuster speculated that the teacher's question asking was reinforced by the class's increased attention during the response card condition.

In contrast with the previously discussed literature, Davis and O'Neill (2004) found variable effects of response cards on disruptive behavior across subjects. The researchers examined the effects of response cards in a 7th/8th grade classroom of children with learning disabilities. An ABAB experiment was conducted in which baseline was hand raising and intervention was write-on response cards. Results indicated an increase in active student

responding and an increase on quiz scores, but variable levels of disruptive behavior during intervention. Even with the variability in the results, a social validity measure indicated that students preferred response cards to hand raising. The researchers attributed the variability in off-task behavior to the students' learning deficiencies making writing more aversive. Other factors that may be able to account for the discrepancy in the results, relative to other response-card studies, is the subjects' age and level of disability. Thus, more research on the use of response cards with older students and differently-abled students is invited.

Godfrey, Grisham-Brown, Schuster, and Hemmeter (2003) took a different approach to examining active student responding methods by comparing the effects of hand raising, choral responding, and response cards on five preschool children with attendance issues. The authors conducted an alternating-treatments design in which baseline was hand raising, Intervention A was choral responding, and Intervention B was preprinted response cards. Choral responding is an active responding technique in which the teacher prompts the class to answer in unison. The response cards were laminated cards related to the calendar and, instead of raising their response cards up, the students would get up to "turn in" their answer to an allotted space. Results indicated the response card intervention was the most effective at increasing active student responding, increasing on-task behavior, and decreasing inappropriate behavior. Then, between choral responding and hand raising, choral responding was slightly more effective than hand raising at increasing active student responding and on-task behavior. However, choral responding was less effective than hand raising at decreasing inappropriate behavior. The social validity measure indicated that students preferred response cards to the other conditions. However, the study suffers from a limitation, particularly with respect to the response cards themselves. The cards were made for a specific exercise, so they required a lot of material (i.e.,

the specific pictures and words for every “turn in”) and therefore could not be used in other lessons. This approach may not be feasible if teachers cannot afford the time or resources to make customized response cards. Nevertheless, the fact that the selected subjects (who had previously demonstrated difficulty attending to classroom stimuli) exhibited an increase in appropriate behavior demonstrates a strong treatment effect. In the discussion, the researchers speculated that the incompatible behavior of getting up to turn in the response cards helped to reduce disruptive behaviors. This is somewhat surprising because instances of getting up and walking around could have presented opportunities to engage in increased disruptive behavior.

Response Cards in Higher Education

Very few studies use single-subject design to examine active student responding in a college classroom. However, one demonstration was conducted by Kellum, Carr, and Dozier (2001), who were the first to examine the effects of response cards in an undergraduate college classroom. They conducted an alternating-treatments design with two conditions: hand raising and preprinted response cards. The response cards consisted of two colored cards with options to answer true/false or multiple-choice questions. Results indicated an increase in active student responding and an increase on quiz scores during intervention. The social validity measure indicated students preferred response cards to hand raising.

Marmolejo, Wilder, and Bradley (2004) systematically replicated Kellum et al. (2001) with a private college, undergraduate classroom. They implemented the same procedure as Kellum et al. and the preprinted response cards consisted of two colored cards with options to answer true/false or multiple-choice questions. However, the cards allowed for four answer options for multiple-choice questions, as opposed to two. Compared to Kellum et al.’s procedure, this allowed for more a more rigorous assessment of students’ responding. Marmolejo et al.’s

results also indicated an increase in active student responding, an increase on quiz scores during intervention, and a preference for using response cards.

Kellum et al. (2001) and Marmolejo et al. (2004) share similar strengths in that, as of yet, these are the only two studies involving an evaluation of response cards in a university setting. Both studies found promising effects of response cards, providing a basis for future replication. Additionally, both studies used a standardized format for answering questions, which addresses the issue Godfrey et al. (2003) discussed regarding the use of subject-specific cards. However, both studies also suffered from a few weaknesses. First, neither study measured any change in disruptive behavior. As such it is impossible to tell whether or not disruptive behavior is inversely correlated with increased participation. Second, having the professor conduct data collection for answer distribution could have been time-intensive and inaccurate. The latter issue may be addressed by incorporating technology into active response systems, as will be discussed in the following section.

Electronic Student Response Systems

Some group design studies have indicated Student Response Systems (SRS) to be effective at increasing participation (Dangel & Wang, 2008; Stowell & Nelson, 2007; Trees & Jackson, 2007) and academic achievement (Shabani & Carr, 2004), while still being preferred (Kaleta & Joosten, 2007) in college classrooms. Student Response Systems are similar to response cards in that the teacher presents a question and all the students have the opportunity to respond. However, SRSs typically involve clickers, which allow students to electronically submit their answers. The SRS program can also collect data on correct and incorrect responding. An SRS system is, in effect, an electronic response card, thereby inviting the question of whether

response cards presented in an electronic form could be as effective as a physical card or white board.

For instance, in the Stowell and Nelson (2007) study, the researchers conducted a group design study to observe the difference between SRS, response card, hand raising, and standard lecture teaching methods. Each group (average $n = 35$) was exposed to the same 30-min psychology lecture. For the control group, classes were conducted like a standard lecture in which the instructor occasionally asked the class open-ended questions. For the experimental groups, the instructor implemented a set of seven multiple-choice review questions after the lecture. In the hand-raising group, students raised their hands upon their answer selection. In the response card group, students raised the card of their answer choice. In the SRS group, students selected answers through their SRS devices. Results indicated participation was highest in the SRS group (followed by the response card group). In addition, the social validity questionnaire indicated students preferred engaging in SRS the most.

However, SRSs do have a couple of disadvantages. First, students are unable to change answers if they are entered by mistake, which could potentially have a punishing effect on participation. Second, depending on the system or device used, such systems could be expensive for either the students or the school. Nevertheless, SRSs present many advantages benefitting the classroom environment. First, they provide anonymity for student responses, which could reinforce participation by decreasing the aversiveness of answering a question in front of one's peers. In addition, unlike traditional response cards, SRSs automatically collect data on student responses.

Statement of the Problem

It is apparent the topic of disruptive behavior in higher education is severely understudied, especially in a modern-day classroom. There is a considerable amount of research on response card use in elementary classrooms, yet only two studies so far have examined using response cards in a college classroom. In this area of research, it is difficult to generalize from studies on elementary school students to college students because the topography of the disruptive behavior is likely to be different in these two settings. Specifically, while disruptive behavior in elementary school classrooms may be overt (e.g., talking loudly or getting out of one's seat (Armerndariz & Umbreit, 1999)), college students may be more likely to engage in covert disruptive behavior (e.g., sleeping or not taking notes (Seidman, 2005)). Generally, covert behaviors are more difficult to change (Seidman, 2005).

Furthermore, response cards and SRSs are functionally similar. The instructor presents a question to the class and both response systems allow the students to answer synchronously. Also, both systems are effective at increasing participation and test scores. However, despite the functional similarity, there is no mention of using something like SRSs in single-subject design studies and no mention of measuring disruptive behavior in group design studies. Therefore, there is no literature to demonstrate how an electronic form of response cards could affect disruptive behavior. This is unfortunate because the behavior-analytic research currently does not accurately reflect modern-day classrooms. Technology is being rapidly incorporated into education; therefore, understanding the effects of technology is of paramount importance. Furthermore, one cannot assume an increase in participation will decrease disruptive behavior. Perhaps there is concern about disruptive behavior increasing with the use of technology, but maybe there will be similar effects to Godfrey et al.'s (2003) results in that appropriate

interaction with the material will be incompatible with inappropriate interactions. Using SRSs could provide students the opportunity to engage appropriately with technology in the classroom, but data need to be collected first to provide some empirical background.

If the intervention is proven effective, it could benefit both teachers and students in many ways. This intervention could provide teachers with an opportunity to use new, empirically-supported, teaching tools that are easy and free to use. Students could gain the opportunity to engage in a more active learning environment and engage in alternative topographies of responding. Moreover, using an electronic-based system in lieu of physical response cards could potentially be a more socially valid intervention for both teachers and students.

The study most germane to the present research question is Marmolejo et al.'s (2004) study, which was conducted with a university classroom with the whole class as the subject. Thus, the purpose of the present study is to examine effects of response card technology on disruptive behavior in a college classroom by systematically replicating Marmolejo et al., with an SRS (Nearpod™) substitution for response cards.

Experiment 1

Method

Subjects and setting.

The subject was a graduate class in the Applied Behavior Analysis and Clinical Science program at Rollins College in Winter Park, Florida. The class consisted of 14 students, all but one of whom were women. All students brought a personal device (e.g., cell phone, laptop) to class that they used to access Nearpod™. Sessions were conducted every other week and took place in a standard college classroom with a projector. All students sat facing the projector. There were no explicit contingencies on reinforcing in-class participation or lack of engagement in disruptive behavior.

Materials.

The materials included the website Nearpod™ (<https://nearpod.com/>) write-on response cards, and a social validity questionnaire. Nearpod™ is an educational tool that allows teachers and students to interact within an online presentation. Through Nearpod™, students can follow the presentation on internet-enabled devices. Throughout the presentation, teachers can present questions and have students input their answers via their devices. Nearpod™ provides options for multiple choice or a variety of free-response question formats. Teachers can see the students' answers in real-time and display the response distribution to the class via a pie chart (for multiple-choice questions) or display an individual student's response (for free-response questions). The professor received instructions on how to operate Nearpod™ (Appendix A). For the write-on response cards, students received laminated paper, dry erase markers, and tissues to write and erase their answers. The social validity questionnaire was a paper handout (Appendix B).

Procedure.

As a systematic replication of Marmolejo et al. (2004), the experiment used an alternating-treatments design. Prior to study onset, the professor instructed students to bring in personal computers or tablets to class for the next 4 classes. During baseline sessions, the professor conducted standard lectures. During Nearpod™ sessions, the professor conducted Nearpod™-incorporated lectures. During response card sessions, the professor conducted response-card-incorporated-lectures. Each condition is described in detail below.

In the Nearpod™ condition, the professor would present a question, display the answers anonymously, and then discuss the answers. The professor often called upon certain students to explain their answer choice.

In the response card condition, the professor presented questions on PowerPoint to the class. The students raised their cards after completing their answers and the professor would give them indication if the provided answers were correct or incorrect. As in the Nearpod™ sessions, the professor would then call upon certain students to explain their answer choice.

In both conditions, if the majority of the class were to answer incorrectly, the professor would provide either more detail or explanation of the question and/or answers and return to the question slide to have the students answer again, in accordance with Marmolejo et al. (2004). This procedure was designed to maintain the opportunity for students to contact reinforcement in the form of getting the correct answer or professor's praise or feedback. However, there was never a need to implement this procedure during Study 1.

A total of 21 sessions were conducted over the course of 3 weeks. Multiple sessions were conducted per class period. Session duration was approximately 10 min, but some sessions were

terminated early dependent on how the professor conducted her class. For example, if a Nearpod™ session was being conducted but the professor stopped using Nearpod™ and began lecturing, the session was ended early and a new (baseline) session began. This was necessary to collect data in such naturalistic setting. On average, the session durations for the Nearpod™, baseline, and response card conditions were 9.8 min, 9.8 min, and 7.3 min respectively.

At the end of the experiment, a social validity questionnaire was distributed and collected. After collecting the questionnaires, the students were debriefed on the purpose of the experiment.

Measurement.

Disruptive behavior (instances of texting, browsing the Internet, or sleeping) was recorded through momentary time sampling with 60-s intervals. Within each interval, behavior was not recorded for 40-s and then recorded for 20-s (i.e., the number of students engaging in disruptive behavior was recorded). This 20-s observation window was necessary to record the behavior of so many participants. Texting was defined as students electronically communicating via phone or computer. Browsing the internet was defined as using one's laptop to engage in off-task behavior (i.e. anything other than note-taking, looking at articles or websites related to class, or engaging in Nearpod™). Sleeping was defined as student's head down on a surface. A total count of the students was taken at the end of class, such that the data could be presented as percentage of students present. The observer(s) sat in a location behind the students to get an appropriate view of the devices. In addition, treatment integrity of teacher implementation of the treatments was recorded with a checklist (Appendix C).

Interobserver Agreement (IOA).

A second observer collected interobserver agreement data during 33.3% of sessions. Interobserver agreement was calculated as mean count per interval by calculating percent agreement for each interval and averaging across all intervals in a session. Mean interobserver agreement was 75% (range from 50% to 100%) for students engaging in disruptive behavior.

Results and Discussion

Figure 1 depicts the percentage of intervals in which any participant engaged in disruptive behavior across sessions. During the first phase of baseline sessions, in which the instructor conducted class as usual, there was a variable, yet slight, decreasing trend across sessions. During the Nearpod™ phase, in which the instructor utilized Nearpod™ to present questions to the class, there was also a variable, yet slight, decreasing trend. Both the first baseline phase and the Nearpod™ phase exhibited moderate levels of behavior. Due to failure to replicate similar effects with Nearpod™, as had previously been observed with response cards, a response card condition was added. During response card sessions, in which the students presented their answer via write-on response cards, disruptive behavior occurred at a high level throughout response card and baseline conditions. However, when reviewing individual subject data, it was observed that only 10 out of 14 students engaged in disruptive behavior at any point in time during the study.

Figure 2 provides individual participant data for students that engaged in disruptive behavior at any point in the study. Participant U engaged in disruptive behavior in the first class period (Sessions 1-5) with variability and at a moderate level across both conditions; for the rest of the study, there are zero-to-low levels of behavior. Participant J's engagement in disruptive behavior during Nearpod™ and the first phase of baseline is variable but maintains at a moderate-to-low level; during the response card condition and the second phase of baseline,

behavior maintains at a zero level. Participants D and F engaged in zero-to-low levels of disruptive behavior throughout the first phase of the study. In the second phase for P. D, there is a sharp increase in disruptive behavior in baseline and the last response card session. In the second phase P. F maintained high levels of disruptive behavior throughout the phase, with a decrease in disruptive behavior in the final response card session. Taken together, these results indicate that the overall effects seen in Figure 1 were due to variability in the responding of only a couple of students at a time, specifically, P. U, P. J, P. D, and P. F.

Figure 3 depicts the average (i.e., mean) disruptive behavior per condition per participant. As seen in the figure, the levels of behavior were quite low across the study (note that for several participants the y-axis is much less than 100%). In summary, inconsistent effects were observed in both interventions, and neither appeared to systematically decrease, or increase, disruptive behavior.

All students were present for the Nearpod™ and response card conditions, but social validity was collected from the 12 students who were present the day questionnaires were distributed. Table 1 summarizes the social validity data for Experiment 1. Results indicated average student rating of Nearpod™ was 4.5 out of 5 and of response cards was 3.6. Nine students preferred Nearpod™ the most, followed by standard lecture then response cards. Students mostly reported that they liked how Nearpod™ was easy to use, interactive, and provided anonymity. Some students did not appreciate all answers being displayed at once especially when their names were accidentally revealed in one instance. For response cards, there was some difficulty in that the laminated paper was difficult to erase; however, some students still reported they liked the act of writing out answers and that it was interactive. The professor rated Nearpod™ as a 3 and response cards as a 4. She preferred implementing response cards

over standard lecture and Nearpod™. She would consider using Nearpod™ again in the future, because it was a, “cool and flexible tool”. However, because of the alternating-treatments design, the instructor disliked the frequent transitioning between Nearpod™ and PowerPoint. In comparison, she like how response cards were easier to use alongside PowerPoint and would consider using it again in the future, but she also felt in this instance the use of response cards was messy.

For baseline and treatment integrity, the professor was present for each class period. Nearpod™ was never used during baseline and Nearpod™ was used during intervention. During intervention sessions, the professor asked more than 4 questions through Nearpod™ each time.

This study presented an opportunity to advance the literature by observing disruptive behavior in a higher education population. Prior research on disruptive behavior had only been conducted with a younger population (i.e., elementary and middle school classrooms). Although the Nearpod™ intervention did not result in meaningfully lower levels of disruptive behavior, it also did not increase disruptive behavior, as might be a key concern of instructors when using this technology. Because of the variability in behavior and the failure to replicate effects of response cards, there were several factors that could have contributed to the results across conditions.

Low levels of disruptive behavior were observed across all conditions of the study, possibly resulting in a floor effect (i.e., it was possibly difficult to further reduce problem behavior initially occurring at such a low rate). The low rate of behavior observed could be due to several variables. One reason could have been student reactivity to an observer present in the classroom, especially with the small class size (i.e., 14 students). Or, perhaps because the class was within a master’s program in which students elect to enroll, attending to the class material

was more reinforcing than engaging in disruptive behavior. The class observed for this experiment was selected due to availability, the author's schedule, and because the professor was willing and able to alter her teaching style to accommodate Nearpod™ and response cards. Floor effects could be addressed by observing students engaging in a higher baseline rate of disruptive behavior.

It is also possible the measurement procedure may have resulted in false negatives (i.e., instances of behavior that were unobserved due to the observational procedure). The MTS procedure consisted of 20-s observation periods and 40-s breaks, therefore some behaviors might have occurred during the 40-s breaks. However, the 40-s break was necessary to record data for so many individual subjects. Moreover, behavior may have been underestimated because obstructions affected observers' ability to see students. For instance, anecdotally, a student's device would be visible during some intervals but then she would move her device out of view, or a neighboring student would change her body position thereby blocking the view of the device. On the other hand, it is possible the measurement procedure overestimated responding in some cases. For example, anecdotally, participants sometimes had displayed websites on their devices but did not appear to be attending to the device. This measurement procedure was used to observe a large group of participants in vivo. Video recording might have helped to address some of these concerns, however, issues related to participant visibility might have been exacerbated by relying on video. The measurement procedure may also be improved by selecting a few, visible students to observe, rather than attempting to observe the entire class (especially given that the individual subject data indicate only a few students engaged in disruptive behavior at all).

The study failed to replicate the results of Marmolejo et al. (2004) and studies that effectively decreased disruptive behavior (Armerndariz & Umbreit, 1999; Chirstle & Schuster, 2003; Davis & O'Neil, 2004; Godfrey et al., 2003; Lambert et al., 2006). Not only did the study fail to replicate results with response card technology, but also failed with traditional, write-on response cards. In comparison to Marmolejo et al., alternating-treatments design was used in both studies, but there was carry over within phases in the present study whereas Marmolejo et al. demonstrated systematic intervention effects. The dependent variables were different between the two studies, so perhaps adaptive behaviors were less resistant to change, relative to problem behaviors. Godfrey et al. (2003), also demonstrated a reduction in disruptive behavior with a response card intervention implemented with an alternating-treatments design; however, the response card procedure required more response effort (i.e., getting up to turn in cards to specific slots as opposed to write-on response cards).

Several other studies in this area of the literature used reversal designs, including Armerndariz and Umbreit (1999), Chirstle and Schuster (2003), Davis and O'Neil (2004), and Lambert et al. (2006). Thus, it may have been the case that Nearpod™ was an effective intervention for decreasing disruptive behavior, but the alternating-treatments design resulted in carryover effects within phases, thereby weakening the differentiation between baseline and treatment conditions. The alternating-treatment design was used to expedite the study to recruit professors to participate. A potential contributing factor could have been the short durations of the sessions. Initially, it was suggested that sessions last 10 min in duration; however, due to the naturalistic setting of the study, the average duration of a session was under 10 min. Carryover effects could be addressed by using a reversal design. Taking into consideration the limitations

of Experiment 1, Experiment 2 sought to address these by recruiting an undergraduate class, conducting a reversal design, and using an improved measurement system for data collection.

Experiment 2

Method

Subjects and setting.

The subject was an undergraduate class at Rollins College. The class consisted of 14 students: 10 females and 4 males. Ages of participants ranged from 19 to 37 years. Out of the 14 students, 3 were selected based on visibility and whether or not they engaged in disruptive behavior within the 10 min screening process before baseline was conducted (described below). Sessions took place in a classroom with a projector at Rollins College. All students sat facing the projector. There were no explicit contingencies reinforcing in-class participation or lack of engagement in disruptive behavior.

Materials.

The materials were the same as Study 1, but without write-on response cards.

Procedure.

The procedure was conducted identically to Study 1, with the following modifications. An ABA reversal design was conducted instead of an alternating-treatments design. The two conditions consisted of baseline and Nearpod™. Condition changes occurred across class periods (see Table 1). The experiment consisted of 42, 10-min sessions over the course of 4 weeks. Prior to baseline, a 10-min screening process was conducted to ensure students selected for inclusion in the study were engaging in disruptive behavior. During the screening, students were marked as either visible or non-visible. For each visible student, frequency of disruptive behavior was

tracked. Students engaging in the most of amount of disruptive behavior were included in the study.

Measurement.

Operational definitions of disruptive behavior were the same as Study 1. Individual participant data were collected using partial interval recording (PIR) with 30-s intervals. Treatment integrity continued to be recorded by using a checklist (Appendix C).

IOA.

A second observer collected interobserver agreement data during 21% of sessions. IOA was calculated as percentage of agreement by calculating percent agreement for each interval within a session. Mean interobserver agreement was 97% (range 85% to 100%).

Results and Discussion

Figure 4 depicts percentage of intervals with disruptive behavior for all participants across all phases of the study. For Participant 1, there was a variable yet stable level of behavior in the initial baseline, a slight decrease in variability and level in intervention, and then an increase in variability and level in the returning baseline. Anecdotally, topographies of behavior included texting, checking social media, and working on future class projects. For Participant 2, there was a decreasing trend in the initial baseline, variability at a moderate-to-low level during intervention, and then a zero-to-low level in the returning baseline. Participant 2 engaged in very high levels of disruption only in the first class period, potentially indicating that the behavior observed during this class was under the control of confounding variables unrelated to the classroom environment (i.e., checking Blackboard at times that were not necessary for class). Anecdotally, topographies of behavior included checking e-mail and Blackboard and leaving those web pages open. For Participant 3, behavior occurred variably and at a high level

throughout the duration of the study. Anecdotally, topographies of behavior included texting, checking social media, checking websites (presumably) related to work, and taking phone calls. Patterns of behavior appeared idiosyncratic across participants, especially in the instances when Participant 3 took phone calls. Dotted phase lines identify sessions in which at least one Nearpod™ activity was presented, and there appears to be no consistent pattern of results even when Nearpod™ was fully “in effect.”

Social validity was collected from the 10 students who were present for the Nearpod™ sessions and the final baseline sessions (see Table 1). Results indicated average student rating of Nearpod™ was 4.8 out of 5 and students preferred Nearpod™ to a standard lecture. Students mostly reported they liked how Nearpod™ was fun, interactive, and an overall great tool. A student reported some technical difficulties with submitting answers. The professor rated Nearpod™ as a 5 and preferred implementing Nearpod™ over a standard lecture. She would consider using it again in the future, liked the variety of question-answer style possibilities, and had no specific dislikes of the program.

For baseline and treatment integrity, the professor was present for each class period. Nearpod™ was never used during baseline and Nearpod™ was used during intervention. During intervention, the professor asked more than 4 questions through Nearpod™.

Consistent with the findings of Experiment 1, the effects of the Nearpod™ intervention were idiosyncratic across participants. During the first class period of baseline (sessions 1-9), in which the instructor conducted class as usual, there was variability in behavior at a moderate level. In the second class period (sessions 10-19), for Participants 1 and 2 (Participant 3 was absent), there was a decrease in level compared the first-class period with a slight increase in trend towards the end of the class period. During the intervention phase (sessions 20-31), in

which the instructor presented a lecture and questions with Nearpod™, the results were not consistent across participants. For the Nearpod™ portion (sessions 21-24), for Participants 1 and 2, there was a moderate-to-low level with a slight increasing trend, and then a lower level post-Nearpod™ with a slight increasing trend. In the return to baseline, the results were similarly inconsistent across participants. For Participants 1 and 3, disruptive behavior was variable with a higher level compared to the initial baseline.

As in Experiment 1, the lack of experimental control demonstrated in this experiment could be due to a floor effect. Despite the fact that this classroom was selected because it was an undergraduate class, and participants were pre-screened for engagement in the target behavior, overall levels of disruptive behavior were variable throughout the study, regardless of condition.

The professor used a variety of teaching techniques throughout the semester both within and across class periods. For example, as outlined in Table 2, the teacher utilized role playing, small group activities, and class discussions in addition to traditional lecturing. Thus, this teaching style possibly functioned more similarly to an alternating-treatments design as opposed to a traditional reversal. Ideally, Nearpod™ would have been conducted throughout the class period as opposed to a time block to potentially increase the salience of the intervention. However, regardless of intervention duration, lower levels of disruptive behavior should be observed during sessions in which Nearpod™ was actively in effect (i.e., data points between the broken phase lines), which does not appear to be the case, as seen in Figure 4.

Experiment 2 presented a procedure that was a stronger test of the Nearpod™ intervention. First, a reversal design was used, which is a stronger experimental design, relative to the alternating-treatments design used in Experiment 1. Additionally, PIR, a more rigorous data collection procedure, was used to record data (Cooper, Heron, & Heward, 2007). However,

despite these improvements in the methodology, no consistent effect (either increase or decrease) in disruptive behavior was observed with Nearpod™. Despite the lack of effect, the intervention was highly socially valid. This investigation extends prior literature (Kellum, Car, & Dozier, 2001; Marmolejo, Wilder, & Bradley, 2004), by using a reversal design, and observing for disruptive behavior in a higher education setting, thereby demonstrating the feasibility of these techniques for future research in this setting.

General Discussion

Across both experiments, electronic response card technology (i.e., Nearpod™) did not appear to significantly impact the disruptive behavior of college students. However, response card technology was observed in a naturalistic environment. Both professors implemented Nearpod™ with high integrity with minimal training, and the intervention was highly socially valid for both professors and students. Moreover, although Nearpod™ did not improve behavior, it also did not worsen behavior. This is particularly notable because instructors may be concerned that by incorporating technology into their teaching (particularly technology in which students use personal devices), inappropriate use of the technology may increase. This does not appear to be the case, based on the present studies.

It could be argued that the antecedent manipulation used in this study is insufficient to affect disruptive behavior and a contingency for engaging in disruption (e.g., reinforcing participation in class or punishing off-task behavior) is necessary to suppress behavior to a meaningful degree. The purpose of the study was to examine if the presence of this particular stimulus (i.e., electronic response cards) would alter behavior. As indicated by previous literature, response cards as an antecedent intervention have had a significant effect on decreasing disruptive behavior (Armerndariz & Umbreit, 1999; Chirstle & Schuster, 2003; Davis

& O'Neil, 2004; Godfrey et al., 2003; Lambert et al., 2006), though in settings with younger students, in which problem behavior is less covert and possibly less resistant to change (Seidman, 2005).

The present experiments failed to replicate response card effects with either Nearpod™ or traditional response cards. Failures of replication could possibly include the presence of personal electronic devices across conditions, which were not present in the previous studies; or observing in a higher education setting, as opposed to elementary or middle school classrooms, which were the setting of the previous studies. Moreover, any observation of either an abolishing or establishing operation cannot be determined from the current data. Perhaps engaging in devices appropriately would create an abolishing operation for engaging disruptively in devices, or the general engagement in devices would create an establishing operation for engaging devices. Currently, the data provides no clear indication of either effect. Also, the data collection procedure was fine-grained enough to track moment-to-moment effects, such as the conditional probability of disruptive behavior following submission of a Nearpod™ answer.

Another possible issue could be with the independent variable itself. Nearpod™ implementation was somewhat inconsistent across experiments. In Experiment 1, Nearpod™ was distributed in short-to-moderate durations (i.e., 8-10 min) throughout the class period, whereas in Experiment 2, Nearpod™ was present for a single, long duration (40 min). Future investigations could explore the possibility of merging the study designs. For instance, the overarching design could be a reversal with an embedded alternating-treatments design, thereby ensuring a distribution of Nearpod™ throughout the class period. This could allow for a clearer differentiation between phases and would provide a better test of the intervention. However, it

may be difficult to arrange such a procedure within the naturalistic constraints of a real-life college classroom.

Across both experiments, low levels of disruptive behavior occurred. Although Geski (1992) stated that lecture-based classes experience more disruptive behavior compared to smaller classes, there is no current literature clearly stating how much disruptive behavior occurs in higher education settings. Nevertheless, disruptive behavior is still a concern among instructors, as anecdotally indicated to me by members of my committee and professors involved in this study. Perhaps if a larger, lecture-based classroom had been observed in conjunction to the present subjects that were smaller, discussion-based classes, the study could have supported the conclusions posed by Geski (1992). Moreover, potentially meaningful effects may have been observed if active responding or test scores were the dependent variable (e.g., Cavanaugh, Heward, & Donelson, 1996; Gardner, Heward, & Grossi, 1994; Kellum, Car, & Dozier, 2001; Marmolejo, Wilder, & Bradley, 2004; Narayan et al., 1990). Nevertheless, disruptive behavior was the focus for the present experiments.

Some recommendations for future research could be to run the experiment for a longer time (e.g., a full semester) to examine if students habituate to the observer and possibly to the response card technology. It is possible either the reactivity to the observe or the novelty of the intervention could be, in part, responsible for any observed effects. Given the proliferation of student response technology, it is important to investigate to determine whether SRSs are a long-term solution to disruptive behavior.

Future studies could further improve the methodology of the present experiments by ensuring that the professor is fluent with using the technology before presenting it to the class. In both experiments, there could have been some participant reactivity based on inaccurate use of

the technology. For instance, in Experiment 2, there was confusion when selecting the correct presentation style between the students' viewing option and the teacher's viewing option; teachers presented the entire class's answers as opposed to selecting answers from a few students. At one point during Experiment 1, students names were accidentally exposed in conjunction with their answers. Also, the observer should become familiar beforehand with which online resources are appropriate for class. Researchers could achieve this by having teachers provide an explanation of the materials and tools that would be used in the upcoming class. This could help eliminate false negatives related to the inability to differentiate appropriate versus disruptive interaction with devices.

Another direction for future research could be to test the effects of different technologies or SRSs on disruptive behavior in higher education settings. Nearpod™ is only one approach, and there are several other classroom response technologies (e.g., Kahoot™ or Quizlet™) that may more effectively decrease disruptive behavior. Nearpod™ was chosen for these experiments due to its similarity to an empirically-supported behavior-analytic intervention (i.e., response cards). However, there could be a lot for instructors and students to gain from these tools, such as decreasing disruptive behavior or increasing engagement; but first, more research needs to be conducted to demonstrate the effectiveness of these tools.

Although there is a sizeable amount of research in elementary classrooms on disruptive behavior (Armerndariz & Umbreit, 1999; Chirstle & Schuster, 2003; Davis & O'Neil, 2004; Godfrey et al., 2003; Lambert et al., 2006) and response cards (Cavanaugh, Heward, & Donelson, 1996; Gardner, Heward, & Grossi, 1994; Narayan et al., 1990), single-subject research in the higher education setting is lacking (Kellum, Car, & Dozier, 2001; Marmolejo, Wilder, & Bradley, 2004). This study was presents an extension of this literature by conducting

behavior analytic research reflecting the modern-day, college classroom, and studying the covert disruptive behavior of college students. Seidman (2005) stated that covert behaviors are more difficult to change: perhaps these experiments are a demonstration of this statement.

References

- Armendariz, F., & Umbreit, J. (1999). Using active responding to reduce disruptive behavior in a general education classroom. *Journal of Positive Behavior Interventions, 1*(3), 152—158
doi.org/10.1177/109830079900100303
- Cavanaugh, R.A., Heward, W.L., & Donelson, F. (1996). Effects of response cards during lesson closure on the academic performance of secondary students in an earth science course. *Journal of Applied Behavior Analysis, 29*, 403—406. doi:10.1901/jaba.1996.29-403
- Christle, C.A., & Schuster, J.W. (2003). The effects of using response cards on student participation, academic achievement, and on-task behavior during whole-class, math instruction. *Journal of Behavioral Education, 12*, 147—165.
doi.org/10.1023/A:1025577410113
- Cooper, John O., Heron, Timothy E. Heward, William L. (2007) *Applied behavior analysis*
Upper Saddle River, N.J.: Pearson/Merrill-Prentice Hall
- Dangel, H. L., & Wang, C. X. (2008). Student response systems in higher education: Moving beyond linear teaching and surface learning. *Journal of Educational Technology Development and Exchange, 1*(1), 93-104.
- Darling-Hammond, L. (2003). Enhancing teaching. In W. A. Owings, & L. S. Kaplan (Eds.), *Best practices, best thinking, and emerging issues in school leadership; best practices, best thinking, and emerging issues in school leadership* (pp. 75-87, Chapter xxiv, 279 Pages) Corwin Press, Thousand Oaks, CA.
- Davis, L. L., & O'Neill, R. E. (2004). Use of response cards with a group of students with learning disabilities including those for whom English is a second language. *Journal of Applied Behavior Analysis, 37*(2), 219-222. doi:10.1901/jaba.2004.37-219

- Gardner, R., III, Heward, W.L., & Grossi, T.A. (1994). Effects of response cards on student participation and academic achievement: A systematic replication with inner-city students during whole class science instruction. *Journal of Applied Behavior Analysis*, 27, 63—71. doi.org/10.1901/jaba.1994.27-63
- Geski, J. (1992) Overcoming the drawbacks of the large lecture class, *College Teaching*, 40, 151–155. doi.org/10.1080/87567555.1992.10532239
- Godfrey, S. A., Grisham-Brown, J., Schuster, J. W., & Hemmeter, M. L. (2003). The effects of three techniques on student participation with preschool children with attending problems. *Education and Treatment of Children*, 255-272.
- Heward, W.L. (1994). Three “low-tech” strategies for increasing the frequency of active student response during group instruction. In R. Gardner III, D. M. Sainato, J. O. Cooper, T. E. Heron, W. L. Heward, J. Eshleman, & T. A. Grossi (Eds.), *Behavior analysis in education: Focus on measurably superior instruction* (pp. 283—320). Pacific Grove, CA: Brooks/Cole
- Heward, W.L., Gardner, R., III, Cavanaugh, R.A., Courson, F.H., Grossi, T.A., & Barbetta, P.M. (1996). Everyone participates in this class: Using response cards to increase active student response. *Teaching Exceptional Children*, 28, 4—11. doi.org/10.1177/004005999602800201
- Kaleta, R., & Joosten, T. (2007). Student response systems. *Research Bulletin*, 2007(10).
- Kellum, K.K., Carr, J.E., & Dozier, C.L. (2001). Response-card instruction and student learning in a college classroom. *Teaching of Psychology* (Columbia, Mo.), 28, 101—104. doi.org/10.1207/S15328023TOP2802_06

- Lambert, M. C., Cartledge, G., Heward, W. L., & Lo, Y. Y. (2006). Effects of response cards on disruptive behavior and academic responding during math lessons by fourth-grade urban students. *Journal of Positive Behavior Interventions*, 8(2), 88-99.
doi.org/10.1177/10983007060080020701
- Marmolejo, E. K., Wilder, D. A., & Bradley, L. (2004). A preliminary analysis of the effects of response cards on student performance and participation in an upper division university course. *Journal of Applied Behavior Analysis*, 37(3), 405-410.
doi:10.1901/jaba.2004.37-405
- Munro, D. W., Stephenson, J., & Roane, H. (2009). The effects of response cards on student and teacher behavior during vocabulary instruction. *Journal of Applied Behavior Analysis*, 42(4), 795-800. doi:10.1901/jaba.2009.42-795
- Narayan, J.S., Heward, W.L., Gardner, R., III, Courson, F.H., & Omness, C.K. (1990). Using response cards to increase student participation in an elementary classroom. *Journal of Applied Behavior Analysis*, 23, 483—490. doi:10.1901/jaba.1990.23-483
- Randolph, J. J. (2007). Meta-analysis of the research on response cards: Effects on test achievement, quiz achievement, participation, and off-task behavior. *Journal of Positive Behavior Interventions*, 9(2), 113-128. doi.org/10.1177/10983007070090020201
- Seidman, A. (2005). The learning killer: Disruptive student behavior in the classroom. *Reading Improvement*, 42(1), 40-47.
- Shabani, D. B., & Carr, J. E. (2004). An evaluation of response cards as an adjunct to standard instruction in university classrooms: A systematic replication and extension. *North American Journal of Psychology*, 6(1), 85-100.

Stowell, J. R., & Nelson, J. M. (2007). Benefits of electronic audience response systems on student participation, learning, and emotion. *Teaching of Psychology, 34*(4), 253-258.

doi.org/10.1080/00986280701700391

Trees, A. R., & Jackson, M. H. (2007). The learning environment in clicker classrooms: student processes of learning and involvement in large university-level courses using student response systems. *Learning, Media and Technology, 32*(1), 21-40.

doi.org/10.1080/17439880601141179

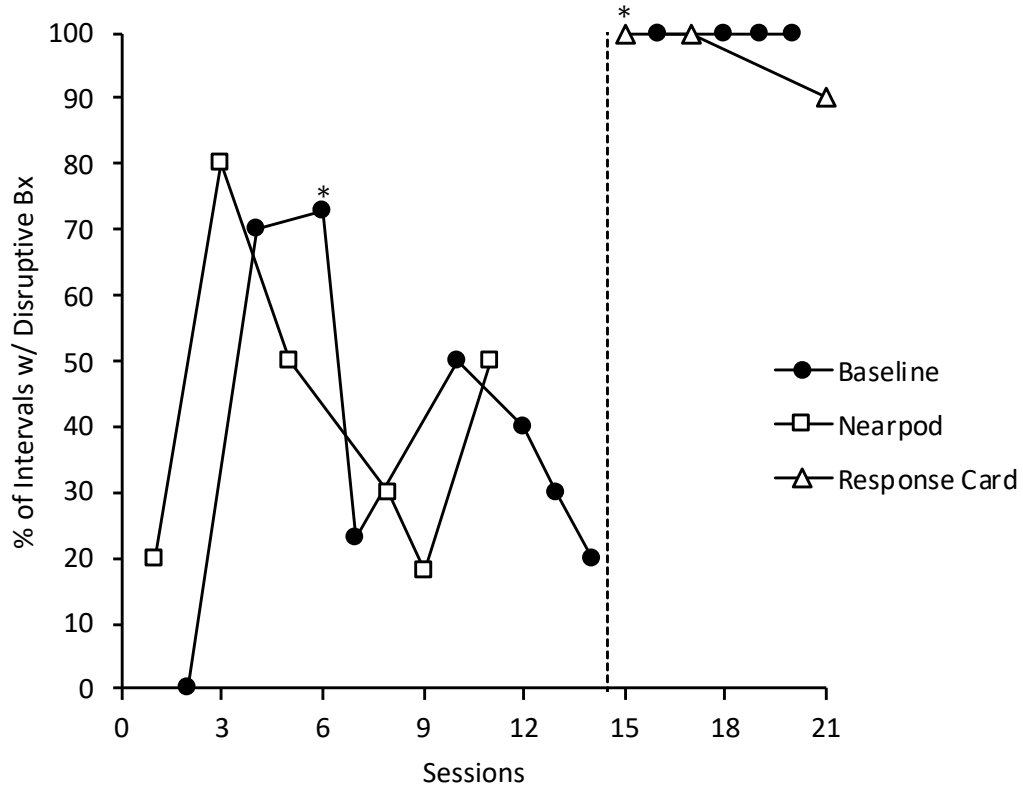


Figure 1. Percentage of intervals with disruptive behavior across baseline and intervention conditions. Dashed phase change line indicates change from Nearpod™ vs. baseline to response card vs. baseline. Asterisks indicate the start of a new class period.

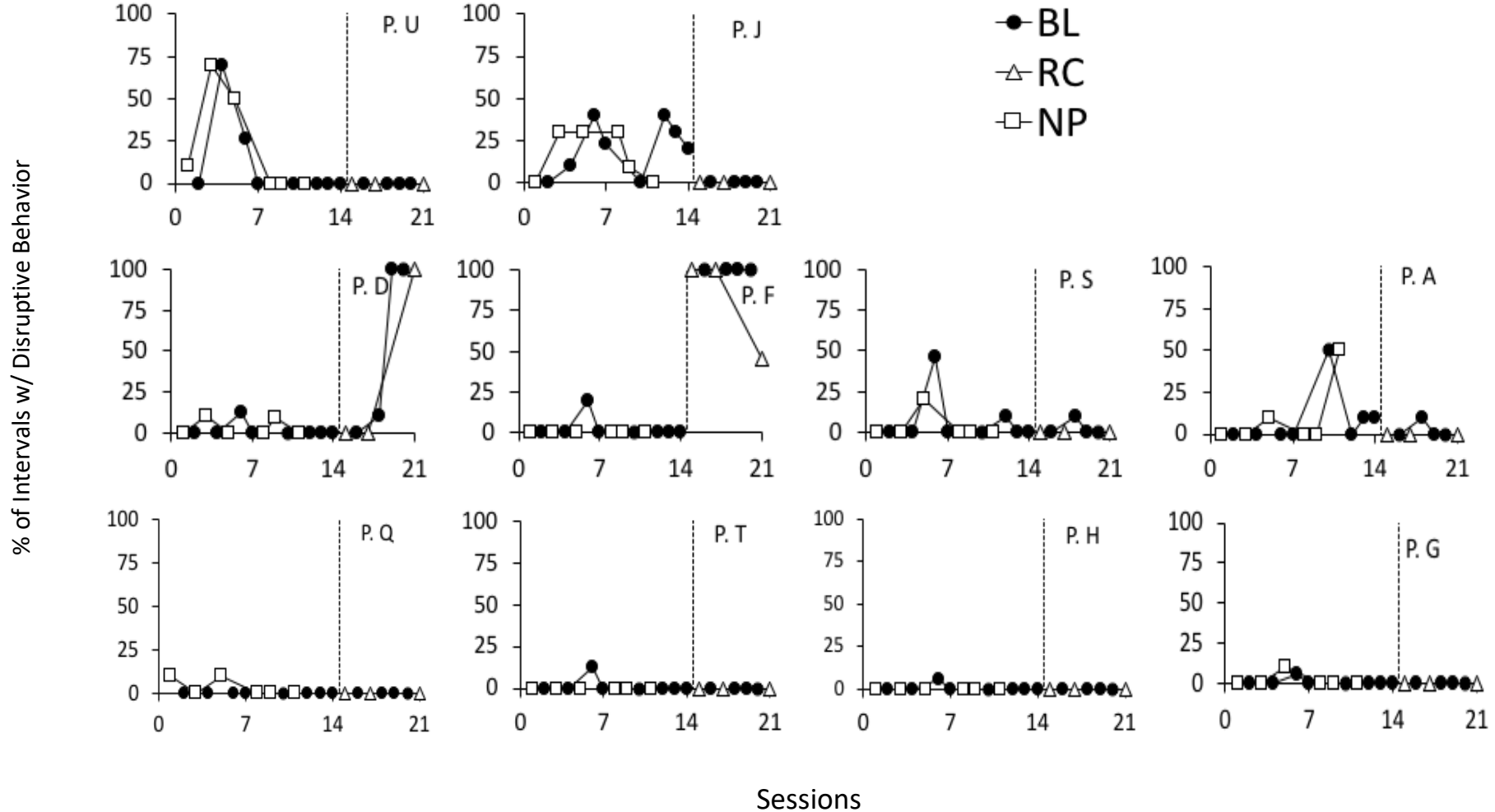


Figure 2. Ten (out of the 14 students) who engaged in disruptive behavior at any point during Experiment 1. Open squares, closed circles, and open triangles represent the Nearpod™, Baseline, and Response Card conditions, respectively. Phase change line indicates change from Nearpod™ vs. baseline to response card vs. baseline.

Average % of Intervals w/ Disruptive Behavior

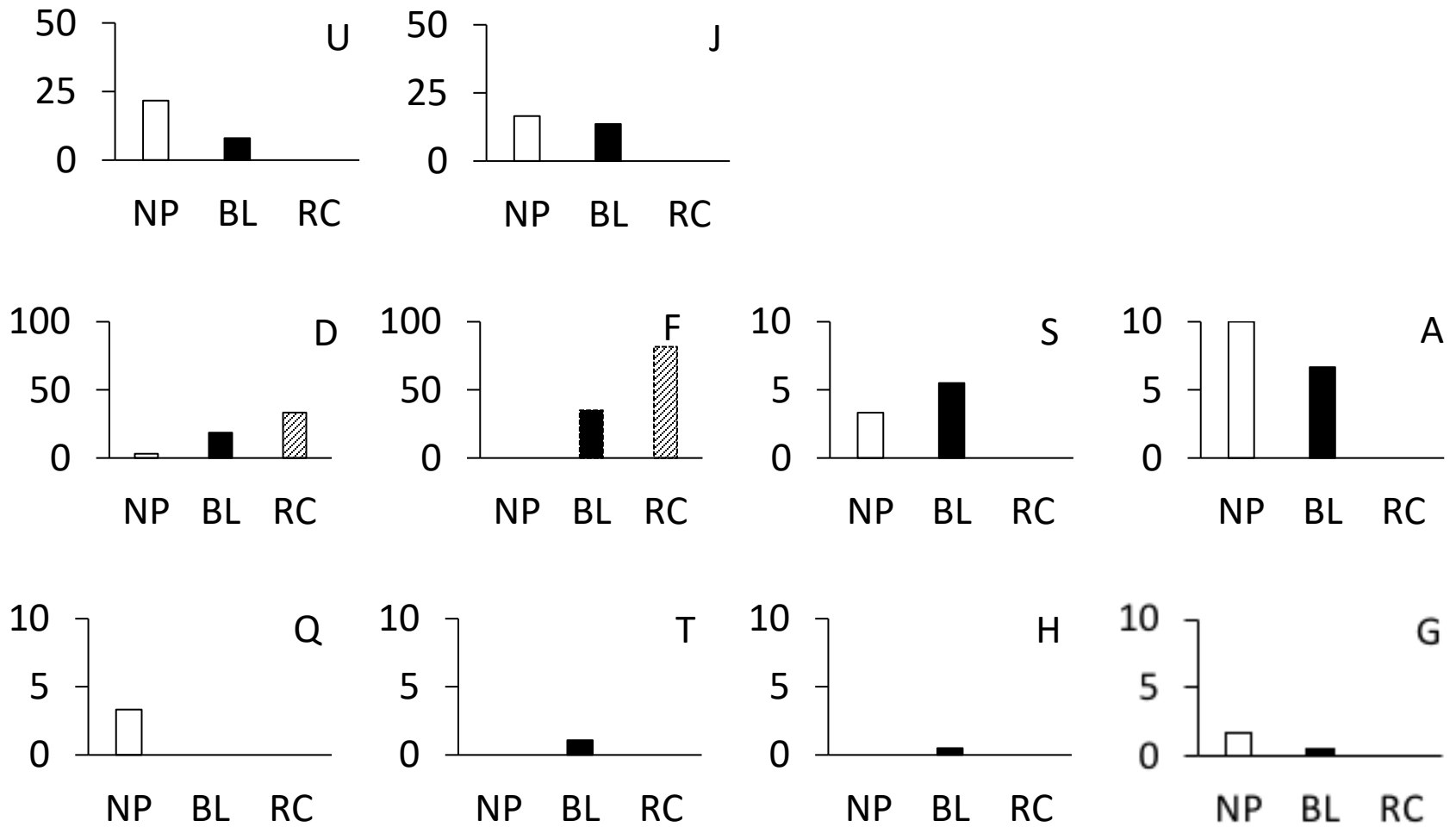


Figure 3. Each participant's average percent of intervals with disruptive behavior across conditions. Note that the y-axes are different across participants.

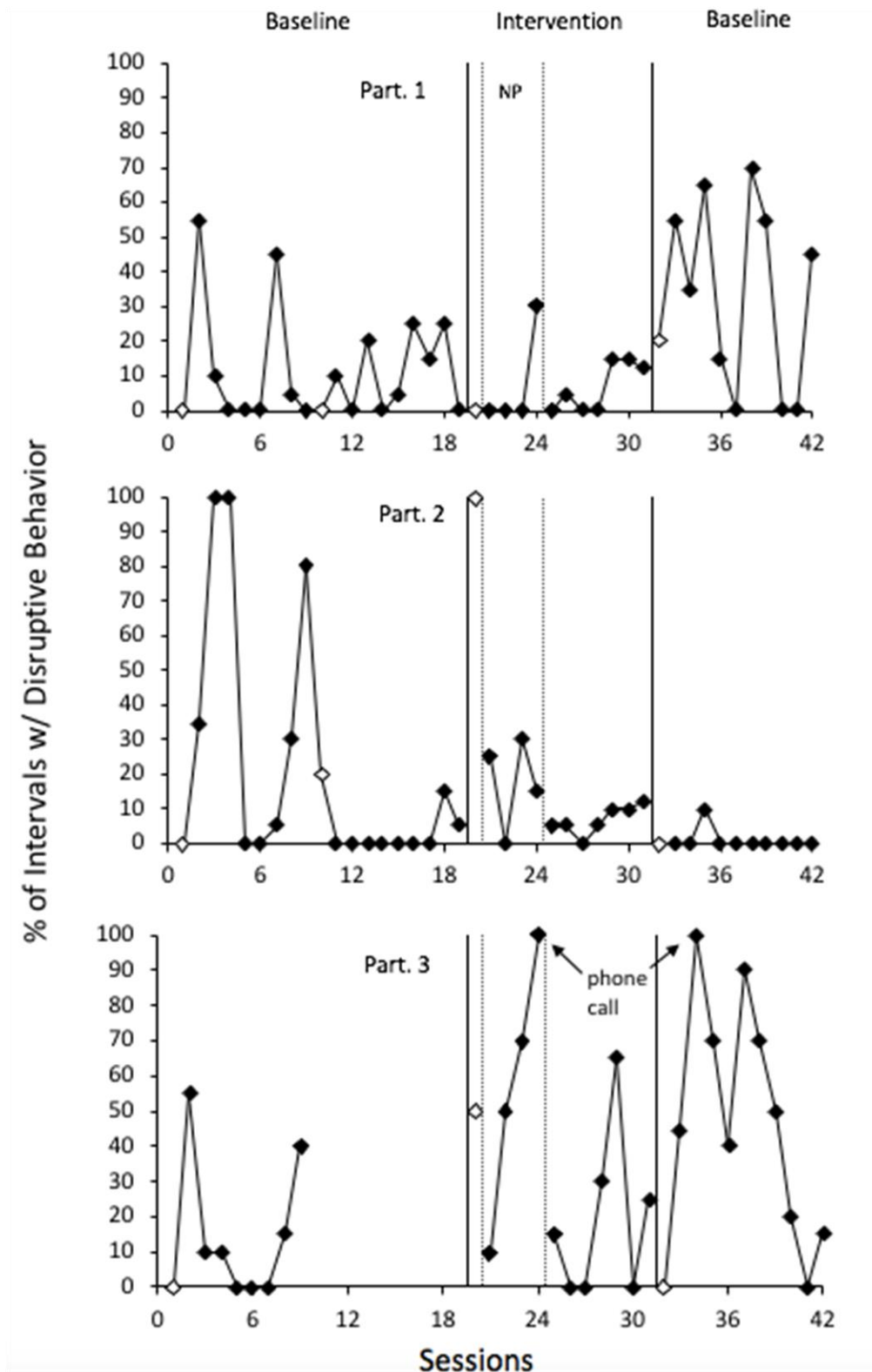


Figure 4. Each participant’s disruptive behavior across conditions. Open markers indicate the start of a new class period. Participant 3 was absent from the second class period. The sessions in which Nearpod™ was conducted have been marked off by broken phase lines.

Table 1

Social Validity of Conditions

	<u>Class 1</u>	<u>Teacher 1</u>	<u>Class 2</u>	<u>Teacher 2</u>
Nearpod Rating	4.5	3	4.8	5
Response Card Rating	3.6	4	–	–
Preference Selections	Nearpod – 9 Standard – 2 Response Card - 1	Response Card	Nearpod – 8 Standard – 1 Both - 1	Nearpod
Nearpod Pros	Anonymity (3), easy to use (4), fun and interactive (3)	Cool, flexible tool, would use again in the future	Fun, interactive, great tool	Variety of response possibilities, would use again in the future
Nearpod Cons	Accident with names being shown (5)	Transitioning between <u>Nearpod</u> and PowerPoint	Technical issues (1), cannot look ahead (1)	None
Response Card Pros	Act of writing out answers (4), Interactive (3)	Easier use and transitioning, would use again in the future	–	–
Response Card Cons	Problematic board erasing (8), lack on anonymity (4)	Messy	–	–

Table 2

Experiment 2 Sequence of Conditions and Classes

Classroom Technique	Session
Teacher Lecture	2 ¹ , 3, 4, 5 ² , 7 ¹ , 8, 9 ² , 10, 34 ¹ , 35, 36, 37, 38, 39 ¹
Web Activity	11, 12, 13, 14, 15, 16 ¹
Student Presentation	1, 2 ¹ , 6, 7 ¹ , 20
Role Playing Activity	18, 19
Nearpod	21, 22, 23, 24
Small Group Activity	25, 26, 27, 28, 29, 32, 33, 39 ¹ , 40, 41, 42
Class Discussion	16 ¹ , 17, 30, 31 ² , 34 ¹ ,

Note. 1 = sessions that included multiple techniques

2 = incomplete session

Appendices

Appendix A

Nearpod™ Instructions

1. Create an account on the Silver Edition (Free).
2. Allow Nearpod™ access to your chosen account.
3. For Class Level, enter "Higher Ed". For Subject Matter, enter your field or "Other".
4. Go through the "Getting Started" presentation to get a better idea of what the program is like and what options it provides.
5. To create a presentation, click on "+New" and then "Lesson"
6. Nearpod™ itself will provide ample instruction on how to create a presentation.
7. Create at least four questions for each intervention presentation. Question styles can be, but not limited to, multiple choice, true/false, and/or any type of free response.
8. Distribute the questions throughout the class time. Do not present all the questions at only one point during class time.

Appendix B

Experiment 1: Social Validity Questionnaire for Teachers

1. How would you rate your experience of using Nearpod™? (1-low, 5-high)
1 2 3 4 5
2. How would you rate your experience of using Nearpod™? (1-low, 5-high)
1 2 3 4 5
3. Which lecture style did you prefer implementing? (circle one)
Standard lecture Nearpod™ lecture Response Card lecture
4. What did you like about Nearpod™?
5. What did you dislike about Nearpod™?
6. Would/Will you consider using Nearpod™ in future classes?
7. What did you like about Response Cards?
8. What did you dislike about Response Cards?
9. Would/Will you consider using Response Cards in future classes?
10. Additional comments?

Appendix C

Experiment 1: Social Validity Questionnaire for Students

1. How would you rate your experience of using Nearpod™? (1-low, 5-high)
1 2 3 4 5
2. How would you rate your experience of using Response Cards? (1-low, 5-high)
1 2 3 4 5
3. Which classroom environment did you prefer? (circle one)
Standard classes Nearpod™ classes Response Card classes
4. What did you like about Nearpod™?
5. What did you dislike about Nearpod™?
6. What did you like about Response Cards?
7. What did you dislike about Response Cards?
8. Additional comments?

Appendix D

Experiment 1: Baseline Treatment Integrity Data Sheet

1. Was the professor present?
2. Conducted for at least 10 minutes?
3. Did not use Nearpod™?
4. Number of questions asked _____

Appendix E

Experiment 1: Intervention Treatment Integrity Data Sheet

1. Was the professor present?
2. Used Nearpod™?
3. Conducted for at least 10 minutes?
4. Number of questions asked
5. Asked a question approximately every 3-5 minutes?
6. Explained correct versus incorrect answers?
7. Allowed students to re-answer question if majority was incorrect?

Appendix F

Experiment 2: Social Validity Questionnaire for Teachers

1. How would you rate your experience of using Nearpod™? (1-low, 5-high)
1 2 3 4 5
2. How would you rate your experience of using Nearpod™? (1-low, 5-high)
1 2 3 4 5
3. Which lecture style did you prefer implementing? (circle one)
Standard lecture Nearpod™ lecture
4. What did you like about Nearpod™?
5. What did you dislike about Nearpod™?
6. Would/Will you consider using Nearpod™ in future classes?
7. Additional comments?

Appendix G

Experiment 2: Social Validity Questionnaire for Students

1. How would you rate your experience of using Nearpod™? (1-low, 5-high)
1 2 3 4 5
2. Which classroom environment did you prefer? (circle one)
Standard classes Nearpod™ classes
3. What did you like about Nearpod™?
4. What did you dislike about Nearpod™?
5. Additional comments?

Appendix H

Experiment 2: Baseline Treatment Integrity

Was the professor present? Y or N

Did they use Nearpod? Y or N

Appendix I

Experiment 2: Intervention Treatment Integrity

Was the professor present? Y or N

Did they use Nearpod? Y or N

Ask at least 4 questions?

Were questions spaced out?