Missouri State University

BearWorks

MSU Graduate Theses

Summer 2020

Cell Phone Use and Class Participation: An Interdependent Group Contingency

Heather R. Becker
Missouri State University, sun9515@live.missouristate.edu

As with any intellectual project, the content and views expressed in this thesis may be considered objectionable by some readers. However, this student-scholar's work has been judged to have academic value by the student's thesis committee members trained in the discipline. The content and views expressed in this thesis are those of the student-scholar and are not endorsed by Missouri State University, its Graduate College, or its employees.

Follow this and additional works at: https://bearworks.missouristate.edu/theses

 Part of the Applied Behavior Analysis Commons

Recommended Citation

Becker, Heather R., "Cell Phone Use and Class Participation: An Interdependent Group Contingency" (2020). *MSU Graduate Theses*. 3554.
https://bearworks.missouristate.edu/theses/3554

This article or document was made available through BearWorks, the institutional repository of Missouri State University. The work contained in it may be protected by copyright and require permission of the copyright holder for reuse or redistribution.
For more information, please contact BearWorks@library.missouristate.edu.

CELL PHONE USE AND CLASS PARTICIPATION:

AN INTERDEPENDENT GROUP CONTINGENCY

A Master's Thesis

Presented to

The Graduate College of

Missouri State University

In Partial Fulfillment

Of the Requirements for the Degree

Master of Science, Applied Behavior Analysis

By

Heather Rose Becker

August 2020

CELL PHONE USE AND CLASS PARTICIPATION: AN INTERDEPENDENT GROUP CONTINGENCY

Psychology

Missouri State University, August 2020

Master of Science

Heather Rose Becker

ABSTRACT

Students face distractions in their learning environments. This is true for all students, including college students. One such distraction for college students can be their cell phones. The purpose of this study was to decrease cell phone usage of college students in class using an interdependent group contingency with a multiple baseline research design across three classes. The study also collected data on class participation to discover if decreases in distraction might lead to increased class participation. Results of this study provide evidence to support the use of an interdependent group contingency to decrease student cell phone usage in class. During intervention, student cell phone usage decreased while class participation remained unchanged. These findings may prove useful to instructors in their quest to reduce student distractions and promote learning.

KEYWORDS: Cell phone usage, class participation, interdependent group contingencies, college students, multiple baseline research design

CELL PHONE USE AND CLASS PARTICIPATION:

AN INTERDEPENDENT GROUP CONTINGENCY

By

Heather Rose Becker

A Master's Thesis
Submitted to the Graduate College
Of Missouri State University
In Partial Fulfillment of the Requirements
For the Degree of Master of Science, Applied Behavior Analysis

August 2020

Approved:

Michael Clayton, Ph.D., Thesis Committee Chair

Melissa Fallone, Ph.D., Committee Member

D. Wayne Mitchell, Ph.D., Committee Member

Julie Masterson, Ph.D., Dean of the Graduate College

In the interest of academic freedom and the principle of free speech, approval of this thesis indicates the format is acceptable and meets the academic criteria for the discipline as determined by the faculty that constitute the thesis committee. The content and views expressed in this thesis are those of the student-scholar and are not endorsed by Missouri State University, its Graduate College, or its employees.

ACKNOWLEDGEMENTS

I would like to thank the following people for their support during the thesis process. Dr. Clayton and Kelsey Kleeman for helping to develop my thesis topic. Lauren Collins, Destiny Lockhart, and Justin Reeves for helping to collect data in the classrooms. My friends and church congregation for their well-wishes. My boyfriend for urging me on. All the wonderful members of my family for their encouragement and love.

I dedicate this thesis to my mother, Cindy Lou Becker.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Students face distractions in their learning environments. This is true for all students, including those in college. Distractions are not only a nuisance to faculty and students themselves, but they can also hinder the overall learning experience and grades. To achieve the goal of a quality education for students, educators may lessen the amount of distractions in classrooms. A case can be made that students' use of cell phones in classroom settings can be distraction. A study conducted by Johnson (2010) with university students found that students are distracted by multiple factors in the classroom. In this study, undergraduate psychology students answered questionnaires regarding the distractions they encountered in the classroom and how they managed to stay focused on the course material.

Johnson (2010) found that students named several factors in the classroom they found distracting. This included environmental noise (8%), student's own behavior (7%; cell phone, daydreaming, etc.), and others' cell phones (4%). The students were also asked about how they managed the distractions listed above. Tuning out the distractions was the most common answer, 38% of the participants listed this as their coping skill. "Pay attention as hard as possible" was used by 21% of the participants. Learning to cope with the distractions was the answer for 9% of the participants. Interesting, only 2% of the participants would ask the disruptive student to stop their behavior. This study provides evidence that students report cell phone use in class as a distractions, and that most students do not address the disruptive use of cell phones with the offending peers.

Sana, Weston, and Cepeda (2013) showed that screens in the classroom can be distracting as well. Students in a college course were asked to take lecture notes on their personal

computers and do additional tasks on their computers during the lecture. The additional tasks were used to simulate browsing on the web during class. The students in this experiment scored 11% lower on comprehension tests than their peers who were asked to take only lecture notes with no additional tasks on their computers. In the second experiment of this study, students were asked to either take notes on a computer and do additional tasks or take notes with pencil and paper. Other students in the class were strategically seated behind either computer note takers (with additional tasks) or pencil and paper note takers. The students seated behind the computer note takers (with additional tasks) scored 17% lower on a comprehension tests than the students seated behind pencil and paper note takers.

A questionnaire was given to the students in both experiments. The students were asked to take lecture notes on their computers and do additional tasks. These students thought that the activity "somewhat hindered" their performance. However, they only believed that their computer usage hindered the learning of their peers a small amount. The students sitting behind individuals using their computers to take notes and do additional tasks were asked if the other students' computer usage distracted their learning efforts. These students said that they were only distracted a small amount and did not believe that other students' computer usage negatively affected their learning. Two important findings of this study suggest that screens in the classroom distract users and their peers, and that the distraction of screens in the classroom is underestimated by students.

LITERATURE REVIEW

Cell Phone Use and Academic Performance

A study by Acharya, Acharya, and Waghrey (2013) gave a questionnaire to 441 college students in India to assess their perceived health effects from using cell phones. The college students attributed a plethora of negative effects to cell phone usage. Some of them being lower level of concentration (47.7%), lower academic performance (34.7%), and anxiety (38.5%). The students attributed the health effects to frequent use of cell phones and the engagement in social communications using their cell phones. The finding of this study suggest that cell phone usage of college students can negatively affect their ability to learn in the classroom.

In a student survey answered by 269 students at a university in Pennsylvania, 95% of respondents said they always bring a cell phone to class, and 92% of students responded that they have either texted or received a text at least once or twice during class with 30% saying they have texted or received text messages daily while in class. This survey also found that 97% of students have noticed other students in class using their cell phones at least once or twice. Interestingly, 54% of the students said that educators in the classroom would be shocked by the amount of texting the students during class. The survey also found that 90% of students felt that it was easier to text discretely in a class of 100 students or more; this percent decreased as the class sizes grew smaller. The results of this study suggest that cell phone usage in classrooms is a common occurrence with 92% of students using their cell phones in class. Students report that they notice peers using cellphones in class (97%), but do not think that teachers are aware of the prevalence of cellphone usage (54%) (Tindell, & Bohlander, 2012).

Felisoni and Godoi (2018), tracked the use of cell phones to see if there is a correlation between cell phone usage and lower academic performance in college students. The researchers used several methods to collect data (i.e., questionnaires, cell phone usage trackers, and academic records). The study found that every 10-minute period of cell phone usage correlated with a decrease in a student's academic performance on a university ranking scale by 0.63 points. The scale starts at 1 (*lowest ranking*) to 100 (*highest ranking*). However, every 10-minute period of cell phone usage *during* class correlated with a decrease in the students' academic performance rank by 1.2 points. These results suggest that cell phone use during class may significantly impact learning.

Interdependent Group Contingency and Student Performance

When an interdependent group contingency is in use, all members of the group must adhere to the rules of the contingency for a reinforcer to be delivered to all members of the group. If one or more members of the group do not adhere to the rules of the contingency, none of the members of the group members will receive a reinforcer (Cooper, Heron, & Heward, 2014). Different interdependent group contingencies have been used in class room settings to increase desired behaviors and decrease undesirable behaviors, but all start with the above definition (Cheatham, Ozga, St. Peter, Mesches, & Owsiany, 2017; Hernan, Collins, Morrison, & Kroeger, 2018; Denune, Hawkins, Donovan, McCoy, Hall, & Moeder, 2015).

The validity of an interdependent group contingency was tested in a study by Denune et al. (2015). This study was conducted in a middle school class of fourteen students. The study used an interdependent group contingency phase and an interdependent group contingency phase

+ self-monitoring procedures phase to increase on-task behaviors and decrease off-task behaviors of the students.

The interdependent group contingency divided the students into teams and used a point system to increase the teams on-task behaviors (e.g., seating in their chairs, using nice language, attending to the lesson, and working on class assignments). The teams could receive up to four points for the on-task behaviors. A random percentage was drawn at the end of class. The percentages were between 75% and 95%, if the teams' points for the day equaled the percent drawn, then the members on the team each won a reward.

The interdependent group contingency + self-monitoring phase was similar to the interdependent group contingency phase. However, the teacher gave each student a list of the on-task behaviors they were supposed to be engaged in during the class. When the teacher took data on the students' behaviors, she also asked the students to indicate on their lists, if they were engaged in the on-task behaviors too.

The results of this study show that the students' on-task behaviors increased during both the interdependent group contingency phase and the self-monitoring phase to similar levels; engaged in on-task behaviors of at least 80% during class time. The students' off-task behaviors decreased to similar levels for both phases; off-task behaviors occurred 20% or lower during class time.

The researchers gave the teacher a social validity questionnaire to complete after the phases were implemented. The teacher indicated that she approved of the overall intervention. She indicated that the interdependent group contingency was good for the students. However, she indicated that she did not know whether the self-monitoring was good for the students and would not use this component in the future.

In a study by Groves and Austin (2017), group contingencies were evaluated in a special school setting with students aged 9 to 10-years-old. The two group contingencies were an interdependent group contingency and an independent group contingency. The goal of both group contingencies was to decrease undesirable classroom behavior (e.g., calling out, sitting inappropriately, off-task behavior) of four of the seven students in a class. During both contingencies the class played a Good Behavior Game (GBG) the same way. The only difference between the contingency was the way in which the reinforcer for the students was delivered. During the interdependent group contingency, all the students received the reinforcer for following the GBG rules, or none of the students received the reinforcer when one or more of the students did not follow the GBG rules. During the independent group contingency, the students that followed the GBG rules received the reinforcer, and the students that did not follow the GBG rules did not receive a reinforcer.

The study found that there was no significant difference between the interdependent group contingency and the independent group contingency on decreasing undesirable classroom behavior. Both group contingencies decreased undesirable classroom behavior to a significant amount from baseline levels. However, when the students were asked which contingency they preferred to use in class, most students said that they preferred the interdependent group contingency. Even students not specifically chosen as the target students in this study preferred the interdependent group contingency over the independent group contingency.

The interdependent group contingency the current study is most closely aligned with is the one used in Jones, Allday, and Givens (2019). The researchers used a reversal design to study the effects of an interdependent group contingency on students in a high school class. The goal of this research article was to decrease the students' cell phone usage during class. The

students' reinforcer for not using their cell phone during class time was a 10-minute break at the end of class to use their cell phones. If one or more students used their cell phones during the class time, the reinforcer was not delivered. This study found that the interdependent group contingency did decrease the students' use of cell phones during class time. The results of a student survey showed that students did not like having limited access to their cell phones, but they also reported that their focus was better during the intervention phases.

In another study by Cheatham et al. (2017), the students of a college class participated in a GBG to increase class participation. The GBG is a form of an interdependent group contingency that divides a group into teams. The teams are delivered points based on behavior. The team with the least amount of points (decrease in undesirable behavior) will gain the reinforcer (Bowman-Perrott, Burke, Zaini, Zhang, & Vannest, 2016). In the case of this present study, the researchers used a multi-element and multiple baseline research design. The study wanted to increase the students amount of hand raises to professor questions about the course content. The two alternating conditions were competition, and competition with reward (GBG). In the competition condition, the classes were divided into two teams, and marks were delivered based on hand raises and correct answers to questions about the course content. The competition with reward divided the class into two teams. Marks were also delivered to teams when a student on the team raised their hand and answered a question correctly. In this condition, at the end of class, all members the team with the most marks received a reinforcer. The reinforcer was an extra point to be added to the students' grade books.

The study found that both conditions increased student hand raises compared to baseline, however, the competition with reward condition had the most increase in student hand raises. During a social validity survey in one of the participating classes, the majority (85%) of students

reported liking the competition with reward condition above the other conditions (i.e., baseline, and competition).

Hypotheses

The purpose of the current study was to evaluate the effectiveness of an interdependent group contingency for reducing cell phone use by students in a college course, and discover whether there was a relationship between reduced cell phone use by students and class participation using a multiple baseline research design across three classes.

METHODS

Participants and Setting

Students enrolled in three undergraduate psychology courses at a university in southwest Missouri served as participants. Classes met twice a week for 90 minutes each day. Class A had an enrollment of 36 students with an average attendance of 31 students. Class B had an enrollment of 30 students with an average attendance of 22 students. Class C had an enrollment of 30 students with the average attendance of 25 students. The three classes were included after three different instructors responded to an email solicitation and met the inclusion criteria (two meetings each week and not more than 40 students a class).

Once the instructors agreed to have their classes included in the study and the semester started, students were given an anonymous demographic form (Appendix A) to complete. The form asked about student age, and biological gender. Twenty-nine students from Class A answered the form. The students ranged in age from 19-years-old to 25-years-old with the average age being 21 years old. Twenty-one students identified their gender as female and eight students identified their gender as male. Twenty-eight students completed the form in Class B. The students ranged in age from 19-years-old to 47-years-old with the average age being 21-years-old. Twenty-five of the students identified at female and three identified as male. Twenty-seven students completed the form in Class C. The students ranged in age from 17-years-old to 30-years-old with the average age being 21 years old. Eighteen students identified as female, seven as male, one as non-binary, and one choose "prefer not to answer".

On the first day of class, students were also told that thesis research would be conducted in their class and that the cell phone policy would temporarily change. They were given an

opportunity to ask questions of the main researcher in Class A and Class B. Class C was given the information by a research assistant. If any of the students in Class C had questions about the thesis, the research assistant was to give them the email address of the main researcher. The main researcher was never contacted by any students in Class C.

Each of the included classrooms had a working clock visible to all students in the room. Class A was held in a classroom with five rows of desks facing the projection screen. Class B was held in a room with a row of desks placed along three walls of the classroom and three rows of desks in the middle of the room facing the projection screen. Class C was held in a classroom with rectangle tables. One to six students sat at each table during class. There were eight tables in the room.

IRB Approval and Consent

IRB approval (IRB-FY2019-700) was obtained on July 11, 2019 and the letter of approval appears in Appendix B. Consent for this study was verbal consent from the instructors to allow the implementation of the procedures and the collection of data during their classes. The students were not given consent forms because they were required to attend every scheduled class meeting, and they were required to be present for the whole class. Students are also required to adhere to all class procedures the instructors' practice and approve. For the purposes of this study, identifying information associated with each student in the classes will only be known to the instructors.

Measurement and Interobserver Agreement

Cell phone usage was defined as a) touching the cell phone screen, or b) looking at a lit cell phone screen (Jones, Allday, & Givens, 2019). If an instructor allowed the students to use cell phones during the data collection period, the observer did not record the cell phone use on the data collection sheet until the instructor told the students to put away their cell phones or the instructor began to lecture again. Cell phone usage was recorded using a 3-minute planned activity check (PLA-check). During the last 20-seconds of the 3-minute interval, the observer scanned the classroom for student cell phone usage and recorded the number of students observed doing this behavior.

Momentary time sampling (MTS) is the standard by which other group data collection methods are compared. When a 3-min PLA-check was compared to the MTS method in a natural environment, the results had a mean difference of +1.2. This mean difference is low and showed that the use of 3-min PLA-check is acceptable as a group data collection method (Dart, Radley, Briesch, Furlow, & Cavell, 2016).

Class participation was defined as any vocal response (e.g., question, answer, comment) or hand-raising behavior directed to the instructor. The vocal response had to be audible. If multiple students in the class gave a vocal response at the same time, this was recorded as one instance of class participation. A new occurrence of vocal response was recorded when a student resumed speaking after an initial comment and an instructor's response. Hand-raising was defined as a student raising one of their hands above their shoulder for at least 3 seconds or until the instructor calls on them. Hand-raising was also defined as a student raising their hand in response to an instructor's questions. Class participation was recorded using a partial interval, 3-minute frequency count. The observer marked any occurrence of class participation from any

student during the 3-minute intervals. A vocal response or a hand raise was recorded in more than one interval, if the behavior continued when a new interval started.

Data collection on student cell phone usage and class participation occurred with students inside the classroom. If a student left the classroom during data collection, their behavior was not recorded until they re-entered the classroom. Students could leave the classroom to use their cell phones, but it was not recorded until they were observed in the classroom using their cell phones. This protocol was put in place to allow students to make or take emergency phone calls. The data collector sat at the back of the class to the side to observe the students' cell phone use and class participation. This was done to help minimize disruption to the class and the influence of the observer's presence on the student participants.

Interobserver agreement (IOA) was collected independently during classroom observations for cell phone usage and class participation. IOA data was collected for 45% of the classroom observations. Data from the data collection sheets were analyzed to find the overall IOA, occurrence IOA, and nonoccurrence IOA for all three classes (Van Houten & Hall, 2001).

The overall IOA for percentage of intervals with cell phone usage was calculated by dividing the number of overall agreements by the number of overall agreements plus disagreements. The result was then multiplied by 100 to create a percentage. This resulted in a mean overall IOA of 93.3% (range, 60-100%) for all three classes. The occurrence IOA for percentage of intervals with cell phone usage was calculated by dividing agreements on occurrence by the number of agreements on occurrences plus the disagreements. The result was then multiplied by 100 to create a percentage. This resulted in a mean occurrence IOA of 71.3% (range, 50-92%) for all three classes. The nonoccurrence IOA for percentage of intervals with no cell phone usage was calculated by dividing the number of agreements on nonoccurrence by

agreements on nonoccurrence plus disagreements. The result was then multiplied by 100 to create a percentage. This resulted in a mean nonoccurrence IOA of 87% (range, 33-100%).

The overall IOA, occurrence IOA, and nonoccurrence IOA for percentage of intervals with class participation was calculated using the same methods as described above. The mean overall IOA was 79.3% (range, 33-100%) for all three classes. The mean occurrence IOA was 66.8% (range, 0-100%) for all three classes. The mean nonoccurrence IOA was 63.6% (range, 9-100%) for all three classes. The mean IOA data for class participation was low for all three types of IOA due to the high frequency of this behavior in Class A. When behavior occurs at a high frequency and is recorded in a partial interval frequency count, the level of accuracy is likely to decrease (Cooper, Heron, & Heward, 2014).

For IOA to occur for cell phone usage, the observers needed to count the same number of individuals using their cell phones at the end of the 3-min PLA-check. For IOA to occur for class participation, the observers needed to count the same number of class participation instances during each individual 3-minute interval during the 45-minute data collection period during class.

Training Data Collectors

Three undergraduate students were included to take data in the three classes. During one-on-one meetings with the main researcher, the students were briefed on the study's procedures, operational definitions, and data collection methods. After the meetings, the main researcher joined each of the three students in class. During the first two observation sessions, the main researcher watched the undergraduate data collectors for adherence to the operational definitions and the data collection methods. The main researcher provided feedback. Two of students were

the main data collectors for the three classes. Towards the end of the study, one of the data collectors was unable to keep their engagement to collect data for the third class, a third data collector was briefed and trained to take data until the main researcher could take over data collection for that class.

Experimental Design

This study used a multiple baseline design to assess the effects of the interdependent group contingency on student cell phone use and class participation across three college courses. The multiple baseline design has been incorporated into several studies to assess the use of an intervention on student behavior in a classroom setting (Cheatham et al., 2017; Sy, Gratz, & Donaldson, 2016).

Procedures

Baseline. Data was collected at the start of class for 45-minutes during the baseline phase. The data collector determined the start time of collection based on class's start time, or when the instructor started to lecture, thereby signaling the start of class. If a student used their cell phones during class, the instructor handled the cell phone usage according to the instructor's normal practices or disciplinary actions. Students in all three classes had access to the instructors' syllabi. The instructors participating in this thesis study had similar cell phone policies. They do not say anything to students using their cell phones in class unless it becomes disruptive to other students or their teaching. Baseline data was taken for two weeks for Class A, four weeks for Class B, and six weeks for Class C.

Interdependent Group Contingency. Before the study, the instructors were given a list

of reinforcers they would be willing to give the students. The instructors indicated that they were willing to use points and exam questions as the reinforcers during the intervention phase. The instructor of Class A decided to give her students 0.5 points per class during the intervention phase when the students meet the interdependent group contingency requirements. The 0.5 points will be added to the final exam. The instructor of Class B decided to give the students one final exam question per class; this essentially allowed the students to study early for the exam. The instructor for Class C decided to give his students 0.5 points per class to be added to an exam.

The main researcher informed the students about the interdependent group contingency. She made the students aware of the rules about cell phone use and of the potential reinforcer. The students received the reinforcer, if all students refrained from using their cell phones during the observation period of class. The students did not receive the reinforcer if one or more students used their cell phones during the observation period of class. On the first day of the intervention, the main researcher also informed the students about one caveat to the rule: If a student needed to use their cell phone during class, they could step out of the room to do so.

The instructors started class, during the intervention phase, by verbally reminding the students about the interdependent group contingency rule. The instructors were asked to repeat the following script to their classes:

If every student stays off their cell phone, then every student will get a reward for today. If one or more students use their cell phone, then no student gets the reward.

Data collection started after the instructors reminded the students about the contingency rules. The instructor for Class A stopped telling the class about the contingency rules halfway through the intervention. She told the students that the rules were still in place, and she did not

feel the need to repeat the script at the beginning of class anymore. After this announcement, data collection started when the instructor began to lecture. For all classes, data was collected for 45-minutes.

At the end of class, the instructors informed the students about the reinforcer status when there was no cell phone usage. The instructors used the following script:

Everyone stayed off their cell phones during class, so I will give everyone a reward.

The instructors giving points to the students were trusted to issue those points on exams as agreed upon.

If one or more students used their cell phones during the observation period of class, the students did not receive the reinforcer. If the students do not receive the reinforcer, the instructor said nothing to the class; this was done to minimize punishing effects. However, if the students asked the instructor about the reinforcer status, the instructors were to follow this script:

Students used their cell phones during class, so no reward will be given today.

At the end of class, the data collector delivered the results of the data collection period by placing a piece of paper on the instructor's lectern. At the end of class, the instructor looked at the paper to know if a reinforcer needed to be given. The observer made sure that the instructors informed the students about their reinforcement status correctly for the first five sessions using a treatment fidelity checklist (Appendix C).

Treatment Fidelity

Treatment fidelity was planned to be measured for the first five classes of the intervention phase for all three instructors (Hernan et al., 2018). However, due to the COVID-19 pandemic, seated-classes were transferred to online platforms. Treatment fidelity was measured for five

classes in Class A, four classes in Class B, and four classes in Class C. For each class, the instructor was given feedback on their adherence to the procedures using a treatment fidelity checklist. The checklist (Appendix C) was used to measure the instructor's adherence to this study's procedures. The checklist for the interdependent group contingency included: Remind students about the contingency's rules using the script, inform students about the delivery of the reinforcer using the script, deliver the reinforcer (this only applied to Class B due to the reinforcer type). Treatment fidelity was calculated by dividing the number of steps completed by the total number of steps on the checklist. This number was multiplied by 100 to create the final percent.

The instructor for Class A had a fidelity of 80% for reminding the students about the contingency's rules, and a fidelity of 100% for informing the students about the delivery of the reinforcer. The instructor for Class B had a fidelity of 75% for reminding the students about the contingency's rules, a fidelity of 100% for informing the students about the delivery of the reinforcer, and a fidelity of 100% for delivering the reinforcer. The instructor for Class C had a fidelity of 100% for reminding the students about the contingency's rules, and a fidelity of 100% for informing the students about the delivery of the reinforcer.

Social Validity

At the end of the intervention, the instructors and students were given online questionnaires to assess the social validity of the interdependent group contingency. The instructors and students were asked questions about the ease of using and following the intervention. Wanting to use the intervention in future classes. If the intervention interfered with

class time. If following the intervention made them a better instructor or student. The students answered the questions on a Likert-type scale from 1 (*strongly disagree*) to 5 (*strongly agree*).

RESULTS

Figure 1 shows the rate of cell phone usage and class participation during each 3-minute interval of the 45-minute data collection period. During baseline, cell phone usage of Class A (top-panel) ranged from 0.4 to 0.6 (M = 0.5), and class participation ranged from 2.0 to 6.4 (M = 3.6). During the intervention, cell phone usage of Class A had an abrupt reduction to zero instances, and class participation ranged from 2.0 to 6.6 (M = 3.9). During baseline, cell phone usage of Class B (middle-panel) ranged from 0.2 to 1.47 (M = 0.88), and class participation ranged from 0.33 to 1.47 (M = 1.22). During intervention, cell phone usage of Class B ranged from 0.13 to 0 (M = 0.03), and class participation ranged from 0.53 to 1.6 (M = 1.33). During baseline, cell phone usage for Class C (bottom-panel) ranged from 0.33 to 1.2 (M = 0.8), and class participation ranged from 0.07 to 2.27 (M = 0.71). During intervention, cell phone usage for Class C had an abrupt reduction to zero instances, and class participation ranged from 0.13 to 0.8 (M = 0.38).

An alternative way to display the data is by graphing cell phone usage and class participation separately and displaying the data by observation sessions. Figure 2 shows the cell phone data collected in 45-minute data collection periods across class periods for Class A (top panel), Class B (middle panel), and Class C (bottom panel). During baseline, cell phone usage of Class A ranged from 6 to 9 (M = 7.25). During the intervention, cell phone usage of Class A had an abrupt reduction to zero instances. During baseline, cell phone usage of Class B ranged from 3 to 22 (M = 13.13). During intervention, cell phone usage of Class B ranged from 0 to 2 (M = 0.50). During baseline, cell phone usage of Class C ranged from 5 to 18 (M = 12.00). During intervention, cell phone usage for Class C had an abrupt reduction to zero instances.

Figure 3 shows the class participation data collected in 45-minute data collection periods across class periods for Class A (top panel), Class B (middle panel), and Class C (bottom panel). During baseline, class participation for Class A ranged from 30 to 96 (M = 53.5). During the intervention, class participation for Class A ranged from 30 to 99 (M = 58.41). During baseline, class participation for Class B ranged from 5 to 22 (M = 18.25). During intervention, class participation for Class B ranged from 8 to 24 (M = 20.00). During baseline, class participation for Class C ranged from 1 to 34 (M = 10.58). During intervention, class participation for Class C ranged from 2 to 12 (M = 5.75).

The social validity questionnaire was given to students and instructors after the intervention was completed. The students answered a questionnaire of four questions using a Likert-type scale. The scale allowed the students to answer from 1 (*strongly disagree*) to 5 (*strongly agree*). The instructors were also given a questionnaire of four questions with the same Likert-type scale.

The student questionnaire was distributed to 96 students (Class A, Class B, and Class C) and 50 students responded. The results to the student social validity questionnaire have also been graphed (see Figure 4). For Question 1, the graph shows that the students rated how easy it was to understand the intervention a mean of 4.22 with a standard error of mean of 0.14. For Question 2, the graph shows that the students rated if they would like the intervention to be used in future classes a mean of 3.34 with a standard error of mean of 0.17. For Question 3, the graph shows that the students did not think that the intervention interfered with class time a mean of 4.00 with a standard error of the mean of 0.11. For Question 4, the graph shows that the instructors rated the intervention in making them better instructors a mean of 2.94 with a

standard error of the mean of 0.14. The results of the student social validity questionnaire have also been displayed in a table for further analysis (see Table 1).

Two of the three instructors were given the social validity questionnaire to complete. The results of the instructor questionnaire have been graphed (see Figure 5). For Question 1, the graph shows that the instructors rated the intervention easy to understand and implement a mean of 5.0 with a standard error of the mean of 0. For Question 2, the graph shows that the instructors rated that they would use the intervention in a future class a mean of 2.5 with a standard error of the mean of 0.5. For Question 3, the graph shows that the instructors rated that the intervention did not interfere with their ability to teach a mean of 4.5 with a standard error of the mean of 0.5. For Question 4, the graph shows that the instructors rated the intervention in making them better instructors a mean of 3.0 with a standard error of the mean of 0. The results of the instructor social validity questionnaire have been displayed in a table for further analysis (see Table 2).

DISCUSSION

The purpose of this study was to evaluate the effectiveness of an interdependent group contingency for reducing cell phone use by students in a college course and discover whether there was a relationship between reduced cell phone use by students and class participation. The interdependent group contingency reduced student cell phone use in all three classes to zero in most cases. Evidence for increased class participation by students as a result of decreased cell phone use was not found. Anecdotally, the main researcher observed that instructor teaching style may be the most influential moderator on student class participation (Shaari, Yusoff, Ghazali, Osman, & Dzahir, 2014). During class sessions, the instructor of Class A engaged students in class discussions and asked students review questions. Class participation remained high during both the baseline and intervention phases with little variability. Overall, evidence was provided to support the use of an interdependent group contingency to decrease student cell phone usage in class and no evidence was provided to support a relationship between a decrease in cell phone usage and an increase in class participation.

The results from the student social validity questionnaires provide evidence that the intervention was acceptable to the students. In particular, the students found that the intervention was easy to follow and understand ($M = 4.22$), and that the intervention did not interfere with class time ($M = 4.00$). The researchers tried to make the intervention easy to understand and as unintrusive as possible for the class. However, the students were more neutral about the use the intervention in future classes ($M = 3.34$). This could be because students do use their cell phones in class and may like to continue to do so without monitoring. The students were neutral ($M = 2.94$) that the intervention made them better students. Students in this intervention may not

categorize cell phone use in class as a factor when determining their level of studiousness. Overall, the outcome of the intervention is socially important because 34% of the student questionnaire respondents replied that the intervention made them better students.

The results of the instructor social validity questionnaire provide evidence that the intervention was acceptable to the instructors in that it was easy to understand ($M = 5$), and that the intervention did not interfere with their ability to teach class ($M = 4.5$). The researchers tried to make the intervention easy to understand and as unintrusive as possible for the classes and instructors. However, the instructors were either neutral or disagreed ($M = 2.5$) that they would use the intervention in future classes. It may be the case that the instructors would like to use extra points for students as incentives on tests or elective paper and projects. The instructors were both neutral ($M = 3.0$) in their answers to whether the intervention made them better instructors. This may be the case because there is a myriad of factors that contribute to the effectiveness of an instructor's teaching. The intervention used in this study was an aide to decrease student cellphone usage, and did not directly modify the teaching of course materials.

Limitations to this study must be considered when interpreting the results of the intervention. First, unobtrusive observation of the classes was difficult. Researchers found that there was no ideal location in the classroom from which to observe students. If the observers sat at the front of the classroom, then students in the back rows were obscured by other students and laptops. If the observer sat at the back of the classroom, then students in the front rows were obscured by other students. It was also hard to see the students work areas because their own bodies obscured their activities. Ultimately, the observers sat at the back of the classrooms to reduce reactivity to the observations. It is possible that a technological solution would yield different results. A video camera could be installed and collect more unobtrusive measurements

but would likely result in other problems. For one, the observer would need to communicate the class's performance quickly without being in the room at the same time. Other issues such as cost, and student privacy would also apply.

Second, the study did not allow students to take notes using their cell phones during class. This had the potential to affect students' class performance. However, the researchers and instructors allowed to students to take notes traditionally with pencil and paper, or with other electronics (e.g., laptops, tablets). If excluding the use of cell phones for note taking is undesirable, future researchers may use a monitoring application installed into the students' cell phones to assess student cell phone usage. A similar procedure was used to track the general cell phone usage of students for a two-week period in a study by Felisoni and Godoi (2018).

Third, researchers did not control for the number of interactions initiated by the instructors directed to the students during class. The instructors' natural frequency of asking the students questions or having individual students review class material for the benefit of the whole class could have increased or decreased the occurrence of student class participation in a way the study did not control for. Future research could implement some data collection techniques like not recording secondary answers to a question initially answered incorrectly, and only recording responses that occur in a given time frame after an instructor asks a question (Cheatham et al., 2017). In addition, class participation could be the primary focus of the study and students could be reinforced by participation.

Fourth, the length of the intervention phases of the study were shortened somewhat due to the cancellation of seated classes. The appearance of a novel coronavirus in the U. S. resulted in the university moving all seated classes online before we had planned to end the study. Future researchers could increase the lengths of the intervention phases to add more data for analysis.

However, the data collected for this current study was sufficient to analysis the results of the study and make conclusions about the effectiveness of the intervention.

Fifth, when a behavior is decreased, a replacement behavior is often observed. During behavioral interventions, the replacement behavior is usually programmed into the intervention by the implementer (Cooper, Heron, & Heward, 2014). In this study, a replacement behavior was not programmed into the intervention. The students still had access to their cell phones for times during class when the instructor found cell phone usage appropriate for learning. The findings of this study suggest that increased class participation did not take the place of student cell phone usage. Anecdotally, we did observe more students taking consistent notes after the intervention phase of the study was implemented. Future research may program a replacement behavior into the intervention such as noting taking or forms of class participation.

Sixth, none of the IOAs (i.e., overall, occurrence, nonoccurrence) for class participation met the 80% acceptable accuracy threshold (Kazdin, 2011). This was due to the high frequency of class participation that took place in Class A. When a behavior occurs at a high frequency, it is harder to observe and record with accuracy using event recording (Cooper, Heron, & Heward, 2014). Class participation overall IOA, occurrence IOA, and nonoccurrence IOA, as explained in the Methods section, for just Class B and Class C are higher. Overall IOA resulted in a mean of 88.1% (range, 73-100%). Occurrence IOA resulted in a mean of 68.9% (range, 0-100%). Nonoccurrence IOA resulted in a mean of 83.7% (range, 67-100%). Another reason the class participation IOAs in the current study are low could be due to the multi-part operational definition that was used. Future researchers may use a more concise operational definition of class participation or a different data collection method to achieve a higher level of IOA.

Despite the limitations listed above, this study provides evidence-based research to the existing literature on the effectiveness of using interdependent group contingencies to change student behavior in classroom settings. The merits of this study include the use of a multiple-baseline research design to evaluate the effects of the interdependent group contingency on the cell phone usage of students in a classroom setting and using a PLA-check measurement to record cell phone usage during data collection.

REFERENCES

Acharya, J. P., Acharya, I., Waghrey, D. (2013). A study on some of the common health effects of cell-phones amongst college students. *Journal of Community Medicine & Health Education*, *3*(4), 1–4. doi: 10.4172/2161-0711.1000214

Bowman-Perrott, L., Burke, M. D., Zaini, S., Zhang, N., & Vannest, K. (2016). Promoting positive behavior using the good behavior game. *Journal of Positive Behavior Interventions*, *18*(3), 180–190. doi: 10.1177/1098300715592355

Cheatham, J. M., Ozga, J. E., Peter, C. C. S., Mesches, G. A., & Owsiany, J. M. (2017). Increasing class participation in college classrooms with the good behavior game. *Journal of Behavioral Education*, *26*(3), 277–292. doi: 10.1007/s10864-017-9266-7

Cooper, J. O., Heron, T. E., & Heward, W. L. (2014). *Applied Behavior Analysis* (2nd ed.). Upper Saddle River, NJ: Pearson.

Dart, E. H., Radley, K. C., Briesch, A. M., Furlow, C. M., & Cavell, H. J. (2016). Assessing the accuracy of classwide direct observation methods: Two analyses using simulated and naturalistic data. *Behavioral Disorders*, *41*(3), 148–160. doi: 10.17988/bd-15-49.1

Denune, H., Hawkins, R., Donovan, L., Mccoy, D., Hall, L., & Moeder, A. (2015). Combining self-monitoring and an interdependent group contingency to improve the behavior of sixth graders with ebd. *Psychology in the Schools*, *52*(6), 562–577. doi: 10.1002/pits.21846

Felisoni, D. D., & Godoi, A. S. (2018). Cell phone usage and academic performance: An experiment. *Computers & Education*, *117*, 175–187. doi: 10.1016/j.compedu.2017.10.006

Groves, E. A., & Austin, J. L. (2017). An evaluation of interdependent and independent group contingencies during the good behavior game. *Journal of Applied Behavior Analysis*, *50*(3), 552–566. doi: 10.1002/jaba.393

Hernan, C. J., Collins, T. A., Morrison, J. Q., & Kroeger, S. D. (2018). Decreasing inappropriate use of mobile devices in urban high school classrooms: Comparing an antecedent intervention with and without the good behavior game. *Behavior Modification*, *43*(3), 439–463. doi: 10.1177/0145445518764343

Johnson, L. M. (2010). Dynamics of the classroom learning environment: classroom distractions. *NAAAS & Affiliates Conference Monographs*, 470–485.

Jones, M. E., Allday, R. A., & Givens, A. (2019). Reducing adolescent cell phone usage using an interdependent group contingency. *Journal of Applied Behavior Analysis*, *52*(2), 386–393. doi: 10.1002/jaba.538

Kazdin, A. E. (2011). *Single-case research designs: methods for clinical and applied settings*. New York, NY: Oxford University Press.

Sana, F., Weston, T., & Cepeda, N. J. (2013). Laptop multitasking hinders classroom learning for both users and nearby peers. *Computers & Education*, *62*, 24–31. doi: 10.1016/j.compedu.2012.10.003

Shaari, A. S., Yusoff, N. M., Ghazali, I. M., Osman, R. H., & Dzahir, N. F. M. (2014). The relationship between lecturers' teaching style and students' academic engagement. *Procedia - Social and Behavioral Sciences*, *118*, 10–20. doi: 10.1016/j.sbspro.2014.02.002

Sy, J. R., Gratz, O., & Donaldson, J. M. (2016). The good behavior game with students in alternative educational environments: Interactions between reinforcement criteria and scoring accuracy. *Journal of Behavioral Education*, *25*(4), 455–477. doi: 10.1007/s10864-016-9257-0

Tindell, D. R., & Bohlander, R. W. (2012). The use and abuse of cell phones and text messaging in the classroom: A survey of college students. *College Teaching*, *60*, 1-9. doi: 10.1080/87567555.2011.604802

Van Houten, R., & Hall, R. V. (2001). *The measurement of behavior: Behavior modification* (3rd ed.). Austin, TX: Pro-ed.

TABLES

Table 1: Student social validity questionnaire

	Number of responses				
Question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The cell phone intervention was easy to understand and follow.	1	4	3	17	25
I would like the cell phone intervention to be used in future classes.	4	9	11	18	8
The intervention did not interfere with class time.	0	3	7	27	13
Being part of the cell phone intervention made me a better student.	4	14	15	16	1

Table 2: Instructor social validity questionnaire

	Number of responses				
Question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The cell phone intervention was easy to understand and implement.	0	0	0	0	2
I will continue to use the intervention in future classes.	0	1	1	0	0
The intervention did not interfere with my ability to teach class.	0	0	0	1	1
Using the intervention made me a better instructor.	0	0	2	0	0

FIGURES

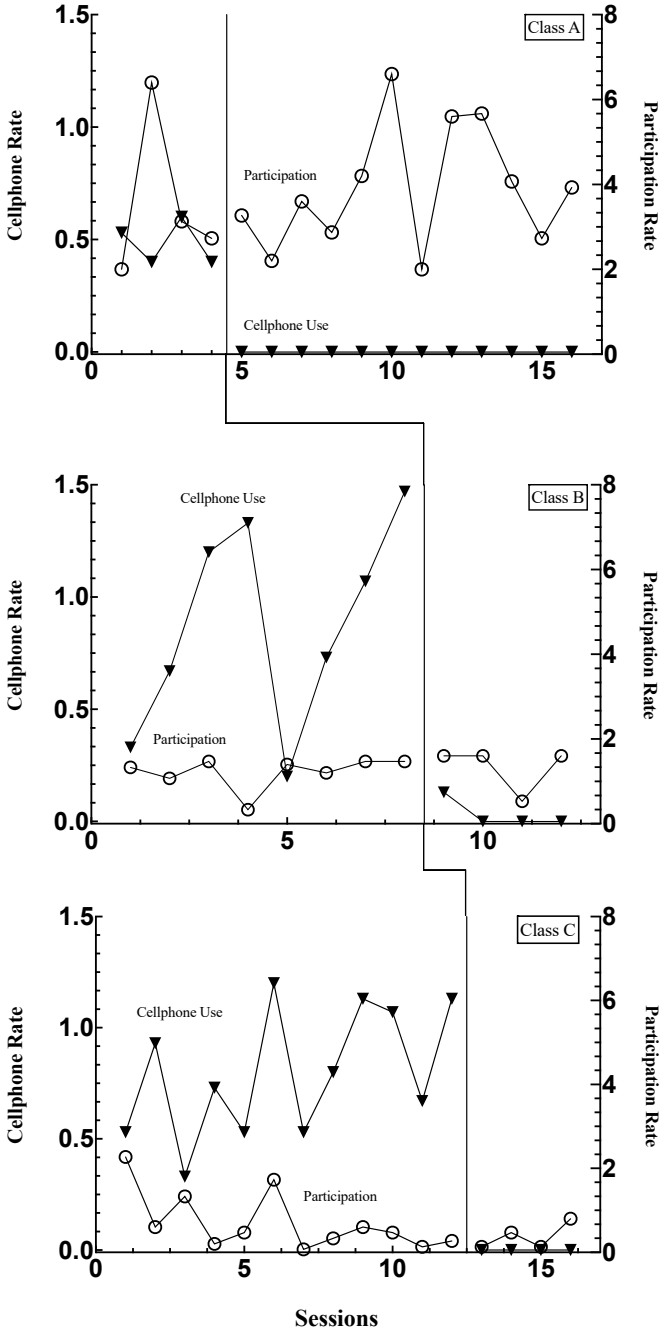

Figure 1. The rate of cell phone usage and class participation during each 3-minute interval of the 45-minute data collection period per class session for Class A, Class B, and Class C.

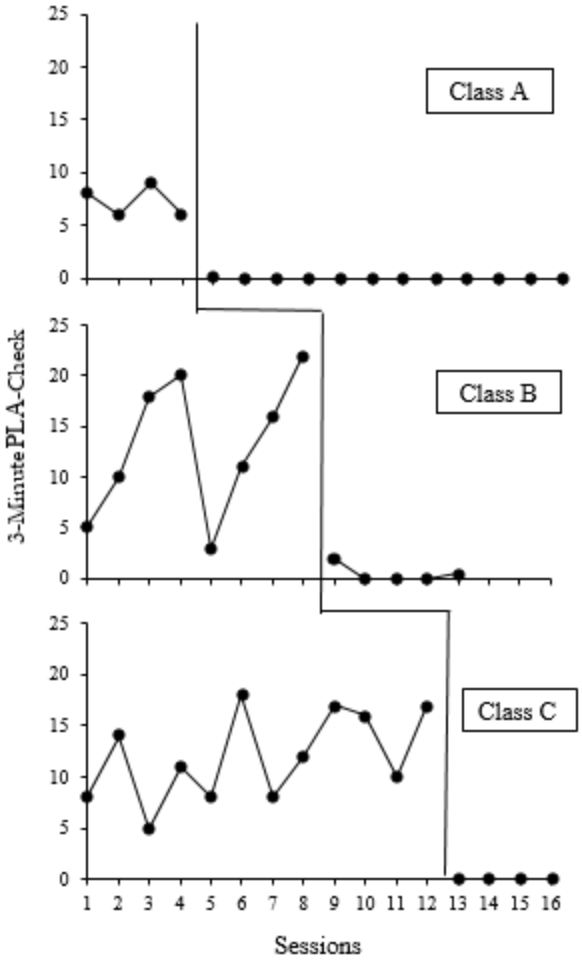

Figure 2. The cell phone data collected in 45-minute data collection periods across class periods for Class A, Class B, and Class C.

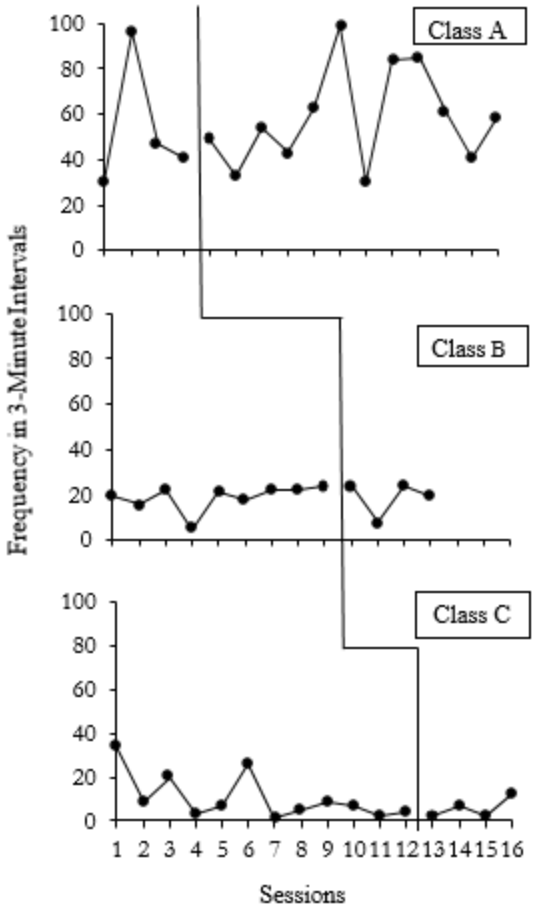

Figure 3. The class participation data collected in 45-minute data collection periods across class periods for Class A, Class B, and Class C.

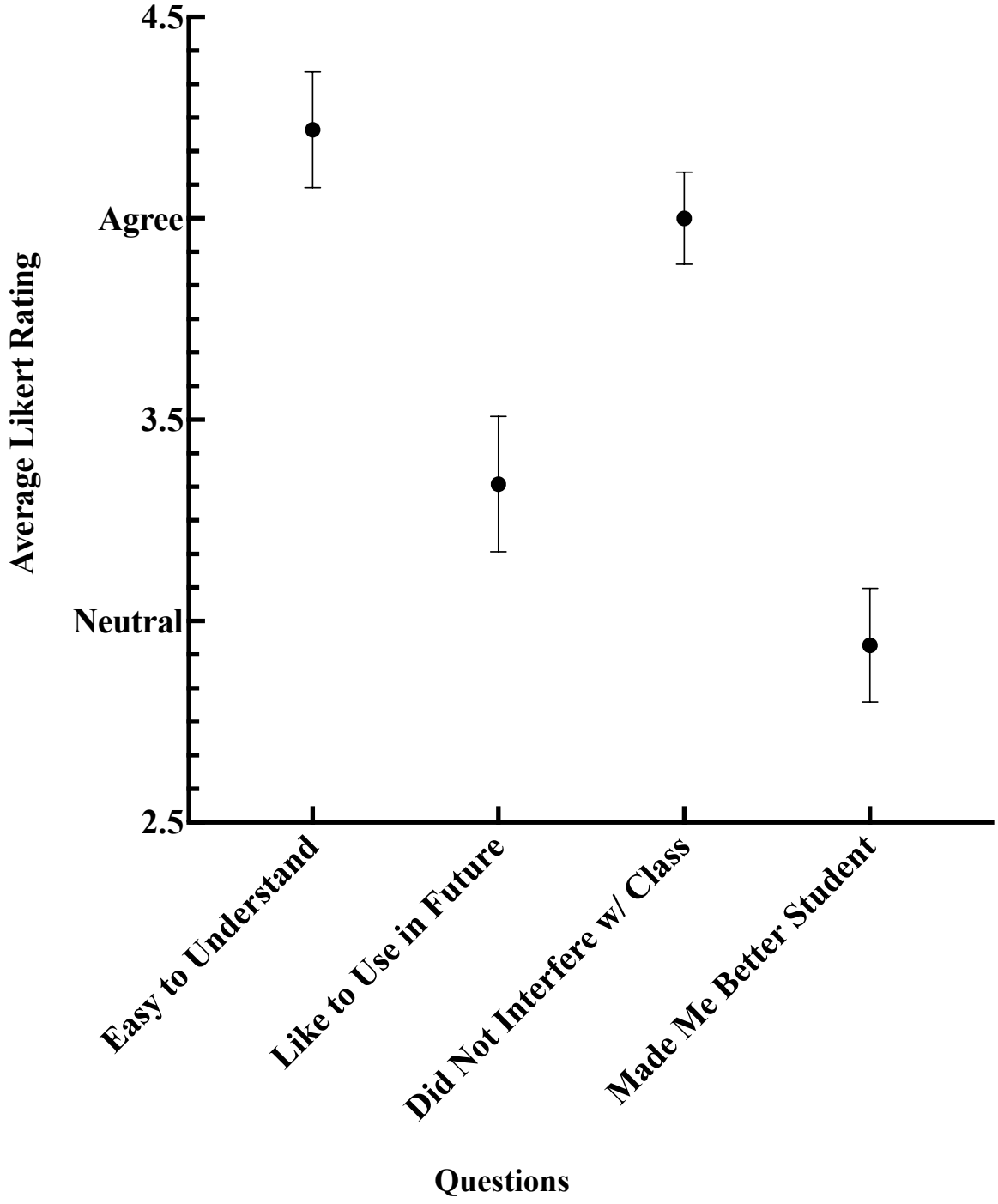

Figure 4. Student ratings of the interdependent group contingency on cell phone usage. Circles represent the mean rating for the student respondents to the social validity questionnaire, and the vertical lines represent the standard error of the mean.

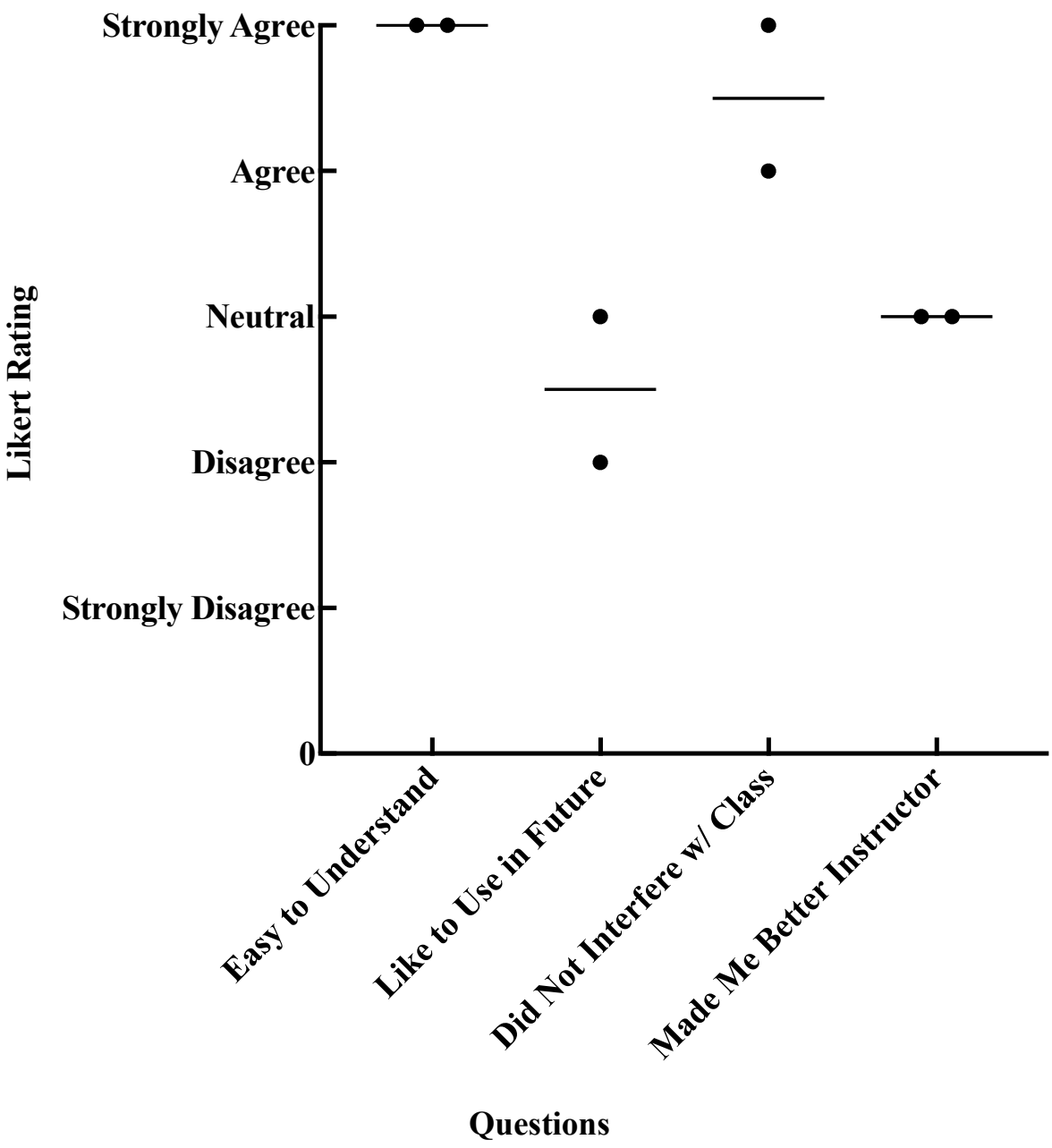

Figure 5. Instructor ratings of the interdependent group contingency on cell phone usage. Circles represent the rating for each instructor respondent for each question, and the horizontal lines represent the mean response across instructors for each question.

APPENDICES

Appendix A: Student Demographic Form

1) Please identify your age: _____
2) Please identify your gender:

   _____ Female

   _____ Male

   _____ Prefer not to answer

   Prefer to self-identify: _____

Appendix B: IRB Approval Form

To:
Michael Clayton
Psychology

RE: Notice of IRB Approval
Submission Type: Initial
Study #: IRB-FY2019-700
Study Title: Decreasing inappropriate cell phone usage of college students using an interdependent group contingency
Decision: Approved

Approval Date: July 11, 2019

This submission has been approved by the Missouri State University Institutional Review Board (IRB). You are required to obtain IRB approval for any changes to any aspect of this study before they can be implemented. Should any adverse event or unanticipated problem involving risks to subjects or others occur it must be reported immediately to the IRB.

This study was reviewed in accordance with federal regulations governing human subjects research, including those found at 45 CFR 46 (Common Rule), 45 CFR 164 (HIPAA), 21 CFR 50 & 56 (FDA), and 40 CFR 26 (EPA), where applicable.

Appendix C: Instructor Treatment Fidelity

Check all items that apply to the instructor's adherence to the procedures.

Interdependent group contingency

_____ Remind students about the contingency's rules using script.

_____ Inform students about the delivery of the reinforcer using the script.

_____ Deliver the reinforcer.