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The Effects of Plickers As Response Cards On Academic Engagement Behavior In High School Students

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THE EFFECTS OF PLICKERS AS RESPONSE CARDS ON ACADEMIC ENGAGEMENT BEHAVIOR IN HIGH SCHOOL STUDENTS

by

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ABSTRACT

THE EFFECTS OF PLICKERS AS RESPONSE CARDS ON ACADEMIC ENGAGEMENT BEHAVIOR IN HIGH SCHOOL STUDENTS

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Multiple studies have demonstrated the effectiveness of increasing student opportunities to respond for increasing academically engaged behavior. The use of response cards has held the most efficacy in terms of increasing opportunities to respond, yet no research has been done with the addition of a technology component. The purpose of this study is to evaluate the utility of technology-based response cards on increasing academically engaged behavior of students in three high school general education classrooms. It is hypothesized that the use of Plickers® will increase academically engaged behavior classwide and decrease disruptive behavior across students in all three classrooms.

Keywords: opportunities to respond, response cards, Plickers, academically engaged behavior

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DEDICATION

I dedicate this document to my fiancé, Philipp, for continuously encouraging me throughout the entirety of this process, for the late night dinners brought to my desk, and for loving me every step of the way. You moved across the county for me to chase my dreams, which I am infinitely grateful for. Your constant smile and positive attitude have forever changed me for the better and have facilitated my progress in school thus far.

To my parents, for loving me from afar and for the endless reassurance that following my crazy dreams is a good idea, even though they have taken me away from home. To my grandparents, for helping me further my education both through your sweet words and the stable foundation that you have built our family upon. To my sister for putting up with me all of these years, and for being my biggest role model of a person who is unapologetically themselves; I'll get there one day.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

LIST OF ABBREVIATIONS

AEB	Academically Engaged Behavior
AU	Autism
BIRS	Behavioral Intervention Rating Scale
CEC	Council for Exceptional Children
DB	Disruptive Behavior
EBD	Emotional/Behavioral Disorders
IOA	Interobserver Agreement
OHI	Other Health Impairment
OTR	Opportunities to Respond
PII	Problem Identification Interview
POT	Passive Off-Task
SLD	Specific Learning Disability
TD-OTR	Teacher Directed-Opportunity to Respond

CHAPTER I - INTRODUCTION

Problems with student behavior have been reported as one of the largest hurdles faced by teachers (Billingsley, 2001; Darling & Hammond, 2003; Muscott, 1987). Student misbehavior has escalated to a point where 40.7% of public school teachers in the United States have reported its interference with their ability to teach (Robers, Kemp, Rathbun, & Morgan, 2014). Unfortunately, when there are higher levels of misbehavior occurring in a classroom, even well behaved students frequently begin engaging in negative behavior (Barth, Dunlap, Lochman, & Wells, 2004).

Excessive misbehavior in the classroom is detrimental to both the student exhibiting the problem behavior and surrounding students (MacSuga-Gage & Gage, 2015). The student exhibiting the problem behavior is often times placed in a more limiting environment (McLeskey, Landers, Williamson, & Hoppey, 2012) or is sent to the office (Sugai, Sprague, Horner, & Walker, 2000), which impedes his or her own learning. For these students, disruptive behavior within the classroom not only has negative short-term effects on learning, but has also been shown to predict antisocial behavior and other negative outcomes later in life (Trentacosta, Hyde, Shaw, & Cheong, 2009).

Disruptive classroom behavior can have aversive effects on surrounding students as well. When it is necessary for teachers to tend to the misbehavior of students, vital classroom instruction time is misused (Riley, Mckevit, Shriver & Allen, 2011). Teachers are not excluded from the impact of student behavior problems (Lum, Tingstrom, Dufrene, & Radley, 2017). Teachers typically utilize reactive behavior management strategies, such as reprimands, to manage students with behavior problems in their

classrooms (Pas, Cash, O'Brennan, & Bradshaw, 2015). With that being said, reactive management, and teachers' use of reactive strategies, has been linked to higher ratings of teacher stress level (Clunies-Ross, Little, & Kienhuis, 2008). Reactive management approaches have also been related to decreases in student on-task behavior (Clunies-Ross, Little, & Kienhuis, 2008; Sulzer-Azaroff, & Mayer, 1986); however, as a way to continue engaging in disruptive behavior, many students avoid being caught by modifying their behavior when their teachers are using said reactive strategies, though this may be a problem of generalization (Skinner, Cashwell, & Skinner, 2000). It must be taken into consideration though, that not all reactive strategies are bad, as examples such as praise can be reactive as well. Brophy (1986) advocated that the foundation of improving student behavior and achievement is actually balanced atop the development of effective teaching and management strategies.

The quantity of effective instruction plays a critical role in effective teaching. The curriculum must be presented at a brisk pace to maximize the quantity of instruction delivered (Brophy, 1986). The amount of content absorbed, in terms of effective teaching, is related to the students' total opportunities of engagement (i.e., total hours in the school day and year; Brophy, 1986). As touched on previously, the length of student engagement time can be lessened by disruptive behavior in the classroom, and thus can decrease opportunities to learn (Riley et al., 2011). Another element of effective teaching is active student responding (ASR; Heward, 1994). Heward (1994) states that when the instructor produces an instructional antecedent, the observable response that the student makes is the ASR. Research has indicated that with the increase of ASR during instruction, learning has been advanced (e.g., Brophy 1986; Heward, 1994; Malanga &

Sweeney, 2008; Pratton & Hales, 1986). Although ASR is needed for effective classroom management and instruction for student achievement, it must be preceded by the opportunity for students to respond.

Opportunities to Respond

Providing every student with opportunities to respond (OTR) is essential for increasing ASR, and it is an effective instruction strategy for promoting learning (Lewis, Hudson, Richter, & Johnson, 2004). OTR can be described as the presentation of an antecedent stimulus that evokes ASR, which is then followed by feedback about the response given (Ferkis, Belfiore, & Skinner, 1997). The guidelines proposed by the Council for Exceptional Children in regards to adequate levels of OTR suggests that students should be prompted at a minimum rate of 4-6 times per minute (CEC, 1987). Improvements in learning outcomes have been correlated with optimal application of OTR in many studies with typically developing children as well (e.g., Brophy & Good, 1986). There are a few different types of OTR—some being individual responding, choral responding, response cards, and a combination of the aforementioned.

Individual OTR refer to a common procedure seen in classrooms in which the teacher poses a question, students raise their hands, and one individual student gets called on to respond (Haydon, Conroy, Scott, Sindelar, Barber, & Orlando, 2010). A study by Sutherland, Alder, and Gunter (2003) focused on increasing the teacher's rates of OTR by providing daily performance feedback using an ABAB design. A goal of 3 OTR per minute was selected for this study, and the dependent variables were on-task behavior, disruptive behavior, and correct responding. All dependent variables were measured using direct observation. The participants consisted of nine elementary-aged students in

a special education classroom. All nine participants were identified as students with Emotional/Behavioral Disorder (EBD).

Based on the results for this study it was indicated that the percentage of students' time on task increased during the OTR intervention (Sutherland et al., 2003). The students' mean rate of correct responses also increased during the intervention phase, while the rate of disruptive behavior decreased slightly; however, a few important limitations of this study need to be considered. First, the participants in the study consisted of one class of students with EBD, making it difficult to generalize these results. Next, the authors discussed that their lack of academic achievement measures limited the ability to interpret the findings. Also, due to the fact that data on individual students were not collected it was unclear whether the intervention was effective for all students (Sutherland et al., 2003).

A more recent study utilizing an individual OTR intervention was conducted by MacSuga-Gage and Gage (2015) which addressed several of the limitations of Sutherland and colleagues (2003)—namely the small and limited sample. In this study, a within-subject interrupted time-series design was utilized to assess the correlation between the increase of teacher directed-opportunities to respond (TD-OTR) and student-level behavior and academic outcomes. Five teachers and 30 students in first through third grade participated in this study and delivered OTR at a rate of 3 per minute. The teachers utilized Direct Behavior Rating-Single Item Scales (DBR-SIS) to measure the student outcomes of academic engagement and disruptive behavior.

A statistically significant positive relationship was found between increased TD-OTR and student academic engagement, with an average correlation of 0.34 ($p < .05$)

(MacSuga-Gage & Gage, 2015). Based on standardized progress monitoring, there was no relationship with academic achievement. Despite the importance of the findings of this study, an important limitation of this study was that teacher report of student behavior was relied on, as no direct observations took place (MacSuga-Gage et al., 2015).

Although individual OTR is one of the most common student responding procedures seen in classrooms, it has a detrimental limitation. With this procedure, only a handful of students, typically those that are higher achievers, raise their hands and actively participate (Haydon et al., 2010). One strategy for increasing OTR for all students is choral responding. Choral responding takes place when a teacher asks a question to which all students are asked to respond aloud simultaneously (Haydon et al., 2010).

In a study utilizing an alternating treatments design, Sindelar, Bursuck, and Halle (1986) compared single-student responding to choral responding. The participants of this study consisted of 11 elementary-aged students, 8 having a learning disability and 3 with mild intellectual disability. The primary dependent variables were on-task behavior and academic achievement as measured through direct observation of behavior and permanent products. During the single student responding, the students sat in a semicircle and were called on in order by the teacher, whereas in the unison or choral responding condition the students all responded simultaneously to the questions presented. The OTR were provided at a rate of 2 per minute for both interventions. Sindelar and colleagues found a small yet important improvement in the rate of acquisition and maintenance during the choral responding condition. Findings regarding academic achievement indicated that the words taught during the unison responding

phase were learned at a faster rate. The differences in rates of acquisition, however, were small (Sindelar et al., 1986). There were several limitations to this study to note, mainly resulting from the lack of ability to generalize the results due to the small number of participants who were all from a special education classroom. Also, as seen in many previous studies, elementary students were used, thus continuing to further the absence of research in high school literature with OTR.

In a more recent example of a choral OTR intervention, Haydon, Mancil, and Loan (2009), implemented an intervention with a fifth grade student who was at-risk for emotional and behavior disorders. The intervention consisted of 10-minute sessions where the teacher would cue all students to respond aloud to the questions presented, then give time for the students to respond before presenting the next question, and provide feedback on responses. An ABA single subject design was employed to determine the effects on the target student's correct responses and on-task behavior (Haydon et al., 2009). In this study it was found that both the student's on-task behavior and correct responses improved when a rate of at least 3 OTR per minute were put into place.

Although the findings demonstrated the efficacy of the intervention, a few important limitations need to be addressed as well. First, an ABA design was used due to class scheduling which made a second intervention phase unmanageable. Although this is understandable due to challenges associated with applied research, the lack of reimplementation of the intervention is worrisome, as no replication of outcomes occurred to verify the initial intervention results. It is also important to note that Haydon and colleagues included an elementary-age participant, as have many other similar

studies (e.g., Gardner et al., 1994; MacSuga-Gage et al., 2015). Thus, the literature on older participants remains lacking.

In a subsequent study by Haydon and Hunter (2011), a more rigorous ABCBC design was utilized as a way to compare the intervention effects of two response strategies. The response strategies in this study were single-student responding and hand-raising, with a rate of at least 3 OTR per minute, using two middle school aged general education participants. During the single-student response, the teacher would call on one student to answer the question, whereas during the unison hand-raising condition the teacher encouraged all students to raise their fingers at the same time to display their answers. Thus, the unison hand-raising condition could be considered a form of choral responding. The variables measured were on-task behavior, academic achievement, correct responses, teacher rate of praise statements, and teacher rate of redirection. All were measured using direct observation except for academic achievement, which was measured using permanent products (i.e., grades).

Rates of redirection during baseline were high while praise statements and OTR were low. During the intervention phases, redirections decreased slightly, while praise increased during both intervention conditions. For the participants, slightly higher levels of on-task behavior, correct responses, and test score percentages were demonstrated during unison hand-raising over single-student responding (Haydon & Hunter, 2011). Though these results are reassuring, some limitations need to be considered. First, the experimental design itself could have been a limitation due to the fact that there was no reversal or withdrawal phase to demonstrate experimental control and replication of the baseline phase. This lack of reversal makes it impossible to rule out other possible

variables contributing to student and teacher behavior changes. Next, these results are difficult to generalize due to the fact that the study took place in one middle school and only included two participants. Thus, Haydon and Hunter (2011) recommended that future research should be conducted to replicate this study to prove the effectiveness of intervention as well as plan for generalization.

Although choral responding can be advantageous over individual responding in that choral responding increases OTR for all students, a large limitation lies in that the teacher or presenter of the OTR cannot hear the answer of each individual student. As an alternative to choral responding, the use of response cards has been proposed as a strategy for providing OTR in which all student responses can be evaluated. The use of response cards as a way to respond involves the implementation of small boards on which students write or display their answers (Hardesty, McIvor, Wagner, Hagopian, & Bowman, 2014). Response cards have been used in preschools, primary and secondary schools, and universities to teach a wide variety of subject matter (Hardesty et al., 2014).

Adamson (2014) compared response cards to other forms of OTR. This study compared three interventions including guided notes, class-wide peer tutoring, and response cards, to investigate the impact on student academic engagement. The participants were three high school aged students with EBD, where rate of OTR provided was individually set for each student teacher dyad. This study used a single subject design with alternating treatments. Based on the results, it was indicated that percentage of academic engagement was increased by all three OTR interventions, but implementation of response cards resulted in the greatest changes in academic engagement.

In another study, Davis and O'Neill (2004) compared the effectiveness of response cards to that of hand-raising in a middle-school resource class. There were four primary dependent measures including percent of trials in which students made an academic response, percent correct academic responses, percent of trials that students responded with raising hands, and percent of trials with off-task behavior (Davis & O'Neill, 2004). The exact rate of OTR provided in this study was not clearly stated by the researchers. Four students participated in this study, all having some form of learning disability, and half were learning English as their second language. During the hand-raising intervention, students were encouraged to raise their hands to respond to the question the teacher provided and would receive a bean for raising their hand and answering if they responded correctly. These beans were later collectively added up to earn a class activity or field trip. Next, during the response card intervention, erasable white boards were used for the students to write their answers on and hold up to show the teacher their response. During this phase the students would receive a bean for writing a response regardless of accuracy; these beans were later used to collectively add up to a class activity or field trip.

The results of this study were inconsistent, considering only two of the four students demonstrated decreased off-task behavior during the response card phase. Increasing trends were apparent in some of the hand-raising phases, but the response cards were found to increase the student's rate of accuracy of responding and also resulted in average weekly quiz scores higher than the hand-raising phase (Davis & O'Neill, 2004). An important limitation to consider for this study had to do with the students that were receiving ESL instruction. Although response cards were found to be

more effective in increasing accurate academic responding, the students reported a preference for hand raising. This may have because some of the students receiving ESL instruction could have found the response card intervention to be aversive due to difficulties reading and writing (Davis & O'Neill, 2004). Though this study had limitations, it is important to note that it was one of the only studies noted that utilized a reinforcement paradigm as part of their intervention.

A similar study was conducted by Narayan, Heward, Gardner, Courson, and Omness (1990). During large-group social studies instruction Narayan and colleagues evaluated two interventions in a fourth grade classroom consisting of 20 students. The first intervention consisted of hand-raising, while the second intervention consisted of the use of write-on response cards. The two conditions were compared in an ABAB design. During baseline the hand-raising condition was used, thus the teacher would ask a question and would then call on a student that had raised their hand, while in the intervention condition the response cards were used as a way for all students to provide their answers. During the hand-raising conditions, a mean level of 1.9 OTR per minute were provided, while during the response card conditions, a mean level of 1.2 OTR per minute were provided to the participants. Dependent variables assessed in the study included academic achievement, which was measured using permanent products, and number of responses and accuracy of student responses. Both dependent variables were measured via direct observation.

Results for this study indicated that the rate of active student response was much higher in the response card condition. During the response card condition, active student responding averaged 15.6 times per session (range = 13.5 to 17.6), compared to an

average of 11.6 times per session the hand raising condition (range = 9.2 to 13.7). Also, daily quiz score means were higher following the response card condition (M = 8.2 and 7.8) compared to scores following the hand-raising condition (M = 6.5 and 7.3). It is also important to note that 19 out of 20 students in the class preferred response cards over the hand-raising condition. A few limitations involved in this study need to be discussed though. Narayan and colleagues addressed that a limitation in their study was the lack of maintenance data in terms of quiz scores over time as a substantial limitation and future research avenue. Along with that, the authors discussed the number of participants, participant skill level and age, duration of the study, and curriculum involved.

In another attempt to compare the efficacy of various types of OTR strategies, Lambert, Cartledge, Heward, Lo, and Koegel (2006) completed a study in which they compared single-student responding to response card responding. Lambert and colleagues then evaluated the effects of the two conditions on academic responding and disruptive behavior, using an ABAB design. Nine fourth grade students participated in this study selected based on a prior history of disruptive classroom behavior and classroom disciplinary issues. As seen in prior studies, during the single-student responding condition, the teacher would ask a question and then call on one student who raised a hand to provide a response. During the response card condition, students were provided with an erasable white board in which they wrote their response on and held up for the teacher to see. Approximately 1.2 OTR per minute were provided to the participants during each condition.

The results for this study indicated that there were sizeable reductions in disruptive behavior as well as increases in academic responding during the response card

condition compared to the single-student responding condition (Lambert et al., 2006). Though it is important to consider that although a decrease in inappropriate behavior is valuable, it does not mean that an increase in acceptable behavior was obtained. There are several other limitations that need to be considered as well. First, data were only collected on the nine target students who displayed high levels of disruptive behavior, though this was the purpose of this study, a there is a lack of research focusing on the effect of response cards on the disruptive behavior of an entire class.

Whereas studies such as Lambert and colleagues (2006) have evaluated the effects of response cards on a subset of students within a classroom, other researchers have endeavored to investigate the effect on the class as a whole. A study by Gardner, Heward, and Grossi (1994) compared hand-raising to response cards as well. This study evaluated the use of response cards using an alternating ABAB design with one class of fifth grade children. Five target students were selected for observation, with academic performance being assessed for the entire class. As in Lambert et al. (2006), during the hand-raising condition the teacher would ask the class a question, and one student that raised their hand would get called on to answer. Similarly, during the response card phase, the students were provided with a white laminated board to write one to two word responses on in reply to the question asked. During the hand-raising condition, mean rate of OTR presentation was 1.54 questions per minute, while during the response card condition mean rate was 0.99 OTR per minute (Gardner et al., 1994).

During the response card condition, the occurrence of active student responding by the target students was 14 times higher than the hand-raising condition (Gardner et al., 1994). Also, following the response card condition, all 22 students in the class scored

higher on the next day quizzes and two-week review tests. Gardner and colleagues also held end-of-study interviews, in which the majority of the students said that they preferred response cards to hand-raising and that the response cards helped them get better grades. The researchers also noted that during the hand-raising condition students would often show frustration when they did not get called on, and that some students would stop raising their hands all together. This study was conducted with elementary school participants, and thus an absence in the research in the area of high school students still exists in the literature. There was also a relatively small sample size for this study as observations of only five students took place (Gardner et al., 1994).

In a review of the literature, Sutherland and Wehby (2001) discussed the connection between increasing OTR to academic requests and behavior outcomes of students with EBD. The studies reviewed all indicated that increasing OTR had lead to higher rates of academic achievement as well as engagement, and lower rates of misbehavior in the classroom. Although these findings are ideal, Sutherland and Wehby (2001) found that descriptive research in these classrooms revealed that teachers rarely provide adequate OTR. It is possible that this lack of ample OTR is due to teacher perception that the strategies previously described are difficult to implement. But, with the use of technology, providing sufficient OTR for students may be made easier.

Technology in Education

Bauer and Kenton (2005) reported that most teachers are mindful that expanding educational opportunities can be addressed through the use of technology, though many teachers neither implement technology into their curriculum nor use technology as a way to deliver instructions. On the other hand, many parents have begun to acknowledge that

improving the quality of work that children produce can be achieved with the use of technology (Kook, 1997). This community realization has put incredible pressure on schools to reconstruct their education systems through technology (Keengwe & Onchwari, 2009). Sivin-Kachala and Bialo (2000) conducted a review focusing on the effectiveness of technology in schools, and concluded that technology can improve learning and teaching. They reported that when engaged in a technology-rich environment, dependable and positive outcomes were found for the students. According to the National Association of School Psychologists Model for Comprehensive and Integrated School Psychological Services (2010), the use of technological resources and information can enhance students' academic and cognitive skills. "Learning to use technology and using technology to learn are essential building blocks for life success," (National Association of School Psychologists, 2006, p. 9). The problem with increasing technology in schools often lies within the cost and complication of incorporating the technology necessary to make substantial education increases. It was found in a national teacher-level survey that of teachers in public elementary and public secondary schools, 97% had one or more computers in their classrooms and of that, 93% had internet access (Gray, Thomas, & Lewis, 2010). Thus, it is possible for teachers to deliver various positive learning experiences by creating technology-based learning environments utilizing tools that many classrooms have readily available (Want & Hoot, 2006).

With the increased focus on the utilization of technology in school settings, clickers have been developed as an OTR strategy. Clickers are handheld electronic devices that allow a student to respond to a teacher question. Clickers offer an

improvement over the previously described OTR strategies, as they allow a student to respond without revealing his or her answer to peers.

In a study involving the use of clickers, Blood (2010) evaluated the effects of a polling system called Student Response System (SRS) on students on-task behavior, academic achievement, and response rate. An ABABC design was utilized with five high school special education students. The SRS was utilized by the students as a way to respond to true/false and multiple-choice questions. During the intervention phase, the rate of OTR was set to 0.75-1.0 per minute during each session. The responses were then displayed immediately as a graph that depicted the percentage of correct responses. It was found that the students more frequently responded to questions when the SRS was used, although there was no functional relationship found for on-task behavior or academic achievement (Blood, 2010).

As addressed prior, there are multiple characteristics of the OTR literature base that leave much of these findings with the inability generalize to the greater population. First, much of the literature focuses on single student case studies or small sample sizes as opposed to classwide research. Classwide research could provide a wider range of student data, and encompass a greater view of the effects of OTR on a variety of student behavior. Similarly, many of the participants were from special education classrooms. In addition, very few studies utilized the high school population, focusing mainly on the elementary or middle school level. These characteristics do not promote generalization due to the limited scope of participants used in this literature base. Considerably, the focus on high school general education students is increasingly necessary, as at this level off-task behavior and school dropout are elevated (Marks 2000).

Plickers®

Despite the utility of clickers discussed above (Blood 2010), widespread adoption has been limited—likely due to cost and reliability (e.g., Barnett, 2006; Poirier & Feldman, 2007). A free application called Plickers® has provided the ability to replicate the use of clickers in a low-cost manner. Plickers® are 5.5 inch by 5.5 inch pieces of paper with a four-sided QR code printed in the center (Figure 1). Using a web-based application, the teacher first enters his or her class roster into the application, assigning each student a unique Plicker®. The teacher then uploads questions into the application. Following distribution of Plickers® to each student, the teacher is able to use a projector or smartboard to display a question and up to four possible responses (i.e., A, B, C, or D). In response to the question, students orient their QR code to the desired answer and hold it up for their teacher to scan all student responses at simultaneously. Letters labeling the four orientations are printed small enough so that only the responding student is able to see which answer they are selecting—allowing students to respond to questions without disclosing to peers which answer they believe to be correct.

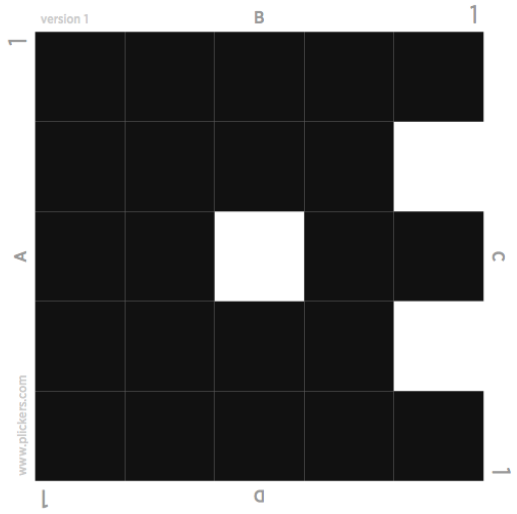

Figure 1. Example of a Plickers® card.

Scanning of student responses is accomplished with a downloadable Pickers® app, which uses the camera of a smartphone or tablet to read all student QR codes simultaneously as a way to respond to their teacher's questions. Student responses are automatically transmitted to the web-based application, allowing the teacher to calculate correct responding quickly. In sum, the use of Plickers® allows teachers to poll their classrooms using individualized "paper clickers" as a way to engage their class and check their students' understanding concurrently. The benefit of using technology such as Plickers® in the classroom eliminates the need for teachers to collect student response data on paper which can easily get lost. Plickers® will store the student response data online for both the teacher and researcher's benefit. Not only will this make things easier for the teacher, but the students will be able to see the response results on the screen immediately while keeping the answers anonymous. Additionally, through the use of Plickers® all students are continuously responding to OTR provided, as opposed to select

students when hand-raising tactics are used. This in turn may allow for a lower dosage of OTR to be provided to the class with the same beneficial results, thus making duties even less constraining for teachers. Although the creation of Plickers® is a potentially useful tool for classrooms, they have yet to be evaluated in empirical research. The lack of research with this application leaves a potentially vital absence in the literature that may improve both learning and teaching with the use of this new technology.

Purpose of the Present Study

The present study was designed to evaluate the effects on academically engaged (AEB) and disruptive behavior (DB) in a general education high school setting using Plickers®. Further research needed to be conducted to extend the previous research in OTR interventions, particularly response cards in the form of Plickers®, as no general education high school-aged participants have been used in previous studies. The present study also provides an important extension of OTR interventions through the incorporation of no-cost technology that is readily available to all educators. The use of this new technology allowed the teachers the opportunity to increase OTR with little effort on their part. This is something that teachers in high school may benefit from as an interactive intervention that can be used classwide to better the learning environment.

Research Questions

1. Is there a functional relation between implementation of Plickers® as an OTR intervention and classwide AEB?
2. Is there a functional relation between implementation of Plickers® as an OTR intervention and classwide DB?

3. Will high school teachers rate the use of Plickers® as a socially valid method for addressing student behavior?

CHAPTER II - METHOD

Participants and Setting

Three general education high school classrooms (i.e., 9th, 10th, 11th, or 12th grade) were recruited from a public school district in the Southeastern United States, with approximately 570 students attending. The school was on a semester-based system with a block schedule of four 95-minute classes a day. The classrooms were selected from prior referrals by school administrators noting classrooms that were exhibiting increased levels of off task behavior. The teachers of the referred classrooms were then contacted and interviewed by the primary investigator as a way to collect specific information on the students' behavior in the referred class. Following the interview, screen-in observations occurred. Only the classrooms engaging in AEB for 70% or less of observed intervals would qualify to take part in the study.

Consent from all participating teachers, and permission from school administrators to conduct the study, was obtained prior to the first observation (see Appendix A & B). Teacher demographic information was also obtained prior to the study (see Appendix C). Due to the fact that all data were combined into a classwide outcome, data for individual students were not reported. Thus, student assent and parental consent were not required. This study was approved by the university Institutional Review Board prior to the initiation of any data collection or teacher training (see Appendix D).

Classroom A was an Environmental Science course during 1st block, which consisted of 26 students (17 males) in the ninth (1), tenth (1), eleventh (13), and twelfth (11) grade. The class consisted of eighteen Caucasian students, and eight African

American students. Four students in this class received special education services, two under the category of Specific Learning Disability (SLD), one under Other Health Impairment (OHI), and one under Emotional Disability (EMD). This class was taught by a 30-year-old Caucasian female in her ninth year of teaching. All observations were conducted an hour into the class period after the class had completed their initial bell work and homework review.

Classroom B was a Human Anatomy and Physiology course during 2nd block, which consisted of 21 students (4 males) in tenth (6), eleventh (8), and twelfth (7) grade. The class consisted of twelve Caucasian students, eight African American students, and one Hispanic student. One student in the class received special education services under the category of Autism (AU). Classroom B was taught by the same teacher as Classroom A. All observations were conducted an hour into the class period, after the class had completed their initial bell work and homework review.

Classroom C was a Contemporary Health course during 2nd block, which consisted of 21 students (18 males) in ninth (8), tenth (4), eleventh (5), twelfth (3) grade, and secondary self-contained special education (1). Five students received special education services, one under the category of OHI, one under SLD, one under EMD, one under AU, and one under the category of Multiple Disabilities (MD). Classroom C consisted of fourteen Caucasian students, and seven African American students. This class was taught by a 28-year-old Caucasian male in his fourth year of teaching. All observations were conducted at the start of the class period.

Materials

Several items were utilized during the intervention, including a teacher script, a student training script, Plickers® cards, a smartphone containing the Plickers® application, and a computer and projector to display student responses.

Teacher Script

The teacher training script (see Appendix E & F) described the steps for training the teacher on the intervention. The script contains information that was presented verbatim to teachers. The teachers were also provided with a training script of their own, which was used to train the class on the intervention (see Appendix G).

Plickers®

All Plickers® cards were provided for the class with each student's number on the back as a way to ensure that each student used the same card each day. The cards were matte laminated to ensure the clarity and durability of the cards throughout the study.

Social Validity

Following the completion of the study all participating teachers were encouraged to rate the intervention on the Behavior Intervention Rating Scale (BIRS; Elliot & Von Brock Treuting, 1991; see Appendix H). The BIRS is comprised of 24 items, and assessed each teacher's individual opinion of the utility and acceptability of the intervention. The BIRS uses a 6-point Likert scale that ranges from strongly disagree (1) to strongly agree (6). Three factors make up the BIRS: Acceptability, Effectiveness, and Time, yielding coefficient alphas of .97, .92, and .87, respectively (Von Brock & Elliott, 1987). Possible scores range from 24 to 144, where higher scores suggest higher levels of social validity for the intervention. Minor modifications were made to the wording of

items, changing "the intervention" to "Plickers®." Prior research has found that such modifications do not affect the psychometric properties of the measure (Sheridan & Steck, 1995; Sheridan, Eagle, Cowan, & Mickelson, 2001).

Dependent Measures

Student Behavior

The primary dependent variable assessed during this study was AEB. AEB was defined as "the student being actively involved or attending to (e.g. looking at) independent seatwork, teacher instruction, designated classroom activities, and/or engaging in task related vocalizations with teachers and/or peers" (Lambert et al., 2015, p. 418).

A secondary dependent measure of student disruptive behavior (DB) was also collected. The definition for disruptive behavior was constructed with the use of a Problem Identification Interview (PII; Kratochwill & Bergan, 1990). Each teacher was interviewed with the PII to find the most frequent disruptive behaviors that occurred in their classroom (e.g., inappropriate vocalizations, out of seat, playing with objects, etc.), which then assisted in forming the individualized definition of disruptive behavior for that class (see Appendix I). All three teachers reported talking, cellphone usage, and sleeping were the most frequent behaviors that they observe. Disruptive behavior was defined for all classes using a modified version the definition from *The Tough Kid Tool Box* (Jenson et al., 1995), playing with objects, out of seat, noncompliance, and talking out, and incorporating the above listed teacher concerns, aside from sleeping. During the observations, students were reported as AEB, DB, or neither, noted as passively off-task

(POT). POT was defined as a student who was not disrupting the class (i.e., DB), nor academically engaged. Examples of POT behavior included sleeping and staring off.

A 10-second momentary time sampling recording procedure was used to assess student behavior. Data were collected from an unobtrusive location by the researcher or trained observers during 20-minute periods. Observers used an audio recording during data collection as a way to be cued for each 10-second interval. At the start of each 10-second interval, one student was observed momentarily and was recorded as either AEB, DB, or POT (see Appendix J). Then, a subsequent student was observed at the beginning of the new interval. The researcher continued in this pattern until all students had been observed, and then they began again following the same pattern until the 20-minute interval was complete. This rotation order was approximately based on the seating patterns of the students in the class. Previous research has found this method of observation to yield valid estimates of group behavior (Briesch, Hemphill, Volpe, & Daniels, 2015; Dart, Radley, Briesch, Furlow, & Cavell, 2016). Data were reported as a classwide percentage of intervals of occurrence, which was calculated by taking the total number of intervals of occurrence of one dependent variable and dividing it by the total number of intervals in the observation. To obtain a percentage, this outcome was multiplied by 100. All dependent variable percentages were reported separately, and the data collection procedures did not change across phases.

A frequency count of OTR provided to the class was also collected throughout the observation. In this study OTR were defined as the presentation of an antecedent stimulus, a question provided, that elicited active student responding, that was then followed by teacher feedback.

Design

An ABCBC design was used to evaluate the effect of the intervention. Phase A represents baseline, where no intervention was implemented. The B phases involved the opportunity to respond (OTR) intervention, and the C phases incorporated the use of Plickers® into the previous phase. These phases allowed for possible prediction, verification, and replication effects as the data were collected. Phase changes were determined through the use of visual analysis to determine level, trend, and stability of AEB. There was a minimum of five data points per phase across the five phases (Kratchowill et al., 2010).

Procedures

Screening

Each teacher was interviewed using the PII (Kratochwill & Bergan, 1990) prior to screening, to determine the most frequent disruptive behaviors in his or her classroom. These specified behaviors were then utilized to form an operational definition for disruptive behavior. The teacher was also asked to identify a period of time when students were the least engaged academically. This time slot was also required to be a time where the intervention was applicable (i.e., not silent reading). The classes then went through the screening process in which teachers were asked to go about instructing their class while utilizing their regular classroom management strategies. A 20-minute observation was performed, and in order to qualify for participation in the study, participating classrooms were required to exhibit 70% or less of observed intervals of AEB during the first screening observation. When the criterion was met, the classroom

continued on into the baseline phase, and the screening observations were retained as baseline data points.

Baseline

During this phase, classwide AEB and DB was recorded during a 20-minute observation using the established operational definitions. In addition, a frequency count of the number of classwide OTR that the teacher provided during the observations was counted as a way to identify baseline levels of OTR that each class was receiving in order to set a relevant increase in OTR for the intervention phases. As in the screening phase, teachers were encouraged to continue with their normal classroom management routines. Prior to the intervention, data were collected for a minimum of five sessions. The treatment integrity checklist was utilized during this phase as a way to ensure that no intervention procedures were being implemented during baseline.

Teacher Training

The primary observer met with the teacher to explain the required amount of OTR to be provided to the class during the following phase. At this time the primary observer provided a definition of what an OTR is and provided an example and non-example of an OTR. The teacher was then required to provide three examples of an OTR that they could provide to the class as a way to show understanding of the requirements. Termination of training occurred when the teacher reached 100% integrity based off of Appendix K. IOA was obtained for 100% of teacher trainings.

Opportunities to Respond Intervention Phase

Implementation of the OTR intervention phase took place after the teacher had been trained. When the researcher or trained observer entered the room and the 20-

minute observation began, the teacher was required to give the class as a whole exactly 20 OTR. The number of OTR required during this phase represented an increased amount from the average of each class's baseline OTR levels and was set as the same amount for all participating classes as a way to decrease variability between the classes. During this time, the observer recorded the AEB, DB, and POT behavior of the class, as well a frequency count of the number of OTR provided. At the conclusion of the 20-minute period, the observer left, and classroom routines continued on normally. If the teacher failed to administer the indicated number of OTR to the class, the primary researcher provided feedback to ensure understanding of the necessary number of OTR to be presented during the following session.

Teacher Training

The primary researcher met with the teacher to provide the individualized Plickers® cards and a demonstration of the application usage. The primary researcher created the online Plickers® accounts for the teachers and provided the teachers with the login information as well as a training on how to upload questions. Teachers practiced using the application and were given the chance to ask any questions before the student training began. Termination of training occurred when the teacher reached 100% integrity based off of Appendix L. IOA was obtained for 100% of teacher trainings.

Student Introduction and Training

During student training, the Plickers® cards were passed out, and the teacher described proper usage of the cards. At this time, behavioral skills training—instruction, modeling, rehearsal, and feedback—was used to ensure the students understanding of card usage. This also gave the teacher a chance to practice scanning the classroom while

the students got accustomed to the cards. Termination of training occurred when the class has reached 100% integrity based off of Appendix M. IOA on was obtained for 100% of student trainings.

Plickers® Intervention Phase

Implementation of the intervention took place after both the teacher and students had been trained. Each day at the start of the identified class period, the Plickers® cards were passed out to all students. When the researcher or trained observer entered the room, and the 20-minute observation began. The teacher was required to give the class 20 OTR using their Plickers® cards. The number of OTR required during this phase was an increased amount from the average of each class's baseline OTR levels and was set as the same amount as the previous phase. Prior to the observations, the OTR would be uploaded to the Plickers® website to ensure that the target number of OTR was provided. When an OTR was presented through the use of a projector, the teacher would record each students' response using the Plickers® application and then would continue on with regular classroom routines and management. During this time, the observer was recording the AEB, DB, and POT behavior of the class, as well a frequency count of OTR provided. At the conclusion of the 20-minute period, the observer left, the Plickers® were put away, and classroom routines continued on normally.

Opportunities to Respond Reimplementation Phase

After the Plickers® intervention phase, the OTR phase was re-implemented. This phase was identical to the prior OTR intervention phase, and a minimum of five data points were required for collected for each classroom.

Plickers® Reimplementation Phase

Following the OTR reimplementation phase, the Plickers® phase was implemented again. This phase was identical to the prior Plickers® intervention phase, and a minimum of five data points were required for collected for each classroom.

Interobserver Agreement

Interobserver agreement (IOA) was assessed between the primary and secondary observer during at least 30% of sessions within each phase. IOA was collected in total for 37% of all sessions. To calculate IOA, the total number of agreements was divided by the combined number of agreements and disagreements, and then multiplied by 100 to obtain a percentage (Cooper, Heron, & Heward, 2007). As in Lum et al. (2017), IOA was calculated separately for both dependent variables and was reported as the total agreement of occurrence and nonoccurrence of behavior.

Observers were graduate students in a school psychology program that had reached a 90% IOA criterion during training sessions. Trainings on the behavioral definitions of the target behaviors and observation procedures occurred prior to any data collection. A minimum of 80% IOA was required from the secondary observer at any point, or a retraining on the operational definitions and observation procedures would occur prior to the continuation of data collection. Retraining occurred on one occasion for Classroom B.

Classroom A's IOA was obtained for 40% of the baseline observations, 40% of all observations in the initial OTR phase, 33% of all observations in the initial Plickers® phase, 40% of all observations in the final OTR phase, and 40% of all observations in the final Plickers® phase. IOA for AEB in Classroom A averaged 93% (range = 87-99%) across all phases, DB averaged 93% (range = 86-99%) across all phases, and POT

averaged 96% (range = 90-100%). Total IOA for AEB, DB, and POT combined averaged 93% (range = 82-99%) across all phases.

Classroom B's IOA was collected for 37% of the baseline observations, 37% of all observations in the initial OTR phase, 40% of all observations in the initial Plickers® phase, 33% of all observations in the final OTR phase, and 40% of all observations in the final Plickers® phase. IOA for AEB in Classroom A averaged 92% (range = 79-98%) across all phases, DB averaged 93% (range = 82-97%) across all phases, and POT averaged 97% (range = 93-100%). Total IOA for AEB, DB, and POT combined averaged 94% (range = 86-98%) across all phases.

Classroom C's IOA was obtained for 40% of the baseline observations, 40% of all observations in the initial OTR phase, 33% of all observations in the initial Plickers® phase, 33% of all observations in the final OTR phase, and 40% of all observations in the final Plickers® phase. IOA for AEB in Classroom A averaged 95% (range = 90-98%) across all phases, DB averaged 95% (range = 91-98%) across all phases, and POT averaged 97% (range = 93-100%). Total IOA for AEB, DB, and POT combined averaged 96% (range = 92-98%) across all phases.

Kappa

The kappa coefficient takes into account chance agreement when establishing the amount of agreement between observers. For this study, kappa was calculated alongside the IOA described prior, using the formula outlined by Uebersax (1982) for AEB and DB. Kappa is a more stringent measure of IOA with possible ranges from -1.00 to +1.00. Values less than 0.00 signify less than chance agreement, 0.01 to 0.20 represents slight agreement, values from 0.21 to 0.40 reflect fair agreement, between 0.41 and 0.60 are

suggestive of moderate agreement, 0.61 and 0.80 are considered substantial agreement, and almost perfect agreement is indicated by values between 0.81 and 0.99 (Viera & Garrett, 2005).

The mean Kappa value for Classroom A was 0.87 (95% CI = 0.56-1.0), signifying that there was 'very good' agreement between observers for AEB, DB, and POT. Classroom B's mean Kappa value was 0.84 (95% CI = 0.40-1.0), indicating that there was 'very good' agreement between observers for all three dependent variables. Classroom C had a mean Kappa value of 0.91 (95% CI = 0.70-1.0) suggesting that there was 'very good' agreement between observers across all dependent variables.

Procedural Integrity

A procedural integrity checklist was completed during teacher trainings to ensure that the primary investigator trained all teachers appropriately (Appendix K & L). The primary observer rated procedural integrity as 100% during all three training sessions. In addition, a secondary observer collected IOA data for all three training sessions and determined the integrity to be 100%. If any steps were missed, the primary investigator would have retrained the teacher on all procedures, though this was not necessary.

A procedural integrity checklist was also completed when the teacher trained the students on the intervention procedures (Appendix M). The primary observer rated Integrity as 100% —with 100% IOA—for all student trainings.

Treatment Integrity

A checklist that described all of the required steps for appropriate implementation of the intervention was utilized during each session to assess treatment integrity (Appendix N & O). Direct observation was used to assess treatment integrity; the

primary investigator completed the checklist immediately following the observation period. A teacher with an integrity score below 90% during intervention phases would be provided with a retraining and appropriate feedback to ensure proper implementation during future observations. Treatment integrity was also checked during baseline phases as a way to ensure that procedures of the intervention were not being utilized at this time. It is important to note that treatment integrity was also assessed during baseline to gauge the amount of intervention that the teacher was implementing before training (i.e.: OTR provided). As noted below, the level of treatment integrity for baseline phases is much higher than commonly seen, in that there were instances where the teacher provided many OTR to the class during a baseline observation. Though this is the case, it is essential to consider the degree of variability during baseline phases and the overall increase in consistency during the intervention phases.

Treatment integrity for Classroom A averaged 41% (range = 0-87%) for baseline, 99% (range = 95-100%) for the initial OTR phase, 100% for the initial Plickers® phase, 99% (range = 95-100%) for the final OTR phase, and 99% (range = 95-100%) for the final Plickers® phase.

Classroom B's treatment integrity averaged 20% (range = 0-87%) for baseline, 95% (range = 90-100%) for the initial OTR phase, 100% for the initial Plickers® phase, 97% (range = 90-100%) for the final OTR phase, and 99% (range = 95-100%) for the final Plickers® phase.

Treatment integrity for Classroom C averaged 2% (range = 0-8%) for baseline, 100% for the initial OTR phase, 99% (range = 95-100%) for the initial Plickers® phase, 100% for the final OTR phase, and 100% for the final Plickers® phase.

IOA for treatment integrity was collected for a minimum of 30% of observations across phases (37% in total). Treatment integrity IOA was calculated as number of agreements of steps completed divided by the number of total steps, and was 100% across all collected sessions in all classrooms.

Data Analysis

As a way to examine level, trend, and variability across phases, visual analysis was utilized. Visual analysis was also used to determine immediacy of effects, data overlap across phases, and consistency of data patterns across similar phases (Horner et al., 2005). Visual analysis served as the primary means of determining the effect of the intervention on AEB and DB.

In addition to visual analysis, Tau-U was calculated following the final intervention phase. Tau-U is an effect size that accounts for nonoverlap across phases, as well as trend, to produce a numerical estimate of the effect of an intervention (Parker, Vannest, Davis, & Sauber, 2011). Tau-U, in comparison to other non-overlap measures, can present a thorough index of change between phases because its score distribution does not display artificial ceilings (Parker et al., 2011).

Each initial OTR phase was compared to the initial Plickers® phase, each initial Plickers® phase to each reimplementation OTR phase, and finally each reimplementation OTR phase to each Plickers® reimplementation phase. A weighted average was then made following the calculations conducted prior. In terms of Tau-U, the data for the baseline phases were examined for indication of significant trend. If trend level resulted in a Tau-U calculation higher than 0.4, the trend was corrected (Vannest, Parker, & Gonen, 2011). Tau-U scores were interpreted using guidelines proposed by Vannest and

Ninci (2015), where a small change is considered a 0.20 improvement, a moderate change is 0.20 to 0.60, 0.60 to 0.80 is a large change, and all above 0.80 is considered a very large change.

CHAPTER III - RESULTS

Classroom A

During baseline, students in Classroom A demonstrated AEB (Figure 2, top panel) for a mean of 57% during observed intervals (range = 50-63%). AEB during this phase was slightly variable with very little trend. When increased OTRs were introduced, AEB remained variable and had a decreasing trend with a mean similar to that of the prior phase, at 56% of observed intervals (range = 45-70%). Upon the introduction of Plickers®, the mean of AEB increased to 61% during observed intervals (range = 45-72%), with a slight increasing trend. When OTR were reintroduced, AEB had a slightly downward trend, but an overall mean of 60% of observed intervals (range = 55-66), comparable to the prior phase. Then, during the final Plickers® phase, AEB dropped to a mean of 49% of observed intervals (range = 44-60%), with a slight decreasing trend during the final implementation of Plickers®. The data patterns for this classroom for AEB were fairly consistent across all phases. The effect sizes for increasing AEB are shown below in Table 1 for this intervention. In Classroom A, this intervention had a small effect overall for increasing AEB.

DB data during baseline for Classroom A were fairly stable, with only one outlying data point, and a mean of 26% of observed intervals (range = 24-34%). When the OTR phase was introduced, DB data became variable with an increasing trend, and a mean of 26% of observed intervals (range = 10-37%), akin to the prior phase. Similar, when the Plickers® phase was implemented, DB data were variable with a mean of 26% during observed intervals (range = 21-33%), though a very little trend was observed. Next, after the OTR phase was reintroduced, DB had a mean of 27% of observed

intervals (range = 17-35%), similar to all phases prior. The data during this phase were less variable than in prior phases, and a fairly stable trend was observed. Finally, during the last phase, DB increased to a mean of 34% of observed intervals (range = 21-48%), and data were variable with an increasing trend. The data patterns across all phases were consistent for Classroom A's DB, aside from the increased mean in DB during the final phase. Below, Table 1 lists the effect sizes for this interventions ability to decrease DB for this classroom using Tau-U calculations. These calculations indicate that this intervention had a small effect overall for decreasing DB for Classroom A.

Classroom A's baseline results for POT were stable and had a mean of 16% of observed intervals (range = 11-18%). During the following phase, POT became slightly more variable, but retained its stability throughout the phase, and its mean of 16% during observed intervals (range = 13-21%). When the Plickers® phase was implemented, POT data were variable and had a decreased mean of 11% during observed intervals (range = 5-21%). Next, when the OTR phase was reintroduced, POT had a mean of 11% of observed intervals (range = 3-16%), akin to the prior phase. During this phase, POT data were variable, but had a stable trend overall. When Plickers® were re-implemented, POT mean increased to 15% of observed intervals (range = 3-26%). During this phase, POT data were variable and trending downward. Patterns were consistent across four of the five phases for POT data. For Classroom A, Tau-U calculations found small effects overall for decreasing POT.

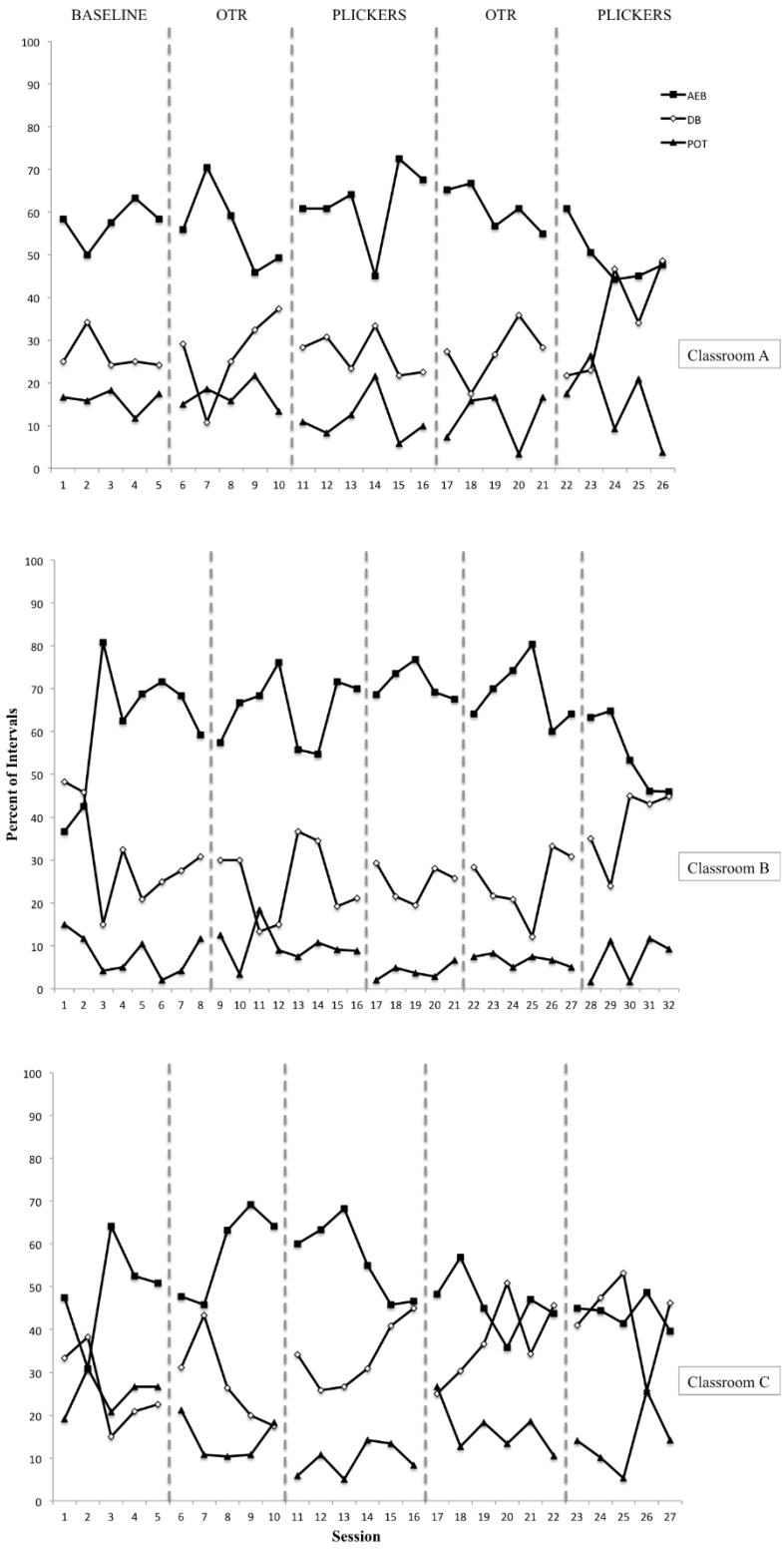

Figure 2. Percentage of intervals of occurrence for academically engaged behavior, disruptive behavior, and passive off-task.

Table 1 *Effect Size Calculations for Classroom A*

	Tau-U	Effect
Academically Engaged Behavior		
Initial OTR/Initial Plickers®	0.40	Moderate
Initial Plickers®/OTR	0.17	Small
OTR/Plickers®	0.84	Very Large
Weighted Average	0.19	Small
Disruptive Behavior		
Initial OTR/Initial Plickers®	0.20	Small
Initial Plickers®/OTR	0.03	Small
OTR/Plickers®	0.28	Moderate
Weighted Average	0.03	Small
Passive Off-Task		
Initial OTR/Initial Plickers®	0.73	Large
Initial Plickers®/OTR	0.07	Small
OTR/Plickers®	0.44	Moderate
Weighted Average	0.08	Small

Classroom B

Students in Classroom B displayed AEB (Figure 2, middle panel), during baseline, an average of 61% during observed intervals (range = 36-80%), with an increasing trend in the variable data. Then, during the first OTR intervention phase, the mean of AEB increased to 65% of observed intervals (range = 54-76%). The data during this phase were variable, though little trend was observed overall. The Plickers® phase for this classroom resulted in an increased mean of 71% of observed intervals (range = 67-76%), the highest of all AEB means throughout the study. The data during this phase were less variable, though a relatively stable trend was observed overall. The reimplementation of OTR resulted in the second highest mean for AEB throughout the study, 68% of observed intervals (range = 60-80%), with fairly stable data. Finally, during the last phase, when Plickers® were reintroduced, AEB data were variable, with a

downward trend and a mean of 54% of observed intervals (range = 45-63%). Data patters were overall fairly consistent between all phases, aside from the increased mean during the first Plickers® phase. The effect size calculations for Classroom B are listed in the table below (Table 2). The intervention in this classroom had a small effect on increasing AEB overall, using Tau-U calculations.

Baseline results in Classroom B for DB exhibited variable data with a downward trend. The mean in this phase for DB was 30% of observed intervals (range = 15-48%). When the OTR phase was introduced, the mean of DB decreased to 24% during observed intervals (range = 13-36%). The data during this phase remained variable, though a reasonably stable trend was observed overall. Next, when the Plickers® intervention was implemented, data were fairly stable with a mean of 24% of observed intervals (range = 19-29%), similar to the prior phase. When the OTR phase was re-implemented, data were variable with a slight increasing trend, and a mean of 24% during observed intervals (range = 12-33%), akin to the prior two phases. Then, when during the final phase, the mean of DB increased to 38% of observed intervals with a range of 24-45% and a slightly increasing trend. Tau-U effect sizes (Table 2) indicate a small effect on decreasing DB.

POT for Classroom B had a fairly stable trend, and a mean of 8% for observed intervals (range = 2-15%). When the phase change was made, POT remained stable with a mean of 9% of observed intervals (range = 3-18%), similar to the prior phase. During the initial Plickers® phase, POT decreased to 4% during observed intervals (range = 2-6%), and data remained stable. Next, when the OTR phase was reintroduced, POT remained stable but had a slight increase in mean (M = 6%; range = 5-8%). Then, POT began a slight increase in trend during the final phase of intervention, along with a mean

of 7% during observed intervals (range = 1-11%). Consistency patterns were seen across all phases for POT rates for Classroom B. Tau-U calculations of overall weighted effect sizes for decreasing POT were small in Classroom B.

Table 2 *Effect Size Calculations for Classroom B*

	Tau-U	Effect
Academically Engaged Behavior		
Initial OTR/Initial Plickers®	0.45	Moderate
Initial Plickers®/OTR	0.20	Small
OTR/Plickers®	0.73	Large
Weighted Average	0.14	Small
Disruptive Behavior		
Initial OTR/Initial Plickers®	0.05	Small
Initial Plickers®/OTR	0.13	Small
OTR/Plickers®	0.80	Large
Weighted Average	0.29	Moderate
Passive Off-Task		
Initial OTR/Initial Plickers®	0.85	Very Large
Initial Plickers®/OTR	0.83	Very Large
OTR/Plickers®	0.20	Small
Weighted Average	0.04	Small

Classroom C

During baseline, AEB for Classroom C (Figure 2, bottom pannel) was variable with a slight increasing trend, and a mean of 49% (range = 30-64%) of observed intervals. AEB then remained variable with an increasing trend during the implementation of the OTR phase, and had am increased mean of 58% during observed intervals (range = 45-69%). Next, during the Plickers® phase, AEB had a mean of 56% of observed intervals (range = 45-68%), slightly decreased from the prior phase, but remained variable, and had an overall downward trend before stabilizing. Upon the reimplementation of the OTR phase, AEB had a decreased mean of 46% of observed

intervals (range = 35-56%). Finally, AEB had a decreased mean of 43% (range = 39-48%) but data remained stable during the final implementation of Plickers®. For AEB in this classroom, data patterns between all phases were fairly consistent. In Classroom C, overall, the intervention had a moderate effect in increasing AEB in terms of the weighted average from the Tau-U calculations (Table 3).

Classroom C displayed variable data for DB during baseline. During this phase, DB had a mean of 25% of observed intervals (range = 15-38%), and a downward trend. DB then had a similar mean of 27% during observed intervals (range = 17-43%), with variable data and a downward trend during the OTR phase. Next, when Plickers® were implemented, DB increased to a mean of 33% during observed intervals (range = 25-45%). During this phase, DB had an increasing trend. When OTR phase was reintroduced, there was an immediate drop in DB, though the mean overall was 37% of observed intervals (range = 25-50%). Lastly, when Plickers® was re-implemented, DB had an increased mean of 42% during observed intervals (range = 25-53%). Though data were variable during this phase, overall the trend was relatively stable for the final phase. Consistency of data patterns was observed during the first three phases, while the final two had an increasing mean. For Classroom C, the weighted Tau-U effect size score for decreasing DB was moderate (Table 3).

POT for Classroom C displayed slightly variable data with a stable trend overall, and a mean of 24% of observed intervals (range = 19-30%). When the phase change occurred, a slight drop in POT was observed initially. POT in this phase had a stable trend and decreased mean of 14% for observed intervals (range = 10-21%). Next, during the Plickers® phase, POT trend remained stable, with a decreased mean from the prior

phase of 9% during observed intervals (range = 5-14%). When the OTR phase was reintroduced POT increased to a mean of 16% of observed intervals (range = 10-26%). During this phase, data were variable and had a decreasing trend. During the final phase. POT data were variable and had a slight increasing trend with a mean of 13% of observed intervals (range = 5-25%). Overall, POT saw a decreased mean in all phases, compared to that of baseline. Effect sizes overall for degreasing POT were small for Tau-U calculations.

Table 3 *Effect Size Calculations for Classroom C*

	Tau-U	Effect
Academically Engaged Behavior		
Initial OTR/Initial Plickers®	0.17	Small
Initial Plickers®/OTR	0.61	Large
OTR/Plickers®	0.23	Moderate
Weighted Average	0.34	Moderate
Disruptive Behavior		
Initial OTR/Initial Plickers®	0.40	Moderate
Initial Plickers®/OTR	0.22	Moderate
OTR/Plickers®	0.40	Moderate
Weighted Average	0.34	Moderate
Passive Off-Task		
Initial OTR/Initial Plickers®	0.47	Moderate
Initial Plickers®/OTR	0.64	Moderate
OTR/Plickers®	0.27	Moderate
Weighted Average	0.02	Small

Social Validity

The BIRS was completed at the conclusion of the intervention by all participating teachers (Elliott & Von Brock Treuting, 1991). This measure was utilized to evaluate the social validity of this intervention in the classroom, and has scores ranging from 1 to 6. For the BIRS, a higher score signifies that there was greater acceptability of the

intervention. Classroom A's teacher yielded an average score of 3.16. For Classroom B, the teacher's overall mean score was 4.25, while Classroom C's teacher rated an overall mean score of 3.83. The BIRS results listed above suggest a moderate level of social validity for the intervention. In addition, the results for Acceptability, Effectiveness, and Time of Effect can be found below (Table 4). It is important to note that the teacher from classroom A and B chose not to answer questions 21 and 22. Question 21 states, "Using OTR using Plickers® did not only improve the students' behavior in the classroom, but also in other settings (e.g., other classrooms, home)", while question 22 states "When comparing the students with other well-behaved peers before and after the use of the intervention, the students' and the peers' behavior more alike after using the intervention." The teachers anecdotally reported that they lacked the adequate information to answer these questions fully, thus these items were not included in the calculations for those classes.

Table 4 *Mean Ratings for Behavior Intervention Rating Scale*

	Classroom		
Factor	A	B	C
Acceptability	3.37	4.43	3.87
Effectiveness	2.6	3.6	3.71
Time of Effect	3.00	4.50	4.00
Overall Mean (Social Validity)	3.16	4.25	3.83

CHAPTER IV – DISCUSSION

Research Questions

Research Question 1

The primary research question of this study evaluated if there was a functional relationship between the implementation of Plickers® as an OTR intervention and classwide AEB. It was hypothesized that the implementation of Plickers® would increase classwide AEB, though visual analysis of the results lead to a different conclusion. Visual analysis of results did not indicate a relationship between the implementation of Plickers® as utilized in this study and AEB in the participating classrooms. This contradicts some previous OTR studies that have found a relationship between the implementation of an OTR intervention and student AEB (Gardner et al., 1994; Haydon et al., 2009; Haydon & Hunter, 2011;Lambert et al., 2006;), though similar results were obtained by Blood (2010). The rate of OTR provided in Blood (2010) was similar to those that were provided in this study, ranging from 0.75-1.0 per minute during each session. Blood (2010) utilized a polling system to evaluate on-task behavior and academic achievement, though no functional relationship was found between increasing OTR and the aforementioned measures.

The current study extended previous research on the usability of Plickers® in the classroom by providing a further understanding of the application of Plickers® as a possible alleviation for lack of increased AEB due to low rates of OTR provided. Due to the lack of increased AEB, it can be stated that in the conditions utilized for this study, Plickers® did not have the ability to compensate for low rates of OTR. Though rate of OTR provided in this study was similar to that of the OTR provided in Blood (2010), it is

important to note that the rate provided was considerably less than the guidelines proposed by the CEC, set at 4-6 times per minute (CEC, 1987). In the same vein, the rate of OTR provided in this study was not consistent with the majority of the studies listed above, though the rates that they provided were closer approximations to the CEC guidelines (CEC, 1987). In this study, all mean levels of baseline classwide OTR provided were increased, and it was thought that in coordination with Plickers® AEB would still increase as a result of the use of this application. Plickers®, as opposed to hand raising or choral responding, requires all students to respond, and allows teachers to evaluate the accuracy of each students individual responses. Thus, with these suggested benefits of Plickers® it was thought that fewer OTR would be needed in comparison to that of the rate of OTR provided for other forms of OTR interventions. Although, it became clear through the absence of an increase in AEB, Plickers® alone were not sufficient enough to overcome the low rates of OTR provided. This realization makes a case that the actual rate of OTR provided matters substantially. Similarly, Tau-U effect size calculations resulted in scores in the moderate range for increasing AEB when comparing phases.

Research Question 2

The goal for the second research question was to determine the presence of a functional relationship between the implementation of Plickers® as an OTR intervention and classwide disruptive behavior. Though it was hypothesized that the implementation of Plickers® would result in a decrease in classwide disruptive behavior, visual analysis of the results reflected no relation between the two for the classes that participated in this study. These results of using Plickers® are inconsistent with previous studies that have

examined the effects of an OTR intervention on student DB (Lambert et al., 2006; MacSuga-Gage & Gage, 2015; Sutherland et al., 2003). It is important to consider, though, the impact that quality may have on OTR provided. In this study it was required that teachers provide 20 OTR during the intervention phases, but the quality of the questions provided was not evaluated. Neither guidelines nor requirements were put in place to establish consistency or provide a foundation of quality for the OTR provided in this study (i.e., true/false questions vs. multiple choice). Quality of questions provided may lead to better student engagement, and possibly more favorable results. Similarly, quality of delivery of OTR could have played a role in the results found as well. The effectiveness of the person implementing the OTR was not evaluated in this study, but may have been helpful to do so for consistency of delivery. In accordance with AEB, effect size calculations were considered moderate for DB.

Research Question 3

The third research question examined if high school teachers would rate the use of Plickers® as a socially valid method for addressing student behavior. Anecdotally, the teacher from classroom A and B's largest complaint was the time that it took to enter the questions each night and assign them to the queue before use. This was something that the teacher did on a nightly basis to ensure that the questions provided the next day would coincide with the lecture and upcoming tests. Though it is important to note that following the study, the teacher from Classrooms A and B also requested to use the Plickers® for one of her upcoming lectures. Based on the results from the BIRS, there were mixed ratings of social validity from the teachers participating in this intervention.

Limitations

It is important to consider possible limitations to this study when assessing the results that were found. First, the participants utilized for this study were all from a single rural high school in a Southeastern state, thus the generalizability of these results must be taken into question. Replications of this study would be beneficial in determining if this intervention would foster the same results in other populations and settings.

In addition, there was no evaluation of classroom management procedures in place during baseline and intervention phases. Thus, it is unclear if implementing basic behavior management procedures (e.g., posting rules, positive reinforcement contingent on good behavior, proximity) prior to the implementation of this study would have been a prerequisite to implementation of an intervention targeting OTRs. It may have been beneficial to begin with general classroom management procedures prior to the implementation of this Plickers® intervention. Future researchers should consider assessing classroom management procedures prior to implementing Plickers® to determine when this intervention should be implemented to produce the most increase in academically engaged behavior.

Next, as stated prior, it was thought that Plickers® would be able to overcome the low dosage of OTR that were provided in this study, though this was not that case. In theory, the ability to facilitate responding from an entire class, through the use of Plickers®, may overcome the large amount of OTR provided per minute recommended by CEC guidelines (CEC, 1987). The ability to allow all students to respond simultaneously, theoretically engages more students than hand raising or choral

responding. By utilizing Plickers® and obtaining that greater number of students responding at a time it was thought that this would allow for a thinner schedule of OTR, though as discussed prior this was not the case. In turn, when the use of Plickers® is concerned, it may be beneficial to increase the number of OTR provided to a denser schedule to have a greater impact on AEB. With that in mind, this is a limitation that may not be feasible to alleviate in that there are logistical barriers and challenges to using Plickers® such that time restraints may not allow for this increase in OTR. Not only is class time available important to consider, but preparation time as well. It was anecdotally reported that teachers spent a large amount of time entering questions prior to the use of Plickers®, which is a large limitation to their use.

Another limitation of this study was the fact that Classroom A and B were taught by the same teacher. Thus, two classes could have been influenced by teacher variables that affect results. This may have been the case, as both of these classrooms performed poorly on the final phase in the study.

The lack of a withdrawal phase is a subsequent limitation to this study. A withdrawal phase would have allowed for a greater level of experimental control. Similarly, a carry-over effect from successive phases due to the lack of a withdrawal phase is a limitation in the design of this study. In addition, sequence effects may have played a role in the data collected, but was not addressed in the design.

An additional limitation of this study was that the teacher from Classroom C was unable to enter the Plickers® questions online due to time constraints, so this responsibility was entrusted with the primary researcher. The teacher would provide the primary researcher with the specific questions/answers each night for the next day. This

is a limitation in that it lessens the social validity of the study as well as the generalizability of this intervention to other teachers.

Finally, a few instances of dysfunctional technology resulted in delayed intervention services. The use of technology in schools can be beneficial and easy to implement, though their malfunction can interrupt this intervention specifically. Twice during the intervention the Internet cut out, and would required a temporary break in the intervention while connection was regained. One instance in particular resulted in a loss of power to the projector, thus eliminating the display of the questions/answers for the students to see. Though the intervention was able to continue through the use of the cellular device, an element of the intervention was lacking.

Possible Future Research

The use of a Plickers® intervention should be replicated in different school settings, particularly using younger students to evaluate if similar effects would be found. Future research should also assess other benefits that Plickers® may have, such as improved performance and the speed of mastering material, that were not assessed during this study. Previous research has not assessed these uses with Plickers®, though academic outcomes were evaluated by MacSuga-Gage and colleagues (2015) with an increased OTR intervention. This study increased TD-OTR but found no significant effect between this increase and student academic achievement, similar to the findings of Blood (2010). Other researchers have found increased academic achievement outcomes when an intervention including increased OTR is implemented (Narayan et al., 1990; Heward & Grossi, 1994; Sutherland & Wehby, 2001; Davis & O'Neill, 2004). Future research needs to bridge this gap by including academic outcome data with the use of

Plickers® to evaluate the possible advantage that this response form has on academic achievement compared to the findings of previous research.

The use of a withdrawal phase in research design is another possibility for future researchers to better assess experimental control when evaluating the use of OTR and Plickers®. In addition, the collection of achievement data could be a beneficial additive to future research in this area to assess the effect that this intervention, or one of the like, has on academic outcomes.

Evaluation of the quality of OTR provided is another outlet for future research. Determining requirements or guidelines for OTR to provide the most engagement for students would be beneficial to the OTR research base. Similarly, investigating the effectiveness of the person implementing the OTR is a valuable avenue in this research as well.

Furthermore, it may be beneficial for future research to find a way of increasing the number of OTR provided in accordance with Plickers®. This would evaluate the effect that Plickers® has on AEB using OTR rates similar to that of previous studies, as a way to better compare results. Furthermore, the use of generic or blank Plickers® questions is a possible future research avenue. This would eliminate some of the prep work involved with Plickers® in that the teacher would not have to type up questions, but could make them up on the spot while still collecting all of the student data that Plickers® use is advantageous for.

Implications for Practice

The results from this study suggest that using Plickers® as an OTR intervention, as done so in this study, will not provide teachers with a method to increase AEB. With

that in mind, the low dosage of OTR provided was unable to be overcome by the use of Plickers® technology, and thus implies that rate of OTR provided matters significantly. Plickers® still have implications for practice in that they may be useful when larger amounts of OTR are provided, or for the possible improved academic performance that they provide. Future research is needed to solidify these possible implications.

APPENDIX A – TEACHER INFORMATION & CONSENT FORM

The Effects of Pickers as Response Cards on Academic Engagement Behavior in High School Students

The purpose of this study is to investigate the effects of an intervention using Plickers® to increase academically engaged behavior and decrease disruptive behavior classwide. Students in high school (grades 9-12) and their teachers can participate in this study, specifically classrooms that exhibit disruptive behavior. Your permission is requested to participate in this study.

Methods and Procedures: Upon agreeing to participate, you will be contacted by the primary researcher to obtain information regarding your class' overall disruptive behaviors and to determine target behaviors to be observed. If the criterion for inclusion is not met, you may request services through an alternative intervention. If the criterion of 70% classwide academically engaged behavior *is* met, you will be asked to implement the OTR intervention. The primary researcher will train you in implementing the intervention using all necessary materials. You will also be given instructions about how to train the students on the OTR intervention. Using Plickers® the students will respond to the questions that you provide. In consultation with the primary researcher, you will select the target behaviors to be observed. At the start of each class during the intervention, you will provide the students with their specific Plickers® card.

After the intervention has been running for a period of time, the primary researcher will ask you to briefly stop the intervention in your classroom. This withdrawal phase is to check if the intervention is in fact causing behavior in the classroom to change. Although this withdrawal phase typically only continues for a few days, if at any time you would like to resume the intervention earlier, please contact the researcher to restart the OTR intervention immediately.

The researcher and trained graduate students will conduct observations during the previously decided time when disruptive behavior is most likely to occur during a learning activity. Disruptive behaviors of concern and appropriate behaviors you wish to improve will be observed and recorded.

Benefits: Your benefits by participating in this study may include observed improvements in student behavior, and learning a unique intervention designed to improve student behavior.

Risks and Discomfort: There are few anticipated risks associated with participation. Initially, you may not be comfortable with the time required to implement this intervention in your classroom. You also may not feel comfortable implementing an unknown and new procedure in your classroom. However, you will be provided with training by the primary investigator as well as any additional materials needed for implementation. The primary investigator will also be available to answer any questions

you may have. Throughout the experiment, your students' behavior will be monitored. Problem behaviors may also increase again to pre-intervention levels during the withdrawal phase. In the event that undesired and unanticipated effects arise (e.g., increase in disruptive behaviors during the intervention), modifications or termination of procedures will occur, and you and your students will be provided with other services.

Confidentiality of Records: All interviews, observations, and other information obtained during this study will be kept strictly confidential. Your name, students' names, and other identifying information will not be disclosed to any person not connected with this study. Results from this research project may be shared at professional conferences or published in scholarly journals; however, all identifying information will be removed from presentations and/or publications.

Voluntary Participation: Your participation in this study is voluntary. You may withdraw from this study at any time without penalty, prejudice, or loss of benefits. Whereas no assurance can be made concerning results that may be obtained (as results from investigational studies cannot be predicted), the primary investigator will take every precaution consistent with the best scientific practice.

Teacher's Consent: If you agree to participate, please read, sign, and return the following page. Please keep this letter for your records. If you have any questions about this study, please contact Morgan McCargo or Dr. Keith Radley (Phone: 601-266-6748; Email: morgan.mccargo@eagles.usm.edu; keith.radley@usm.edu). This project and this consent form have been reviewed by the Human Subjects Protection Review Committee, which ensures that research projects involving human subjects follow federal regulations. Any questions or concerns about rights as a research subject should be directed to the Institutional Review Board Office, The University of Southern Mississippi, Box 5147, Hattiesburg, MS 39406-5147; (601) 266-6820.

Sincerely,

Morgan McCargo, B.A.,	Keith Radley, Ph.D.
School Psychologist-in-Training	Supervising Licensed Psychologist
Department of Psychology	Department of Psychology
The University of Southern Mississippi	The University of Southern Mississippi

THIS SECTION TO BE COMPLETED BY TEACHER

Please Read and Sign the Following:

I have read the above documentation and consent to participate in this project. I have had the purpose and procedures of this study explained to me and have had the opportunity to ask questions. I am voluntarily signing this form to participate under the conditions stated. I have also received a copy of this consent. I understand that I will be asked to implement a classroom-based intervention, and observations will be conducted in the classroom on the students' behavior. In order to do so, I will be required to complete a consultation session, to implement the intervention, and to complete a structured questionnaire to assess my satisfaction with the intervention. In addition, I will be trained on all of the intervention procedures by the primary researcher. I further understand that all data collected in this study will be confidential and that my name and the students' names will not be associated with any data collected. I understand that I may withdraw my consent for participation at any time without penalty, prejudice, or loss of privilege.

_____ _____

Signature of Teacher *Date*

_____

Signature of Witness

APPENDIX B – SCHOOL CONSENT FORM

Forrest County Agricultural High School

215 Old Highway 49 East, Brooklyn, MS 39425

Phone: (601) 582-4741

Fax: (601) 582-9031

Mary Taylor
CTE Director

Charles Johnson
Principal

Austin Alexander
Athletic Director

August 11, 2016

Dear Institutional Review Board of The University of Southern Mississippi,

Morgan McCargo has approached me with a research project idea that she would like to implement on campus at Forrest County Agricultural High School. I have met with Ms. McCargo and given approval of the project with details to be determined as target classrooms are identified.

If you have any questions or concerns about my support of Ms. McCargo's research project, please contact me at the school.

Sincerely,

Charles Johnson
Principal
Forrest County Agricultural High School

APPENDIX C – TEACHER DEMOGRAPHICS FORM

(completed by the teacher)

Teacher Demographics:

Age _____

Number of years teaching _____

Race _____

Gender _____

Highest Degree earned _____

Classroom Demographics:

Number of students in the class _____

Number of: Males _____ Females _____

Number of: African-American _____ Asian _____ Caucasian _____

Hispanic _____

Number of SPED students in your classroom: _____

Please list the disability categories of each child in SPED (do not include names or any other identifying information):

_____

_____

_____

APPENDIX D – IRB APPROVAL

THE UNIVERSITY OF
SOUTHERN MISSISSIPPI

INSTITUTIONAL REVIEW BOARD
118 College Drive #5147 | Hattiesburg, MS 39406-0001
Phone: 601.266.5997 | Fax: 601.266.4377 | www.usm.edu/research/institutional.review.board

NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months.
  Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: 12345678
PROJECT TITLE: How to Achieve IRB Approval at USM
PROJECT TYPE: New Project
RESEARCHER(S): Jonas Doe
COLLEGE/DIVISION: College of Education and Psychology
DEPARTMENT: Psychology
FUNDING AGENCY/SPONSOR: N/A
IRB COMMITTEE ACTION: Expedited Review Approval
PERIOD OF APPROVAL: 01/02/2015 to 01/01/2016
Lawrence A. Hosman, Ph.D.
Institutional Review Board

APPENDIX E – TEACHER OTR TRAINING SCRIPT

1. Describe opportunities to respond

Say: Classwide opportunities to respond can be described as the presentation of an antecedent stimulus—being the question that you are providing—that elicits active student responding, which is then followed by feedback about the response given (your correction or encouragement if they got the answer correct).

2. Provide example

Say: One example of a classwide OTR would be "What do you call the smaller of the two leg bones located below the knee cap?"

3. Provide non example

Say: One example that does not qualify as an OTR is, "Johnny, what do you call the smaller of the two leg bones located below the knee cap?"

4. Set criteria for daily OTR

Say: In this stage of the study, during each observation you will need to provide 20 opportunities to respond to the class (rate of 1 per minute). Please provide exactly that number, no more, no less if possible, and avoid accidentally slipping in other questions at that time (even simple questions like raise your hand if you are finished).

5. Have teacher provide example of a classwide OTR

Say: Now I want you to practice. Can you give me three classwide OTR examples?

6. Provide feedback for their examples

7. Double check time frame that works for observation

Time & Days: _____

_____

_____

8. Ask if the teacher has any questions

APPENDIX F – TEACHER PLICKERS® TRAINING SCRIPT

1. Describe Plickers®

Say: Plickers® are 5.5 inch by 5.5 inch pieces of paper with a four-sided QR code printed in the center. Using a web-based application, I will show you how to enter your class roster into the application, and assigning each student a unique Plicker®. I will then show you how to upload questions into the application. In response to questions, the students orient their QR code to the desired answer and hold it up for you to scan. Letters labeling the four orientations are printed sufficiently small so that only the responding student is able to see which answer they are selecting—allowing students to respond to questions without disclosing to peers which answer they believe to be correct.

Scanning of student responses is accomplished with a downloadable Pickers® app, which uses the camera of a smartphone or tablet to read the student QR codes as a way to respond to their teacher's questions. Student responses are automatically transmitted to the web-based application, allowing you to quickly calculate correct responding. The use of Plickers® allows you to poll your classroom using individualized "paper clickers" as a way to engage your class and check your students' understanding concurrently. The benefit of using technology such as Plickers® in the classroom will eliminate the need for you to collect student response data on paper which can easily get lost. Plickers® will store the student response data online for both the your benefit as well as mine. Not only will this make things easier for you, but the students' will be able to immediately see the response results on the screen while keeping the answers anonymous.

2. Give online login information

Say: Here is your personalized login info for your account on Plickers®. You will need to save this to login and upload questions for the intervention

Username: _____

Password: _____

3. Have the teacher log in to https://plickers.com/

4. Show how to upload questions using steps from script

Say: Click on Library in the top left corner
Click add new question
Type question
Choose multiple choice or true/false
Enter answers (up to 4)
Check the box for the correct answer

Click Save if finished or save and create new to add another question

5. Have teacher upload a practice question to be used during student training

6. Give Plickers®
    a. show the names on the back

7. Go over daily requirements of OTR to provide
    #: _____

8. Read over student training script with teacher

9. Set date and time for student training
    Date: _____
    Time: _____

APPENDIX G – STUDENT TRAINING SCRIPT

1. Describe Plickers®

Say: Plickers® are 5.5 inch by 5.5 inch pieces of paper with a four-sided QR code printed in the center. Each of you will have a unique Plicker® that you will used to respond to questions that I ask. To answer my questions you will orient your QR code to the desired answer and hold it up for me to scan using my smart phone or tablet.

Your responses are then automatically transmitted to the web-based application, allowing you to quickly calculate correct responding. We will then be able to immediately see the response results on the screen while keeping the answers anonymous.

2. Pass out Plickers®

3. Teach students how to answer questions

Say: As you can see on your cards each side of the square has a letter in the middle of it. Those letters will correspond with the answers to the questions that I ask. You will hold your card up in front of your chest, perpendicular to your desk, with the letter that you think the correct answer is as the top of your card. Hold your card still so that I can then scan the class for every students' response.

4. Show good example and bad example of card usage
   Hold the card at a 90 degree angle in front of your chest, perpendicular to the floor and show the students the proper way to hold the card.

Say: This is the proper way to hold the card. Make sure that your hand isn't covering any part of the QR code or your response may not be scanned properly.

Now hold the card in front of your chest at a 45 degree angle (like a diamond).

Say: This is not the appropriate way to hold the card, and if you hold it this way your response will not be scanned accurately.

Demonstrate one last time of how to hold the card appropriately. Have all students hold the card appropriately. Give corrective feedback if not holding the card appropriately. Instruct students not to play with the cards because if bent they may not scan correctly.

5. Have class participate as a whole in a sample question until 100% of student answers appear on screen

6. Collect Plickers®

APPENDIX H BEHAVIOR INTERVENTION RATING SCALE

(completed by the teacher)

Please respond to each of the following statements thinking about the intervention you implemented (i.e., OTR). Please then circle the number associated with your response. Be sure to answer all statements.

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
OTR using Plickers® was an acceptable intervention for the students' problem behavior(s).	1	2	3	4	5	6
Most teachers would find OTR using Plickers® appropriate for other classroom behavior problems.	1	2	3	4	5	6
OTR using Plickers® proved effective in helping to change students' problem behavior(s).	1	2	3	4	5	6
I would suggest the use of OTR using Plickers® to other teachers.	1	2	3	4	5	6
The behavior problems were severe enough to warrant use of this intervention.	1	2	3	4	5	6

Most teachers would find OTR using Plickers® suitable for the classroom use described.	1	2	3	4	5	6
I would be willing to use OTR using Plickers® again in the classroom.	1	2	3	4	5	6
OTR using Plickers® did *not* result in negative side effects for the students.	1	2	3	4	5	6
This intervention would be appropriate for a variety of students.	1	2	3	4	5	6
OTR using Plickers® was consistent with interventions I have used in the classroom setting.	1	2	3	4	5	6
OTR using Plickers® was a fair way to handle the students' problem behavior.	1	2	3	4	5	6
OTR using Plickers® was reasonable for the problem behaviors described.	1	2	3	4	5	6
I liked the procedures used in OTR using Plickers®	1	2	3	4	5	6

OTR using Plickers® was a good way to handle the students' problem behavior.	1	2	3	4	5	6
Overall, OTR using Plickers® was beneficial to the students.	1	2	3	4	5	6
OTR using Plickers® quickly improved the students' behavior.	1	2	3	4	5	6
OTR using Plickers® produced a lasting improvement in the students' behavior.	1	2	3	4	5	6
OTR using Plickers® improved the students' behavior to the point that it did not noticeably deviate from other classmates' behavior.	1	2	3	4	5	6
Soon after using OTR using Plickers®, the teacher noticed a positive change in the problem behavior.	1	2	3	4	5	6
The students' behavior remained at an improved level even after OTR using Plickers® was discontinued.	1	2	3	4	5	6

Using OTR using Plickers® did not only improve the students' behavior in the classroom, but also in other settings (e.g., other classrooms, home).	1	2	3	4	5	6
When comparing the students with other well-behaved peers before and after the use of the intervention, the students' and the peers' behavior more alike after using the intervention.	1	2	3	4	5	6
The intervention produced enough improvement in the students' behavior so the behavior was no longer a problem in the classroom.	1	2	3	4	5	6
Other behaviors related to the problem behavior were also likely improved by the intervention.	1	2	3	4	5	6

Adapted from Elliott, S., & Von Brock Treuting, M. (1991). The behavior intervention rating scale: Development and validation of a pretreatment acceptability and effectiveness measure. *Journal of School Psychology*, *29*, 43-51.

APPENDIX I PROBLEM IDENTIFICATION INTERVIEW FORM

Student: _____ Teacher (s): _____

School: _____ Age: _____ Sex: Male Female

Date: _____

1. Describe the class' behavior problems in order of severity and give examples.
2. How manageable is the problem behavior?
3. In what settings does the problem behavior occur?
4. Goals for the problem behavior (what would you like to see happen)
5. Tell me about what happens before the behavior occurs. After the behavior occurs?
6. Intervention attempts, degree of success, reasons for failure.

a. What procedures have you tried in the past to deal with this problem behavior?

b. What, if anything, have you done to deal with similar behavior problems in the past?

c. What's worked? What hasn't?

7. Rules and typical procedures carried out in the classroom (constraints and assets).
8. Reinforcers - used now and potentials for future (e.g., praise, activities, or notes sent home).
9. Any data collected presently?
10. Ask teacher for any additional comments or questions.

Adapted from Kratochwill, T. R., & Bergan, J. R. (1990). *Behavioral consultation in applied settings: An individual guide.* New York, NY: Plenum Press.

APPENDIX J OBSERVATION FORM

Class:_____ Date:_____
Observer:_____ IOA: N Y _____ Phase: _____

Interval	AEB	DB	Interval	AEB	DB	Interval	AEB	DB	Interval	AEB	DB
1.1			6.1			11.1			16.1		
1.2			6.2			11.2			16.2		
1.3			6.3			11.3			16.3		
1.4			6.4			11.4			16.4		
1.5			6.5			11.5			16.5		
1.6			6.6			11.6			16.6		
2.1			7.1			12.1			17.1		
2.2			7.2			12.2			17.2		
2.3			7.3			12.3			17.3		
2.4			7.4			12.4			17.4		
2.5			7.5			12.5			17.5		
2.6			7.6			12.6			17.6		
3.1			8.1			13.1			18.1		
3.2			8.2			13.2			18.2		
3.3			8.3			13.3			18.3		
3.4			8.4			13.4			18.4		
3.5			8.5			13.5			18.5		
3.6			8.6			13.6			18.6		
4.1			9.1			14.1			19.1		
4.2			9.2			14.2			19.2		
4.3			9.3			14.3			19.3		
4.4			9.4			14.4			19.4		
4.5			9.5			14.5			19.5		
4.6			9.6			14.6			19.6		
5.1			10.1			15.1			20.1		
5.2			10.2			15.2			20.2		
5.3			10.3			15.3			20.3		
5.4			10.4			15.4			20.4		
5.5			10.5			15.5			20.5		
5.6			10.6			15.6			20.6		

Occurrence of AEB = _____/120 = _____%
Occurrence of DB = _____/120 = _____%
Occurrence of Passive = _____/120 = _____%
AEB will be defined as “the student being actively involved or attending to (e.g. looking at) independent seatwork, teacher instruction, designated classroom activities, and/or engaging in task related vocalizations with teachers and/or peers” (Lambert et al., 2015, p. 418).
DB: _____, _____, & _____.

APPENDIX K PROCEDURAL INTEGRITY FOR OTR TEACHER TRAINING

(completed by the observer)

Class:_____ Date:_____

Observer:_____ IOA: N Y _____

	Intervention Steps	Yes	No
1	Describe OTR using script		
2	Provide example		
3	Provide non-example		
4	Set Criteria for daily OTR		
5	Have teacher provide 3 examples		
6	Provide feedback for their examples		
7	Set time and days to observe		
8	Ask if the teacher has any questions		

Number of steps competed: /8 = _____%

APPENDIX L PROCEDURAL INTEGRITY FOR TEACHER TRAINING

(completed by the observer)

Class:_____ Date:_____

Observer:_____ IOA: N Y _____

	Intervention Steps	Yes	No
1	Describe Plickers® using script		
2	Give online login information		
3	Have teacher Log in		
4	Show how to upload questions using steps from script		
5	Have teacher upload a practice question to be used during student training		
6	Give Plickers®		
7	Go over daily requirements of OTR to provide		
8	Go over student training script		
9	Set date and time for student training		

Number of steps competed: /9 %: _____

APPENDIX M TREATMENT INTEGRITY FOR STUDENT TRAINING

(completed by the observer)

Class:_____ Date:_____

Observer:_____ IOA: N Y _____

	Training Steps	Yes	No
1	Describe Plickers® using script		
2	Pass out Plickers®		
3	Teach Students how to answer a question using script		
4	Show Good Example and bad example of card usage		
5	Have class practice as a whole until 100% of student answers appear on screen		
6	Collect Plickers®		

Number of steps competed: /6 %: _____

APPENDIX N TREATMENT INTEGRITY FOR OTR

(Completed by the observer)

Class:_____ Date:_____ Phase: _____

Observer:_____ IOA: N Y _____

	Intervention Steps	Yes	No
1	Ask first OTR question		
2	Ask second OTR question		
3	Ask third OTR question		
4	Ask fourth OTR question		
5	Ask fifth OTR question		
6	Ask sixth OTR question		
7	Ask seventh OTR question		
8	Ask eight OTR question		
9	Ask ninth OTR question		
10	Ask tenth OTR question		
11	Ask eleventh OTR question		
12	Ask twelfth OTR question		
13	Ask thirteenth OTR question		
14	Ask fourteenth OTR question		
15	Ask fifteenth OTR question		
16	Ask sixteenth OTR question		
17	Ask seventeenth OTR question		
18	Ask eighteenth OTR question		

19	Ask nineteenth OTR question		
20	Ask twentieth OTR question		
21	Does not ask more than 20 classwide OTR		

Number of steps competed: /21 %: _____

APPENDIX O TREATMENT INTEGRITY FOR PLICKERS®

(Completed by the observer)

Class:_____ Date:_____ Phase: _____

Observer:_____ IOA: N Y _____

	Intervention Steps	Yes	No
1	Provide Plickers® cards to students		
2	Ask first OTR question		
3	Ask second OTR question		
4	Ask third OTR question		
5	Ask fourth OTR question		
6	Ask fifth OTR question		
7	Ask sixth OTR question		
8	Ask seventh OTR question		
9	Ask eight OTR question		
10	Ask nineth OTR question		
11	Ask tenth OTR question		
12	Ask eleventh OTR question		
13	Ask twelfth OTR question		
14	Ask thirteenth OTR question		
15	Ask fourteenth OTR question		
16	Ask fifteenth OTR question		
17	Ask sixteenth OTR question		

18	Ask seventeenth OTR question		
19	Ask eighteenth OTR question		
20	Ask nineteenth OTR question		
21	Ask twentieth OTR question		
22	Scan room for Plickers® after each OTR provided		
23	Does not ask more than 20 questions		
24	Collect Plickers® cards from students		

Number of steps competed: /24 %: _____

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