ASSESSING EFFECTIVENESS OF ACCESS TO CHOSEN PREFERRED MUSIC ON THE OFF-TASK BEHAVIOR OF STUDENTS WITH AUTISM OR OTHER SELF-REGULATION DEFICITS DURING INDEPENDENT WORK TASK

by

SARAH MILLER KROLL

(Under the Direction of Cynthia Vail)

ABSTRACT

A need exists for development of strategies to help students with ASD or other self-regulation deficits multitask more efficiently. In the following study, effects of access to non-contingent chosen preferred music on off-task behavior during a neutral independent work task (math fact practice) were determined using an alternating treatments design compared to teacher preference, headphones, and baseline conditions. Frequency of disruption and correct math facts completed were determined each session. Results were evaluated using percent of non-overlapping data points and the most successful intervention in a "best alone" condition was established. Results are discussed and implications for practice recommended.

INDEX WORDS: Autism, Noncontingent Reinforcement, On task Behavior, Off task behavior, Background Music, Self-regulation Deficit, Pandora

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by

SARAH MILLER KROLL

BA, Piedmont College, 2007

MAT, Piedmont College, 2010

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SARAH MILLER KROLL

Major Professor:	Cynthia Vail
Committee:	Tom Clees Rebecca Lieberman-Betz Stacey Neuharth-Pritchett

Electronic Version Approved:

Ron Walcott
Interim Dean of the Graduate School
The University of Georgia
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DEDICATION

I dedicate this dissertation to my precious children and adoring partner Andrew. I also dedicate this dissertation to my mother Lynn Miller who has been the embodiment of perseverance my entire life. I dedicate this dissertation to my father who instilled in me a deep love of learning and scientific inquiry. Most relevant however, I dedicate this dissertation to the incredible students I have been blessed to work with from 2010 until present day. They inspired this endeavor and were crucial to my having the will to keep pushing until I reached the finish line.

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CHAPTER I

Context

Music listening, in general, is involved in almost every part of life (e.g., shopping, working, and exercising) (Cassidy & MacDonald, 2009). Young people spend a sizable amount of time listening to music, often while doing homework or completing other academic tasks (Hallam & Godwin, 2015). The multitude of variables that exist during music listening and task completion make the study of their relationship complicated. For example, music with lyrics may inhibit reading comprehension but enhance efficacy during data entry. Therefore, researchers cannot make blanket statements either in favor of or in opposition to the combination (Hallam & Godwin, 2015). The effects of music on the brain of an individual are highly personalized; hence, continued mixed results occur for most studies (Hallam & Godwin, 2015; Johansson, Holmqvist, Mossberg, & Lindgren, 2012). For example, some researchers study effects of classical music and not everyone in the study reacts the same way. The purpose of this study was to assess whether access to student chosen preferred music is related to off-task behavior during independent work for individuals with ASD or other self-regulation deficits. The following sections describe music as it relates to preference, choice, and arousal from a general perspective. Specific focus is then given to how music is related to task completion, and more specifically how music relates to those with Autism and other self-regulation deficits who struggle to stay on task in the classroom environment.

Music Consumption, Preference, Choice

Prior to the last two decades, opportunities for musical consumption were limited to radio stations or using physical collections of music through a related device (e.g., CDs/CD player, records/record player). While this required relatively little effort on the part of the listener, control over music choice was limited to the output of a radio station or the availability of the means necessary to acquire physical collections of music as well as the device that could play them (e.g., CD collection/player). Before physical devices were available or radio accessible, there was little opportunity for variety or control over one's music listening habits, and consumption of music was limited to one's music making capabilities (i.e., singing or instrument playing) or attendance at live performances (e.g., church or other community gatherings, actual concerts).

Currently, a vast majority of individuals use technology to consume music at some point during their daily activities (e.g., while driving, working out, or completing tasks at work) (Krause, North, & Hewitt, 2014). With the rapid pace at which technology is advancing, individuals can be more selective when choosing how to consume music (Krause et al., 2014). As instant access to high-quality sound with an unending array of musical choices becomes more readily available, processes for determining user musical preference have begun to evolve (Krause et al., 2014).

Researchers aiming to learn more about musical preferences found that listeners desire familiarity, stemming from an underlying preference for repetition (Baumann & Hummel, 2005). Individuals will typically choose to hear songs they know even when those songs score lower on preference scales than unknown songs (Ward, Goodman, & Irwin, 2006). For example, an individual may highly enjoy a piece of music after hearing it once but, when given a choice for listening, will pick another song they know well. Other researchers have examined evaluative conditioning, or how the context under which we hear music affects an individual's reaction

(Egermann & Kopiez, 2013). For example, a song first heard with a loved one may have different emotional connotations than a song heard during a music appreciation class.

Krause et al. (2014) examined the role of perceived control and its relation to musical choice. The ability to create personal playlists from one's music collection allowed researchers to examine the effects of listening to music from such lists. This type of listening was associated with high perceived levels of control, even when individuals pressed a "shuffle" function where songs from the list play at random. Researchers studied perception of control regarding listening preference, and how this might influence how individuals consume music in daily activities (e.g., exercise or work completion). Preferred music from the listener's collection has been found to increase a person's perceived control over painful stimuli and regulate heart rate in situations where physical pain is present in some form (e.g., running long distances, lifting heavy weights, or getting a tattoo) (Krause et al., 2014, Cassidy & MacDonald, 2009). Previous work found that patients receiving care in the hospital who listened to self-selected music showed lower anxiety levels in comparison to control groups and those listening to researcher-selected music (Cassidy & MacDonald, 2009). Having the ability to control or choose what music is consumed is positively correlated with reported listener enjoyment and focus (Krause et al., 2014). By contrast, having little control over music selection resulted in individuals having no reaction to music and even perceiving the music as an aversive stimulus (Krause et al., 2014).

Arousal and Music

Arousal (focus) as a component of multitasking, is essential to task completion, regardless of the task or individual. Arousal levels in the brain and their relation to stimulation from the environment play a determining role in whether extra stimulation will enhance or deter performance, according to some researchers (Doyle & Furnham, 2012). Arousal levels are shown

to enhance task completion only to a specific threshold, beyond which performance begins to suffer. Factors affecting this process include task complexity, with more complex tasks leading to over-arousal. In contrast, a simple task requires a higher level of arousal for continued focus (Hallam & Godwin, 2015). For example, completing a difficult math word problem will allow the mind to tolerate less background stimulation than tracing the number six 30 times.

Personality type in terms of introversion or extroversion is thought to determine arousal thresholds, according to some researchers (Doyle & Furnham, 2012; Johansson et al., 2012; Rothbart & Posner, 2015). Children who are highly creative and children who have psychosis have been found to perform better with distractions in the environment (Doyle & Furnham, 2012). Students with less self-regulatory ability are found to be more likely to engage in a multitasking strategy, as they contain a broader capacity for arousal or are sensory seeking (Rothbart & Posner, 2015). The alerting network is highly involved in determining compatible environmental factors for various task types (Rothbart & Posner, 2015). Those engaged in a task involving the use of rote skills and working memory (e.g., subtraction with regrouping) performed significantly worse with the distraction of a secondary task where similar processes were affected (working memory) than with other distractions (Smith, Waters, & Jones, 2010). Some researchers found that students may prefer a quiet room for a reading assignment but not so for a math assignment (Anderson & Fuller, 2010).

Other researchers investigated the effects of different types of secondary stimuli on the performance of a primary task (Smith et al., 2010). These researchers found that separate conversation was a major distraction for most participants involved, as well as the sounds of various machines within the building (Smith et al., 2010). However, participants adapted to

machine sounds after 10 minutes, while others' talking continued to distract them (Smith et al., 2010).

Previous research related to music and task completion in general has involved the measurement of cognitive arousal, specifically (a) how much arousal the average person needs and (b) what types of music can cause various levels of arousal (Johansson et al., 2012). Continuous and monotonous noise may lessen arousal over time, whereas intermittent noise may maintain arousal at levels similar to initial levels (Johansson et al., 2012). For example, the noise of a loud fan in the room may increase arousal at first but will eventually blend in with the background due to the lack of variation in sound. Cohen and Weinstein (1981) describe a difference in "noise" and "sound," where "noise" is just tolerated but "sound" is sought out. Predictability within variability is another descriptor of "sound" said to have a psychological effect (Cohen & Weinstein, 1981). Task complexity plays a role in determining if background music (as secondary stimuli) would be useful and, if so, what type (Johansson et al., 2012). For example, a simple six-note melody repeated would have a different effect than a complex violin concerto with sophisticated themes within a melodic variation.

The complex nature of music exposure also influences the amount of arousal or over-arousal involved in the environment (Smith et al., 2010). Research results suggest that high volume and tempo raise arousal more quickly (Hallam & Godwin, 2015). Listening to novel and complex music could cause multiple processes to be in use, leaving less for the completion of the target task (Hallam & Godwin, 2015). Some researchers found that listening to low-complexity music improved reading comprehension compared with both silence and listening to high-complexity music (Johansson et al., 2012). However, other findings when investigating reading and music listening suggest these two actions contain possible conflicting variables within and between task

type and context (Johansson et al., 2012). Still another study found that reading accompanied by nonpreferred music significantly hindered performance, whereas reading to preferred music and background noise did not (Johansson et al., 2012).

Music Interventions and Students with Autism or other Self-Regulation Deficits

Music has been particularly relevant for individuals with Autism Spectrum Disorder (ASD), who often respond to it strongly in various ways. Reschke-Hernandez (2011) reviewed the history of music used with individuals with ASD, indicating that the first case studies using music with children with autism date back to the 1940s, when music therapists worked in psychiatric hospitals and schools. Music therapy strategies involving individuals with ASD in the early literature emphasized their unusual musical abilities and attraction to music (e.g., unusual interest, tendency to sing differently, and ability to reproduce unfamiliar pieces with accuracy). Therapists used music to enhance patient self-expression, socialization, rehabilitation, psychological enrichment, and recreation in both individual and group settings (Reschke-Hernandez, 2011). Nordoff and Robbins (Nordoff, 1964) proposed that children with ASD may perceive music as non-threatening and become more likely to engage in a musical experience relative to other activities (e.g., musical calendar songs vs. spoken call-and-repeat classroom activities).

More current studies involving students with Autism or other self-regulation deficits and music often introduce a type of musical stimulus as an environmental factor noncontingent upon any given behavior. Lanovaz and Sladeczek (2011) introduced a preferred musical stimulus into the environment through a stereo in the classroom and found it to decrease vocal stereotypy. Rapp (2007) introduced musical toys (e.g., toy piano) and music from a CD player during different treatment conditions, and both reduced vocal stereotypy by over 50%. Katagiri (2009) used background music as an instructional aid to help students encode different emotional states (e.g.,

mad, happy, sad). Two other studies used the removal of background music as negative reinforcement contingent upon the occurrence of an inappropriate target behavior (Buckley & Newchok, 2006; Devlin et al., 2008), and both found that this effectively reduced excessive wiggling.

Self-regulation Deficits and On-Task Behavior

Current best practices in the classroom dictate a need for small-group instruction, where some students are engaged with a teacher and others work independently. For this classroom structure to work successfully, students must be able to stay on-task when working on their own (Coughlin et al., 2012). Researchers have found that students often display more off-task and disruptive behaviors during small-group rotations where they are independently working and teacher attention is diverted (Cirelli, Sidener, Reeve, & Reeve, 2016). Remaining on task during independent work time is a necessary component for classroom success (Coughlin et al., 2012). Researchers have determined that students who are off task 50% or more of the time experience difficulties academically and behaviorally (King, Radley, Jenson, & O'Neill, 2017).

Within the general or special education classroom, one of the most commonly reported problems that children with ASD or other self-regulation deficits exhibit is off-task behavior. These students have difficulty maintaining on-task behavior due to an inability to regulate attention allocation (i.e., what to focus on at a given time) and an inability to switch attention from preferred to nonpreferred stimulus (de Bruin, Deppeler, Moore, & Diamond, 2013). Continued emphasis on successfully including students with ASD or other developmental disabilities into the general education classroom setting, requires those involved in their education to facilitate the acquisition of independent behaviors that can be applied and generalized in different settings (Lillian, Gregory, & Saul, 2003). It is not enough for these students to display skills in a small-group or resource

setting if they cannot generalize them into a larger setting, especially if they are cognitively able to learn and acquire knowledge at rates similar to their same age peers (Lillian et al., 2003).

Statement of the Problem

Research is clear that students with Autism and other self-regulation deficits often have difficulty staying on task. Research also shows that these students have a history of responding to music in various ways, and research generally shows that music can benefit a person's arousal. To date, there is little to no research in existence examining the effects of preferred music on the on-task behavior for those with Autism or other self-regulation deficits. Falcomata, Roane, Hovanetz, Kettering, and Keeney (2004) examined the effects of music on off task behavior of a student with self-regulation deficits, but no method for determining preference or providing choice was reported. Research within the general population shows that preference should be taken into consideration as well as choice. General research on the relationship between music and arousal (focus) shows there is a possible correlation but that the number of variables involved leave this correlation dependent on the individual's unique characteristics, making the use of group research inappropriate. Single subject research methods can account for an individual's unique variables and may be the best option for researching the effects of chosen preferred music. Reporting a systematic method of determining an individual's musical preference is an important component if others are to accurately replicate a single -case research study.

Purpose of Study

It was the purpose of this study to assess whether access to student chosen preferred music (determined through parent surveys, Multiple Stimulus Without Replacement (MSWO), and duration of engagement preference assessment) can decrease the percentage of off-task intervals during an academic work task (math problems) of individuals with ASD when compared to

baseline, headphones only, or teacher preference conditions. For this study, student *off-task behavior* was defined as anything except eyes looking in the direction of the paper or eyes looking away no more than 5 seconds and hands (a) writing numbers or tick marks on paper or (b) engaging in finger counting, with breaks lasting no more than 5 seconds. Data were collected on disruption and accurate math fact completion within 5 minutes were assessed as a secondary measure.

Research Questions

The purpose of this study was to answer the following research questions using a single-case research design.

1. Will chosen preferred music decrease off-task behavior compared to the baseline?
2. Will teacher preferred music decrease off-task behavior compared to the baseline?
3. Will placement of headphones on a student decrease off-task behavior compared to the baseline?
4. Which condition will most effectively reduce off-task behavior (chosen preferred, teacher preferred, headphones only).
5. Will disruption decrease as a result of decreased time off task?
6. Will math fact fluency increase as a result of decreased time off task?

Summary

Chapter I provided the background related to music preference, arousal and study conditions, music and task completion, music and autism, and off-task behavior and autism. Music can sometimes provide a beneficial secondary stimulus, but this is variable based on factors within the music and those associated with the individual (Hallam & Godwin, 2015). Preference and choice are key considerations when involving music in the environment (Ward et al., 2006). Individuals with ASD have a history of responding strongly to musical stimuli in any environment and researchers have shown background music as a potentially beneficial environmental variable for increasing on-task behavior for this population (Reschke-Hernandez, 2011). Using a single-

case research design and a combination of systematic preference assessments to measure the effect of chosen preferred music provides an observable way to assess the effectiveness of background music for individuals with self-regulation deficits.

CHAPTER II

Theoretical Constructs and Relevant Literature

In learning, optimal efficiency relies upon environmental factors adjusted such that sustained focus is attainable (Rothbart & Posner, 2015). Understanding what conditions facilitate focus for various task types requires an understanding of cognitive processes as they relate to task completion, multitasking, and individual differences. In individuals with autism spectrum disorder (ASD) or other self-regulation deficits, one inhibiting factor that often leads to decreased productivity is an abnormal reaction to auditory stimuli found within the natural environment (Ashburner, Ziviani, & Rodger, 2008; Menzinger & Jackson, 2009; O'Brien et al., 2009). These children often find large amounts of unpredictable auditory input overwhelming and instead seek input they can process more efficiently (Ashburner et al., 2008). Preference for predictable input may explain why music has been used to aid in communication, adaptation, and task completion for individuals with autism and self-regulation deficits for the past 50 years (Reschke-Hernandez, 2011; Lanovaz & Sladeczek, 2011; Rapp, 2007; Devlin, Healy, Leader, & Reed, 2008; Buckley & Newchok, 2006). The following chapter provides theoretical foundations for concepts relevant to the process of determining what knowledge and gaps exist for both broad informing constructs (i.e., multi-tasking theory) and those topics specific to the purpose of the dissertation study (on-task behavior, non-contingent reinforcement, preference assessments).

Multitasking

Multitasking involves the switching of focus between stimuli to complete one or more tasks, and the complexity of a task is directly related to the effort involved in switching attention

(Colom et al., 2010; Ewen et al., 2012; Poarch & Bialystok, 2015; Rothbart & Posner, 2015). Some researchers also describe multitasking as alternating attentional focus between more than one source of sensory input (e.g., computer, smartphone, radio, books, or interactions with other people (Rothbart & Posner, 2015).

An environment where multitasking is absent does not exist (Ewen et al., 2012). Even the most basic tasks involve the switching or resistance of switching between sections of the brain (Rothbart & Posner, 2015). Identifying ways to efficiently navigate the world while multitasking is of great importance, and an understanding of the processes involved when engaged in multitasking is essential to comprehending what factors can improve or hinder the performance of a task or set of tasks. Researchers divide the processes into four stages: (a) visual registration (identifying relevant stimuli), (b) stimulus evaluation (determining whether the stimuli is worth attending to), (c) response selection (deciding which possible response to make), and (d) response execution (actually completing the response) (Ewen et al., 2012). Evidence shows that performance of some of these steps can occur in a parallel fashion (e.g., multiple stimuli evaluated at the same time). Other stages must be executed one at a time (Ewen et al., 2012; Rothbart & Posner, 2015).

Brain networks involved in multitasking include the orienting network (i.e., what to focus on) and the alerting network (i.e., arousal) (Rothbart & Posner, 2015). These networks are crucial to the process of assigning an attentional hierarchy, or sorting stimuli based on relevance (Nijboer, Taatgen, Brands, Borst, & van Rijn, 2013). Researchers describe a *cost* in brain capacity when switching between tasks and recognize this process as increasing when the brain switches from a complicated task to an easy task, or from a complex task to another complex task (Poarch & Bialystok, 2015). The severity of this cost varies with the complexity, frequency, and processes

required for the multiple tasks in question (Ewen et al., 2012). For example, when finishing homework (complex task) while also drinking soda (semi-complex task), delays occur in processes as switches between the tasks are made.

Performance cost has been explained using two main theories: bottleneck and capacity sharing. The bottleneck theory asserts that certain stages of processing must be completed one at a time, delaying one task response until the completion of a previous one. Under the capacity sharing theory, tasks that require the use of the same resources create a shortage (Nijboer et al., 2013). For example, one cannot process a request for the hand to write a homework problem and simultaneously hold the soda for drinking. Environmental distractors can also consume thoughts or threads unintentionally, causing a decline in performance (Courage, Bakhtiar, Fitzpatrick, Kenny, & Brandeau, 2015). For example, if an individual is attempting to complete a timed task and there are people talking loudly nearby, this may interfere with the individual's concentration and lower his or her performance. Crosstalk can occur when two tasks require the same processes, such as auditory input (Feng, Schwemmer, Gershman, & Cohen, 2014). If an individual is attempting to get information from a podcast while also talking to their spouse, the two process are demanding focus on auditory input and will hinder comprehension of one another. Completing multiple tasks using two different processes (such as auditory and gross motor) is less problematic (Jansen, van Egmond, & de Ridder, 2016; Wu, 2016). Many individuals find it preferable to engage in a gross motor task while also engaging in auditory stimulation (i.e., music or book on tape).

Remaining alert to potentially essential stimuli, or those required for task completion, relates to the efficiency with which one makes responses and attentional shifts. Stimuli that exist but are not a critical component of task completion can in some instances serve to elevate the

alerting network (e.g., talking while driving or listening to music while studying certain types of material) (Rothbart & Posner, 2015).

Researchers assert that multitasking is directly related to executive functioning, as the components overlap (Poarch & Bialystok, 2015). There are three elements of executive functioning: monitoring and mental set shifting, working memory, and selective attention and inhibition (Poarch & Bialystok, 2015; Rothbart & Posner, 2015). Executive function is decision making, including self-control, which may have a direct relationship with variations in multitasking strategy choice and effectiveness (Poarch & Bialystok, 2015; Rothbart & Posner, 2015).

Every occasion of multitasking requires attending to the sensory modality of the stimuli involved. Different modalities (e.g., visual, auditory) still involve the same area of attentional processing. The brain must develop a hierarchy of importance when considering the stimuli to process based on events in the environment (e.g., hearing one's own name called or hearing a siren). The absence of stimuli in the environment can also evoke an attention shift in the hierarchy until the stimulus returns (e.g., iPhone not within visual periphery and shifting attention to finding it) (Rothbart & Posner, 2015).

Voluntary and involuntary attentional shifts change what the brain chooses to direct importance towards. Involuntary shifts are the definition of distraction, and the severity of these should be tempered if possible (Jansen et al., 2016). For example, if a doctor is performing a procedure on a patient, it would be problematic if someone jumped into the room and yelled "surprise!" unexpectedly. Task preference may have an impact on which task is attended to during multitasking, even when another task is supposed to be more critical (Jansen et al., 2016). For example, when trying to eat your favorite snack and work at the same time, you might find yourself

spending a much larger portion of time on the food compared to the work task because the food is more pleasing. Other activities involve more extended periods of focus on one task or the other before alternating, and this pause requires extended use of executive functioning skills (Poarch & Bialystok, 2015). In a hypothetical situation where an individual is required to jump rope and eat a bowl of cereal, these two tasks require very different sets of behaviors and would take a large amount of time to switch between.

Many procedures used by researchers to assess the completion of multiple tasks do not consider the aspect of multitasking where individuals complete processes at the same time, or simultaneous multitasking (Ewen et al., 2012). Concurrent tasks involve those that are possible to perform simultaneously (Poarch & Bialystok, 2015). While most researchers agree that multitasking decreases performance, they also agree that the act of multitasking is unavoidable. If the activities are neither physically incompatible nor mentally demanding, multitasking can even seem effortless (e.g., chewing gum and walking) (Courage et al., 2015). Long-term exposure to a multitasking environment (e.g., bilingualism) strengthens performance during other multitasking scenarios in the future (Poarch & Bialystok, 2015).

On-Task Behavior

Researchers describe on-task behavior as a skill that can aid in increasing independence and overall self-determination for young students with disabilities (Coughlin et al., 2012). Remaining on task during independent work time is a necessary component for classroom success (Coughlin et al., 2012). students who are off task 50% or more of the time experience difficulties academically and behaviorally (King, Radley, Jenson, & O'Neill, 2017).

Within education, there continues to be an emphasis on successfully including students with ASD or other developmental disabilities into the mainstream classroom setting, requiring

those involved in their education to facilitate the acquisition of independent behaviors (i.e., on-task) that can be applied and generalized in different settings (Lillian, Gregory, & Saul, 2003). It is insufficient for these skills to be exhibited only in small-group within a resource setting; such skills need to generalize to other settings, especially if they are cognitively able to learn and acquire knowledge at rates similar to their general peers (Lillian et al., 2003).

On-Task Behavior and Overall Classroom Structure

Current best practices dictate a need for small-group instruction, where some students are engaged with a teacher and others work independently in groups around the room. For this classroom structure to work successfully, the students have to be able to stay on task when working on their own (Coughlin et al., 2012). Researchers have found that students often display more off-task and disruptive behaviors during small-group rotations when they are working independently while other students receive direct instruction (Cirelli, Sidener, Reeve, & Reeve, 2016).

On-Task Behavior Components from Literature

Research-based definitions of off-task behavior nearly always include a description of visual orientation and a description of what a student's hands and body should be doing (e.g., eyes looking at paper and hands engaged in writing) (Cirelli et al., 2016; King-Sears, 2006; Moore et al., 2005). While "on-task" can look different in given situations, when completing an independent academic task, the two components of visual orientation and motor engagement are almost always required (Cirelli et al., 2016). Many researchers measure the inverse, or off-task behavior, depending on the study context and what can be more accurately measured and reported (Coughlin et al., 2012).

On-Task Interventions from Literature

Self-Monitoring. One intervention used in the research to increase on-task behavior is self-monitoring (Coughlin et al., 2012). Self-monitoring involves setting up a system for prompting a student to remember to behave a certain way at set time intervals. For example, a student might be given an interval timer set to vibrate every 30 seconds while completing an independent task. When the timer vibrates, the student is taught to notate on a provided chart whether they are on task or not and then continue with their assigned task (Coughlin et al., 2012). This procedure often requires time spent training students and typically begins with the teacher marking the chart at the predetermined intervals to model the action.

While research shows this intervention can be effective, it is still not widely used in the school setting (Coughlin et al., 2012). Researchers conclude that one reason for this disconnect lies in a lack of practitioner training and, even more importantly, a lack of consideration of practitioner feedback related to how interventions actually work within the classroom (King-Sears, 2006). Another reason self-monitoring may not be as successful in the classroom setting is related to how multitasking works. Researchers of multitasking describe a large decrease in performance when subjects are required to engage in sequential multitasking, or task switching (Conard & Marsh, 2014). Studies show that interruptions increased the time it took to resume the primary task (Conard & Marsh, 2014). Self-monitoring interventions require the use of an interruption at set intervals and, even though the interruption is brief, task resumption may be delayed.

Picture Schedule or Visual Task Analysis. Another intervention from research involves providing a visual list of those tasks the student is to complete during their independent work time (Bryan & Gast, 2000). For example, a student might be given a card with pictures prompting them to get their pencil, write their name, complete the work, then turn the work into a “finished” bin. Such visual aids have shown to be effective for students with ASD and self-regulation deficits in

the research setting and in the classroom environment (Bryan & Gast, 2000; Mechling, Gast, & Seid, 2009). While these interventions have proven to be effective in increasing independence and time on task, the improvement has mostly included time spent transitioning from one task to another. Students who are given higher academic expectations often spend time engaged in one extended task, such as math fact completion or another skill practice requiring them to stay on task within an activity and not just between activities (de Bruin et al., 2013).

Preferred Reinforcers. Researchers have seen improvements in on-task behavior for such students with self-regulation deficits when considering preference of reinforcers contingent on task completion. For example, if a student loves Pokémon, providing brief access to a plastic Pikachu figure, contingent on task completion, may be a more effective reinforcer than a delivery of a Skittle (if Skittles were the usual reinforcer) (Schatz, Peterson, & Bellini, 2016; Southall & Gast, 2011; Stasolla, Perilli, & Damiani, 2014).

Background Music and On-task Behavior in the Classroom

Hallam and Price (1998) aimed to determine if background music would increase math productivity and improve on-task behavior. They included eight boys and 2 girls between the ages of 9 and 10 who were attending a day school for children with emotional behavioral disorders. Participants displayed high frequencies of disruption and hyperactivity (Hallam & Price, 1998). All participants were in the average range of intellectual functioning (Hallam & Price, 1998). Researchers used a predetermining method to ensure the background music was perceived as calming by exposing the students to excerpts of music and having them rate their perception of the music as calming or not calming. The researchers measured math fact completion and "rule breaking" defined as calling out, leaving seat, hitting, making threats, or banging objects (Hallam & Price, 1998). Students were directed to sit quietly, and complete math facts and conditions were

counterbalanced where one included background music and one did not. Results indicated slight improvement in behavior during the background music condition and slightly improved math fact performance. The researchers determined a wide range of variability between participant reactions and saw very small differences in behavior between conditions for 7 out of the 10 participants (Hallam & Price, 1998).

Falcomata, Roane, Hovanetz, Kettering, and Keeney (2004) assessed the effects of non-contingent access to music through headphones in order to decrease off-task behavior in the form of vocal stereotypy (VS) in an 18-year-old man diagnosed with ASD living in a residential setting. They compared this condition to one where music was delivered and then removed for 5s contingent on inappropriate vocalizations, or a response cost procedure. These two conditions were compared to baseline in an ABCACBC single subject design (Falcomata, Roane, Hovanetz, Kettering, & Keeney, 2004). The participant was asked to sit quietly in a room during all conditions. Results indicated that the participant's vocal stereotypy decreased slightly during the Noncontingent reinforcement condition and decreased a large amount during the response cost condition. Method for determining music preference was not reported and the response cost procedure required constant adult attendance (Falcomata, Roane, Hovanetz, Kettering, & Keeney, 2004).

Nolan and Filter (2012) replicated the findings of Falcomata et. al. (2004) by examining the effects of music access on the stereotypic and disruptive behavior of an 8-year-old male in the fourth grade at a public elementary school using an ABAB withdrawal design. Access to music was provided noncontingently with the addition of a response cost procedure where target behavior resulted in 15s removal of the music (Nolan & Filter, 2012). The student had been diagnosed with Attention Deficit Hyperactivity Disorder and exhibited a variety of disruptive behaviors. Results

indicated a large reduction in disruptive behaviors during the treatment condition (Nolan & Filter, 2012). Method for determining music preference was not reported and the response cost procedure required constant adult attendance (Nolan & Filter, 2012).

Noncontingent Reinforcement

Noncontingent Reinforcement (NCR) includes the delivery of a reinforcer independent of a specific response and is usually directly related to the function of the target behavior (Cooper et al., 2007). For example, a student might yell out for attention every five minutes; if a teacher gives the student attention every three minutes no matter what behavior the student exhibits, the teacher is giving attention noncontingently, possibly reducing the student's calling out behavior as the attention would have an abolishing effect on the students establishing operation for attention. According to Long, Hagopian, DeLeon, Marhefka, and Resau (2005), studies have shown that NCR procedures can efficiently reduce the problem behavior of students with autism and other disabilities (Hagopian, Fisher, & Legacy, 1994; Vollmer, Iwata, Zarcone, Smith, & Mazaleski, 1993).

These researchers conducted a functional analysis to identify a reason for a behavior, and then they decreased the problem behavior by presenting a reinforcer noncontingently (Fisher, DeLeon, Rodriguez-Catter, & Keeney, 2004; Long et al., 2005). During a functional analysis, therapists attempt to evoke the occurrence of behavior by first manipulating the environment to create an establishing operation and then presenting a hypothesized discriminative stimulus (S^D). The behavior is reinforced upon its occurrence with the hypothesized function (e.g., attention, tangible). For example, if a student is "throwing" and the hypothesized function is attention, therapists would provide attention every time the participant throws and measure whether the frequency of the behavior increases or decreases (Fisher et al., 2004; Long et al., 2005). Therapists

might then implement an intervention that provides continuous attention noncontingently and measure the change in the rate of the problem behavior (e.g., throwing).

Per Fisher et al. (2004), this kind of NCR can pose difficulties because therapists, teachers, or caregivers may not always be able to deliver the reinforcer that maintains the problem behavior. Fisher et al. (2004) gave an example in which problem behavior is reinforced by attention from a caregiver, noting that the caregivers cannot always be available to provide constant interaction, thus confounding the integrity of treatment efficacy. Through continued research, new ideas have surfaced about NCR as two events in the environment co-occurring where a preferred stimulus can act as a reinforcer, even if it is not connected to the function of a student's behavior. (Fisher et al., 2004; Jennett, Jann, & Hagopian, 2011; Long et al., 2005; Vollmer et al., 1993).

Preference Assessment Procedures

A crucial component of implementing an NCR procedure is determining a preferred stimulus for the individual. Within the field of applied behavior analysis, there have been multiple methods for assessing preference described in the literature (Hagopian, Long, & Rush, 2004). Generally, preference assessments fall within two broad categories: (a) multiple-stimulus preference assessments (DeLeon & Iwata, 1996) and (b) single-stimulus preference assessments (Hagopian, Rush, Lewin, & Long, 2001). Preference assessments within both categories have been noted for having benefits in different areas.

Multiple-stimulus preference assessments involve a therapist placing several items (or pictures of the item) in front of student and asking them to pick their favorite. In a multiple-stimulus with replacement (MSW) assessment, the student would point to their favorite item, and the therapist would place it back into the array of items to choose from and repeat the request for the participant to choose their favorite for a predetermined number or trials (Cooper et al., 2007;

Hagopian et al., 2001). In a multiple stimulus without replacement (MSWO) assessment, the therapist would again place several items in front of student and ask them to pick their favorite. The therapist would then remove that item and present only the remaining items in the next trial. Both MSW and MSWO assessments have been shown as an efficient way to quickly assess student preference (Lanner, Nichols, Field, Hanson, & Zane, 2009; Rapp, Rojas, Colby-Dirksen, Swanson, & Marvin, 2010). However, the MSWO assessment has been shown to reduce the occurrence of false negative reinforcers by requiring the student to choose from the remaining items (DeLeon & Iwata, 1996).

Single-stimulus preference assessments have been used to determine if length of time with an item can determine its reinforcing effects (Lanner et al., 2009; Rapp et al., 2010). For example, some items may not become reinforcing until an amount of time has passed (e.g., music, television, computer games). For this reason, researchers allow certain amounts of time for reinforcer consumption and then measure engagement (Lanovaz, Rapp, & Ferguson, 2012). Other researchers will give participants access to a reinforcer and the direction for them to communicate when they want to stop. Researchers then measure the duration of consumption for each item (Lanovaz et al., 2012).

In either preference assessment category (single- or multiple-stimulus), the stimuli chosen for the assessment are determined by an interview or inventory provided by caregivers or familiar educators (Fisher, Piazza, Bowman, & Amari, 1996; Fisher et al., 2006). Many researchers report having used the Reinforcer Inventory for Individuals with Severe Disabilities (RAISD) (Fisher et al., 2006). Many times, a combination of parent inventory, multiple-stimulus, and single-stimulus are used. The parent inventory gives researchers a starting point for item selection, the multiple-stimulus can narrow down preference in an efficient way, and then the single-stimulus can

determine preference comprehensively in cases where the item requires time for consumption (Hagopian et al., 2001; Long et al., 2005).

Lanovaz et al. (2012), used procedures described by Horrocks and Higbee (2008) to determine whether highly preferred musical stimuli would have a larger effect on vocal stereotypy when compared to nonpreferred music. Their findings showed that noncontingent access to high-preference music can produce lower levels of vocal stereotypy better than noncontingent access to low-preference music for some individuals. High-preference music also reduced vocal stereotypy when compared to baseline levels (Lanovaz et al., 2012).

Research involving the use of high preference music to treat problem behavior to date has involved participants with moderate-to-severe behavioral and intellectual deficits (Long et al., 2005; Jennett et al., 2011; Groskreutz et al., 2011; Lanovaz et al., 2012; Saylor et al., 2012). Little research has been conducted to determine if preferred music delivered noncontingently would be beneficial for those who are higher functioning. Such students might include those with ASD or other self-regulation deficits who may be required to complete a task while listening. Using preferred musical stimuli may provide an avenue for positively affecting the off-task behavior of higher functioning individuals.

Summary

Based on information presented in previous sections we know that multi-tasking is an unavoidable complex process that is manageable given the correct circumstances (Rothbart & Posner, 2015). We know that auditory processes can aid in multi-tasking allowing an individual to focus more efficiently. We know that research related to on-task behavior previously has involved interventions such as self -monitoring, task analysis, and reinforcement (Conard & Marsh, 2014). Research tells us that noncontingent reinforcement can be a very efficient way to improve behavior

and that assessing preference is a necessary component to many interventions (Hagopian, Long, & Rush, 2004). Researchers have used music as a means of non-contingent reinforcement but often not during task completion (Falcomata, Roane, Hovanetz, Kettering, & Keeney, 2004). One study used music to determine its effects on task completion but did not take preference into consideration (Hallam & Price, 1998). No studies to date have examined whether assessing music preference then providing choice will have an effect on an individuals on-task behavior.

The purpose of this study was to assess whether noncontingent access to chosen preferred music via an individualized Pandora radio-station, could decrease percentage of off-task behavior during an academic work task (math problems) for individuals with ASD or other self-regulation deficit when compared to baseline, headphones only, or teacher preferred music (classical or nature sounds). Since research has shown the importance of perceived choice, students were given a choice of three of their most preferred types of music during the chosen preferred condition. Student music preferences were assessed using a combination of parent interview, MSWO preference assessment, and ultimately a total-duration preference assessment. Research questions for high-functioning students with ASD or self-regulation deficits were as follows: (a) will student-chosen preferred music decrease off-task behavior compared to baseline; (b) will teacher chosen decrease off-task behavior compared to baseline; (c) will placement of headphones on a student decrease off-task behavior compared to baseline; (d) will disruption decrease as a result of decreased time off-task; (e) will math fact fluency increase as a result of decreased time off-task.

CHAPTER III

Method

Participants

Six individuals between the ages of 7 and 9 participated in the study. Pseudonyms are used to protect participant anonymity. Parents were given a form of consent explaining the aspects of the study, including time commitment, procedures, and equipment to be used. They were made fully aware that participation was strictly voluntary. A copy of the letter of consent is found in Appendix A. Students were read a script of assent matched to their cognitive ability level in order to make sure they were aware of the requirements for participation and that they could choose not to participate at any time without penalty (assent script can be found in Appendix A). They were asked to write their name and indicate verbally whether they would like to participate (all participants possessed the ability to legibly write their name).

Participants were considered for this study if they met eligibility criteria for special education services under the following categories: (a) Autism or (b) significant developmental delay, as determined by the school psychologist using commonly accepted assessment measures for such determination, i.e., Autism Spectrum Rating Scale (ASRS) (Goldstein & Naglieri, 2010) (mild–moderate range); Differential Ability Scales—Second Edition (DAS-II) (Elliott, 2007) (scores between 70–90); Kaufman Brief Intelligence Test (Kaufman & Kaufman, 2011) (average–below average range). Only students who were enrolled at a specific suburban elementary school were considered for inclusion, as this is where the researchers had permission to conduct the study.

To ensure that the study did not take time away from the participants' targeted academic or behavioral instruction, only participants who had an Individualized Education Plan (IEP) objective related to computation or staying on task were considered. The objectives ranged from single-digit addition or subtraction to multiple-digit addition or subtraction with or without regrouping. Participants had to have the prerequisite skill of independently adding one-digit numbers with accuracy for participation consideration. All participants must be present for more than 90% of school days.

Participant Descriptions. For individual demographic information see Table 1.

Cam. Cam was a second-grade student performing at grade level in all subjects except for reading comprehension and writing. Cam displayed more severe off-task and disruptive behavior during nonpreferred tasks and would occasionally throw a tantrum to the extent that he must be removed. Cam's off-task behavior looked mostly like daydreaming and mouthing inedible objects. Cam had little interest in his peers and makes fewer than five attempts to socialize per week. Based on his parent report, Cam was able to sing or script songs (i.e., spontaneously quote lines over and over again) before he could speak, and he had been reading since he was 2 years old. He had a very sensitive ear, and found preferred music extremely pleasing and nonpreferred music very disruptive.

Ted. Ted was a second-grade student performing just below grade level in math, science, and social studies. Ted had a delayed ability to communicate verbally but evidenced interest in his peers and was constantly seeking peer attention. Ted showed severe off-task behavior or hyperactivity during most instructional and independent work settings. Ted's off-task behavior looked like daydreaming, sometimes fidgeting with a pencil or another item, or quietly trying to interact with peers when they were available. Ted could, on occasion, become volatile and

aggressive towards peers and teachers when frustrated, to the extent that he had to be removed be removed.

Bird. Bird was a second-grade student performing at grade level in math, science, and social studies, and slightly below grade level in reading and writing. Bird was appropriately verbal for his age and was constantly talking to his peers or adults. Unlike many of the students within the class, Bird had well-developed social skills. Bird engaged in high amounts of off task behavior when peers were near or when he finds the task hard or frustrating. Bird very rarely exhibited full tantrum behavior but would cry or make whining noises when he perceived a task as difficult.

Ellie. Ellie was a second-grade student performing just below grade level in all subjects. She displayed compliance most of the time. She had slightly delayed communication but sought peer interaction and made attempts to socialize often. Ellie's off-task behavior was present during both instruction and independent work. Ellie's off-task behavior looked like a fixed gaze not apparently directed at anything or anyone in particular or quietly socializing with peers. She very rarely showed signs of being upset (i.e., facial grimace, crying sounds, head down on desk) and had IEP goals related to self-advocacy for this reason.

Bill. Bill was a second-grade student who performed at grade level in reading and below grade level in all other areas. Math was the area of most need for Bill. While all other participants completed problems containing problems up to 10, Bill completed only problems adding zero or one to another digit. Bill had no verbal or social delays. He showed a large intolerance (i.e., crying noises, attempts to elope) of unpredictable ambient noise and will often escape under a table to rock and hold his ears. Bill's has tantrums that last up to an hour almost weekly. Bill's off-task behavior looked like daydreaming (i.e., fixed gaze not apparently directed at anything or anyone in particular) or looking around the room.

Jed. Jed was a second-grade student who performed below grade level in all areas. He had delayed communication but will sometimes initiate interactions with peers. Jed was a very compliant student. Jed would sometimes display off-task behavior during instruction and independent worktime in the form of daydreaming. Jed did not exhibit tantrums or aggression towards individuals.

Setting

The following assessments occurred in a separate room located near the self-contained classroom: (a) initial exposure training, (b) multiple-stimuli without replacement assessment, and (c) total-duration preference assessment. Assessments were conducted by the primary researcher, who is studying special education at the University of Georgia.

The baseline and comparison phases of the study took place within a self-contained classroom designed for students with autism and self-regulation deficits (i.e., inability to regulate body in term of staying in a assigned area, or able to regulate reactions to occurrences in the environment causing them to cry and tantrum, as assessed by direct observation over time as a part of the placement process within special education). During a typical academic segment, the room contained 10 students, one teacher, and at least one paraprofessional. All sessions took place during a math rotation where students were grouped in pairs and then required to transition through four rotations (mini-lesson with teacher, skill practice with paraprofessional, fact fluency, independent practice). Students were seated together in chairs at a medium rectangle table (3ft by 5ft). The study took place during the fact fluency rotation and fit seamlessly within the classroom structure. The classroom teacher was able to run each condition. The primary researcher set up a camera and computers each morning but was otherwise out of the room. Each session lasted exactly five minutes.

Table 1

Participant Demographics

Name	Age/Gender	Eligibility	Cognitive	Academic Achievement	Related goal
Cam	7.9/M	ASD	DAS II GCA 91	KTEA 103-123 (85-115 average)	Cam will remain on task and in area during work time.
Ted	7.11/M	ASD	DAS II GCA 88	TEMA 24; TEMA 58	Ted will remain on task during work time showing whole body working.
Bill	8.2/M	SDD	DAS II GCA 90	KTEA standard scores 52-102 (85-115 average)	Bill will add and subtract 1- and 2-digit numbers up to 20 without a model.
Bird	7.6/M	SDD	DAYC-2 SS: 71	TERA: 95; TEMA: 105	Bird will follow teacher directions to initiate a task (preferred or nonpreferred) and remain on task across settings.
Ellie	7.8/F	ASD	WPPSI-V Full scale IQ 91	TERA: 72; TEMA: 70	Ellie will remain on-task during work time showing whole body working.
Jed	8.1/M	SDD	none	KTEA standard scores 72-95 (85-115 average)	Jed will solve 2-digit addition problems.

Materials and Equipment. Materials included: (a) pencils, (b) math sheet packets (printed on letter size copy paper with 20 problems per page and 15 pages per packet), and (c) a visual board showing students their condition for the day (see Figure 1 for an image of the visual board). All interventions within each condition were antecedent based, meaning along with the visual for each condition, the environmental variables were also different. Discrimination of conditions is less crucial for antecedent interventions compare to interventions using differing reinforcement contingencies for example (Gast, 2010).

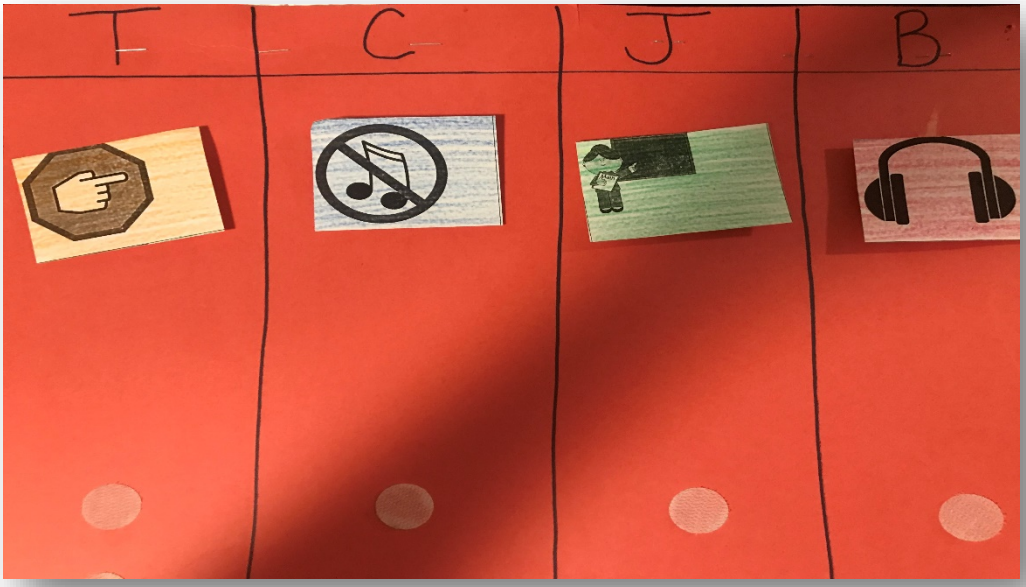


Figure 1

Daily Condition Visual Aid

The following equipment was used: (a) a student laptop capable of playing Pandora internet radio, (b) a PDF developed by the primary researcher where initial exposure visuals were shown and linked to Pandora playlists (see Figure 2), (c) generic over the ear headphones

used daily within the classroom, and (d) a small handheld digital timer. Materials required for data collection included: (a) an iPhone or equivalent device capable of running Countee IOS application (Davor Peic, 2016) for collecting duration and event recording data, (b) an iPad and tripod for video collection, and (c) an answer key to determine the number of correct problems.

Assessment Procedures

Initial assessment. This study aimed to determine if personalized music would increase on-task behavior during work tasks already within the participants' repertoire. The work task chosen for these participants involved fluently adding single-digit addition problems. To ensure that participants were not expected to independently solve addition problems that were still in the acquisition phase, they were given an initial assessment to determine which addition problems were already in maintenance and able to be practiced for fluency. This initial probe also served to ensure that the task complexity was such that the addition of other stimuli would be beneficial and not harmful based on multitasking theory (Rothbart & Posner, 2015).

The assessment was generated from www.interventioncentral.org and included at least one example of every addition problem combining the digits (0:10) + (0:10). Assessments were scored, and participants received only those problems that they had answered correctly in later conditions. Further practice packets were generated from www.interventioncentral.org. Students were given large packets and the researcher marked where they had started and stopped each day after collecting the packets. The researcher checked each morning to ensure that students had enough pages before each session. All participants accurately completed problems with digits (0:10) + (0:10), except for one student (Bill) who completed digits (0:10) + (0:1).

	1) BL	2) HP	3) Teacher	4) Choice
Bird (skroll@uga)				
Ellie (sarahmiller9)				
Ted (skroll@uga)				
Cam (sarahmiller9)				
Jed (skroll@uga)				
Bill (sarahmiller9)				

Figure 2

PDF with Visuals for Teacher Preffered and Chosen Preferred Conditions

Parent Questionnaire. In order to determine personalized music genres, the researcher developed a parent survey based on the Reinforcer Assessment for Individuals with Severe Disabilities (Fisher et al., 1996), specifically focusing on participant preferences related to auditory stimuli (Appendix B). This was administered to parents over the phone by the primary researcher to allow for further probing for specific examples based on parents' responses. Parents had the opportunity to rate a total of 19 genres from 10 (most preferred) to 0 (not preferred), and then were asked to give specific song examples for each genre scoring above a 5. The song examples for the five highest scoring genres were used during the remainder of the study as station titles within the Pandora music application. Table 2 shows the parent-reported song choices.

Initial Exposure and Picture Association Training. Initial exposure to the top five genres occurred by showing an image paired with a song and the task direction to "touch the picture to listen to music." The researcher allowed the student to listen for 10 seconds, or until they communicated "done" signifying they would like to stop. Then, a second picture was presented that was paired with the next preferred song.

Next, the songs were played one at a time, and a choice of three randomly placed corresponding pictures was provided. The researcher asked, "which picture?", and then prompted the student to choose the corresponding picture using the System of Least Prompts with a 3-second delay. The instructor waited 3 seconds and then gestured to the correct picture (previously used in initial exposure) as the controlling prompt. The next phase of the preference assessment did not occur until the participant reached the criteria of 100% correct independent responding in a field of three when asked to match each picture when its corresponding song was played for three consecutive trials. For all participants, this initial training took less than 10 minutes, with all participant reaching 100% independent responding.

Table 2

Results from Parent Questionnaire and Preference Assessments

Participant	Parent Chosen Top Five Genres	Order from MSWO	Listening Duration (in Seconds)
Cam	1) Hip-Hop (Ed Sheeran)	1	60
	2) Pop (Girls Like You)	2	38
	3) Oldies (Uptown Girl)	3	45
	4) Classic Rock (Led Zeppelin)	4	2
	5) Contemporary County (Miranda Lambert)	4	7
Ted	1) Upbeat TV Theme Songs (Paw Patrol)	1	55
	2) Slow Disney (I Can Show You the World)	2	2
	3) Soft Classical (Mozart)	5	1
	4) Loud Classical (Wagner)	4	1
	5) Hip-Hop (Ed Sheeran)	3	15
Bird	1) Upbeat TV Theme Songs (Paw Patrol)	1	60
	2) Pop (Girls Like You)	2	10
	3) Slow Disney (I Can Show You the World)	4	1
	4) Oldies (Uptown Girl)	3	35
	5) Nature Sounds (Rain)	5	1
Ellie	1) Dance/Electronic (Evacuate the Dance Floor)	1	45
	2) Slow Disney (I Can Show You the World)	5	2
	3) Rap (Kids bop rap)	2	30
	4) Pop (Girls Like You)	3	25
	5) Oldies (Uptown Girl)	4	20
Bill	1) Sounds in Nature (Sleep Machine)	3	40
	2) Soft Classical (Mozart)	2	40
	3) Upbeat TV theme songs (Paw Patrol)	1	50
	4) Hip-Hop (Ed Sheeran)	5	50
	5) Pop (Girls Like You)	4	45
Jed	1) Soft Classical (Mozart)	2	28
	2) Slow Disney (I Can Show You the World)	3	30
	3) Nature Sounds (Ocean)	4	25
	4) Upbeat TV theme songs (Paw Patrol)	1	19
	5) Dance/Electronic (Evacuate the Dance Floor)	5	1

Multiple-Stimulus Without Replacement and Total-Duration. Once participants reached 100% on picture association, the researcher placed all five pictures out on the table and gave the direction to "pick your favorite." After the participant selected their favorite, the researcher played the associated song and said, "when you're done listening you can say "done" If the participant did not say "stop," the music played for 1 minute. The chosen picture is then removed and the process repeats until all pictures are chosen. For participant choices and durations see Table 2. The top three genres with the longest duration of listening were used during the chosen preferred music condition. For example, if Jed chose to listen to slow Disney for 30s, rap music for 10s, dance music for 22s, and oldies for 25s, Slow Disney, dance, and oldies would be chosen as choices for the preferred music condition even if rap music was ranked higher in the MSWO. This was done to increase the likelihood students were actually attending to the auditory stimulation and not just the picture icon associated with each song.

Data Collection

Dependent Variables. For all participants, off-task behavior was defined as anything except eyes looking in the direction of the paper or eyes looking away no more than 5 seconds and hands (a) writing numbers or tick marks on paper or (b) engaging in finger counting, with breaks lasting no more than 5 seconds. For each observed instance of disruptive behavior, the observer tapped a corresponding button within the Countee IOS application (Davor Peic, 2016). Disruption was defined as a) any sound from the mouth, b) touching others or objects within a peer workspace (area around the math page) or moving more the one foot away from assigned areas with body. Math fact packets were collected after sessions and scored each afternoon. Sessions were video recorded and the researchers played them back while coding for two types of data: (a) primary dependent variable—duration of off-task behavior and (b) event recording of problem behavior

within 5 minutes. Originally, the researchers (primary researcher and teacher researcher) planned to code on-task behavior but were able to more reliably identify occurrences of off-task behavior. The researchers recorded total duration by pressing the "start" button within the Countee IOS application (Davor Peic, 2016) upon the occurrence of off-task behavior and pressing the button again when the student returned on task. If students began session off task researchers immediately pressed the button to begin recording.

Interobserver agreement and procedural reliability. Before study initiation, the researcher collecting IOA met with the primary researcher for initial training sessions. The primary researcher and the interobservers practiced by coding random videos of students working until they were able to have over 90% agreement for off-task and disruption. Only after these sessions did the study commence.

For off-task behavior, total-duration interobserver reliability was collected during 20% of the sessions for all conditions, for each participant using total-duration IOA. Total-duration IOA was calculated by dividing the shorter time by the longer time and multiplying by 100. IOA results for each participant by condition are listed in tables 2, 3, 4, and 5.

Practice math sheets were scored by two independent observers to determine correct problems completed during the 5-minute sessions for 20% all conditions. Interobserver Agreement for disruption was calculated by dividing the smaller number by the larger number and multiplying by 100 to get a percentage. Interobserver agreement for math problems, and disruption are logged in tables 2,3,4, and 5.

Procedural fidelity was collected for at least 20% of the sessions for each condition for each participant. A task list was devised for procedures and study conditions so that an observer could check off when each step had been correctly completed. The results of these data are reported

as percentage of steps completed correctly by condition in tables 2,3,4 and 5. The task list used to collect procedural reliability can be found in Appendix C.

Social validity. Social validity is evaluated by an intervention's effect on participants' everyday environment and should be noticeable even to an untrained eye (Baer, Wolf, & Risley, 1968). For this reason, social validity of the effectiveness of listening to personalized music during an independent work task was determined by showing graphs of each participant to a blind

Procedures

Baseline Condition. During the baseline condition, the teacher, a second year special education teacher also enrolled in a master's program and studying to obtain board certification as a behavior analyst, directed the students to a worktable as part of their math rotations. The teacher turned on the video camera placed on a tripod located a few feet away from the student. Once seated, the student was given a pencil, math packet, and shown the visual for the baseline on a poster developed by the primary researcher (see Figure 1). The teacher then set the timer for five minutes and said, "you may begin." The teacher did not provide any further verbal directions. When the timer sounded, the student handed the packet to the teacher and began the next activity. Data collection ended when the timer sounded, and the video recorder was then turned off. The sheets were scored later to determine students' productivity and accuracy via permanent product during each work session.

Headphones only condition. To determine if headphones alone affected behavior, the only variable that changed during the headphones only condition was the placement of headphones with the chord removed on the student's desk, along with the math sheet and pencil. The teachers pointed to a visual of headphones on the board and then gave the directive to

"please take the headphones on your desk and put them on. Keep your headphones on the entire time you are working."

Music condition, Teacher preferred. The teacher preferred music condition began with the pencil and packet already on the student's desk along with a student laptop connected to the exact same type of headphones. Student was shown the visual for choice condition on poster on wall about three feet away. The teacher turned on the video recorder located on a tripod a few feet away from the student. The teacher pointed to the "teacher choice" visual and said, "it's teacher choice music day. Please look at the screen and click one of the teacher choice icons." This action of using a laptop was one the students were familiar with and they were able to independently click on the corresponding image associated with the music. The student clicked an icon under his or her name that opened a Pandora page playing either soft classical or nature sounds. The teacher double checked volume was okay for student then turned the computer away from the student and set a timer. The teacher did not provide any further verbal directions. When the timer sounded, the student handed the packet to the teacher and began the next activity. Data collection ended when the timer sounded, and the video recorder was then turned off. The sheets were scored later to determine students' productivity and accuracy via permanent product during each work session.

Music condition, chosen preferred. The chosen preferred music condition began with the previous materials already on the student's desk along with a student laptop connected to the exact same type of headphones. The teacher turned on the video recorder located on a tripod a few feet away from the student. The teacher pointed to the "I choose" visual and said, "it's I choose music day. Please look at the screen and click one of the 'I choose' icons under your name." The student clicked an icon that opened a Pandora page playing one of three previously determined preferred genres. The teacher turned the computer away from the student and set a timer. The teacher did

not provide any further verbal directions. When the timer sounded, the student handed the packet to the teacher and began the next activity. Data collection ended when the timer sounded, and the video recorder was then turned off. The sheets were scored later to determine students' productivity and accuracy via permanent product during each work session.

Interobserver agreement and procedural reliability. For off-task behavior, total-duration interobserver reliability was collected during 20% of the sessions across all conditions, for each participant using total-duration IOA. Total-duration IOA was calculated by dividing the shorter time by the longer time and multiplying by 100. IOA results for each participant are listed by condition in Tables 3, 4, 5, and 6.

Before study initiation, the individuals collecting IOA met with the primary researcher for initial training sessions. The primary researcher and the interobservers practiced by coding random videos of students working until they were able to have over 90% agreement. Only after these sessions did the study commence.

Practice math sheets were scored by two independent observers to determine correct problems completed during the 5-minute sessions. IOA for disruption was calculated by dividing the smaller number by the larger number and multiplying by 100. IOA for off-task behavior, math problems, and disruption are logged by condition in table format in tables 3, 4, 5, and 6.

Procedural fidelity was collected for at least 20% of the sessions across all conditions for each participant. A task list was devised for procedures and study conditions so that an observer could check off when each step had been correctly completed. The results of these data are reported as percentage of steps completed correctly per condition in tables 3, 4, 5, and 6. The task list used to collect procedural reliability can be found in Appendix C.

Table 3

Participant IOA Baseline

Participant	Total Duration IOA	Disruption Event Recording IOA	Accurate Problems in 5min IOA	Procedural Fidelity
Cam	94.0	67.0	100	100
Ted	98.0	75	100	100
Bird	97.0	100	100	100
Ellie	96.0	100	100	100
Bill	90.9	80	100	100
Jed	90.0	100	100	100

Table 4

Participant IOA Choice

Participant	Total Duration IOA	Disruption Event Recording IOA	Accurate Problems in 5min IOA	Procedural Fidelity
Cam	98.0	100	100	100
Ted	92.9	75	100	100
Bird	86.9	80.5	100	100
Ellie	89.4	100	100	100
Bill	97.6	80	100	100
Jed	78.5	100	100	100

Table 5

Participant IOA Teacher Preferred

Participant	Total Duration IOA	Disruption Event Recording IOA	Accurate Problems in 5min IOA	Procedural Fidelity
Cam	94.0	78	100	100
Ted	92.0	83	100	100
Bird	70.0	72	100	100
Ellie	92.0	100	100	100
Bill	95.9	80	100	100
Jed	80.6	100	100	100

Table 6

Participant IOA Headphones

Participant	Total Duration IOA	Disruption Event Recording IOA	Accurate Problems in 5min IOA	Procedural Fidelity
Cam	99.0	100	100	100
Ted	86.0	100	100	100
Bird	86.9	70	100	100
Ellie	93.0	100	100	100
Bill	92.8	66	100	100
Jed	83.5	100	100	100

Social validity. Social validity is evaluated by an intervention's effect on participants' everyday environment and should be noticeable even to an untrained eye (Baer, Wolf, & Risley, 1968). For this reason, social validity of the effectiveness of listening to personalized music during an independent work task was determined by showing graphs of each participant to a blind observer who tried to label which conditions were intervention versus baseline during the comparison phase. The intervention was considered socially valid if the blind observer rated conditions correctly.

Experimental Design

An alternating treatment design (ATD) was used to evaluate whether access to personalized music choices during a work task would decrease percentage of off-task behavior in five minutes when compared to a teacher preferred, no music baseline, or headphones alone conditions. This design is appropriate because of the reversibility of "off-task" behavior (Wolery, Gast, & Hammond, 2010). The brevity of this design helped to control for maturity threats to internal validity, as students are very likely to progress in their ability to add fluently over time and with practice. After all initial assessments had been completed, the comparison phase of the study began with a baseline alone condition, followed by rapid alternation of no music, headphones only, teacher preferred music, and music choice conditions. Conditions were assigned a number between

one and four then a random number sequence was generated using numbers one through four (e.g., 2,1,4,3). This process was repeated until a large enough random number string existed. This was done for each participant. Using numbers grouped this way prevented excessive repetition of one condition. Sessions were conducted one per day, for a minimum of 12–15 days (3–5 sessions per condition). A "best alone" phase followed the comparison phase where the condition with the highest percentage of on-task behavior was conducted alone for at least three sessions

Data Reporting

For on-task behavior, disruptions within 5 minutes, and problems complete within 5 minutes, data collected for each student during the baseline alone phase and the comparison phase are graphed according to recommendations based on graphing alternating treatment designs (Dixon et al., 2009; Lanovaz, Cardinal, & Francis, 2019), and are separated with a condition change line. The best alone phase is plotted after the comparison phase and separated by a condition line. The data from the comparison phase are graphed where each condition has its own line and data point symbol. Legends are located to the right of the graph.

Data Analysis

The percentage of nonoverlapping data points is a common method of analyzing data within an alternating treatments design (Gast, 2010). For off-task behavior, the percentage of nonoverlapping data points between the baseline and each condition after were calculated by dividing the number of data points that do not cross one another by the total number of data points between the two conditions and multiplying by 100.

Mean percentage of time off task during 5-minute sessions was calculated in order to determine which condition to use during the best alone phase, and to determine if participants met the criteria of an average of less than 30% of the time off task during any condition in order for

the intervention to be considered successful. This percentage was chosen as the criteria for mastery for students with behavior goals related to staying on task is 70%, since the researchers aimed for this data collection to be useful to the participating teacher and students. Mean problems completed in 5 minutes was also calculated per condition for each participant, as the most applicable way this task is reported is that an academic IEP goal has been met.

CHAPTER IV

Results

Results are reported by dependent variable. Off-task behavior was the main dependent variable and results are presented based on each condition. The two secondary dependent variables, problems completed in five minutes and disruption are summarized and reported in general.

Off-task Behavior

Baseline. During interspersed baseline, most participants displayed off-task levels lower than their average teacher-reported daily levels. As the study progressed, students habituated to the camera and tripod in the environment. See Figures 3 and 4 for graphed results of off-task behavior. Table 8 gives average participant time off task for each phase and condition of the study.

Headphones Only. During the headphones only condition, participants completed math problems while wearing the exact headphones worn during the teacher preferred and chosen preferred conditions, but with the cord removed. No real visual difference can be seen graphically (see Figures 3 and 4). For Cam, Bill, and Bird, the percentage of time off task increased slightly compared to interspersed baseline, with the following percentage of nonoverlapping data points: 10%, 20%, and 0%, respectively. For Ellie, Ted, and Jed, the percentage of time off task decreased slightly, with the following percentage of nonoverlapping data points: 27%, 8%, 0%, respectively.

Teacher Preferred. During the teacher preferred condition, students listened to soft classical or nature sounds while they were directed to look at the computer visual. For Bird, Ted, Ellie, and Jed, a visual difference is observable (see Figures 3 and 4). Cam, Bird, Ellie, Ted, and Jed made slight improvements compared to the baseline alone, with the following percentage of

nonoverlapping data points: 0%, 62%, 42%, 13%, 8%, respectively. Bill had an increase in off-task behavior from baseline to teacher preferred and a nonoverlapping data points percentage of 0%. Visual analysis is less clear in determining a difference between choice and teacher preferred.

Chosen Preferred. During the chosen preferred condition, students were directed to look at the computer and choose from three icons with music links specifically chosen for them based on their preference assessments. Visual analysis indicated a lower overall data series during chosen preferred for all but Cam. All participants had lower mean percentages of time off task. Bill, Bird, Ellie, Ted, and Jed had an average decrease in time off task from the baseline to the chosen preferred condition of over 30%. Bird, Ellie, and Ted had 100% nonoverlapping data points from the baseline to the chosen preferred condition. Cam, Bill, and Jed had the following percentage of nonoverlapping data points: 15%, 57%, 36%, respectively.

All participants had the lowest average off-task behavior during the chosen preferred condition; therefore, the best alone phase utilized this condition for all except Cam. Cam did not meet the determined criteria of an average of less than 30% time off task during any condition for intervention to be considered successful; therefore, the researchers developed an adapted condition during the best alone phase. This will be discussed in detail during the discussion section.

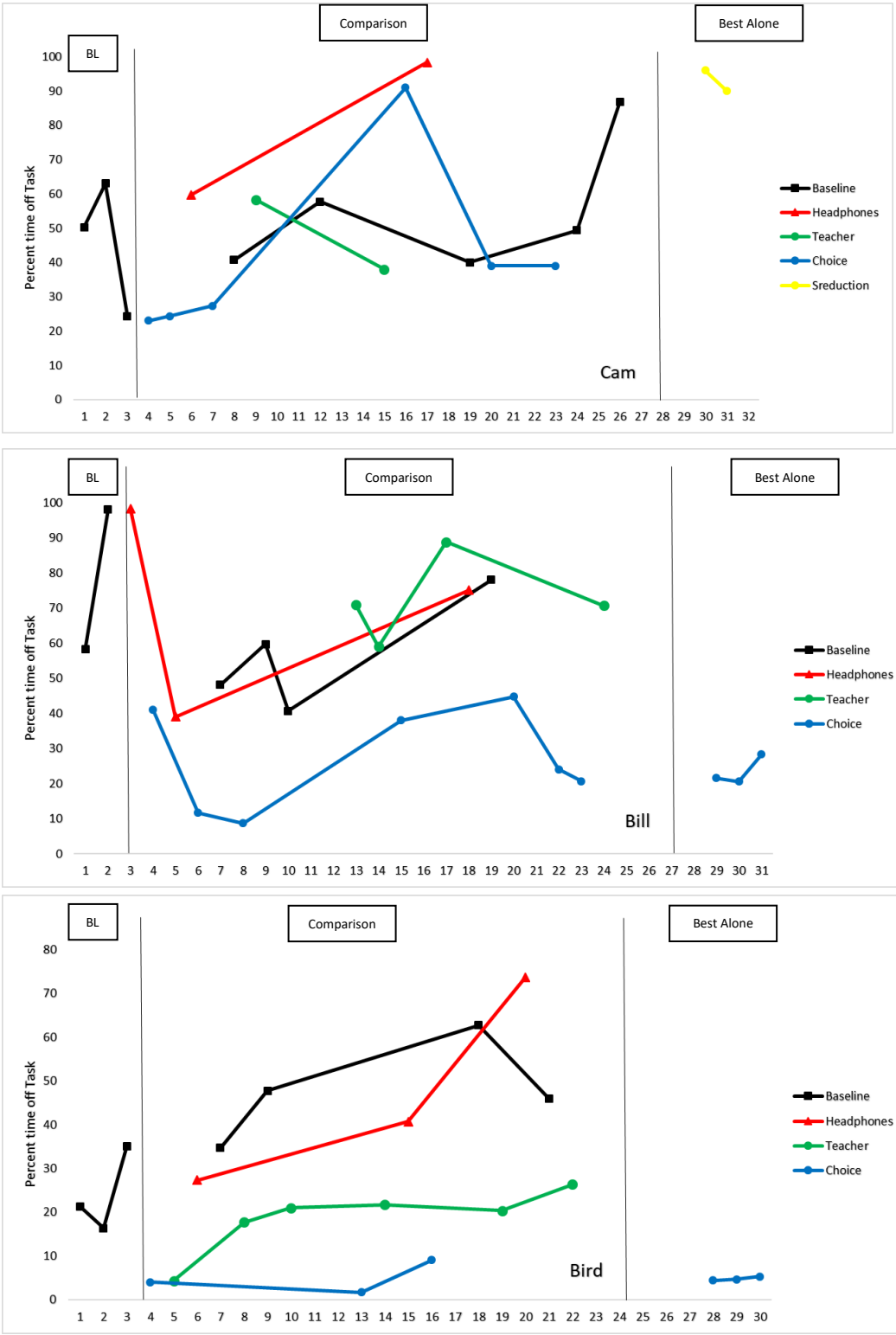
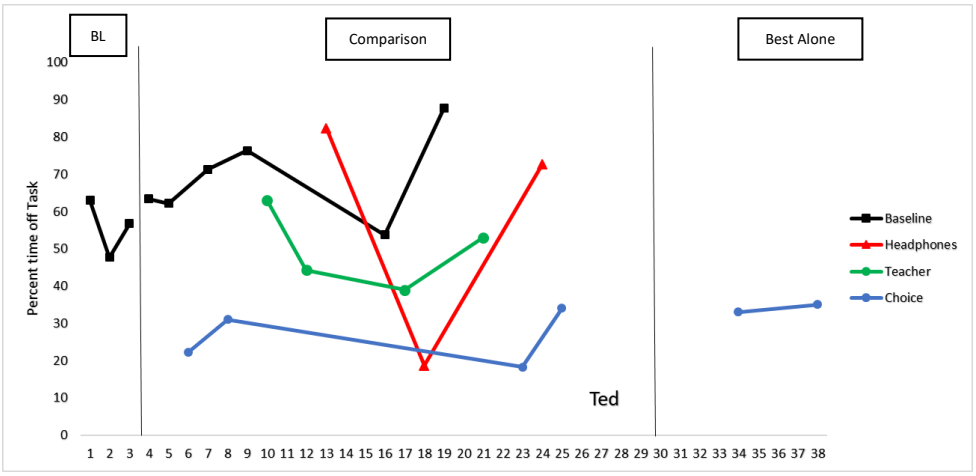
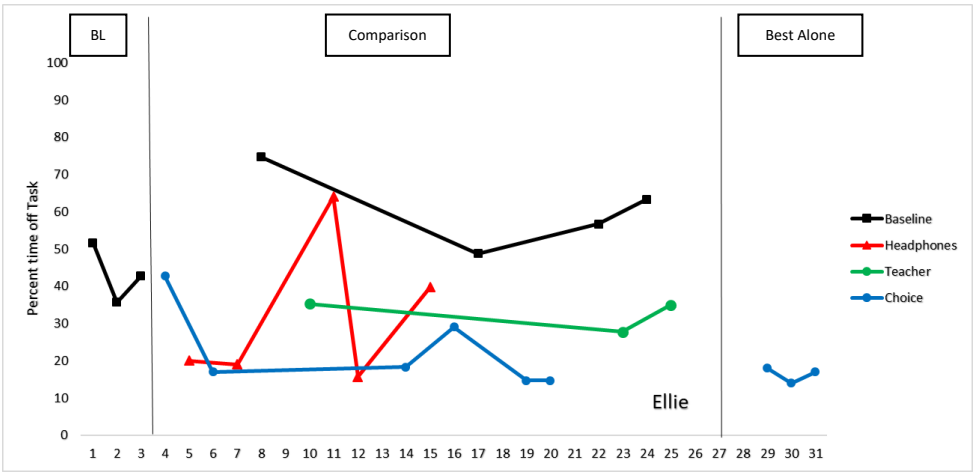


Figure 3

Participant Percentage of Time Off Task within Five Minutes (Cam, Bill, Bird)





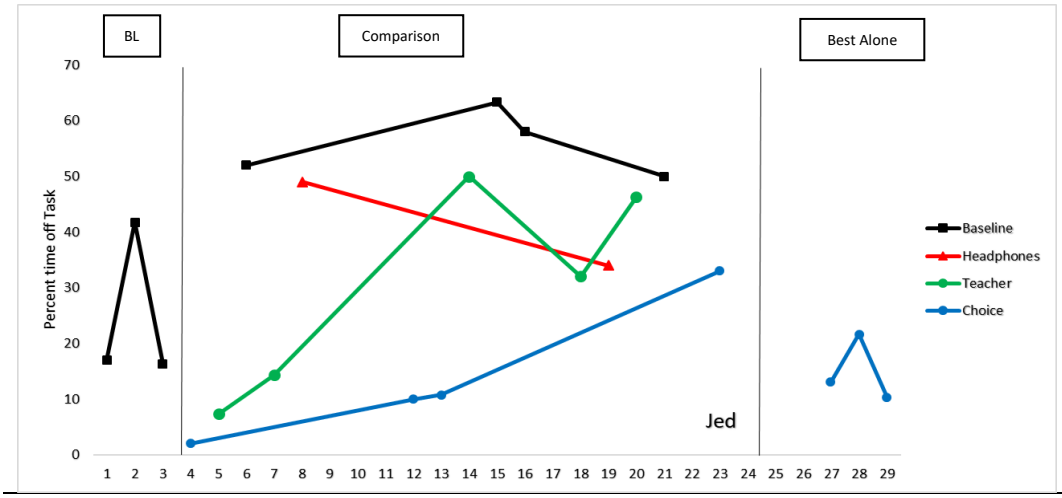


Figure 4

Participant Percentage of Time Off Task within Five Minutes (Ted, Ellie, Jed)

Table 7

Percentage of Nonoverlapping Data Points Between Baseline and Intervention Conditions for Off-Task Behavior

Participant	Baseline/Headphones	Baseline/Teacher	Baseline/Chosen
Cam	10	0	15
Bill	20	0	57
Bird	0	62	100
Ellie	27	42	100
Ted	8	13	100
Jed	0	8	36

Table 8

Mean Percentage of Time Off Task within Five Minutes

Participant	Baseline	Headphones Only	Teacher Chosen	Chosen Preferred
Cam	51.5	79.0	48.2	**47.8**
Bill	63.7	70.8	72.4	**27.0**
Bird	37.7	47.3	18.6	**4.9**
Ellie	53.4	31.7	32.7	**22.7**
Ted	64.7	57.9	49.8	**26.4**
Jed	42.6	41.5	29.9	**13.9**

Problems Completed within Five Minutes

Based on visual analysis alone, no clear differences could be seen between conditions for problems completed in five minutes. Averages are reported to describe results but are not meant to justify any causal relationship. Four participants averaged more problems completed correctly in the chosen preferred condition than any other condition. Cam completed an average of 9.5 more problems during chosen preferred than baseline. Bill averaged 10.5 more problems, and Jed averaged 6.8 more. Ted averaged a much larger number of problems during the chosen preferred condition, averaging 20.2 more problems. Bird and Ellie averaged higher in teacher preferred and headphones only conditions, respectively. These results are interpreted more fully in the discussion section. Averages across all conditions can be seen in Table 9, and graphical displays in Figures 5 and 6.

Disruption

Overall, disruption was variable across conditions for all participants. Bill, Bird, Ted, and Jed had the lowest average instances of disruption during the chosen preferred condition. Ellie had the lowest average instances of disruption during the headphones only condition, and Cam during the baseline condition. Possible rationale for these inconsistencies are detailed in the discussion section. Averages across the conditions can be seen in Table 10, and graphical displays in Figures 7 and 8.

Social Validity

Anonymized graphs for each participant containing data for the chosen preferred condition and baseline condition were stripped of labels and presented to a blind observer. The observer was an employee at a nearby college who had familiarity with visual analysis. The observer was asked to decide which line represented the baseline and which represented intervention when shown graphs during the comparison phase. The observer was able to identify the conditions correctly for five out of six participants. The observer did not identify conditions correctly for Cam.

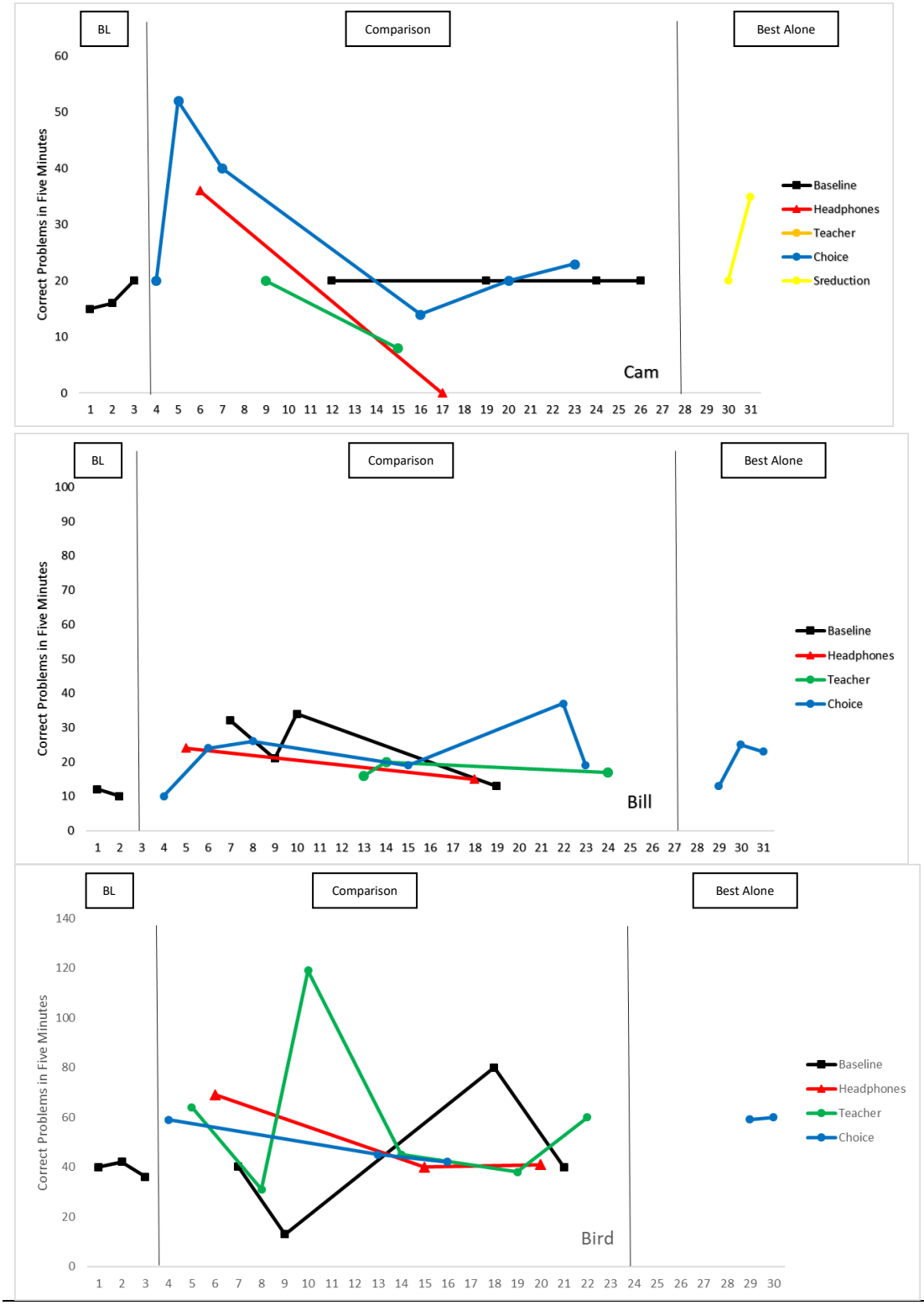


Figure 5

Correct Problems within Five Minutes (Cam, Bill, Bird)

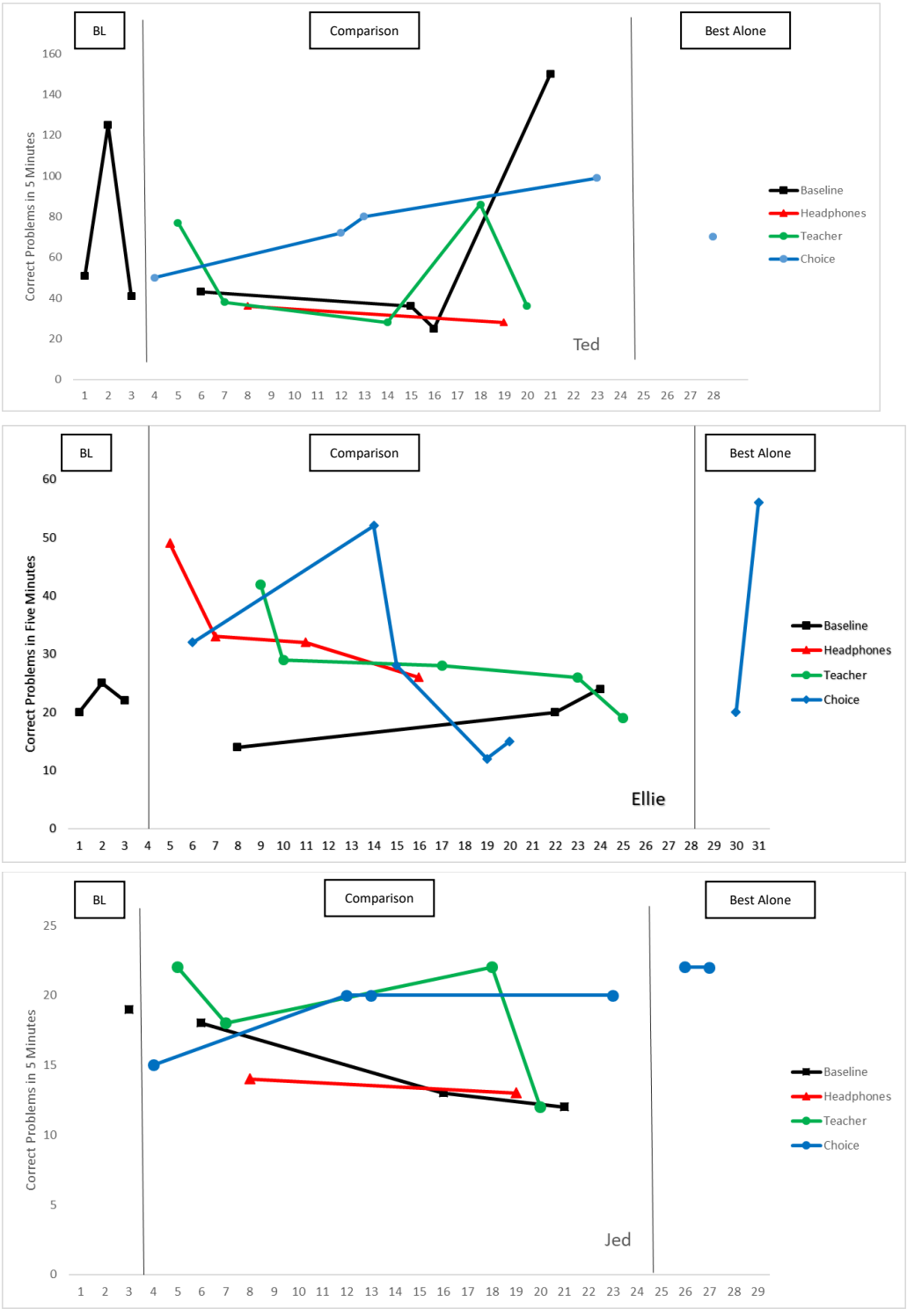


Figure 6

Correct Problems within Five Minutes (Ted, Ellie, Jed)

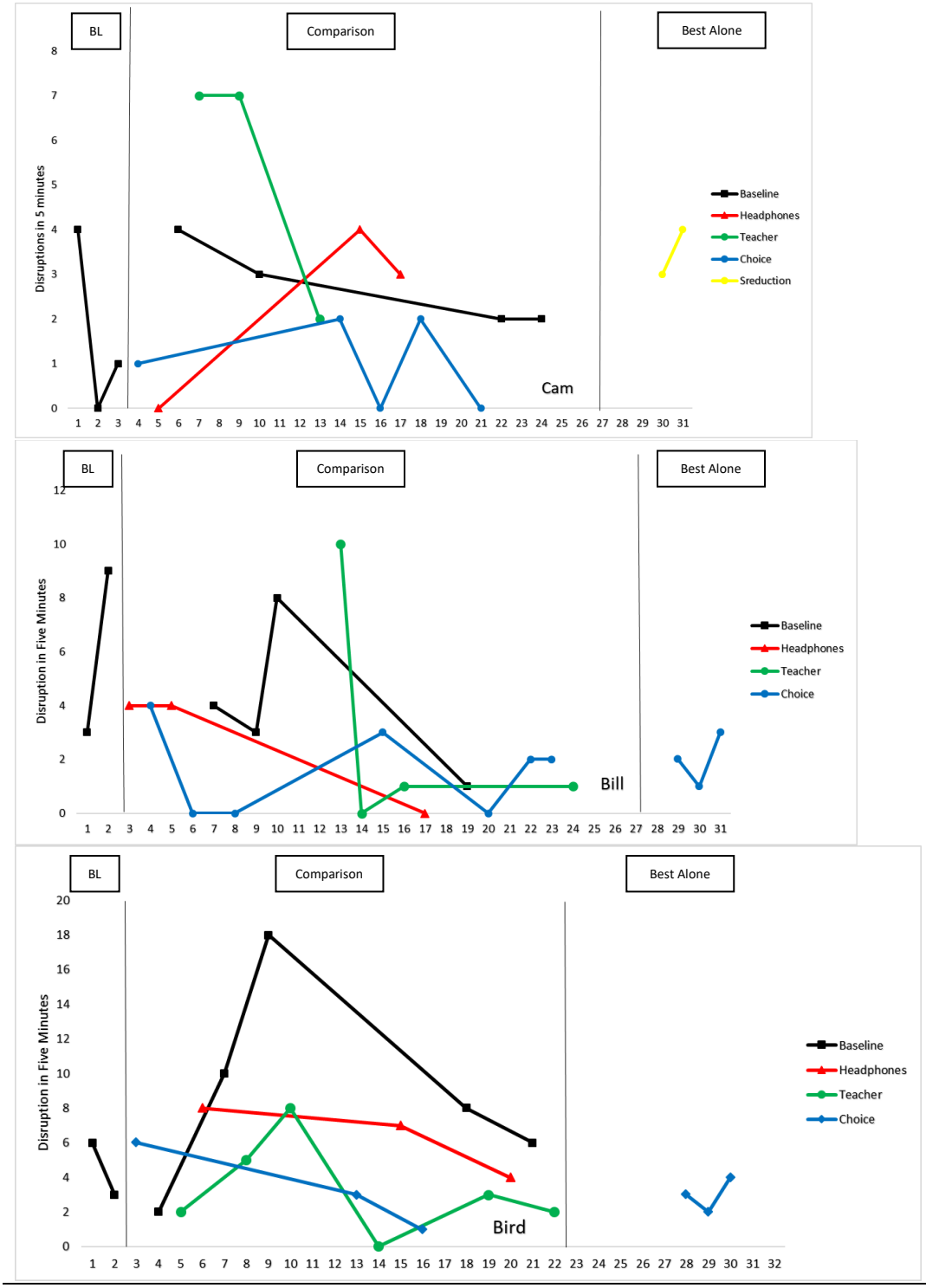


Figure 7

Disruption Events within Five Minutes (Cam, Bill, Bird)

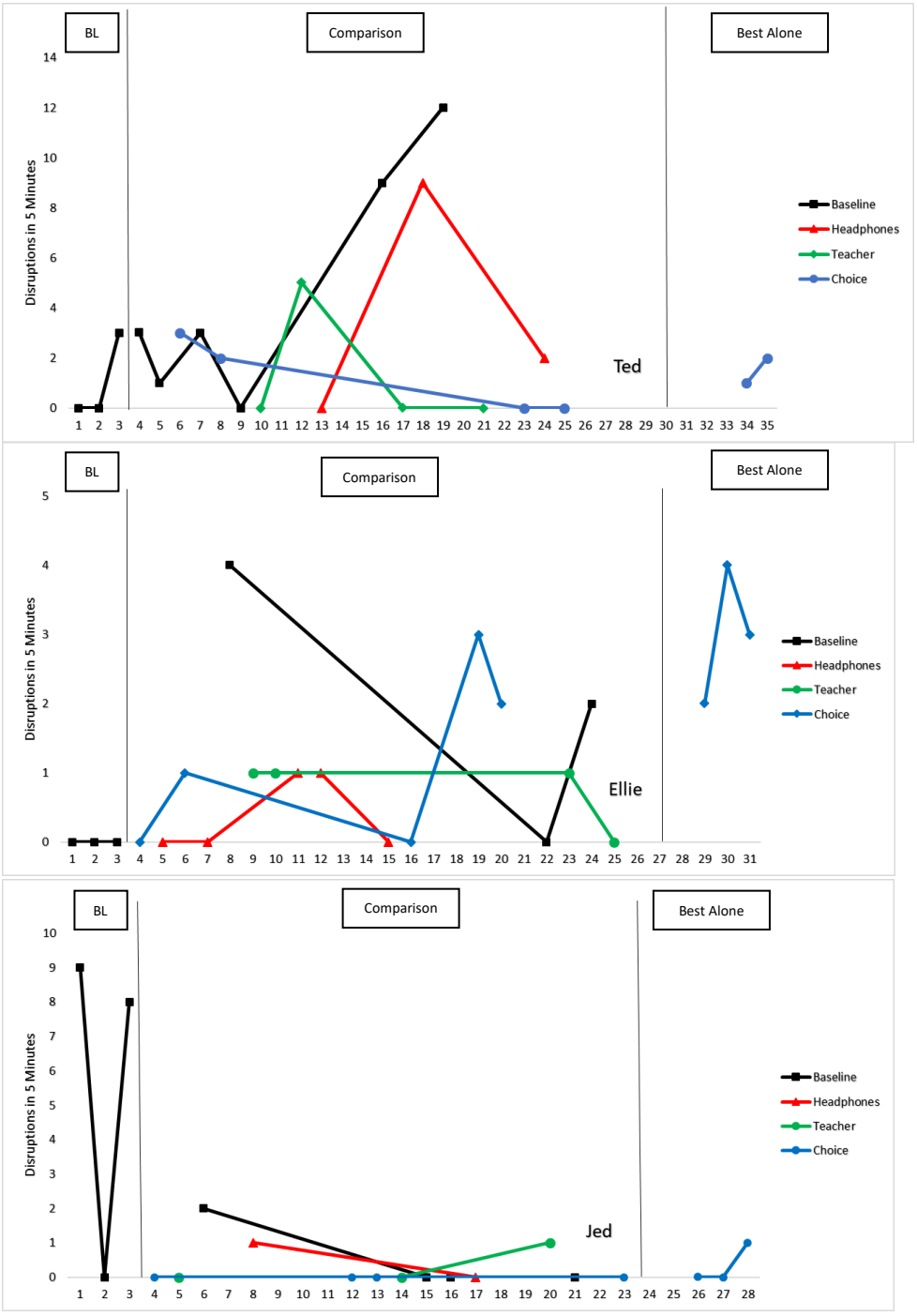


Figure 8

Disruption Events within Five Minutes (Ted, Ellie, Jed)

Table 9

Mean Problems Completed Correctly within Five Minutes

Participant	Baseline	Headphones Only	Teacher Preferred	Chosen Preferred
Cam	18.7	18.5	14.0	**28.2**
Bill	12.8	19.5	17.7	**23.3**
Bird	34.4	50.0	**54.7**	48.7
Ellie	20.8	**32.0**	28.0	29.8
Ted	55.0	32.0	53.0	**75.2**
Jed	13.2	13.5	19.75	**20.0**

Table 10

Mean disruption events in Five Minutes

Participant	Baseline	Headphones Only	Teacher Preferred	Chosen Preferred
Cam	**2.3**	2.5	5.3	3.5
Bill	4.7	2.8	3.1	**1.9**
Bird	8.2	6.3	3.4	**2.5**
Ellie	1.0	**0.4**	0.7	1.9
Ted	3.6	3.8	1.6	**1.5**
Jed	3.3	0.4	0.5	**0.3**

CHAPTER V

Discussion

The purpose of this study was to determine if providing students with self-regulation difficulties access to a choice of preferred music (determined via preference assessments) would have a positive effect on their ability to refrain from off-task behavior during independent work time within the structure of a small-group rotation compared to headphones only, teacher choice, and baseline alone condition. In the following sections research questions are examined and specific notable variables are described. Researcher aimed to answer the following questions:

1. Will student chosen preferred music decrease off-task behavior compared to the baseline?
2. Will teacher-preferred music decrease off-task behavior compared to the baseline?
3. Will placement of headphones on a student decrease off-task behavior compared to the baseline?
4. Which condition will most effectively reduce off-task behavior (chosen preferred, teacher preferred, headphones only, or baseline)?
5. Will disruption decrease as a result of decreased time off task?
6. Will math fact fluency increase as a result of decreased time off task?

Visual analysis and determination of percent of nonoverlapping data points (reported in results sections) indicate the answer to question one was yes for each participant. The results indicate that all students had lower off-task behavior during the chosen preferred condition than baseline alone. For research question two, most of the participant's off-task behavior decreased slightly during the teacher preferred music condition. Cam, Bird, Ellie, Ted, and Jed made slight improvements compared to the baseline alone, while Bird's off-task behavior increased. This is

interesting as Bird's chosen genre was very similar to the teacher preferred music. Also, of note is the confound of emotional instability with Bird, as he struggled with an internal imbalance chemically and emotionally (e.g., on and off multiple psychotropic medications).

Researchers were less confident about the results of research question three with off-task behavior increasing for three participants (Cam, Bill, and Bird) during headphones condition, and decreasing for the other three (Ellie, Ted, and Jed). This condition was designed to parse out the effects of choice music and placement of headphones on student's head. For this reason, researchers used the exact same headphones as during the two music listening conditions, and this may have confused participants. A more natural choice might have been to use noise cancelling headphones instead, or playing music with no choice. Research question four resulted in the chosen preferred condition most effectively reducing off-task behavior for all participants.

Research question five was unable to be successfully answered as results did not indicate that decreased off-task behavior also corresponded with reduced disruption for all participants. While mean disruption was lowest for four participants during the chosen preferred condition, the graphic results show no real distinction between conditions. Two participants had less disruption during conditions other than chosen preferred (Ellie, and Cam). While Ellie often engaged in "daydreaming" during the baseline, the chosen preferred condition seemed to elicit more alert behavior from her (eyes opened wider, sitting up straighter). Given her history of seeking attention from peers, perhaps she interacted more actively with peers when she was more alert, thus increasing off-task behaviors, this is supported by her higher level of disruption. Cam showed the least disruption during baseline alone. Cam also engaged in high levels of stereotypical behavior as he listened to music, particularly classical music in the teacher preferred condition and this affected his off-task, disruption, and math fact completion.

Research question six related to the correlation between time off-task and math fact completion rate. Four participants completed more math problems during the chosen preferred condition, which was when they also had lowest percentage of off-task behavior. However, looking at the data graphically, no clear difference is shown, and two participants completed more problems during a condition where they had more off-task behavior. One possible explanation for this variability is the lack of incentive for problems completed. Another possible explanation, especially for Ellie and Bird, who had more problems completed during other conditions, relates to the level of surrounding distraction. These two participants sat at the same table during the study and both exhibited disruption in the form of attempts to communicate with each other, possibly causing them to become more distracted based on peer behavior.

Another point of note is that participants with higher levels of problem completion during the baseline condition showed more variation within and between conditions. Some participants worked to their potential each time, even though they were not able to complete high numbers (Jed, Ellie, Bill), whereas others could complete higher numbers but did not do so each time, even when they may have displayed low percentages of off-task behavior (Bird, Ted). Cam was generally unmotivated throughout the study to complete the number of problems he had shown he could complete in the past (more than 100 in 5 minutes). Researchers hypothesize that Cam realized early on that the general classroom reinforcement and response cost system was not enforced during the 5-minute sessions. Also, as stated in the methods, Cam has historically reacted very sensitively to music in that he will throw a tantrum when nonpreferred music is played but becomes euphoric when his preferred music is played.

Findings Related to Past and Future Research

This study replicates findings of Lanovaz et al., 2012 in showing that noncontingent access to preferred music (determined through an explicitly described preference assessment) reduced a target behavior in students compared to baseline alone conditions. This study also replicates findings of Falcomata et.al (2004) and Nolan and Filter (2012) who found that non-contingent access to music could reduce a target behavior. Lastly this research replicates findings of Hallam and Price (1998) who found that background music reduced off task behavior during math fact completion.

This study extends the findings of Lanovaz et al., 2012 by including a choice condition and requiring participants to complete math problems. This study also included participants who are higher functioning in a small group setting as opposed to an individual setting. This study extends the findings of Falcomata et.al (2004) and Nolan and Filter (2012) by systematically assessing preference, including a choice condition, and requiring participants to complete math problems. Finally, this study extends the findings of Hallam and Price (1998) by considering preference and choice for each participant.

Results from this study raise a couple of questions that should be systematically examined in the future: would (a) adding a response cost procedure more effectively reduce disruption, (b) adding generalization comparisons with different task types. Other researchers administered music noncontingently and with a response cost contingency where off-task behavior or disruption resulted in the removal of music for a time (Falcomata, Roane, Hovanetz, Kettering, & Keeney, 2004). However, these studies did not include any preference assessment or choice condition. Studies should combine the consideration of preference and choice while also implementing a response cost procedure. This might have reduced the variability of disruption and might have

produced more effective results for participants like Cam. The only downside is related to the amount of staff time involved in the implementation of response cost.

Implications for Practice

Intervention during small-group instruction. Best practices dictate the need for small-group instruction in reading, writing, and math, especially in a high-functioning, self-contained classroom where students have large gaps in ability, and differentiation is always required. Teachers must find ways to engage directly with small groups of students, leaving others in the class to work independently. This is often the time when students engage in daydreaming or disruption instead of working productively. Most often there are no extra adults in these settings to prompt them to stay on task, so interventions need to be self-sufficient. Allowing students to listen to music while completing a practice task, especially students who have high levels of daydreaming or socializing when they are supposed to be working, may assist during independent working within small-group rotations.

Technology is a factor that must be taken into consideration when using music choice as an intervention. During the study, poor Wi-Fi limited the speed at which Pandora would load onto iOS devices, causing the researcher to use student laptops instead. One way around this would be to download playlists based on student preference. The availability of technology is still extremely variable between classrooms and school districts, so teachers may have to get creative in how to allow students access to music.

Part of larger self-advocacy instruction. Many special education students need explicit instruction not only in what to learn, but in how they learn best. Teaching students how to advocate for tools that may help them successfully navigate a school day is an important part of any student's individualized education plan. In the context of this study, the teacher could give student feedback

based on the data to help them better understand how they focus best. For example, Ted clearly stayed more focused with his choice of music, so he could be taught to ask for music to help him focus. Ellie was successful with headphones only and with music, so she could be taught to request either option if she needs to focus. Cam is clearly distracted by music, so he should be taught to request a quiet environment.

The goal of all education is to prepare kids to be successful adults. That is what makes an intervention like this, which seems so simple, very important. An IEP team makes decisions for students who are very young related to how they learn and what they need to best learn. As they get older, ideally these decisions will be made by the students themselves. Something simple like listening to music might seem obvious to typically developing individuals, but those who may need interventions like this the most may not ever think to use them.

Potential additional training for intervention implementation. In order for this intervention to be implemented, teachers may need training in the following: (a) basic data collection skills, (b) how to administer basic preference assessments—MSWO, and single stimulus total-duration, (c) how to navigate Pandora or another music streaming application, and (d) how to manage technology within the classroom. A single stimulus total duration preference assessment is necessary as a part of an overall preference assessment given the nature of music consumption. Music requires listening over time and cannot be consumed immediately like edibles for example. Any teacher wanting to implement and monitor the effects of this study would need to know how to collect data on off-task (or on-task) behavior. This might include methods such as momentary time sampling or event recording. The researchers in this study used total-duration to measure off-task behavior, although this procedure is difficult to do in real time while also teaching. Momentary

time sampling can be done with a looping timer where the teacher only has to look directly at student for a moment at the end of a determined interval of time.

Teachers would need to know how to administer preference assessments, such as those described in the methods section. In this study, the researcher first conducted a multiple-stimulus without replacement preference assessment as a quick way to gain a hierarchy of student preference for song genres. The researcher then conducted a total-duration preference assessment to see which song a student wanted to listen to the longest, and then songs were ranked based on this data. This took a total of about 10 minutes per participant and was an important step, as it directly informed the music that was offered during the chosen preferred condition. Researcher used one song to represent the genre (including multiple songs) that would be listened to during choice conditions.

Another step taken during the preference assessment was to link the audio stimulus with a visual stimulus. The researcher paired each music genre with a simple icon and then trained students to pair the two. This may seem like an arbitrary step, but for students with limited communication, articulating exactly what music they want can be a very hard thing. Teachers will save time later by making the choosing process a visual one.

A premium Pandora account was obtained by the researcher and used to create playlists and stations throughout the preference assessments and study due to the systematic way Pandora links similar music together. Other music streaming applications may work just as well, or music can be stored directly on a device, removing the need for an application if funds to purchase songs are available. The researcher chose to use a steaming service so that student song preference could be mostly unlimited. As with any procedure, taking time to teach students to properly complete each step is important so that they gain independence of the process. In order to facilitate independence

with station selection, the researcher created a PDF file in which each student had their previously paired icons connected directly to the Pandora station. To choose their station, they were taught to click the picture and then click the triangle. This eliminated the need for the teacher to have to set up the student listening device each time. Teachers will need to be able to create some type of similar visual menu with embedded links.

Limitations

Within study limitations. One limitation within the study design includes having a choice of two types of teacher preferred music during the teacher preferred condition and then a choice of music the students prefer during the chosen preferred condition. To truly isolate whether choice plays a role in student off-task behavior, there would need to be a condition where they had access to preferred music that the teacher chose. For example, if the teacher made the decision which of their top three genres to play for that day instead of letting the participant choose.

Variability of data for each participant during baseline alone and during the comparison phase makes visual analysis the only true resource for determining treatment effectiveness. Given the lack of data points for some conditions, assessing percent of nonoverlapping data points and mean presents problems and can provide misleading results. These two methods were included as a way of discussing results with the understanding that visual analysis is the main deciding factor. Mean was used to determine intervention effectiveness as this is the method used to determine progress and mastery on IEP objectives for these students.

Also, due to personnel limitations and the teacher running the study while also running instruction researchers did not record exactly which picture link students chose each time out of the three provided. This information would have been useful in determining the accuracy of the preference assessments and in seeing if a certain song type influenced behavior, especially for

Cam. External validity of this study is limited to participant characteristics and the exact study specifications (Cooper et al., 2007). For example, these results may have been different if students were lower functioning, or of a really young age and unable to tolerate headphones for extended periods of time.

Lastly, using parent auditory reinforcer questionnaires meant limiting options for initial exposure and throughout the assessment phase of the study. Music genre types might have existed that were never presented to the students within the scope of the preference assessments.

Outside calendar and other factor limitations. This applied research study took place in an actual classroom and was run by an actual teacher. As such, the study was exposed to outside environmental influences, such as personnel changes, schedule changes, other student behavior, and time of year. While the study only took place when the head teacher was present, teacher assistants would often change due to paraprofessional absence or because of end-of-year testing. As in any public school, assemblies, field trips, testing, and many other events required the students' math time to change. Another environmental factor was reactivity to the placement of the iPad and tripod. Results might have been more accurate if camera had been placed long before study initiation to allow for participant habituation to its presence.

The largest disrupter with possible influence on study results is the behavior of the other students in the room. This study was conducted in a self-contained room for students with self-regulation needs who often throw tantrums (e.g., scream, kick, or throw items). While this would clearly affect concentration, it also shows what students are exposed to daily and that even though music can be viewed as a distraction, it may be a much more predictable distraction compared to a screaming child. Lastly, this study was conducted up until the week before school ended, overall

distractions were increased and student behavior throughout the entire school was escalated. This may have impacted relative effects of the music.

Conclusions

The findings of this study indicate that chosen preferred music is associated with a decrease in off-task behavior in students with self-regulation difficulties and, for some participants, increase accurate math fact completion. Preferred music was determined through two preference assessment procedures: multiple-stimulus without replacement and total-duration. The Pandora music streaming application was used to provide music during teacher choice and chosen preferred music conditions. While off-task behavior was reduced for all participants, accurate problems completed and disruption results were more variable, and a possible response cost condition should be considered in the future to possibly correct this.

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Appendix A

Letters of Consent and Assent

UNIVERSITY OF GEORGIA
CONSENT FORM
Effects of Personalized Music During Independent Math Task on On Task Behavior in Students with Deficits in Self Regulation

Researcher's Statement
I am asking you to take part in a research study. Before you decide to participate in this study, it is important that you understand why the research is being done and what it will involve. This form is designed to give you the information about the study so you can decide whether to be in the study or not. Please take the time to read the following information carefully. Please ask the researcher if there is anything that is not clear or if you need more information. When all your questions have been answered, you can decide if you want to be in the study or not. This process is called "informed consent." A copy of this form will be given to you.

Principal Investigator: Cynthia Vail PhD
Department of Communication Sciences and Special Education
Cvail@uga.edu

Purpose of the Study
Small group instruction is the most effective classroom structure to ensure students can receive instruction at their level of need. This often requires groups to work independently and be productive while the teacher is with another group. Sometimes children have a hard time staying on task when asked to work independently in this way.
The purpose of this study is to determine if certain types of personalized music will help students remain seated and focused when asked to independently complete simple math problems (to help build their fluency). Student performance will also be measured to see if correct math fact completion rate increases as a byproduct of staying seated and focused.

Study Procedures
If you agree to participate, you will be asked to …

- First, parents will be given an interview/questionnaire related to how their child interacts with music and will be asked to list favorite genres and specific songs enjoyed by their child. Researchers will use this information to develop multiple Pandora playlists customized to child's preferences.

Risks and discomforts

- We do not anticipate any risks from participating in this research.

Benefits

- Students participating in this research may benefit by increasing their math fact fluency.
- Students participating in this research may benefit by obtaining a strategy for staying on task that may help them in other areas of their school day.
- If personalized access to music is shown to improve performant and focus, this knowledge may be used to benefit other students in the future...

Privacy/Confidentiality

This data will be kept by the University of Georgia after the completion of the study with no identifying information attached. The results of the research study may be published, but your name or any identifying information will not be used. In fact, the published results will be presented in summary form only.

Taking part is voluntary

Your involvement in the study is voluntary, and you may choose not to participate or to stop at any time without penalty or loss of benefits to which you are otherwise entitled. Your decision whether to participate or allow your child to participate won't affect your child's grades or the availability of school services.

If you have questions

If you have any questions about this research project, please feel free to call me Sarah Kroll at (706) 768-2393 or send an e-mail to skroll@uga.edu.

If you have any questions or concerns regarding your rights as a research participant in this study, you may contact the Institutional Review Board (IRB) Chairperson at 706.542.3199 or irb@uga.edu.

Research Subject's Consent to Participate in Research:

To voluntarily agree to take part in this study, you must sign on the line below. Your signature below indicates that you have read or had read to you this entire consent form, and have had all of your questions answered.

_____	_____	_____
Name of Researcher	Signature	Date
_____	_____	_____
Name of Participant	Signature	Date

Assent Script/Form for Participation in Research
Effects of Personalized Music during Independent Math Task on On-Task Behavior in Students with Deficits in Self-Regulation

We are doing a research study to find out how children like you complete math problems when listening to music. We are asking you to be in the study because you are in a class where learning to do math facts quickly is important. If you agree to be in the study, you will practice math facts for five minutes during math class. Sometimes you will listen to music and sometimes you will get to choose the music you listen to. Other times you will wear headphones with no music and sometimes you will not have anything. Being in the study may improve your ability to complete math facts quickly. We also hope to learn something about music and focus that may help students in the future.

You do not have to say "yes" if you don't want to. No one, including your parents, will be mad at you if you say "no" now or if you change your mind later. We have also asked your parent's permission to do this. Even if your parent says "yes," you can still say "no." Remember, you can ask us to stop at any time. Your grades in school will not be affected whether you say "yes" or "no."

Will take a video of you during the sessions and this will be kept in a safe place. We will use a pretend name for you.

You can ask any questions that you have about this study. If you have a question later that you didn't think of now, you can find Miss Kroll and ask her your questions or write them down and give them to her.

Name of Child: _____ **Parental Permission on File:** ☐ Yes ☐ No**
***(If "No," do not proceed with assent or research procedures.)*

(For Written Assent) **Signing here means that you have read this paper or had it read to you and that you are willing to be in this study. If you don't want to be in the study, don't sign.**

Signature of Child: _____ **Date:** _____

(For Verbal Assent) **Indicate Child's Voluntary Response to Participation:** ☐ Yes ☐ No

Signature of Researcher: _____ **Date:** _____

Appendix B

Auditory Preference Questionnaire

Student_____ Date:_____

This questionnaire will help us determine what types of noise and/or music your child enjoys. It will also help us determine at what volume and which output devices you child prefers to hear sound from.

1. Some children like really loud exciting noises while others prefer quiet calm noises, which does your child prefer?
    - Examples and Specifics:

2. Does his/her preference change depending on environment? (Ex. Loud noise can be ok if it is expected?) Yes/No
    - Examples and Specifics:

3. Does your family listen to music in the car? If so can you describe what he/she does during this time? Yes/No
    - Examples and Specifics:

4. Are there any specific songs that he/she finds really appealing? Yes/No
    - Examples and Specifics:

5. Are there any TV shows that he/she really enjoys? Are there specific songs or types of music within these shows? Yes/No
    - Examples and Specifics:

6. Does he/she have any devices that make noise such as an Ipad, PSP, Xbox 360, etc.? Yes/No
    - Examples and Specifics:

7. What does he/she do when there is no noise in the environment? Yes/No
    - Examples and Specifics:

8. Does he/she enjoy times like this? Yes/No
    - Examples and Specifics:

9. Are there any noises heard in your daily environment that he/she finds aversive? (ex., fire trucks, construction equipment, lawn mowers, vacuum) Yes/No
    - Examples and Specifics:

10. Are there any noises heard in your daily environment that he/she finds appealing? Yes/No
    - Examples and Specifics:

11. Does he/she play with any toys that make noise? Yes/No
    - Examples and Specifics:

12. Does he/she have any musical instruments at home? Yes/No
    - Examples and Specifics:

13. Are there any activities at school that he/she avoids due to noise he/she doesn't like? Yes/No
    - Examples and Specifics:

14. Does he/she like activities at school where singing or musical instruction are occurring? Yes/No
    - Examples and Specifics:

15. Does he/she have an aversion to a certain type of head phone? Yes/No
    - Examples and Specifics:

16. Is there a specific type of head phone he/she is used to using at school/home? Yes/No
    - Examples and Specifics:

17. Of the following genres listed below, rate his/her preference for each (1 being most preferred and 10 being least preferred). If any are unfamiliar mark an X. Please list any specific examples you can think of in the space provided after each preferred genre (for top 5 only).
    - ☐ Soft Classical (Mozart, Bach)_____
    - ☐ Loud Classical (Beethoven, Wagner)_____
    - ☐ Disney/children's television music (slow) _____
    - ☐ Children's television theme songs (upbeat) _____
    - ☐ Hip hop _____
    - ☐ Jazz/Blues _____
    - ☐ Cinematic (Lord of the Rings, Star Wars) _____

☐ Contemporary country _____
☐ Classic country _____
☐ Classic rock (60's, 70's) _____
☐ Oldies (50's) _____
☐ Punk rock _____
☐ Heavy Metal _____
☐ Reggae _____
☐ Pop _____
☐ Alternative _____
☐ Dance/Electronic _____
☐ Contemporary Rock _____
☐ Sounds in nature (rain, ocean, etc.) _____

Appendix C

Procedural Fidelity Data Sheets

Check here if observed:	Initial exposure:
1	Student is sitting at a table
2	Teacher explains, "I'm going to play some music for you while I show you a picture that matches. Try to remember the picture that goes with the song. We will listen for 20s, but if you want the song to stop say or sign, "done".
3	Song is played
4	Image is shown
5	Song plays for 20s or until student says "done"
6	Steps 3-5 repeated for five song/picture pairs

Check here if observed:	Picture song association training:
1	Song is played
2	Choice of three pictures that have already been associated will be provided
3	Teacher says, "which picture matches?"
4	Wait 3s
5	Begin prompt sequence (G, FP)
6	Reinforce independent responses with previously identified preferred item (token, fidget, or edible)

Check here if observed:	MSWO:
1	Student is sitting at a table
2	5 previously paired pictures of song choice are presented
3	Teacher says "pick your favorite song"
4	Student picks up preferred picture
5	Picture is remove and choices are re presented minus chosen picture
6	Steps 3-5 are repeated for five trials

Check here if observed:	Math problem Pre-test
1	Students are seated in a quiet environment
2	Teacher says, "here are some math problems try to answer each one correctly, when you are done raise your hand and I will collect your paper."
3	Students are given 10 minutes to complete problems. (problems 1:10 + 1:10 will occur one time each in random order)
4	As students raise their hands, papers are immediately collected and placed in research folder

Check here if observed:	Baseline condition Procedures:
	Ipad on tripod is set up with student torso in view
	Sheets with more problems than can be completed in a 5min period are placed on student desks with one wooden pencil.
	Students are directed to have a seat.
	Say, "It's time to practice addition. You may begin."
	Teacher does not provide any further verbal directions.
	When time is up say, "please put down your pencils, you are all done practicing addition"
	Sheets are taken up and placed in research folder

Check here if observed:	Headphones only condition:
	Ipad on tripod is set up with student torso in view
	Sheets with more problems than can be completed in a 5min period are placed on student desks with one wooden pencil. Pair of (specific type) headphones with no chord attached is placed on student's desk ahead of time.
	Students are directed to have a seat. Proceed when all students are seated.
	Say, "It's time to practice addition. Please take your pencil and write your name and date (wait 15s)."
	Say, "Please take the headphones on your desk and put them on. Keep your headphones on the entire time you are working."
	Teacher does not provide any further verbal directions.
	When time is up say, "please put down your pencils, you are all done practicing addition. You may now remove your headphones."
	Sheets are taken up and placed in research folder.

Check here if observed:	Preferred Music Condition choice
	Ipad on tripod is set up with student torso in view

	Sheets with more problems than can be completed in a 5min period are placed on student desks with one wooden pencil. A lap top connected to the exact same type of headphones placed on the student's desk.
	Students are directed to have a seat. Proceed when all students are seated.
	Please take the headphones on your desk and put them on (wait 10s).
	Say, "Keep your headphones on the entire time you are working. You will be allowed to listen to music you like while you work. Please choose which type you would like to listen to now by pressing the corresponding picture shown on the device on your desk (wait 10s).
	Say, "When you have chosen, please turn the device around so that it does not distract you"
	Teacher does not provide any further verbal directions.
	When timer is done say, "Please put down your pencils, you are all done practicing addition. You may now remove your headphones"
	Sheets are taken up and placed in folder.

Check here if observed:	Preferred Music Condition Teacher choice
1	Sheets with more problems than can be completed in a 5min period are placed on student desks with one wooden pencil. An lap top connected to the exact same type of headphones
2	Students are directed to have a seat. Proceed when all students are seated.
3	Please take the headphones on your desk and put them on (wait 10s).
4	Say, "Keep your headphones on the entire time you are working. You will be allowed to listen to teacher music you like while you work. (wait 10s).
5	Say, "Please turn the around over so that it does not distract you. You may begin". (set timer)
6	Teacher does not provide any further verbal directions.
7	When timer is done say, "Please put down your pencils, you are all done practicing addition. You may now remove your headphones"
8	Sheets are taken up and placed in folder.