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Comparing Indirect Assessment Results to a Direct Function Focused Preference Assessment to Identify Potential Reinforcers to Increase Task Completion in a School Setting

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COMPARING INDIRECT ASSESSMENT RESULTS TO A DIRECT FUNCTION-FOCUSED PREFERENCE ASSESSMENT TO IDENTIFY POTENTIAL REINFORCERS TO INCREASE TASK COMPLETION IN A SCHOOL SETTING

THESIS

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Science in the
College of Education
at the University of Kentucky

By

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ABSTRACT OF THESIS

COMPARING INDIRECT ASSESSMENT RESULTS TO A DIRECT FUNCTION-FOCUSED PREFERENCE ASSESSMENT TO IDENTIFY POTENTIAL REINFORCERS TO INCREASE TASK COMPLETION IN A SCHOOL SETTING

In the present study, a concurrent operant analysis (COA) was conducted for one elementary aged student in a publicly funded school to determine if the results yielded an interpretable outcome to identify a potential reinforcer to increase work completion. A simultaneous treatments design was used during the COA to assess choice making behavior. The results of the COA indicated the student's choice making behavior was maintained by access to attention. An indirect measure of motivation was used as a secondary assessment to identify a potential reinforcer to increase work completion and to determine if the results would align with the outcomes of the COA. Results of the indirect assessment yielded different outcomes and indicated the students work completion behavior was maintained by access to tangibles. Outcomes of the assessments were used to develop a token economy where the student could earn their preferred reinforcers contingent upon work completion. An alternating treatments design was used to systematically compare work completion during sessions where the reinforcer identified by the COA were available to sessions were the reinforcer identified by the indirect assessment were available. Results indicated that working for either identified reinforcer increased work completion to 100% completion.

KEYWORDS: Concurrent operant analysis, indirect assessment, work completion, school

Kailee Joy Matthews

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Date

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INTRODUCTION

Within the school setting, the Individuals with Disabilities Education Act (IDEA) mandates the use of functional behavior assessments (FBA) prior to designing behavior intervention plans for students with disabilities engaging in interfering behaviors (IDEA, 2004). The FBA process can include a variety of direct and indirect measures that assist professionals in understanding the variables in the environment that are maintaining the interfering behavior(s) of concern. These measures include, but are not limited to, dichotomous indirect assessments (e.g., rating scales), open-ended indirect assessments (e.g., interviews), direct observations (e.g., data collection), choice making preference assessments, and functional analysis (FA; Gresham et al., 2004; Lloyd et al., 2020; Quigley et al., 2013). Cooper et al. (2020) referred to the FBA process as, "a systematic method of assessment for obtaining information about the purposes (functions) a problem behavior serves for a person…" (p. 792). The functions of behavior are broadly described as positive or negative reinforcement contingencies. Meaning the individual is seeking to access or avoid something that will increase and therefore maintain their challenging behavior. The functions of behavior are as follows social positive reinforcement (attention), social negative reinforcement (escape), tangible reinforcement, automatic positive reinforcement, and automatic negative reinforcement (Cooper et al. 2020). Once these methods identify the function(s) surrounding the interfering behaviors, the outcomes are used to guide the programming of a function-based intervention aiming to increase desired behaviors and decrease interfering behaviors (Quigley et al., 2013). The variety of interventions that can be implemented concluding the FBA process take a

proactive approach to prevent the interfering behavior and replace it with more socially acceptable alternatives.

A key element to the FBA process is conducting preference assessments. A preference assessment refers to the set of procedures that professionals can utilize to determine the extent that a student prefers, or dislikes, an item or activity compared to others (Leaf et al., 2015; Ledford, Lane, & Barton, 2019). A variety of preference assessments are available when considering the best way to assess the likings and disliking's of your specific learner. A sampling of assessments that have been used previously in the FBA process include approach-based assessments such as single-stimulus, paired-stimulus, and multiple stimulus with and without replacement (Fisher & Mazur, 1997; Fisher et al., 1992; Keen & Pennell, 2010; Weaver et al., 2017). Additionally, engagement-based assessments can be utilized where children are presented with multiple stimuli and the duration of time spent with each of the items presented is recorded (Harding et al., 1999; Keen & Pennell, 2010). The results of a preference assessment are then used to identify potential reinforcers that are available to increase motivation for certain student behaviors. Weaver et al. (2017) describes reinforcers as, "a reward that is presented to a student as a consequence for a specified behavior [which] serves to increase the future occurrence of that behavior" (p. 6). While Weaver et al. (2017) is speaking specifically to intentionally reinforcing desired behaviors, reinforcement is applied to all topographies of behavior, such as challenging behavior (e.g., screaming). Additionally, while reinforcing behavior can be planned (e.g., providing behavior specific praise for students who raise their hand to ask a question), challenging behaviors can be unintentionally reinforced as well. For example, a student

screams when they need help with an assignment and the teacher always responds with a verbal reprimand and increasing proximity. While the teacher may think they are addressing the issue, if this behavior is maintained by accessing attention the teacher is unintentionally reinforcing the behavior, consequently, increasing the likelihood of its occurrence in the future. Providing reinforcers in this way is described as positive reinforcement, since a preferred item, activity, or person is added to the learner's environment increase the future likelihood of that behavior in similar situations. It is important to note that items, activities, or people that are identified as unpleasant to the learner can also be removed following a behavior to increase the likelihood of that same behavior occurring in the future; this is referred to as negative reinforcement (Cooper at al., 2020).

The outcomes from a preference assessment are utilized in a reinforcer analysis to determine if any of the preferences identified from the assessment will be salient enough to act as reinforcers (Hanratty & Hanley, 2021; Leaf et al., 2018). It is essential to conduct a reinforcer analysis, as not all preferences are motivating enough to increase a student's desired behaviors, such as task completion or task engagement in school settings. When evaluating the importance of understanding learner preferences, professionals must consider what their role is in the FBA process. It is the responsibility of the professionals involved to provide effective treatment in reducing interfering behaviors and increasing student's academic and social skills. Therefore, identifying salient reinforcers is a prerequisite for professionals when seeking to increase prosocial and academic behaviors (Weaver et al., 2017).

While it is the goal of preference assessments to determine a student's choice-making behaviors regarding their likes and dislikes, there are some assessments that have a more focused presentation of choice (e.g., single-stimulus or paired-stimulus), meaning individuals are presented with two or more stimuli at a time and required to make a decision between what is presented to them. In contrast to these, a concurrent operant preference assessment (COPA), also referred to as a free operant preference assessment (Ortiz & Carr, 2000), is a flexible presentation of preferred stimuli which yields a variety of data. A COPA is a direct approach because it removes parameters from the participants ability to choose throughout the assessment and allows professionals to collect data based on observation of their behavior. During a COPA, the client is presented with two choices concurrently available in the environment, but each having an independent schedule of reinforcement (Hanley et al., 1997). Ledford et al. (2019) outline general procedures to guide practitioners in using a COPA. Implementers begin by identifying multiple stimuli that are preferred to the child, this may be done by direct preference assessment (e.g., multiple stimulus without replacement). Next, they arrange the environment by spreading the stimuli in varying locations within the assessment environment then explain to the child they can play with any of the items at any time. During the assessment implementers measure the duration in which the child spends with the item(s) available. Once the child becomes unengaged with an item the timer is stopped and is restarted when they begin engaging with the next item (Ledford et al., 2019). The use of a COPA and the concept of choice-making (Fisher & Mazur, 1997) has

influenced the design of an assessment referred to as a concurrent operant analysis (COA).

A COA is an analysis where two stimulus conditions are available concurrently. The student participant has full access to either choice throughout the duration of the condition with the ability to move freely between the available stimuli (Fisher & Mazur, 1997; Lloyd et al. 2020). While some assessments in the FBA process focus on identifying the function of a student's interfering behavior (i.e., FA), the COA analyzes a student's choice allocation and determines the function of their decision-making behavior (Lloyd et al., 2020). Emerging behavior analytic literature has shown that a COA can successfully identify valued reinforcers (e.g., Casey, 2008; Lloyd et al., 2020), indicating that identifying the function of a student's choice-making behavior can be utilized as a reinforcer in a function-based intervention. It is noteworthy to differentiate that while a COA has similarities to widely used preference assessments, their key difference is that the COA framework is focused on identifying function-based reinforcers. Direct preference assessments previously mentioned such as single stimulus, paired stimulus, multiple stimulus with replacement, or multiple stimulus without replacement aim to identify which items or activities are most selected or engaged with. The stimuli offered are typically limited to varying tangible items (e.g., toys, food) but can occasionally include attention from peers or adults (e.g., Keene & Pennell, 2010; Leaf et al., 2015; Weaver et al., 2017). Stimuli simultaneously presented within a COA provide a more specific understanding of an individual's current motivation state, or establishing operation, (e.g., specific adult attention vs. attention) by comparing stimuli that align with the functions of behavior (Fisher & Mazur, 1997; Lloyd et al., 2020).

When considering the importance of the use of COAs in the school setting, Weaver et al. (2017) reminds us that "a functional approach to problem-solving in the area of behavior is not one size fits all" (p. 6). Due to this consideration, a COA may be a component utilized in the FBA process in addition to or in leu of a FA. A COA might be incorporated when outcomes of the standard FBA process do not yield results that are easily interpreted (Piazza et al., 1997; Quigley et al., 2013), FA results are inconclusive (Finkel et al., 2003; Hanley et al., 1997), students do not engage in the identified interfering behaviors (Derby et al., 1992; Finkel et al., 2003), conducting an FA is not feasible or safe (Lloyd et al., 2020), or when a FA would benefit from adding a supplementary assessment, such as times when more information is needed on the reinforcing aspects of specific stimuli, such as teacher attention (Harding et al. 2002; Quigley et al. 2013). In other research, authors have studied the use of specific assessments commonly applied in the FBA process. Specifically related to FA feasibility, Oliver et al. (2015) surveyed close to 700 behavior analysts regarding providing services in the school setting surrounding the components of the FBA process most used. Of the participants included, 71.8% of respondents indicated that informant (i.e., indirect) assessments were used more frequently than FAs, and 83.1% of respondents shared that descriptive assessments were used more often than FAs. Respondents also listed the following barriers when asked why they do not conduct FAs; a) lack of time, b) lack of space, c) lack of training, d) prohibited by administration or families, e) are not necessary or useful, and f) not enough funding from insurance. The nature of COAs is that they work as a function-based preference assessment, indicating that they can be used as a descriptive assessment in the FBA process. COAs are focused on the function of choice-

making behavior, therefore they do not intentionally evoke maladaptive behavior, such as aggression, self-injury, or destructive behaviors, during the assessment and their results identify conditions that are preferred for reinforcing appropriate behavior. It is advised to consider that this approach may be more compassionate for clients with severe behaviors and better suit the needs of clients when reviewing their unique individual learner characteristics (Lloyd et al., 2020). For example, the outcomes of a COA have been used for increasing on-task behavior and task completion (Harding et al., 2002; Harding et al., 1999; Lloyd et al., 2020; Quigley et al., 2013), increasing independent play and appropriate vocal and non-vocal exchanges (Harding et al., 1999), and increasing adaptive behaviors in a student exhibiting passive behaviors (Quigley et al. 2013). When behavior analysts are deciding what types of assessments will be used during the FBA, it is important to review which assessments are socially valid according to practitioners and other authentic implementers (e.g., parents, teachers). Lloyd et al., (2020) surveyed the perspectives of practitioners on three different hypothesis testing strategies: antecedent analysis, COA, and FA. Their results illustrated that the participants identified the COA as more acceptable and feasible than the AA and FA. Items ranked high in support of the COA's acceptability included like less likely to evoke challenging behavior, easier to embed into the school day, feeling confident about their ability to implement the assessment with fidelity, and taking too much time to complete. Results in favor of the COA were further reinforced when participants ranked the COA most likely to use across elementary and middle school grades, disability (e.g., emotional behavioral disorder), setting type (e.g., general education), and behavior risk status (e.g., high-risk behavior). In summary, the purpose of the FBA process is to identify the function of the target

behavior, including function-based reinforcers that can be used effectively in a treatment plan. The literature has shown that the outcomes of a COA have produced potent reinforcers that were successfully used in reinforcement-based interventions (Harding et al., 1999, 2002; Lloyd et al., 2020; Quigley et al., 2013). These findings, in addition to the considerations of feasibility and acceptance discussed in the Lloyd et al. (2020) article, speak to the importance of COAs role in the FBA process in schools.

Lloyd et al. (2020) sought to implement a COA in place of a FA during the FBA process and to utilize the outcomes to determine if the function(s) identified for the participants could be successfully used to increase on-task behaviors and task completion. After the completion of all four COAs, students were given a task demand in their repertoire that typically produced low rates of task engagement. They were told what type of function-based social reinforcer they were working for in each condition: escape from task demand, preferred tangible item or activity, or preferred social attention. Students were allowed to complete as little or as much of the task as they wanted, but the more work they completed the longer they had access to the reinforcer associated with that condition. Conditions alternated per session, and every student was exposed to each of the three conditions. Choice probes were conducted sporadically at the end of intervention comparison to determine if the student's preferred reinforcer aligned with the function identified in the COA. During each choice probe, implementers presented all three token types to each participant and asked what they wanted to work for in that session. Researchers found that two of the four participants supported that the outcomes of the COA could be used as a reinforcer to increase on-task behaviors and task-completion. The third participant had preliminary support for the COA due to some

variability in his choice making probes. For the last participant, implementers were unable to identify persistent differentiation for the number of problems completed in his task or the duration of his engagement, therefore, his results were inconclusive.

The purpose of the current study is to systematically replicate the Lloyd et al. (2020) study using the COA framework to identify the function of a student's choice making behavior through observing their response allocation when concurrently presented two choices. The present study will extend the COA literature by comparing the treatment effectiveness when the treatment is based on COA results compared to the results of the Questions About Behavioral Functions (QABF) assessment. The behavior determining if one treatment is more effective than another is the amount of work completed (e.g., level of work completion). If implementers identify differentiation in the level of work completed in one intervention versus the other, they can conclude that one intervention is superior to the other indicating treatment effectiveness. The QABF (Matson & Vollmer, 1995), is an indirect measure that can be utilized to hypothesize functions of behavior and potential reinforcers. This indirect measure is a rating scale comprised of 25 questions that align to the individual functions of behavior. Watkins & Rapp (2013) sought to determine the validity of results identified in the QABF in relation to their alignment with FA outcomes for a target behavior. The study had six participants all diagnosed with autism spectrum disorder and their ages ranges from 9- to 19-years-old. Each participant's parent(s) completed the QABF, and researchers implemented a brief FA. Results in the study showed that the function identified in the QABF and FA aligned for 5 of the 6 participants. Similarly, Healy et al. (2013) used the QABF and FA to identify the function of 32 participants challenging behaviors (e.g., self-injurious) and

sought to compare the outcomes to determine if they yielded the same results. The outcomes of this study produced exact agreement of function from the QABF and FA for 24 of the 32 participants. Remaining participants had partial agreement except for one. By comparing the results of the COA and the QABF through systematically alternating the interventions, practitioners can analyze if the use of a more complex assessment, such as a COA, is necessary to identify potential reinforcers or if less complex measures, such as the QABF, can produce similar results. The following research question will guide the study:

Research Question 1: Can the COA framework produce differentiated allocations of choice-making that are understandable and can lead to the identification of a potential reinforcer to increase work completion for an elementary student?

Research Question 2: To what extent do the overall outcomes of a COA and the QABF yield similar findings?

Research Question 3: When the outcomes of a COA and the QABF differ, do interventions based on these results lead to differences in independent task completion for an elementary student with ADHD?

METHOD

Concurrent Operant Analysis and QABF

Participants

Student. After obtaining study approval from the University of Kentucky's Institutional Review Board, implementers recruited student participants that were a) in grades K-5; b) attending publicly funded schools; c) referred for behavior support services or currently receiving special education services in the following categories: Intellectual Disability (ID), Specific Learning Disability (SLD), or Other Health Impairment (OHI); d) identified by their classroom teacher or another primary staff member as a student who engages in low levels of task completion; and e) in attendance for at least 90% of school days. Additional skills that participants needed in order to qualify for the present study included being able to a) follow one-step directions, b) wait for a prompt, and c) independently transition from one location to another. Students met inclusion criteria upon the evaluation of teacher interviews and an initial observation utilizing a screening measure (e.g., a student completed 50% or less of an identified task). The screening measure included each part of our inclusion criteria and a section for notes. To determine if 50% or less task completion was occurring Implementers interviewed the teacher and she referred to academic data for each participant. Exclusion criteria consisted of student's who engaged in any dangerous behaviors toward themselves or others. This decision was made based on the population of participants used in previous studies utilizing COAs. Informed consent was obtained from each participant's legal guardian(s) and written assent was acquired from each student prior to the onset of data collection.

Three 5th grade students receiving services by the same special education teacher were screened as potential participants in the current study. All students were referred to the Implementers by the district behavior analyst and the school's special education teacher. Three observations were conducted across a two week period, and only one participant met the inclusion criteria. Max was a 10-year-old Caucasian boy in fifth grade who had a diagnosis of attention deficit hyperactivity disorder (ADHD) and was being serviced under the IDEA category of Other Health Impairment (OHI). Max spent 80% of his time receiving instruction in the general education setting, and 20% of instruction in the resource classroom for writing and reading. Max's special education teacher was a 53-year-old Caucasian woman who had been teaching for 10 years; she had her bachelor's degree in special education dually certified in Moderate to Severe Disabilities (MSD)/ Learning and Behavior Disabilities (LBD).

Others. Implementers for this study were two Caucasian graduate students pursuing their master's degree in applied behavior analysis at a large, southeastern university. One Implementer was female, and the second was male. In addition, both had received their bachelor's degree in special education and were dually certified in Moderate to Severe Disabilities and Learning and Behavior Disabilities. The male Implementer was referred to as Implementer 1 and the female Implementer was referred to as Implementer 2. Implementers were tasked with determining if potential participants met the inclusion criteria, conducting direct measures (i.e., COA and indirect measures (i.e., Questions About Behavioral Functions (QABF)) to determine reinforcers to utilize within the treatment, implementing the interventions, and collecting data for all

components of the study (e.g., COA, QABF, intervention, procedural fidelity (PF), and interobserver agreement (IOA)).

Settings and Materials

COA sessions for the participant were conducted in the resource classroom where the student typically received instruction in a time frame where the classroom was not being used for instruction. COA sessions were arranged using two identical rectangular tables (0.73 m X 1.46 m) approximately 1.67 m apart from either other, one table for each arranged choice area. The space between the two tables represented the participant making "no choice" during that condition and was used as a neutral space prior to each session beginning while Implementer 2 explained the condition and provided directions. Each table was arranged with two seats available for the student and the adult providing attention to be seated next to each other. Student choice allocation during the COA was measured using the Countee (Gavran & Hernandez, 2020) mobile application.

COA assessment materials assigned to each individual choice condition (i.e., highly preferred items, neutral/low preferred items, task demand materials) were placed on their associated table and were adjusted as the condition changed. High and low preference for tangible items were identified through interviewing the participant and their primary teacher. High preferred items were identified as board games such as Connect Four and tic tac toe, and low preferred items included sensory toys and a Chrome Book. Task demand materials included in the COA were identified through teacher interviews. The tasks selected were required to be within the participants' academic repertoire but were commonly observed to have low levels of work completion. For Max, the task demands during the COA were writing worksheets that were

commonly used in his resource writing services. Writing was reported to be a non-preferred content area for the student but was in his repertoire of skills meeting both criteria to be used in demand conditions of the COA.

The QABF was an indirect measure to hypothesize the function of a maladaptive behavior, such as off-task behavior. This was utilized as a secondary assessment to hypothesize why the function of the target behavior, low levels of task completion. The QABF was comprised of 25-questions focused on identifying the function of a single target behavior, and the informant (in this study the classroom teacher) used a Likert rating scale (3= often, 2= sometimes, 1= rarely, 0= never, and X= doesn't apply) to indicate how often then behavior was observed in various circumstances. The assessment was a single page 21 cm by 27 cm document.

Table 1 *COA Procedures by Condition and Participant*

Choice Area	Participant Max
A: Demand without attention materials	Student sits alone and completes work independently
Materials	Writing worksheet
B: Free play with attention and preferred items	Student plays with therapist and preferred items (no prompts)
Materials	Connect 4, Tic-Tac-Toe, Chromebook
C: Direct play with preferred materials	Therapist delivers prompts on how to play with preferred items (i.e., play my way)
Materials	Connect 4, Tic-Tac-Toe, Chromebook
D: Free play with preferred items and without attention	Student plays alone with preferred items
Materials	Connect 4, Tic-Tac-Toe, Chromebook
E: Demand with attention	Therapist delivers prompts and assistance to complete academic task
Materials	Writing worksheet
F: Alone	Student sits alone in area without any items or activities
Materials	NA
G: Free play with attention and low preferred items	Student plays with therapist with neutral or low preferred items (no prompts)
Materials	Sensory toys (e.g., stretchy jelly noodle or Pop It)
H: Free play with low-preferred items and no attention	Student plays alone with neutral or low preferred times
Materials	Sensory toys (e.g., stretchy jelly noodle or Pop It)

Measurement System and Response Definitions

During COA sessions, the dependent variable was the percentage of time the participant spent in each choice area per session, otherwise referred to as choice allocation. While there were three available choices throughout the assessment (i.e., Choice Area A, Choice Area B, or No Choice) the independent variable was the two arranged choice areas (i.e., Choice A and Choice B) concurrently presented to the student participants. Choice allocation was defined as more than 50% of the participant's body being in a defined choice area with a 3 s onset (i.e., Choice A was coded after the

participant had been in the defined area for 3 s). Examples included the participant sitting at the Choice A table, standing at the Choice B table, sitting on the Choice A table, standing within an arm's length distance of the Choice B table. Non-examples included a participant attempting to take items from Choice A to Choice B.

No choice was defined as having more than 50% of the participant's body move out of a defined choice area, being in the neutral space/no choice area, or the student leaving a choice area and wandering around the room. The following were additional examples of "no choice", (a) any attempt to move an item or activity from one choice area to another was blocked and the student was redirected to the neutral space and told to make a choice again, (b) if the participant successfully moved items to a different choice area and remained in that space for at least 3 s it was coded as no choice, and (c) if the student became unengaged with an item or activity in a choice area for more than 15 s Implementers began coding no choice; however these examples did not occur within this study therefore were never scored. Non-examples included sitting or standing in a defined choice area.

Choice allocation was recorded using the Countee (Gavran & Hernandez, 2020) mobile application on the Implementers' personal electronic devices. When setting up the application three buttons were created "Choice A", "Choice B", and "No Choice" (see Figure 1). Each button was assigned its own color to assist in distinguishing between buttons while coding. Data collectors entered in the total session time for the condition in seconds, which was 300 s, or 5 min throughout all COA conditions. Duration data began when the participant met the definition of choice allocation described above. This was measured by pressing the button associated with the choice area in which the student was

present. If the student changed their mind during the assessment and moved to a different area, Implementers pressed the button again to stop the duration data in that choice area, and started the duration timer for the next choice area approached. Once each session in the COA concluded, the Countee mobile application automatically generated a percentage of time the participant spent in each choice area. Implementers replicated the branching framework created by Casey (2001) to sequence COA conditions and select and compare the stimuli available in each choice area throughout the hierarchical sequence. The COA framework included six possible conditions (see Figure 2). In the framework some condition comparisons are repeated in a different order, so it appears that there are eight total branches when the six possible conditions may be repeated and appear at a different point in the framework. Two choice areas were concurrently available in each condition a hierarchical sequence to assess the value of attention, tangibles, and escape as potential reinforcers to each individual participant. The participant was exposed to at least four choice conditions per COA. To move from one condition to the next within the COA framework, choice allocation data need to yield a differentiation of 70% or more time spent in one identified choice area. This criterion indicated that a participant allocated the majority of their time to one space indicating one choice area as more preferred.

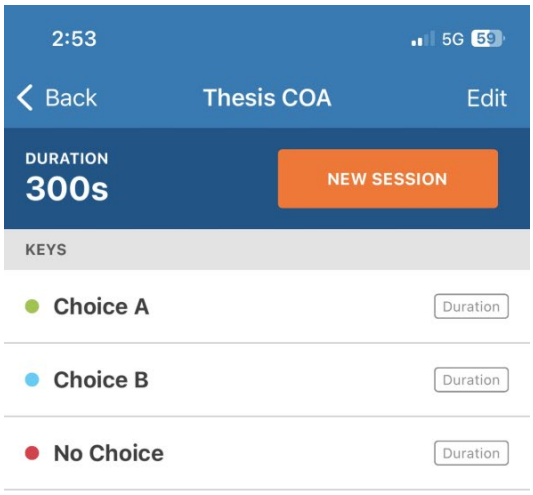

Figure 1 *Countee Mobile Application (Gavran & Hernandez, 2020)*

Experimental Design

The COA conducted used a simultaneous treatments design (Barlow & Hayes, 1979; Lloyd et al., 2020) to concurrently compare the differential time spent, or choice allocation, in the different conditions. Barlow and Hayes (1979) differentiated the simultaneous treatments design from both the alternating treatments design and the multi-treatments design, it is sometimes referred to as a concurrent operants design. This design

is set apart from the alternating treatments design and the multi-treatment design due to the two primary characteristics being to evaluate choice making behavior by concurrently presenting two choices to identify participant preference (Ledford & Gast, 2018). This design was chosen because choice allocation was the primary behavior of interest, and the nature of the COA was to simultaneously present two conditions to further analyze a participant's choice making behavior. Also, the simultaneous treatments design was selected to answer the first research question, which sought to determine if a COA could produce results that were interpretable and could lead to the identification of a potential function-based reinforcer. Condition order was predetermined based on responding in previous conditions (Casey, 2001; see Figure 2) and evaluated the participants' choice allocation when presented with two conditions simultaneously. The overall duration of the complete COA was 20 min. Implementers transitioned to the next condition in the flow chart (see Figure 2) upon the participant allocating at least 70% of their time in one choice area during the 5 min condition. If the student's choice allocation did not meet the 70% criteria for one choice area in a condition, another session was implemented until the criterion was met. The primary threats to internal validity for simultaneous treatments design include multi-treatment interference and procedural infidelity due to the concurrent choices available. Multi-treatment interference was controlled by differentiating the choice areas available. This was done by explicitly stating the rules and expectations to the participant prior to the condition beginning (e.g., You can choose to be in Choice A or Choice B during the next 5 min and can move freely between choice areas). Procedural infidelity was controlled by having clearly defined behaviors for data collectors and training the implementation steps for procedural fidelity to 100% accuracy.

In addition, due to the nature of the COA, the Implementers wanted to be conservative in collecting this data and chose to collect procedural fidelity for the entirety of the COA conducted. The Hawthorne effect was also a threat to internal validity due Implementers being novel stimuli; the was controlled for by having both Implementers present while observing Max during the screening process, however there was limited interaction with the participant during this time. Other threats to internal validity such as adaptation, history, maturation, and testing were less likely due to the short duration of this design. Review Table 2 for a description of various threats to internal validity when utilizing an alternating treatments design (Ledford & Gast, 2018).

Table 2 *Threats to Internal Validity and How Controlled in the Present Study*

Possible Threats	Likelihood	Detect	Attempts to Control	Report
Instrumentation	Likely due to a minimum of one session per condition	Low IOA due to differences in observers	Carefully formulated definitions; train implementers to criterion; discuss and resolve discrepancies	Describe all reliability procedures and results; report reasons for low agreement
Procedural Fidelity	Likely due to a minimum of one session per condition	Formative analysis of direct observational recording of fidelity data	Train implementors to criterion; re-train if necessary; provide supports to implementors such as reminder checklists	Describe all fidelity procedures and results, including training, supports, and re-training
Adaptation	Likely due to novel conditions	Participant behavior varies from the norm; anecdotally	Clearly define each set of concurrent choices	Describe anecdotal evidence supporting the

		determined from primary educator	available in each condition	participant behavior differs from their typical behavior
Hawthorn Effect	Likely when participants are sensitive to perceived desirable behaviors	Participant behavior is inconsistent with expectations when the study begins	Participant will be introduced to primary investigators prior to the study beginning	Describe anecdotal evidence supporting that participant choice making behaviors were due to the Hawthorn effect
Multitreatment Interference	Likely due to each condition having concurrent choices presented; each condition had a minimum of one session	Not detectable via visual analysis	Clearly define choice areas in each condition; explicitly state the instructions for each condition	Describe anecdotal evidence supporting that behaviors in one condition carried over from exposure to the previous condition
Instability	Likely if there is not sufficient understanding of procedures	Visual analysis; participant not making a clear choice; frequently moving between available choice areas	Explicitly describe choice areas available in each condition; provide clear instructions to pick their favorite and move freely if desired; model if needed; repeat condition if criterion is not met	Describe the degree in which data instability within sessions impacted the conditions

Procedures

Screening Condition. Prior to the indirect assessment measure being given out and the COA being implemented, an initial observation was done for the participant. This observation served as our screening condition. All potential participants were referred to the implementers by a Board Certified Behavior Analyst who worked for the school district the present study was taking place in; this individual was also a member of the research team. During this observation the Implementers conducted a brief interview with the participant's teacher to ensure that the student met all inclusion criteria, and observed the student in their natural environment during their typical routine. During this observation, Implementers determined what types of academic tasks produced low levels of work completion to identify academic content to use in conditions of the COA that required task demands. Academic tasks appropriate to use in the COA required observed low levels of work completion (e.g., 50% or less work completion) and confirmation from the participant's teacher that the identified task was a performance deficit not a skill deficit. For example, if it was observed that math was a content area that was non-preferred to the student and they rarely engaged in worksheets with double digit addition, but the skill was in their repertoire, Implementers confirmed with the participant's teacher and identified two sets of double-digit stimuli to use in each intervention condition within the intervention comparison. Additionally, through teacher and student interview Implementers were able to identify potential reinforcers to use in the COA. These reinforcers included tangible items (e.g., tic-tac-toe) and preferred people the student enjoys receiving attention from.

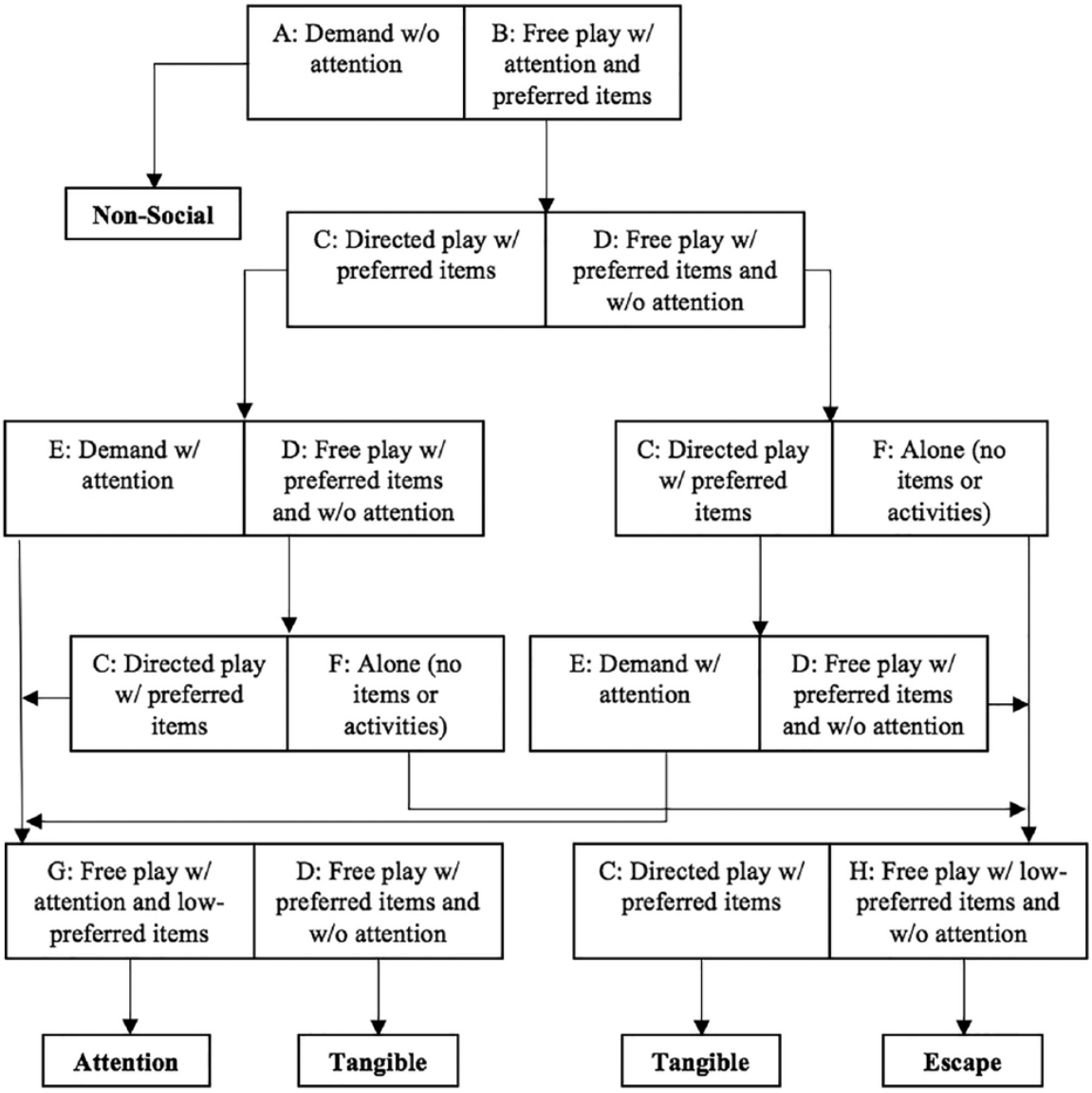

Figure 2 *Decision Framework for Concurrent Operant Analysis (adapted from Casey, 2001)*

Concurrent Operant Analysis (COA). Implementers conducted one COA for the participant. The COA was completed in one 45 min visit. Each COA session required two adult roles, (1) a facilitator and a primary data collector (herein referred to as Implementor 2) and (2) an attention provider and a secondary data collector (herein referred to as Implementor 1). The facilitator role entailed (a) setting up the required

materials for each condition, (b) explaining the available choices in each condition, (c) asking the participant if they had any questions, and (d) prompting the participant to move to the neutral area before making a choice. The attention provider role entailed delivering attention in conditions of the COA that were testing for an attention function and collecting secondary data. Implementers determined who would provide attention based on an interview with the special education teacher. She reported that Max enjoys having any adult or peers' attention but prefers male attention. From this conversation the facilitator and data collector role were assigned to Implementer 2, and the adult attention and secondary data collector role were assigned to Implementer 1.

During each COA condition, two choices were concurrently available to the participant. The room had two clearly defined choice areas that were indicated by arranging two identical rectangular tables at separate sides of a classroom, one being assigned to Choice A and the other to Choice B. There was a neutral space between each table where the participant was brought to prior to the first session of each condition beginning. Implementers used the typical set up of the room to conduct the COA and did not rearrange the classroom space or use tape to mark the two choice areas as previous COA studies have done due to the classroom naturally lending itself to have clear choice areas with space in between the tables to act as a neutral space. Implementer 2 explained the "rules" of the condition. Once the student was instructed to "make a choice" if he moved to the neutral space during the session, it was coded as "no choice". In conditions where attention or prompts were included in one of the available choices, Implementer 1was seated in the corresponding choice area. If the participant chose to be in that choice area Implementer 1 was seated next to the participant while the facilitator, Implementer

2, was nearby observing and collecting data during the condition. Prior to the start of each condition, Implementer 2 brought the participant to the neutral space and explained each choice area that was available to them and that they were able to move freely between the choice areas, and that any items or individuals available had to remain in the assigned choice area (table) throughout the condition. Finally, the Implementer 2 asked the participant if they understood what had been explained to them. An example opening statement from Implementer 2 was "Over here you can work on writing, but Mr. Lane will be sitting with you. And over there you can play with all your favorite toys, but you'll be playing by yourself. You can change tables anytime you want, but the toys and items must stay in their separate areas. Do you have any questions?" After all questions were answered, the COA began, and Implementer 2 prompted the participant to "make a choice" and the 5 min session began. During each condition Implementer 2 reminded the participant once that they were able to switch between choices at any point, this prompt was given on a variable interval 2 min schedule. The procedures were repeated in every condition until the participant had moved through all sequenced conditions in the COA framework.

Indirect Assessment. Implementers used the QABF indirect measure of motivation to collect information from the participant's teacher regarding the hypothesized function of the participant's problem behavior (i.e., low levels of work completion). The QABF consisted of 25 questions and were scored based on a Likert scale. The Likert scale included: 0= Never, 1= Rarely, 2= Some, and 3= Often. Implementer 1stated each question to the teacher and asked them to rate each one using this scale. When questions contained jargon, Implementer 1 used laymen's terms to

explain and if any questions were still confusing a jargon-free example was given to clarify the intent of the question. For example, when asking about item 14, "engages in the behavior when there is something bothering him/her physically, the Implementer stated, "Max engages in the behavior because he was physically uncomfortable, such as his shirt was itching him." Once the questionnaire was completed, Implementers independently scored each section of the document by calculating the total number for each of the questions related to the functions of behavior listed (i.e., attention, escape, non-social/automatic, tangible, and physical). The identified outcome of the QABF (e.g., attention) was used as a reinforcer in one of the intervention conditions in Study 2. Implementers sought to determine if the identified function in a less complex indirect measure of motivation would produce results that increased work completion compared to the outcome of a function-focused preference assessment, the COA.

Reliability and Fidelity

Interobserver Agreement. Implementer 2 served as the primary data collector and Implementer 1 collected secondary data. Prior to the onset of the study, Implementers trained to meet 100% agreement for IOA in the COA sessions. Training was conducted at a clinic associated with their training institution in which data collectors both implemented two COAs using elementary-aged volunteers and collected primary and secondary IOA data in vivo. Both COAs were recorded, and the Implementers continued to practice coding until they met 100% agreement. IOA was collected for 100% of sessions across all conditions in the COA. IOA was calculated using point-by-point agreement. Agreement points were time stamps within a +/- 3 s window based on the time stamp when the student entered a choice area. For example, if Implementer 2

recorded 0:04 as the time in which Max entered a choice area, Implementer 1 needed to timestamp the same choice selection from 0:01 to 0:07 to count as an agreement. IOA was calculated by dividing the number of agreements by the number of agreements plus disagreements multiplying by 100. Any occurrences of IOA falling below 80% agreement were resolved through the Implementers identifying the discrepancies and coming to a consensus decision. Throughout the COA, IOA was 88% agreement (range 66-100%). Condition 1 was the only condition where Implementers did not meet at least 80% agreement. In this condition, Implementers agreed with Max entering choice area B, however, Max briefly got up (10s) and walked around the room to find a different tangible to use in the "free play with preferred items and access to attention" choice area. Implementer 2 coded this as "no choice" as he was not choosing to be in an identified choice area. Implementer 1 did not code "no choice" because he left the area to get something related to the choice area. This was resolved at the end of the session by reviewing the definitions and determining that Max leaving the area counted as "no choice" even though he left to retrieve items related to the choice area. Implementers agreed that he remained in choice area B for the duration of that condition, however, because there were only 3 choices coded (e.g., Choice B, No Choice, and Choice B again) this left Implementers with 66% agreement based on how IOA was calculated.

For the QABF, Implementer 1 was the primary data collector and Implementer 2 was the secondary data collector. IOA was collected using a permanent product. This was measured by using point-by-point summary of the indirect assessment. IOA was calculated by dividing the agreements of items entered correctly and summarized correctly by the number of agreements plus disagreements of items entered correctly and

summarized correctly. Like collecting IOA for the COA, any occurrences of IOA falling below 80% agreement were resolved through the Implementers identifying the discrepancies and coming to a consensus decision. However, this was not an issue in the present study. For the QABF, IOA was 100%.

Procedural Fidelity. Before the study began, Implementers trained to meet at least 80% fidelity agreement in COA sessions. Training was conducted at a clinic associated with the Implementers' training institution. While Implementer 1 was conducting the COA, Implementer 2 scored Implementer 1 on their fidelity in following the outlined steps for the assessment. Both Implementers conducted a COA and coded the other on procedural fidelity. Procedural fidelity data collection included the number of observed implementor behaviors divided by the planned implementor behaviors multiplied by 100. Implementers checked for any discrepancies and resolved them. Training continued until there was 100% fidelity agreement for two COA practice sessions. Procedural fidelity was collected for 100% of sessions and conditions in the COA. Procedural fidelity was recorded based on the occurrence of the following Implementer behaviors for each COA session: a) correct materials were in each choice area, b) each choice area per condition was explained, c) asked the participant if they had questions, d) prompted the participant to go to the neutral space/ "no choice" area before the session began, e) prompted the student to "make a choice", and f) reminded the student at least once a session that they could switch choice areas at any point. Procedural fidelity data were represented as a percentage of correct implementation which was calculated by dividing the number of correct responses by the number of total planned behaviors multiplied by 100. PF for the COA was 100%, with no implementor errors.

Intervention

Settings and Materials

All sessions were implemented in the participants' natural setting for writing group instruction, the resource classroom. Sessions were conducted in a one-to-one arrangement (i.e., the Implementer and the participant) within the resource room while other students were working independently or in small groups on their assigned writing tasks.

Like the COA, task demands for baseline and intervention conditions were identified through observation and teacher interviews. The academic skill selected was required to be within the participants' academic repertoire but were commonly observed to have low levels of work completion. For Max, writing was identified as a task that the student had a motivation deficit with and consistently completed 50% or less of the assigned work given to him (refer to Figure 3). The worksheets given to him were age-appropriate writing directions that required 1-3 sentences, the expectations for each worksheet were communicated in all conditions. The worksheets were provided by the classroom teacher and were part of the regular curriculum used in his classroom, Learning Without Tears (2008). This content would've been required to complete regardless of his participation in the study. Each worksheet has 6-10 questions requiring a complete sentence, the participants primary teacher identified this number of problems was feasible to complete in a 5 min time frame. A digital timer was used to track work time (5 min) and reward time (variable based on amount of work completed; see Intervention section below). When Max was working for tangible reinforcement, Implementer 1 asked him what he wanted to work for. He had full access to choose from

anything available in the classroom and continually chose to work free time on his Chromebook.

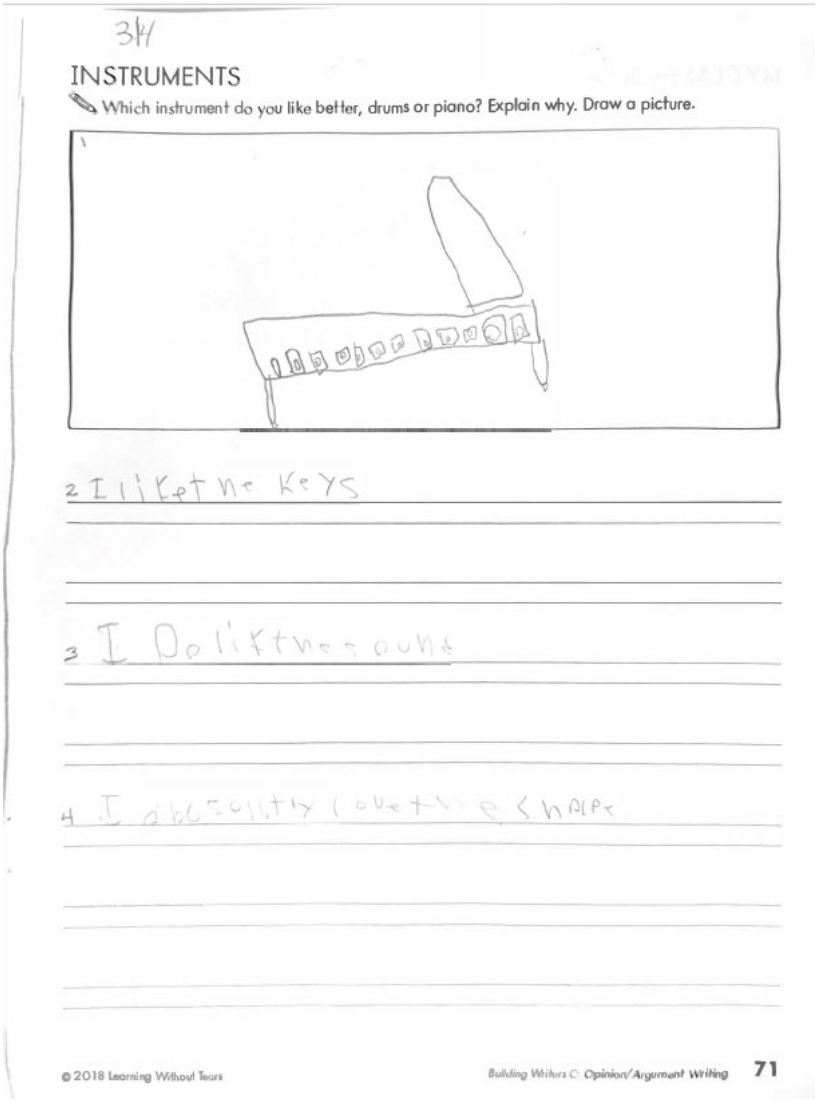

Figure 3 *Example Writing Worksheet (Learning Without Tears, 2018)*

Measurement System and Response Definitions

The dependent variable during the intervention condition was percentage work completion. Work completion was defined as the student answering all identified parts of the directions and writing in complete sentences when instructed to write. The number of

items required per worksheet was explicitly stated on the sheet. Examples directions included ‘Pick your favorite out of two provided choices. Draw a picture of your choice and give two supporting reasons with complete sentences.’ Complete work consisted of the student answering all parts of the directions, writing their choice in a complete sentence (defined below), drawing a picture of their choice, and writing two complete sentences supporting their choice. Non-examples include omitting two supporting reasons in response to instruction asking you to support your decision, not writing in complete sentences, or leaving an item blank.

A complete sentence was defined as including a subject, a verb, and two or more of the following: adjective, adverb, preposition, or noun. Sentences were required to have at least four words and the sentence needs to be contextually relevant to the directions given. Examples included “I like the keys more than the guitar”, “I like red apples”, or “Sparky is a smart puppy”. Non-examples included “I like it”, “I want”, or creating a sentence that meets all aspects of the definition, but it was not contextually relevant to the instructions (e.g., asked about dogs and the sentence discusses crabs).

The expectations set for writing worksheets were individualized to the participant, specifically the number of items per worksheet and the predetermined point value of each task. Implementers consulted the participant corresponding teacher to identify the type of worksheet that would be used, the requirements for each question or item being completed, and the number of checkmarks that could be earned.

Each completed question, based on the definition above, earned one checkmark and each checkmark signified accessed 30 s of a reinforcer based on the independent variable of the condition. It is important to note that the worksheets were not scored for

accuracy, only completion. Work completion was measured using permanent products (i.e., writing worksheet). Permanent products were the best way to measure this behavior because Implementers needed to more easily see if the identified steps per question were taken, if the question was completed, and calculate how many points were earned. By using permanent products, the worksheets doubled as the data collection sheets for Implementer 1 and Implementer 2 (i.e., IOA) illustrating work completion most simply and accurately.

Experimental Design

Throughout the intervention study an alternating treatments design (Ledford & Gast, 2018) was utilized to evaluate differential work completion when earning a reinforcer identified through a COA and a reinforcer identified through the QABF. The alternating treatments design answers demonstration questions (effectiveness) and comparison questions through the rapid and repeated alternation of two interventions (Ledford & Gast, 2018). This design was chosen over other designs due to the rapid alternation of intervention conditions comparing one identified reinforcer to another or a single identified reinforcer to a control condition (extended baseline). Additionally, alternating treatments designs have been proven to be efficient in the school setting due to the comparison of conditions being relatively quick (Ledford & Gast, 2018). This design best aligned with research question three, which sought to evaluate the effectiveness of two reinforcers (demonstration question) by using a comparison analysis (comparison question). In addition, an alternating treatments design was chosen over an adapted alternating treatments design because the dependent variable, work completion,

was a reversible behavior. Reversible behaviors revert to baseline levels of responding upon the removal of an intervention (Ledford & Gast, 2018). This applies to work completion as the removal of reinforcers decreases student motivation to engage in task demands.

In situations where the outcomes of the COA were different than the QABF, there were alternating differentiated reinforcement contingencies in place. If the outcomes of the COA and the QABF aligned, the reinforcer identified was compared to a control condition where the participant was not working for any identified reinforcer but accessed a break where no supplemental attention or tangibles were available. However, for Max, the COA and QABF assessments yielded different results, so this modification was not needed.

The present study began with baseline condition to establish a pre-intervention pattern of responding. The control condition within the intervention comparison represented an extended baseline to help control multi-treatment interference. To move from the initial baseline condition to the intervention comparison, baseline had to have a minimum of 3 stable data points in a contra therapeutic or zero-celerating trend and fell below 50% task completion. In the intervention comparison phase, visual analysis was used to evaluate any differentiation between the COA- and QABF-reinforcer conditions and the control condition. A minimum of four data points per condition (i.e., COA, QABF, and extended baseline/control) were conducted to ensure that Implementers were able to make a minimum of 4 point-by-point comparisons between the data pathway associated with each condition. A clear differentiation in level was needed to signify superiority between interventions. Implementers identified one condition as more effective than another upon the level of work completion being consistently higher across

three or more series of conditions within the same phase (Wolery et al., 2018). Additionally, the superior intervention's data path needed to produce at least 80% work completion across 3 consecutive sessions. The research team hypothesized that the outcome of the COA would produce consistently higher levels of work completion compared to conditions where the outcome of the QABF were implemented.

The primary threats to Internal validity for alternating treatments design include multi-treatment interference and instrumentation due to the rapid alternation of intervention conditions. Multi-treatment interference was controlled by having the stimuli in the different interventions be clearly differentiated. This was done by having the reinforcer being worked for being explicitly stated to the participant and clearly written at the top of the worksheet being given at the start of a session. To add additional components of discriminating stimuli, the reinforcer for each condition was written in a different color (e.g., COA reinforcer was written in blue pen whereas the QABF reinforcer was written in orange pen) and all sessions were randomized, but only two consecutive sessions per intervention could occur. Sessions were randomized a priori by using an online randomizer software, random.org, in blocks of 5 to control data instability and cyclical variability (e.g., alternation effects). Procedural infidelity was controlled by having clearly defined behaviors for Implementers and by collecting procedural fidelity for at least 20% of all sessions for all conditions. Other threats to internal validity such as adaptations, history, maturation, and testing were less likely due to the short duration of the study. Review Table 3 for a description of various threats to internal validity when utilizing an alternating treatments design (Ledford & Gast, 2018).

Table 3 *Threats to Internal Validity for ATD and How Controlled in the Present Study*

ATD	Likelihood	Detect	Attempts to Control	Report
Instrumentation	Likely due to the rapid alternation of sessions	Visual analysis; differences between observers	Carefully formulated definitions; data collected via permanent product; train implementers to criterion; discuss and resolve discrepancies	Describe all reliability procedures and results; report reasons for low agreement
Procedural Fidelity	Less likely due to having consistent procedures repeated	Formative analysis of direct observational recording of fidelity data	Train implementors to criterion; re-train if necessary; provide supports to implementors such as reminder checklists	Describe all fidelity procedures and results, including training, supports, and re-training
Adaptation	Likely due to novel conditions	Participant behavior varies from the norm; anecdotally determined from primary educator	Clearly defined auditory and visual stimuli to differentiate the two separate treatments	Describe anecdotal evidence supporting the participant behavior differs from their typical behavior
Hawthorn Effect	Likely when participants are sensitive to perceived desirable behaviors	Participant behavior is inconsistent with expectations when the study begins	Participant will be introduced to primary investigators prior to the study beginning	Describe anecdotal evidence supporting that participant behavior were due to the Hawthorn effect

Multitreatment Interference	Likely due to rapid alternation of conditions; particularly when minimal time is allotted between sessions	Not detectable via visual analysis	Clearly define conditions with differentiated visual and auditory stimuli	Describe anecdotal evidence supporting that behaviors in one condition carried over from exposure to the previous condition
Instability	Likely if there is not sufficient understanding of procedures	Visual analysis	Explicitly describe conditions and associated protocols	Describe the degree in which data instability within sessions impacted the conditions
Unequal Behavior Difficulty	Unlikely due to consistent work sheets being utilized across all conditions	Author report	Determine expectations and standards for work completion prior to beginning the study	Describe in written report

Procedures

Baseline. All baseline sessions were facilitated by Implementer 1and were a duration of 5 min. Before the session began, Implementer 2 brought the student to an independent workspace and provided instructions for the task presented. Specific instructions regarding the content varied depending on the assigned worksheet (e.g., explaining that each question listed on the writing worksheet needed to be answered with a complete sentence). Implementers explained to the student that it was time to work independently for 5 min, he could do as much or as little work as they wanted, and once

the 5 min were complete, they could sit at their desk quietly for 5 min. No access to attention or tangibles were provided, only access to escaping task demands. Implementer 1 asked if the student had any questions; if he did, they were answered accordingly. If the participant had no questions, Implementer 1 instructed the student to begin working, and a visual timer was set for 5 min. During the session, Implementers were in close proximity (i.e., 1.5 m) but not sitting directly with the student. If the participant asked for help, Implementers responded to the question with minimal attention. Implementer 1 did not respond to any other attempts to access attention (e.g., whining, complaining, laying their head down). No additional prompts to continue working were given during baseline sessions. At the end of every session the participant accessed a 5 min break, and Implementer 1 collected the work sample and independently reviewed the amount work completed for data collection.

Starting at session 4 (i.e., Baseline 2 phase), Implementers began reviewing the previous sessions' work sample with Max. At the start of a session, the implementor presented the work sample from the previous session and awarded checkmarks for each completed item, giving feedback alongside the checkmarks to ensure the student understood why a checkmark was or was not given. This addition was based on feedback from the primary teacher explaining how she provides feedback to her students. She shared that when an assignment was completed, she would provide feedback the next day.

A minimum of three baseline sessions were conducted in the Baseline 2 phase prior to moving into the intervention comparison condition. The specific number of sessions was determined upon the data in baseline remaining stable and work completion

being at or below 50% responding. Baseline sessions were probed every 5 sessions in the intervention comparison as a control condition.

Intervention Comparison. Implementor 1 facilitated each intervention condition, and Implementer 2 collected all IOA and procedural fidelity data. The intervention comparison condition was identical to the baseline condition, except for the addition of checkmarks being given upon the completion of a question allowed the participant access to the identified reinforcers from the QABF and the COA. Checkmarks were rewarded at the end of each 5 min session. The independent variables were the different reinforcers being used following work completion. The primary goal of the intervention comparison was to create two intervention conditions based on the outcomes of the COA and QABF to increase work completion. These intervention conditions only differed with respect to the reinforcer earned for work completion.

At the start of each session, Implementer 1 wrote down what reinforcer was available for that session at the top of the worksheet using different colored pens to add another distinguishing factor to the stimuli. Implementer 1 explained to Max that earning a checkmark meant they had access to the reinforcer that was written on their worksheet (e.g., access to attention from Mr. Lane for 30 s). Next, the Implementer explained how many checkmarks were available (i.e., 8 checkmarks), how the checkmarks were earned (i.e., what steps were required to be completed per problem to earn a checkmark), and when they could be exchanged (i.e., at the end of the 5 minute work session).

During intervention sessions, Implementer 1 conducted all sessions and was the primary data collector. Implementer 2 collected and secondary data (i.e., procedural fidelity and IOA). Each intervention session lasted 5 min and 6-10 checkmarks were

available during each session contingent upon how many items each worksheet had and the participant's work completion. Implementer 1 began each session by reviewing the contingency to remind the participant a) what they would be working for, b) the work requirement to earn one checkmark, c) and when the checkmarks could be exchanged. Then, Implementer 1 asked the student if they had any questions and answered questions as needed. The participant was reminded they could do as much or as little of the worksheet as he wanted. Once Implementer 1 finished reviewing the rules, they started a 5 minute visual timer. Checkmarks were provided by Implementer 1 at the end of a session upon determining if each problem was completed. Once a 5 minute session had concluded, each checkmark earned was exchanged for 30 s of access to the reinforcer corresponding to this intervention condition. Max could earn up to a 3-5 minute break depending on how many items were identified on the specific worksheet given and if he earned all available checkmarks during the session. After the 5 min work session had concluded or the participant completed the entire worksheet, Implementer 1; sat parallel to the Max, reviewed his writing worksheet, and gave check marks while providing feedback on why a check mark was given or withheld. Implementer 1 then calculated how long the participant had access to their reinforcer. A visual timer was set to reflect how long of a break they earned. If a participant had not earned any checkmarks during the session, Implementer 1 indicated the participant had not earned access to their reinforcer but could choose to work for checkmarks in the next session. During the intervention comparison condition, two sessions were implemented daily with 5 to 10 min between sessions. This was determined based on the participant's typical daily schedule and the duration of break periods in between academic tasks. Sessions for

intervention conditions (i.e., COA, QABF) were randomized a priori, but only two consecutive sessions could occur for each condition. Additionally, every five intervention sessions a baseline session was conducted.

COA-based reinforcement. The COA indicated that Max had a clear preference for accessing attention. In sessions where attention was being utilized as the reinforcer, the participant was working for blue checkmarks. Additionally, Implementer 1 explicitly stated at the beginning of each session that he would be working for "hangout time with Mr. Lane", this was also written in blue marker at the top of Max's worksheet. Associating a specific color to this condition added another stimulus to help the participant discriminate between conditions. If checkmarks were earned in this condition, the attention from Implementer 1 was provided to the student for the allotted amount of time. Unlike baseline, checkmarks were given at the end of the session with feedback to explain why the participant received a certain amount of access to their reinforcer. The participant only gained access to Implementer 1's attention, no other components were included (e.g., adult attention was the reinforcer, therefore, no tangible items were available).

QABF-based reinforcement. The QABF indicated Max had a preference for engaging with tangible items. In sessions where tangible items were being used as the reinforcer (e.g., Chromebook), the participant worked for orange checkmarks. Additionally, the specific tangible item chosen to work for per session (e.g., Chromebook) was written in orange marker at the top of the worksheet. If checkmarks were earned in this condition, Max gained access to his requested tangible item for the allotted amount of time. Like the COA condition, checkmarks and feedback were given

after a session was completed. Max gained access solely to the identified reinforcer for this condition, no other components were included (e.g., if attention was earned, no tangibles were included).

Control. An extended baseline (control) was probed in the intervention comparison condition to continue to analyze if the student's level of work completion would return to baseline levels upon the removal of either reinforcer. Control sessions were identical to Baseline 2 sessions.

Reliability and Fidelity

Interobserver Agreement. IOA was collected for at least 20% of all sessions across all conditions. Implementer 1 provided the initial checkmarks for work completion based on the operational definitions for work completion and sentence completion and Implementer 2 independently scored work completion on the same permanent product afterward. The point-by-point method for each item was utilized to score IOA for the writing worksheets. IOA was calculated by dividing the number of agreements by the number of agreements plus disagreements multiplying by 100. Any occurrences of IOA falling below 80% agreement were resolved through the Implementers identifying the discrepancies, coming to a consensus, and then retraining by meeting with the research team (i.e., thesis chairs) and reviewing the permanent product together. Collecting IOA resumed once the Implementers reached 100% agreement in training. As of March 31, 2023, mean IOA was 100% agreement.

Procedural Fidelity. Procedural fidelity for baseline and intervention sessions were trained by practice in vivo coding of planned Implementor behaviors until at least 100% agreement was met. Procedural fidelity was collected for at least 20% of all

sessions across all conditions. During baseline data collection sessions, procedural fidelity was collected on the following implementer behaviors: (a) correct materials being present in the work area, (b) providing feedback and checkmarks based on the previous sessions work completion, (c) an explanation of the work to be done, (d) review of how checkmarks were earned, (e) asking if the participant had questions, (f) starting the 5 minute visual timer, (g) collecting the work sheet upon the completion of the 5 min session, and (h) telling Max he earned a 5 min break to just sit as his desk and relax. Differences in protocol from baseline to intervention made were adding the following steps: (a) writing the reinforcer worked for at the top of the page after being presented the work, (b) providing check marks and feedback immediately at the end of each session, (c) providing the correct reinforcer based on the condition (e.g., attention or tangible), and (d) the total amount of time the student had access to the reinforcer was dependent on work completion. Procedural fidelity data was represented as percentage of correct implementation which was calculated by dividing the number of correct responses by the number of total planned behaviors multiplied by 100. Any occurrences of procedural fidelity data falling below 80% agreement were resolved through the Implementers identifying the discrepancies, coming to a consensus, and then retraining by practicing a baseline/intervention session while being scored. As of March 31, 2023, mean PF was 99% (range 92 to 100%) with Implementor errors consisting of writing the reinforcer associated with the condition at the top of the worksheet prior to the session beginning and providing explicit feedback over why each checkmark was earned.

STUDY 1 RESULTS

COA

Max's COA results are presented in Figure 3. Research question one was, "Can the COA framework produce results that are interpretable and can lead to the identification of a potential reinforcer to increase work completion?" The results of Max's COA showed a strong preference to choice areas where attention was available. This outcome was interpretable and suggests that attention could be used as a reinforcer to increase work completion. During each condition of the COA, Max chose to allocate almost all 5 min to one choice area. As a result, no sessions were repeated within a condition.

In the first condition of the COA, the two choices concurrently available were demand/alone or free play with preferred items and access to attention. Max allocated 97% of his time to engaging in free play/preferred items/attention. This communicated a preference for socially mediated stimuli. In the second condition, Max allocated 99% of his time to accessing attention and engaging with preferred items. It is important to note that in this condition attention was being provided through directed play. For example, the investigator would provide task demands such as, "put the "x" here" while playing tic-tac-toe. This condition indicated a preference for accessing attention, even in the form of demands, and preferred tangibles. Additionally, it provided evidence against the function of his choice making being maintained by escaping demands. In the third condition, Max allocated 98% of his time to the choice area where attention was available, but he was required to work on academic tasks (e.g., writing worksheet). Implementer 1 provided attention by talking with Max while he was completing the worksheet, engaged with him based on his answers (e.g., "I like hot dogs too"), and

responded to any bids for attention (e.g., asking questions). Again, this condition provided evidence against accessing escape and communicated a strong preference toward accessing attention. In the final condition, condition 5, Max allocated 99% of his time to accessing attention and low-preferred items. Items offered as low-preferred were sensory toys (e.g., jelly string noodles or Pop It toys) and the Chromebook. Items offered in the other choice area included highly preferred tangibles such as tic-tac-toe and Connect 4. These results communicated that Max had a clear preference to accessing attention, and provided evidence that attention was more motivating for Max to make a choice than highly preferred tangibles.

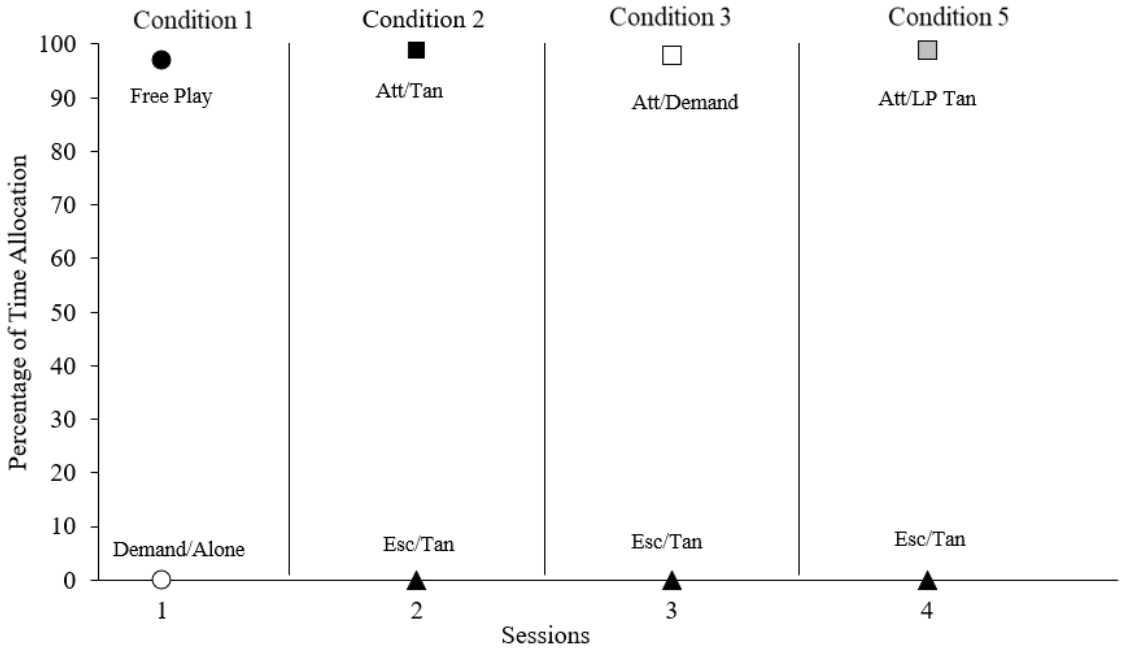

Figure 4 *Results of Max's Concurrent Operant Analysis*

Note. Att = attention; Tan = tangible; Esc = escape; LP= low preferred

QABF

Research question two was, “to what extent does the COA align with the results of an indirect assessment measure (e.g., QABF)?” The results of Max’s QABF, completed by his primary educator, indicated that he was most motivated by access to tangible items. This identified that a complex function focused preference assessment and an indirect measure of motivation can produce different outcomes suggesting two different potential reinforcers to increase work completion.

When scoring the QABF access to attention, tangibles, and escaping task demands were all scored relatively similar. Access to tangibles was scored only one point (11 points) higher than attention or escape (both scored 10 points). While the result of the QABF was not distinctly higher than the other functions being scored, there was still an interpretable outcome that was able to be used in the reinforcer based intervention.

STUDY 2 RESULTS

Baseline

Max's intervention comparison outcomes are presented in Figure 4. The dependent variable was the percentage of work completed per session. Implementers had two sets of baseline data. The first set was variable, the range varied from low (12.5% work completed) to high (71.4% work completed). Upon analyzing the participants' work in the first set of baseline sessions, Implementers determined the definition for work completion needed to be more rigorous. After discussing with Max's teacher her expectations for a complete sentence, and obtained model sentences, Implementers further operationalized the definition for work completion and added an additional step into our protocol to provide feedback before a session began. Implementers re-scored baseline 1 data with the adjusted definition to ensure accuracy across baseline 1 and baseline 2. After implementing Baseline 2 procedures with pre-session feedback on previous work, data collection continued with five additional baseline sessions to ensure stability. While the data still had some variability the range in the level decreased, and all data points fell at 50% work completion or below. There was a decelerating contratherapeutic trend from sessions five to seven, despite the level increase from session seven to eight Implementers determined there was enough predictability in the data path to move into intervention.

Intervention Comparison

Upon the introduction of the COA intervention there was a delayed immediacy of effect from baseline to COA sessions. The COA data path had a gradual stable accelerating therapeutic trend until session four when the data hit ceiling criteria (100%). The data was zero-celerating at 100% work completion for the remainder of sessions. There were 80% non-overlap in the COA data path compared to baseline. When analyzing the introduction of the QABF intervention, there was an abrupt immediacy of effect in the data path. The level of the data were high, stable, and accelerated in a therapeutic trend. At session two the data path hit ceiling criteria and was zero-celerating at 100% work completion for the remainder of sessions. The QABF intervention data had 0% overlap with baseline data.

Implementers continued to collect baseline during the intervention comparison condition. Extended baseline data was variable with the level ranged from low to high. From session one to two there was a decelerating contratherapeutic trend. From sessions two to three the data path was accelerating in a therapeutic direction. Finally, from session three to four the data returned to a decelerating contratherapeutic trend. There was a 75% non-overlap compared to pre-intervention baseline data. Compared to COA data, the baseline data was variable with levels ranging from low to high, and overall, there was 50% non-overlap between COA and baseline data points. When compared to the QABF data, the baseline data had a lower level then QABF data, with 75% non-overlap. Upon analyzing QABF and COA data, both data pathways are stable with an accelerating therapeutic trend. However, there is a significant difference in level in the first three sessions. The level in the COA data pathway were moderate ranging from 33%

to 87.5% percentage of work completed, whereas, QABF data had a high level and ranges from 86% to 100% percentage of work completed. At session four of the COA data, work completion hit ceiling criteria. In sessions four to five both the QABF and COA data pathways were zero-celerating at 100% work completion. There was a 60% non-overlap in the data pathways. Research question three was, “When the outcomes of a COA and the QABF differ, do interventions based on these results lead to differences in independent task completion?”. Through analyzing the two conditions being tested, Implementers can confidently conclude that Max’s results of using the reinforcer identified from the QABF produced higher levels of work completion, indicating it was the superior intervention and more efficient in producing the desired outcomes.

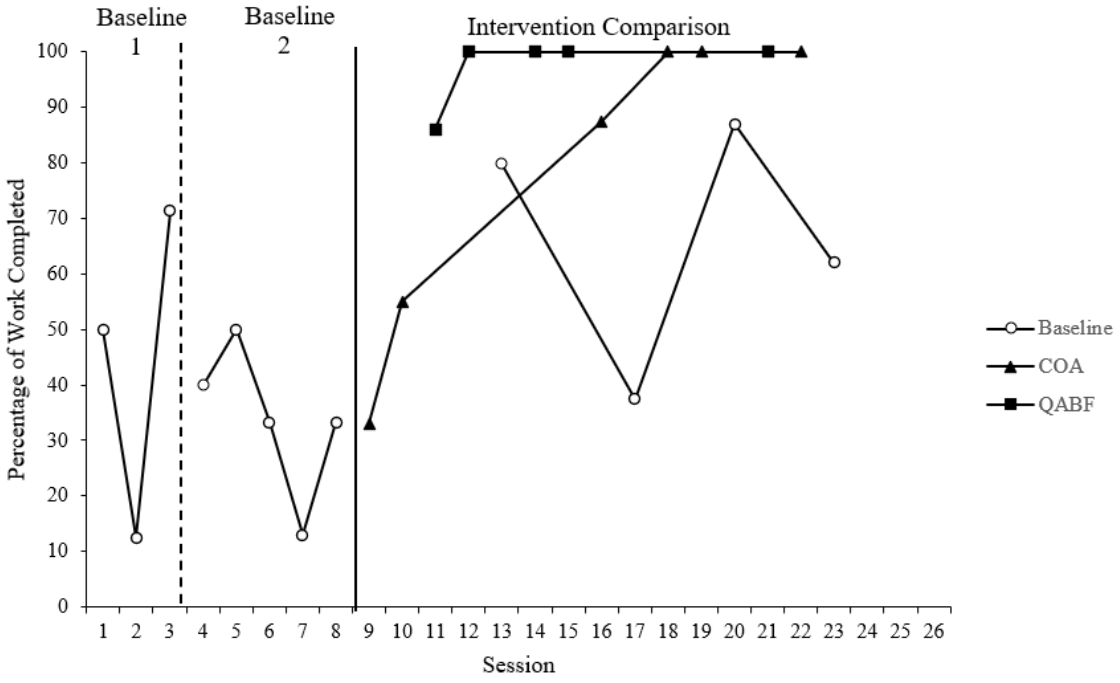

Figure 5 *Effects of Intervention Conditions on Work Completion*

DISCUSSION

The goal of the present study was to determine a) if a COA could produce an interpretable outcome, b) if the outcome of a COA would align or differ from a reinforcer identified through an indirect assessment, and c) would the reinforcers identified through a COA and the QABF produce differences in levels of work completion. While the foundation of this study was created from the work conducted by Lloyd and colleagues (2020) which sought to determine the utility of the COA in identifying reinforcers to use to increase work completion, the current study differed from their research by seeking to compare the results of a COA to the QABF in increasing work completion. Implementers sought to understand if a more complex function focused preference assessment was required to identify reinforcers to be used to increase work completion, or, if a less complex indirect measure of motivation would produce a reinforcer that yielded the same or different (a) outcomes as the COA and (b) outcomes in work completion. The results of the present study supported that when the outcomes of an indirect measure (QABF) and a direct measure (COA) vary, as both reinforcers produced 100% work completion over time. While there was not a difference in superiority between the reinforcers identified in the COA and QABF, the data illustrated a difference in levels of work completion between conditions when reinforcers were available compared to baseline when no reinforcers were available. These results have significant practicality for the field when seeking to identify reinforcers that could increase task completion. Indirect measures of motivation, like the QABF, are often a key component during the FBA process. Likert rating scales and or questionnaires addressing the function of challenging behavior are substantially more feasible for educators to complete compared to finding the time, space, and resources to conduct a more complex assessment like a COA or FA.

While the present study is the first to have compared an indirect measure of motivation and a COA, there is practicality in the results supporting the idea that more feasible assessments can be used to produce higher levels of work completion. The outcomes and setting of this study also indicate significant ecological validity. All assessments and interventions were conducted in the student's typical academic context for receiving writing support. This indicates potential applicability and generality to other students with similar demographics receiving support in similar classroom settings. Additionally, the present study had social validity due to the outcomes having significance to both the student's academic success and to his primary educator's ability to provide reinforcement that is effective to produce desired academic outcomes.

Limitations

Results of this study should be considered in light of the following limitations. First, the primary concern and threat to the internal validity of the findings of Study 1 that influenced Study 2 was the Hawthorne effect. Through teacher interview, Implementers learned that Max enjoyed adult attention specifically from male adults, therefore it was intended that the adult providing attention in the COA would not be a novel individual but an indigenous preferred male adult. This was modified due to a scheduling conflict with the planned adult implementer, and thus Implementer 1 served as the attention provider in both the COA assessment and the COA-intervention sessions. While both Implementers had observed Max in his natural setting during screening and initial data collection, they had minimal interaction with him. Consequently, Implementer 1's attention provided in the COA was novel, potentially affecting the true nature of the participant's behavior in the assessment. The data collected in the COA indicated a clear

preference for choice areas where attention was available to Max. It is likely that Max habituated to this attention after the COA since, upon the introduction of the intervention, data showed that working for the tangible (i.e., Chromebook) was more motivating than working to access attention (i.e., talking with Implementer 1). The initial exposure to Implementer 1 could have produced behaviors in Max that were not typical since he was a novel individual, affecting Max's choice allocation during the COA. Another limitation that plays into the Hawthorne effect was that Implementers did not conduct a direct preference assessment (e.g., paired stimulus) to determine high and low preferred items prior to the COA. Implementers relied on indirect assessments (i.e., teacher and student report) and unstructured direct observation (i.e., natural observation). This was a limitation because the teacher indicated that the Chromebook was his most preferred tangible item, but during the COA the student reported he "didn't really care about the Chromebook". However, when beginning QABF sessions in Study 2, the student only wanted to work for the Chromebook. This correlates to the Hawthorne effect because Implementer 1's novelty was so strong that Max's day-to-day preference to access his Chromebook for free time was altered and it became unpreferred in the assessment.

A second limitation was Implementer 1 was used to provide attention during COA conditions in the intervention comparison. This was a limitation because upon the completion of the study Implementer 1was not able to remain a reinforcer. While our outcome showed that the tangible reinforcer identified through the QABF was more reinforcing, this limitation should be considered in future research. Another limitation in Study 1 was side bias. The Casey (2001) COA framework has a left and right choice area to indicate how to code choice allocation. However, to control for side bias implementers

should have randomized which table represented choice A or choice B so that implementer 1 was not sitting on the same side for all conditions with attention. This evokes the question, was Max's choice allocation because he was interested in the available stimuli or because he had a history of reinforcement associated with one table over another. Finally, randomization was also a limitation to Study 1. The first two sessions of the intervention comparison condition were COA reinforcement sessions when the new reinforcement contingency was first introduced (e.g., work completed influenced the amount of time accessing the reinforcer). The immediacy of reinforcement used in the present study did not align with typical classroom procedures, as work completion was not reinforced in the moment on a day-to-day basis. Therefore, the low-moderate change in level in work completion for the first two sessions of the COA intervention would be a result of the introduction of a brand new contingency.

The secondary threat to internal validity of Study 2 was instrumentation. Specifically, a potential risk for bias in Implementer 2 when scoring IOA. During data collection, each session was scored using a permanent product. Implementer 1 would immediately score the participants' work in front of him once his 5 min timer concluded. The Implementer provided check marks when a question was complete or an "X" if a question was not complete. Data were collected in this nature to provide visual stimuli to indicate that the student had completed the whole question, this information was used in the moment to calculate how many minutes of reinforcement Max received. Implementer 2 scored IOA on the same permanent product after Implementer 1 had scored it. While both Implementers scored Max's completed work by the same definition of work

completion and sentence completion, there was a potential for bias in Implementer 2's data collection since they were not independently scoring the work.

Finally, a threat to external validity was only having one participant. While Implementers identified clear outcomes in the intervention comparisons, few claims can be made about COA and QABF reinforcers being used to increase work completion without additional participant data.

Future Research

COAs are relatively new in behavior analytic literature. Casey (2001) created the COA framework and began this research by comparing the results of COAs to the results from FAs. This framework could be used when designing and structuring COPAs so the stimuli concurrently available systematically align with the functions of behavior to identify and tease apart function-based reinforcers. Lloyd et al. (2020) extended this and branched out by determining the utility of COAs to identify reinforcers to use to increase task completion. This study also conducted two COAs per participant one led by an indigenous adult, and one led by a researcher to investigate if COA results differed based on who was providing attention. It is suggested to consider this in future studies to control for the novelty of new individuals affecting a participant's true behavior. Additionally, researchers should consider implementing a direct preference assessment to identify high and low preferred items to utilize in the COA instead of solely relying on indirect measures. Future research in this area should also determine if the results found in the current study are consistent with other forms of indirect assessment measures, and if these results can be replicated across similar participant demographics. It is suggested that any replications or extensions of the present study should consider a data collection

method to decrease the likelihood for bias when collecting IOA data, such as taking a picture of the unscored writing sample for the secondary data collector to code.

APPENDICES

APPENDIX A

Questions About Behavioral Function (QABF; Matson & Vollmer, 1995)

Student's Name_____ Date: _____

Behavior: _____ Respondent: _____

QUESTIONS ABOUT BEHAVIORAL FUNCTION (QABF)

Rate how often the student demonstrates the behaviors in situations where they might occur. Be sure to rate how often each behavior occurs, not what you think a good answer would be.

X = Doesn't apply 0 = Never 1 = Rarely 2 – Some 3 = Often

Score	Number	Behavior
	1.	Engages in the behavior to get attention.
	2.	Engages in the behavior to escape work or learning situations.
	3.	Engages in the behavior as a form of "self-stimulation".
	4.	Engages in the behavior because he/she is in pain.
	5.	Engages in the behavior to get access to items such as preferred toys, food, or beverages.
	6.	Engages in the behavior because he/she likes to be reprimanded.
	7.	Engages in the behavior when asked to do something (get dressed, brush teeth, work, etc.
	8.	Engages in the behavior even if he/she thinks no one is in the room.
	9.	Engages in the behavior more frequently when he/she is ill.
	10.	Engages in the behavior when you take something away from him/her.
	11.	Engages in the behavior to draw attention to himself/herself.
	12.	Engages in the behavior when he/she does not want to do something.
	13.	Engages in the behavior because there is nothing else to do.
	14.	Engages in the behavior when there is something bothering him/her physically.
	15.	Engages in the behavior when you have something that he/she wants.
	16.	Engages in the behavior to try to get a reaction from you.
	17.	Engages in the behavior to try to get people to leave him/her alone.
	18.	Engages in the behavior in a highly repetitive manner, ignoring his/her surroundings.
	19.	Engages in the behavior because he/she is physically uncomfortable.
	20.	Engages in the behavior when a peer has something that he/she wants.
	21.	Does he/she seem to be saying, "come see me" or "look at me" when engaging in the behavior?
	22.	Does he/she seem to be saying, "leave me alone" or "stop asking me to do this" when engaging in the behavior?
	23.	Does he/she seem to enjoy the behavior, even if no one is around?
	24.	Does the behavior seem to indicate to you that he/she is not feeling well?
	25.	Does he/she seem to be saying, "give me that (toy, food, item)" when engaging in the behavior?

Attention	Escape	Non-social	Physical	Tangible
1. Attention ☐	2. Escape ☐	3. Self-stim ☐	4. In pain ☐	5. Access to items ☐
6. Reprimand ☐	7. Do something ☐	8. Thinks alone ☐	9. When ill ☐	10. Takes away ☐
11. Draws ☐	12. Not do ☐	13. Nothing to do ☐	14. Physical problem ☐	15. You have ☐
16. Reaction ☐	17. Alone ☐	18. Repetitive ☐	19. Uncomfortable ☐	20. Peer has ☐
21. "Come see" ☐	22. "Leave alone" ☐	23. Enjoy by self ☐	24. Not feeling well ☐	25. "Give me that" ☐
Total	Total	Total	Total	Total

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APPENDIX B

COA- Procedural Fidelity

Steps of Protocol	Condition Label							
Countee App is ready								
Gather materials for condition (toys, demand materials, etc.)								
Set Condition								
Move student to the neutral space in between Choice A and Choice B								
Provides instructions to student "You can ____ in choice A or you can ____ in choice B. You are allowed to switch sides whenever you would like. Do you have any questions?"								
Answers questions if any are asked								
Provide statement to start the condition "Alright, make a choice"								
Start 5-minute timer and begin collecting data on the Countee App								
Provide verbal prompt once per condition "remember you can change your mind and go to the other choice at any point" on a VI-2 schedule.								
Once timer, goes off tell student that the condition has concluded and tell them to take break in the neutral area								
Analyze data and ensure 70% of the participants choice allocation was for one Choice area								
Review flowchart and determine next condition								
Number Correct/ Total # Steps								
Percentage Correct								

APPENDIX C

Baseline- Procedural Fidelity

Steps of Protocol	Date + Session							
Have materials ready (e.g., worksheet, pencil, 5-min timer)								
Tell Max it's time to work								
If Max is not at his desk ask him to move to his desk								
Set session by providing and explaining the worksheet expectation (e.g., how many questions there are, writing in complete sentences, how many reasons he has to give, etc.)								
Provide the direction "It's time to start working, you are working for a 5-min break where you can just relax. You can do as much or as little of the worksheet as you want"								
Do you have any questions? If so, answer questions.								
Start 5-min timer								
If Max asks a content related question during the session you are able to engage								
If Max has any bids for attention (e.g., starting unrelate conversation, laying head down, whining, etc.) ignore the behaviors								
Once the 5-min timer is up or Max has completed the whole worksheet, tell him is done working and collect the worksheet								
Tell Max he has accessed a 5-min break and start his timer								
Score the permanent product for work completion (divide the # of questions completed/ total # of questions)								
Start timer for break								
Tell Max his 5-min break is over when the timer goes off								

Provide checkmarks at the beginning of the next intervention session								
Explain why he earned each check mark								
Number Correct/ Total # Steps								
Percentage Correct								

APPENDIX D

Intervention Comparison-Procedural Fidelity

Steps of Protocol	Date + Session							
Have materials ready (e.g., worksheet, pencil, 5-min timer)								
Tell Max it's time to work								
If Max is not at his desk ask him to move to his desk								
Write the reinforcer being worked for on the top of the page								
Set session by providing and explaining the worksheet expectation (e.g., how many questions there are, writing in complete sentences, how many reasons he has to give, etc.)								
Provide the direction "It's time to start working, you are working to ___ (i.e., hangout with Lane, play with toys, or break at the desk). Each checkmark you get at the end gives you 30s with ___. You can do as much or as little of the worksheet as you want, you have 5 minutes.								
Do you have any questions? If so, answer questions.								
Start 5-min timer								
If Max asks a content related question during the session you are able to engage								
If Max has any bids for attention (e.g., starting unrelate conversation, laying head down, whining, etc.) ignore the behaviors								
Once the 5-min timer is up, tell Max he is done working and collect the worksheet								
Score the permanent product for completion in front of Max and providing checkmarks								
Give feedback on why each checkmark counted								
Tell Max how much time he earned with the reinforcer for that specific condition								
Start timer for break								

Tell Max his break is over when the timer goes off								
Number Correct/ Total # Steps								
Percentage Correct								

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