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UNIVERSITY OF CALIFORNIA  
RIVERSIDE

The Use of Metamotivational Vocational Interventions on  
Task Engagement and Productivity

A Dissertation submitted in partial satisfaction  
of the requirements for the degree of

Doctor of Philosophy

in

Education

by

Anneta MingXiu Hsu Phillips

June 2011

Dissertation Committee:  
Dr. Sharon A. Duffy, Chairperson  
Dr. Jan B. Blacher  
Dr. H. Lee Swanson

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2011

The Dissertation of Anneta MingXiu Hsu Phillips is approved:

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*I would maintain that thanks are the highest form of thought; and that gratitude is happiness doubled by wonder. ~G.K. Chesterton*

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*We can only be said to be alive in those moments when our hearts are conscious of our treasures. ~Thornton Wilder*

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## ABSTRACT OF THE DISSERTATION

The Use of Metamotivational Vocational Interventions on Task Engagement and Productivity

by

Anneta MingXiu Hsu Phillips

Doctor of Philosophy, Graduate Program in Education  
University of California, Riverside, June 2011  
Dr. Sharon A. Duffy, Chairperson

The improvement of work behaviors among people with ID is frequently identified as a critical variable to achieving community integration. Individuals with ID exhibit various vocational skill deficits that impact their employment opportunities. The current study examined the effectiveness of three (music alone, music interspersed with auditory prompts, and auditory prompts alone) metamotivational vocational interventions to improve work productivity and task engagement levels in individuals with ID. A randomized alternating treatments design with maintenance and generalization phases was used. During the intervention period participants received each of the three randomly assigned interventions each day for a total of 18 sessions over 6 days. Participants, ages 35 to 61, were included in the study if they had a diagnosis of moderate or severe intellectual disability, evidenced poor task engagement and work productivity, and had the ability to interact without a pattern of persistent or chronic behavior issues. Four of the nine participants improved their productivity and task engagement levels with at least one of the treatments. Although the results did not provide strong support for the prediction that the combination of classical music and auditory prompts would be the

most effective strategy for all participants, the results do suggest that low cost, low tech MP3 players can have a positive impact on task engagement and work productivity for adults with intellectual disability.



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## Chapter 1: Introduction

A powerful treble force drives quality of life outcomes for individuals with intellectual and developmental disabilities (ID). The product of fifty years of interplay between research, policy, and practice is a myriad of social, academic, vocational, and community progress for individuals with ID. Research has empirically demonstrated that vocational interventions, instructional strategies, and behavioral therapies can be effective in enhancing the vocational skill sets of people with ID. Employment figures have confirmed that individuals with ID, including those with the most significant disabilities, are increasingly able to work productively in integrated vocational settings.

Along with research, policy has dramatically expanded the employment opportunities available to people with ID. Principal pieces of legislation include the Rehabilitation Act of 1973 and its amendments (1998), the Americans with Disabilities Act of 1990, the Individuals with Disabilities Education Act (IDEA) of 1990, 1997, and 2004, and the Ticket to Work and Workforce Incentives Improvement Act (TWWIIA) of 1999. Each of these laws has underscored the importance of independence, productivity, and integration of people with ID (Mank, 2007).

The third compelling force that has influenced employment opportunities for people with ID is support of community agencies (i.e., activity centers), special education programs, and vocational rehabilitation agencies. These organizations provide vocational training, assistance in locating and maintaining employment, community experiences, administration of skill and interest inventories, and other vocational preparatory and placement services that have significantly advanced the job skills and opportunities of

people with ID. These agencies provide practical and hands-on training for adults with ID to prepare them to enter various vocational settings. With the practice of vocational teaching, training, and counseling these agencies bolster the vocational endeavors for which some people with ID strive. Research, policy, and practice are all active and vital forces working to improve the quality of life outcomes of people with ID.

### *Current Status of Individuals with Intellectual and Developmental Disabilities*

The American Association of Intellectual and Developmental Disabilities (AAIDD) defines ID as a disability characterized by significant limitations both in intellectual functioning and adaptive behavior. Adaptive behavior is expressed in conceptual, social, and functional adaptive skills. By definition, intellectual disability is manifested before age 18 (AAIDD, 2010).

Although people with ID have benefited greatly from research, policy, and practice, and made great strides in the area of employment, people with ID continue to experience high rates of underemployment and unemployment. In a literature review of post-school employment outcomes for people with ID Harvey (2000) showed that the U.S. Commission on Civil Rights (1983) found unemployment among people with ID to be between 50% and 75% as compared to only 7% among people without ID. In a national investigation of employment and income status of adults with ID, Yamaki and Fujiura (2002) found that the majority of adults with ID had very limited financial resources, even when earnings from employment and benefits from governmental support programs were both included. They reported that 27.6% of adults with ID were employed in any given month in comparison to 75.1 % for the general adult population.

Yamaki and Fujiura noted that most of the employed workers with ID were involved in either service occupations or laborer jobs. They found that individuals with ID who seek employment work an average of 23 hours per week and most work part-time. However, the overwhelming majority of people with ID were unemployed. Boeltzig, Gilmore, and Butterworth (2006) reported that average weekly earnings for people with ID were only \$163 for individual jobs in their study. Mank (2007) reported figures as high as 75% for unemployment or underemployment in the last part of the 2000's. These figures suggest that despite the progress that research, practice, and policy have achieved, high unemployment and underemployment rates for people with ID persist.

Research has shown that individuals with ID, including those with the most significant disabilities, are able to be productive on vocational tasks and work productively in integrated vocational settings. Nevertheless, some employers hold negative perceptions about the ability of people with ID to work productively. This has been identified as a major barrier to successful job placement (Gilbride, Stensrud, Ehlers, Evans, & Peterson, 2000). In general, individuals with severe and profound ID require intensive training and support in order to become productive workers and successfully employed. Some adults with ID exhibit personality and motivational traits that affect their ability to self-regulate, and ultimately, their performance. There is some evidence, however, that suggests that if effective interventions that increase productivity and enhance work behavior are made available to assist individuals with ID, employers' receptivity toward hiring people with ID can be improved (Levy, Jessop, Rimmerman, &



Levy, 1992). Thus, there is a need for research to develop effective interventions that will improve work productivity in persons with severe ID.

### *Personality and Motivation Differences in People with ID*

Researchers who study intellectual disability previously focused mostly on how cognitive processes affect task performance. According to Zigler (2001) IQ is only one of many factors considered in explaining the differences in behavior of people with ID. Researchers look closely at the people's social environments, educational histories, the child-rearing practices used in their homes, and the attitudes, motives, goals, and experiences that they bring to the assessment situation. Zigler suggests that researchers assume that the cognitive deficits of people with ID are so pervasive that they determine their total functioning. He also states that researchers depend so heavily on the cognitive deficiencies of individuals with ID that they tend to neglect environmental events that are known to be central in the development of personality in individuals without ID. Zigler also asserts that improving the performance of an individual with ID on a task is possible through the manipulation of motivational factors.

A comparable perspective, advanced by Switzky (2001) is that the performance of individuals with intellectual disability is generated by a complex interaction between personality and motivational and cognitive processes. According to Switzky (2001) personality and motivational processes are the key factors that drive all other psychological, learning, and self-regulatory processes that support the performance of people with ID. Personality and motivational processes can affect what information is saved in the long-term memory system, how that information is organized, and what

information is utilized to assist people with ID to adaptively and functionally perform in society.

*Personality and motivational traits.* Studies have shown that people with ID exhibit motivational and personality differences when they are compared to individuals without developmental disabilities. The continuous interaction between these traits and how a person responds to the environment either strengthens or hinders preexisting personality and motivational characteristics (Hodapp, 2001).

Currently, there is a paucity of research that examines strategies that motivate people with ID to stay on task (Van Haneghan & Turner, 2001). Staying on task affects productivity levels that are critical to obtaining and sustaining employment. The various personality and motivational traits of individuals with ID make it difficult for them to activate or inhibit the appropriate cognitive, self, and affective systems that are necessary to stay on task or achieve a goal. There are numerous studies that have utilized vocational interventions to improve work performance. However, few of these studies have examined how the motivational and personality differences of people with ID affect their work performance. Interventions that integrate cognitive and motivational components (i.e., attention) to improve task engagement and productivity levels in people with ID may enhance their vocational opportunities. Studies also show that assistive technology (AT) devices are effective in augmenting and enhancing the vocational skill sets of people with moderate and severe ID (Mechling, 2007). These studies used AT devices as part of vocational intervention packages to improve the work performance of employees with ID.

### *Purpose of the Present Study*

The purpose of the study was to evaluate the effectiveness of three vocational interventions on the task engagement time and productivity levels of individuals with moderate and severe ID. The first intervention (Treatment B) utilized an assistive technology device embedded with music. The second intervention (Treatment BC) was a multiple level process that used an assistive technology device embedded with music interspersed with auditory prompts that was coupled with informed and self-control training. Lastly, the third intervention (Treatment C) consisted of using an assistive technology device with auditory prompts and informed and self-control training. Music was not incorporated in the last intervention. A secondary aim of the study was to examine whether the most effective of the three interventions for each participant would generalize to a new setting (e.g., community employment). The following research questions guided the study:

1. Did listening to music on an AT device (i.e., Mp3 Player) lead to improved task engagement times (i.e., number of minutes actively working on a task) and productivity levels (i.e., number of products completed)?
2. Did the combined use of an AT device (embedded with music interspersed with auditory prompts) and informed and self-control training (Treatment BC) contribute more than Treatment B to improving task engagement time and productivity levels in individuals with moderate and severe ID?

3. Was the use of an AT device interspersed with auditory prompts combined with informed and self-control training (Treatment C) more effective than Treatment BC in improving the target behaviors?

4a. Did the use of Treatment BC generalize to a new setting with a similar task?

4b. Did the task engagement time and productivity levels improve in the new setting with the use of Treatment BC?

### *Statement of the Problem*

Employment is one of the key factors that can contribute to the quality of life of adults with or without ID. Gainful employment is a post-school adult outcome that promotes independence and amplifies the economic, social, physical, and emotional health of people with and without ID. Unfortunately, individuals with severe ID have been found to work fewer hours and are less likely than others to be paid at the minimum wage (Jahoda, Kemp, Riddell, & Banks, 2008). High unemployment and underemployment rates for people with ID endure despite intervention research in this area. The gap between the poor employment statistics of people with ID and the progress made by research, policy and practice necessitates the identification of effective interventions that can constrict this gap. According to Mank (2007), the need for an extensive implementation of evidenced based interventions and strategies is accompanied by the need for effective interventions at the individual level.

### *Importance of the Study*

This study is important for four reasons. First, employment can be a critical factor in independence and community integration for adults with intellectual disability.

Employment is a means to economic independence, a route to social identification, and a source for personal networking for people with ID. Enhancing the employment potential of people with ID allows them to take part in and be successful in these significant life activities.

Secondly, despite the progress that has been made in relation to research, practice, and policy on employment of adults with ID, high unemployment and underemployment rates for people with ID persist. People with ID continue to exhibit a number of vocational skill deficits that hinder their ability to be the productive employees that employers are looking for. In addition to these deficits, some people with ID have personality and motivational characteristics that impact their work performance.

Thirdly, there is a need for interventions at the individual level. There should be an emphasis on customizing interventions that consider the specific accommodation needs of an individual with ID. These interventions can be tailored to not only meet the needs of the employee but also the requirements of the employer. Features of a person's disability and components of their vocational responsibilities could be discreetly disclosed to guide the development of these individualized interventions. The current study addressed this need by evaluating the effectiveness of three interventions on the task engagement times and productivity levels of individuals with moderate and severe ID. Improved task engagement time and productivity levels contribute to increased positive vocational behaviors that could improve employment stability.

Lastly, this study utilizes a low-tech, low cost AT device that is commonly used by persons with and without ID. AT devices have been found to improve work

performance by decreasing maladaptive behaviors and increasing task engagement levels (Cihak, Alberto, & Fredrick, 2007). They have been shown to improve productivity by increasing task completion and task initiation skills (Ackerman & Shapiro, 1984) and improve acquisition of new skills (Furniss, Ward, Lancioni, Rocha, Cunha, Seedhouse, Morato, & Waddell, 1999). AT devices have also been used to improve social and work related behaviors (Rigsby-Eldredge & McLaughlin, 1992), and improve independent problem solving skills in people with ID (Davies, Stock, & Wehmeyer, 2003). The current study incorporated vocational interventions to address some of the motivational factors that impact work performance in people with ID, and utilized AT devices to improve their task engagement and productivity levels.

## Chapter 2: Literature Review

The improvement of work behaviors among people with ID is frequently identified as a critical variable to achieving community integration. Skill deficits that affect the performance of people with ID have been identified as difficulty in processing information, poor social judgment, poor ability to communicate, inability to self-regulate, and an inability to reason beyond the here and now (Menolascino & Fleisher, 1991). However, a large body of empirical research supports a conclusion that the vocational skill deficits of people with ID can improve with effective interventions. As effective interventions have been administered, individuals with ID have shown improvement in task engagement levels, task completion rates, skill acquisition levels, behavioral challenges, problem solving skills, and independent task change or sequencing skills (Ackerman et al. 1984; Cihak et al. 2007; Copeland et al. 2000; Davies et al. 2002; Davies et al. 2003; Furniss et al. 1997; Lancioni et al. 1993; Lancioni et al. 1999; Lancioni et al. 1999; Rigsby-Eldredge et al. 1992; Steed et al. 1997; Wacker et al. 1983; Wacker et al. 1985). For example, Graff, Gibson, and Galiatsatos (2006) examined the task completion performance of four adolescents with ID in a residential school classroom. Using a combined reversal and alternating treatments design they found that pictorial (i.e., picture prompts) and tangible reinforcers (e.g., candy, chips, apple wedges) were effective in improving the task completion performance for all four students. Maintenance of the skills or generalization of the intervention to a new setting may not have been examined. In another study, Davies, Stock, and Wehmeyer (2002) used a portable palmtop computer program to improve task accuracy and increase independence

for ten adults with mild, moderate, and severe ID in a community-based program. Independence was measured by the number of prompts required for each step and accuracy was measured by the number of errors made for each vocational task. The tasks utilized in the study included assembly of pizza boxes and software packaging. Maintenance of task accuracy and independence levels and generalization of the intervention to a new setting were not reported. Likewise, Furniss, Ward, Lancioni, Rocha, Cunha, Seedhouse, Morato, and Waddell (1999) used a palmtop computer to improve the task accuracy of six individuals with severe ID at a day center. They examined the percentage of task steps correctly completed. The tasks consisted of assembling aqualung pillar valves and packing boxes. The task accuracy levels of the six participants were maintained for eleven sessions after the intervention period but the generalization of the intervention to a new task or setting was not noted.

### *Personality and Motivational Differences in People with Intellectual and Developmental Disabilities*

Although cognition is vital in the development of vocational skills among adults with intellectual disabilities, motivational factors have also been found to have a strong influence on work performance. According to Reiss (2001) a motive or a desire is a reason for one to instigate behavior. Motives are connected to an end or a goal because it is the end that motivates an individual's behavior. In other words, goals are called ends because they can serve as logical explanations for purposeful behavior. Ends or goals are self-motivating because individuals intrinsically value the goal. Means on the other hand are aimed at accomplishing intermediate goals that eventually lead to satisfying an end



desire. People with and without ID are generally motivated by intrinsic or extrinsic goals. However, many theories suggest that there are individual differences in motivational and personality factors in people with ID that influence their daily functioning regardless of the level of their intellectual functioning (Van Haneghan & Turner, 2001).

Research has shown that individuals with ID exhibit personality and motivational differences when they are compared to individuals without ID. Investigators have found that people with ID are slower to reach automaticity. Merrill, Goodwyn, and Gooding (1996) found in two experiments that people with ID were slower to reach automaticity in tasks requiring them to identify whether pictures were of common or abnormal objects. In their study, the acquisition of automatic processing in adults with and without ID was examined. In the first experiment 24 participants (mean age 18.2 yrs) without ID and 12 participants (mean age 17.4 yrs; mean IQ = 63.2) with ID viewed slides of pictures of objects to determine whether the object belonged to a designated category. The participants without ID decreased their ability to sort the objects into the designated groups with practice which reflected difficulty in the acquisition of automatic processing. In the second experiment 10 participants with ID (mean age 17.7 yrs; mean IQ = 64.7) and 10 participants without ID (mean age 18.5 yrs) searched for designated abnormal shapes in groups containing 2, 3, or 4 shapes. A significant decrease in the ability to identify designated shapes was exhibited in 6 out of 10 participants with ID, but only 1 out of 10 participants without ID. In both experiments, participants with ID required more practice to achieve automatic processing than did participants without ID. Slower

acquisition of automaticity may suggest that people with ID may be slower in compiling plans to meet goals (Merrill et al. 1996).

Merrill et al. (1996) also found that once they learned a routine and it became relatively automatic they had difficulty suppressing that automatic behavior. If individuals with ID are unable to subdue the automatic behavior of one routine then that inability to suppress the automatic behavior may interfere with the performance of a different task. People with ID who possess this characteristic may have difficulty maintaining good work performance.

Another characteristic of individuals with ID is distractibility (Tomporowski & Tinsley, 1997). Merrill and Taube (1996) found that people with ID have difficulty suppressing irrelevant goals. In their investigation negative priming was examined to study the processing of distractor information by adults with and without ID. Participants included 18 adults with ID (mean age 17.8 yrs; mean IQ = 62.2) and 18 adults without ID (mean age 19.1 yrs). Participants viewed various probe displays and the investigators recorded the response times of the participants to identify the target and distractor information. On the first recording all participants were able to identify the targets in the probe display. On the second recording only the participants without ID exhibited inhibition of the distractors and participants with ID did not suppress responding to the distractors. If these irrelevant goals (or distractors) remain active and are not inhibited, then the environmental stimuli that triggered those goals may lead the individual with ID to be distracted from the goal that is currently being pursued (Van Haneghan & Turner, 2001). This characteristic could cause people with ID to either lose track of what they

are working on or they may have difficulty staying on task. Both these outcomes could lead to low levels of productivity in a vocational setting.

People with ID also have a tendency to spend more time thinking about unfulfilled goals (Kuhl & Kraska, 1989). Dwelling on unfulfilled goals takes up processing capacity and makes it difficult for people to pursue other goals effectively. The continuous processing of unfulfilled goals decreases the amount of working memory (i.e., temporary maintenance and manipulation of information) capacity available for other tasks. Working memory limitations and distractibility are factors that could significantly influence work performance. Thus, people with ID should benefit from interventions that redirect their attention to vocational tasks rather than focusing on unfulfilled goals.

Individuals with ID may be less vigilant than their peers without ID. This may be a result of being engrossed in pursuing unfulfilled or irrelevant goals. Working memory capacity plays a role in assisting a person to engage in a particular goal and prevents the automatic initiation of another goal. However, if there is not enough memory capacity to oversee the goal being pursued, then goals activated by environmental cues can redirect behavior in an unintended direction (Van Hanegan & Turner, 2001). This process can increase the distractibility of people with ID and therefore decreasing their vigilance. People with ID are less vigilant in carrying out tasks over time and they are especially disjointed when the processing demands of a task increase (Tomprowski & Tinsley, 1997). The inabilities of individuals with ID to remain vigilant and to be attentive are characteristics that could negatively impact work performance.

Another characteristic of people with ID related to motivation is that they exhibit outerdirectedness, or the tendency to copy the behavior of others, rather than rely on internally generated actions (Dykens, 2001). Research has shown that people with ID are more likely to imitate and model the behavior of others in solving a problem than to use their own skills and abilities to solve a problem. They may attempt to make the other person's actions and intentions their own. Dykens (2001) suggested that they may do this in order to maintain social contact with others and they have a lack of confidence in their own skills. Moreover, some individuals with ID focus on avoiding failure rather than on attaining goals (Hodapp, 2001; Zigler, 2001). Failure avoidance may be detrimental to work performance if an individual works in an environment where the tasks are always changing. If an individual with ID is afraid of completing new tasks for fear of failing it, then this fear will prevent the person from learning new skills that are necessary to perform well in a work setting.

Another characteristic of individuals with ID is learned helplessness. This is defined as having the perception that one has no control over outcomes. This belief leads one to attribute one's failures to uncontrollable factors, which decreases task perseverance following each failure experience (Hickson & Khemka, 2001). Other motivational characteristics, such as low expectancy of success, increased need for social reinforcement, low self-esteem, high anxiety levels, and overdependency have also been found to affect the performance of people with ID (Dykens, 2001; Hodapp, 2001; Switzky, 2001; Zigler, 2001). These characteristics may negatively impact work

performance and hinder people with ID from working at a level consistent with their potential.

### *Motivation and the Environment*

The motivational characteristics of people with ID can interact with the environment and this interaction can negatively impact performance. Hodapp's (2001) research supports the premise that states that there may be an interaction affect or a connection between the genetic disorder of an individual with ID and the higher likelihood of one or more behaviors, to the parental reactions and behaviors of their parents. Hodapp (2001) described an interactional-transactional view which emphasized the need to recognize both direct and indirect effects of genetic intellectual disability disorders. He stated that different genetic disorders predispose people with that disorder to different personality styles and other personal characteristics. These characteristics become exacerbated or diminished by each person's interactions with the surrounding environment. These continuous reactions either reinforce or deny already-existing personality and motivational characteristics (Hodapp, 2001). It stands to reason that the interaction between the individual's environment and his or her traits could impair his or her work performance.

*Executive function deficits.* Along with having motivational and personality differences, research findings have suggested that individuals with intellectual disability also have deficits in executive functioning (Watson & Westby, 2003). Executive functions are defined as a set of control functions that guide and regulate cognitive behavior (e.g., paying attention, remembering information) and social behavior (e.g.,

being polite around people you do not like). Deficits in executive functions are manifested as self-regulation difficulties, poor attention, distractibility, and difficulty with organization and planning (Barkley, 1997). Some students with executive function deficits are unable to internalize the skills necessary for executive functioning (Russell, 1997). These deficits could also diminish work performance.

Thus, there is a need for interventions to assist individuals with ID in ameliorating the affects of the deficits in executive functioning and motivational characteristics on their work performance. Zigler (2001) suggested that researchers have relied so heavily on the cognitive deficiencies of people with ID that they have overlooked environmental factors that are known to be central to the development of personality traits in people with normal intelligence. He suggested that practitioners can improve the work performance of a person with ID through the manipulation of motivational factors, as long as performance on the work task is directed by cognitive as well as motivational factors. Strategic changes in motivation can result in successful employment at an occupation that has cognitive demands within the limits of a person's intellectual ability (Zigler, 2001). Russell (1997) suggested that the focus of the intervention should be to structure the environment as much as possible and provide external prompts to facilitate appropriate behaviors. Other strategies that have been found to be effective in improving the domestic and academic performance of individuals with ID are cognitive modeling (the investigator models the thinking process out loud) and verbal mediation (student uses language overtly and covertly to regulate behavior) (Brown et al., 1981; Lima & Abreu-Rodrigues, 2010). These strategies are discussed further in the present study section.

### *Metamotivation*

Cognitive abilities and motivational factors have been viewed by psychological researchers as the two fundamental types of determinants of performance (Zigler, 2001). A third class of variables has been examined in recent years. One of these variables includes metacognitive processes that coordinate the cognitive skills involved in memory, reading, and text comprehension (Brown, 1978). Another variable that falls in this class is metamotivational processes. Metamotivation encompasses higher-level skills that control motivational processes. These skills are based on metamotivational knowledge or knowledge regarding one's own motivational functioning (e.g., what thoughts produce an increase or decrease in motivation, what environments contain personal incentives, etc.) (Kuhl & Kraska, 1989).

Research has found that children use different kinds of strategies to control their own motivation and task performance. Kuhl (1986) examined various strategies people with ID use to sustain attention to a task. The first strategy examined was attention control. This strategy enhances the cognitive preference for working and hinders the cognitive preference for playing by directing attentional resources towards an intention or goal. Attention control consists of attention selectivity which contributes to processing goal-supporting information and inhibits processing of information unrelated to the intended goal. Specifically, attentional selectivity is a metamotivational skill that consists of focusing attention toward stimuli that are connected to accomplishing a goal and veering away from distractors (Kuhl, 1986). A second metamotivational strategy is motivation control. Motivation control enhances the activation of the emotional

preference for working and decreases the emotional temptation for playing. A third metamotivational strategy is environmental control. This strategy occurs when individuals set up the environment to increase the likelihood of successfully accomplishing a goal. Attention control, motivation control, and environmental control could increase the likelihood that people with ID will successfully perform their intended action and self-monitor their behavior (Kuhl & Kraska, 1989). In other words, these strategies could be used to develop interventions to support people with ID in improving their vocational skills and work performance.

There is some evidence that people with ID have the ability to effectively use some of the metamotivational skills mentioned by Kuhl. For example, Levine and Langress (1985) noted that people with ID often succeed in grocery shopping by using environmental control. They observed that they arrange their environment in such a way that assists them in accomplishing their goal. They found that people with ID will go to the same cashier each week so they know for sure that they will be taken care of at the market, or they will bring large sums of money to avoid problems associated with not having enough money to purchase their groceries. Metamotivational strategies can be used to assist people with ID to improve their ability to attend to task related functions and the strategies can be incorporated into vocational interventions to improve work performance in people with ID (Kuhl & Kraska, 1989; Switzky, 2001; Van Hanegan & Turner, 2001).



### *Motivation and Attention*

Attention and motivation have been linked by some researchers (Brown & Pessoa, 2007; Mogg, Bradley, Field, & De Houwer, 1998). Brown & Pessoa, (2007) examined the interaction between motivation and attention and they found that stimuli carrying motivational significance engaged a person's attention. Elevated motivation leads to improved efficiency in directing and redirecting a person's attention. In other words, attention is sharpened when salient motivational conditions are present (Posner, Snyder, & Davidson, 1980). Attention and motivation can influence a person's work performance if the task they are working on is not motivational then that person's attention can shift from the unmotivating task and transfer their attention to something he/she views as more interesting (e.g., food).

*Issues of motivation and attention.* Moreover, motivation is relevant to attention because goals direct people to pay attention to specific elements of stimuli, and motivation helps individuals sustain vigilance in completing a task. Three issues are important when motivation and attention are considered together. The first is that the process of attention may not be a conscious behavior. Therefore, it is possible that there are motivational factors that are driven by environmental cues that stimulate attention preconsciously (Bargh, 1990). For example, people who are working might listen to a type of music that is invigorating and gives them enjoyment. As a result they may work faster, or perhaps slower, than they would have if they were not listening to music. A second motivational issue is that external cues in an environment can stimulate different goals (Tomporowski et al., 1997). This implies that there may be preconscious goals that

are prioritized by importance and as a result, goal shifting may occur during a task. For example, while an individual is working, a neighboring group of coworkers might abruptly start laughing or talking loudly. The individual may stop working to listen in on the conversation because he/she is curious about what is causing the commotion. A third issue is that a goal generally has many sub-goals and these goals can further direct attention and behavior in certain ways (Tomprowski et al., 1997). For instance, an individual may have a goal of finishing as many products as possible within a certain time period, but he/she may also have a sub-goal of pleasing his/her supervisor. Instead of working faster, the sub-goal may cause the individual to slow down his/her work pace because he/she is focusing on precisely positioning the materials. This may lead the individual to persevere on the proper positioning of the materials rather than moving on to completing the next product.

*Types of attention.* Attention control is a key component to the ability of a person with ID to self-manage his or her behavior (Shapiro & Schwartz, 2000). Self-management skills enable individuals to select and maintain behaviors to accomplish the intended goals. Self-management of attention includes controlling one's actions by focusing one's attention on a task, while avoiding giving attention to distractors, and resisting temptations. Self-management of attention consists of the ability to organize incoming stimuli, delay gratification, tolerate change, and provide the necessary cognitive and behavioral response to goal related stimuli (Luszczynska, Diehl, Gutierrez-Dona, Kuusinen, & Schwarzer, 2004). According to Tomporowski & Tinsley (1997), there are three types of attention. The first kind of attention is focused attention.

Focused attention is the ability to respond discretely to specific visual, auditory or tactile stimuli. This type of attention involves selective processing of information or determining which stimuli receive additional processing and which stimuli do not. The second type of attention is sustained attention and this is the ability to maintain a consistent behavioral response during continuous and repetitive activity. This type of attention involves vigilance or paying attention to a task over an extended period of time. The third type of attention is divided attention. Divided attention is the highest level of attention and it refers to the ability to respond simultaneously to multiple tasks or multiple task demands. This involves processing two or more sources of information (Tomporowski & Tinsley, 1997). Furthermore, Kuhl (1986) explains that attentional selectivity is a metamotivational skill that can be used to train individuals with ID to manage their attention. Selective attention is the ability to maintain a behavioral or cognitive position in the face of distracting or competing stimuli. Attention selectivity contributes to the processing of goal-supporting information and inhibits processing of information unrelated to the intended goal. Therefore this type of attention injects a level of freedom from distractibility. These types of attention make up some of the skills necessary for an individual to manage their behavior. These types of attention need to be understood in order for one to develop interventions that will properly reinforce skills that may improve work performance in individuals with ID.

### *Music and Motivation*

Several beneficial effects of music listening on the behavior and development of people with and without ID have been demonstrated. Different types of music have

varying affects on individuals with and without ID, but research suggests that music listening may motivate people with and without ID to improve their academic and work performance. A study by Hallam and Price (1998) examined effects of providing background music in the classroom on the behavior and performance in mathematical tasks of ten children attending a school for children with emotional and behavioral challenges. The study found that there was a significant improvement in behavior and mathematics performance for all children when background music was used during the lesson. The effects were especially powerful for those whose problems were related to constant stimulus-seeking and over-activity. Other improvements in behavior that were observed in the children were improved cooperation and a reduction in aggression during the lessons following the completion of the study (Hallam & Price, 1998).

Scott (1970) found that four students with hyperactivity were more productive on arithmetic tasks when background music was introduced into the normal classroom setting. In another study, Savan (1996) found that ten children with special needs became calm and cooperative when classical music (e.g., Mozart) was played in the classroom. Prior to the intervention the students exhibited angry and disruptive behavior during the lessons. However, while the music was being played Savan noted significant improvements in their behavior.

There is also evidence of beneficial effects of music listening on work productivity. A study by Oldham, Cummings, Mischel, Schmidtke, and Zhou (1995) examined the relationship between stereo headset use and employee work responses. The employees (n = 75) in the treatment group used the headsets for four weeks and the

remaining employees (n = 181) were not allowed to use the stereo headsets. They reported that employees in the stereo condition exhibited significant improvements in performance, organization satisfaction, and mood states. They also found that employees in relatively simple jobs responded most positively to the stereos. In another study, Lesiuk (2005) measured the effect of music listening on affect, work quality and time-on-task of computer information system developers. The results for the study indicated that positive state affect (e.g., mood) and quality-of-work scores were lowest with no music, while the time-on-task was the shortest when music was removed. In other words, they were in a bad mood, exhibited poor work quality and their work performance slowed down when the music variable was removed (Lesiuk, 2009). Based on the research reviewed above, there is evidence that music listening can improve academic, behavioral and work performance in children and adults with and without ID in school or vocational settings.

#### *Assistive Technology (AT)*

Numerous studies report that assistive technology (AT) devices are effective in improving work performance in people with moderate and severe ID. An assistive technology device is any piece of equipment that is customized and used to increase, maintain, or improve functional capabilities of an individual with a disability. AT devices meet the visual, auditory, and tactile sensory needs of people with ID. There are two levels of AT devices that have been used as self-management tools, including: low tech devices (e.g., picture prompts, picture schedules, recording devices, vibration devices) and high tech devices (e.g., Palmtop PCs, computer-based systems).

According to Mechling (2007), assistive technology devices have been used as a self-management strategy for controlling antecedents used by individuals with ID to influence their own behavior. This occurs when the control of the behavior is transferred to a prompting device controlled by the individual with ID. Mechling's (2007) literature review examined forty investigations that used assistive technology devices as self-management tools for people with ID. She analyzed studies that included pictorial prompts, tactile prompts, auditory prompts and computer-aided systems. She found that assistive technology devices have enhanced the independence of people with ID. These strategies have also decreased the need for constant monitoring and prompting by others (Alberto, Taber, & Fredrick, 1999; Allen, White, & Test, 1992; Grossi, 1998; Mechling, 2007). These antecedent self-management strategies can prompt or direct a person's behavior by using stimuli such as pictures or audio cues that are introduced before the occurrence of a behavior without needing another person to be present. These antecedent cues can enhance performance, improve fluency of responding (e.g., productivity), and foster maintenance of skills already acquired (Bambara & Ager, 1992; Furniss et al. 1999; Lancioni & O'Reilly, 2001; Mechling, 2007).

Researchers have found that adults with ID prefer to use assistive devices that allow them to work more independently. For example, a study by Reid, Parsons, and Green (1991) offered three adults with multiple disabilities the choice of two working conditions that varied by the availability of assistive technology devices. They found that the participants chose to work more often in the condition in which their accustomed assistive device was available, decreasing the amount of job coach support they needed.

Therefore, AT devices can be used to improve work performance in individuals with ID.

AT devices has also been known to improve task engagement levels in people with ID.

*Constructive task engagement.* Constructive task engagement is defined as the amount of time a person effectively attends to a task. Being able to remain constructively engaged in a task is an important employment factor for a number of reasons including: it encourages adaptive responses and decreases withdrawal or behavioral problems, it enhances sensory input, it improves general image and social status, and it increases job opportunities within community environments or within current work contexts (Lancioni, O'Reilly, & Oliva, 2001). Cihak, Alberto, and Fredrick (2007) examined the task engagement levels of four participants with moderate to severe ID at a community-based vocational training site. Their study compared the effectiveness of a self-operated auditory prompting (SOAP) device against differential reinforcement of alternative (DRA) behaviors. Both SOAP and DRA were effective at decreasing target behaviors and increasing task engagement levels for all students. The self-operated auditory prompting device was considered more socially acceptable than the DRA. Maintenance of the results and generalization to a new condition were not reported and may not have been examined.

In a study by Grossi (1998) two AT devices were examined to assess their effectiveness on the task engagement time of two employees with severe ID using a reversal design. The study evaluated the effectiveness of a self-operated auditory prompting system comprising of musical tapes interspersed with auditory prompts and a computer-based system consisting of a palm-top computer, an auditory output device,

and a vibration box on the task accuracy and length of time on task. Results indicated that task fluency, accuracy, and length of time worked increased for both employees with ID. The study did not examine whether it was the combination of the music and auditory prompts, the music alone, or the prompts alone that improved performance. The report also did not mention the type of music that was used with the participants. It was reported that the employees maintained these self-management strategies 1-4 months after the intervention period, but generalization to other tasks or another setting was not examined.

Lancioni, Van Den Hof, Boelens, Rocha, and Seedhouse (1998) reported that a computer-based system consisting of a palm-top computer, an auditory output device and a vibration box was more effective than the card system in promoting correct task performance for all three employees with severe ID at a day activity center. Again, maintenance of skills and generalization of the intervention were not noted in the study. In a similar study using an A-B-A design, Lancioni, O'Reilly, Van den Hof, Furniss, Seedhouse, and Rocha (1999) reported that a computer-aided system was more effective than a card system in improving the number of task steps performed correctly without intervention by the experimenter with four employees with severe ID at a day activity center. Maintenance of the skills was reported but the study did not provide the actual time the skills were maintained after the completion of the intervention and generalization of skills was not noted in the study.

*Task Completion.* AT devices have also shown to improve productivity levels in people with ID. AT devices have improved productivity levels of people with moderate



and severe ID by increasing their task completion and task initiation rates. Lancioni, Van den Hof, Furniss, O'Reilly, and Cunha (1999) used an alternating treatments design to examine the performance of four employees with severe ID. They found that 3 of the 4 employees reached percentages of correct responses above 90% using a portable computer-aided system. They also reported that clustering instructions worked better than omitting instructions and clusters assisted employees to maintain high percentage levels of correct performance. Neither maintenance of skills after the completion of the intervention nor generalization of skills to a novel condition were reported.

Another study that examined the work productivity levels of people with ID using a multiple baseline across subjects design, found that productivity levels increased for five participants with mild, moderate and severe ID at a community-based sheltered workshop (Ackerman & Shapiro, 1984). The intervention utilized a self-monitoring device consisting of a grocery store counter to assist the participants to keep track of the number of packages that were completed. It was reported that verbal praise and physical encouragement was also used to improve productivity levels. However, it was stated that productivity levels were not maintained over time and generalization was not reported.

Copeland and Huges (2000) examined the productivity levels of two individuals with severe ID. They used a multiple baseline across subjects design to evaluate a picture prompt strategy on task completion levels. Both participants showed a positive, but modest change in level. There was an immediate increase in independent task initiations for both participants as well as increased rate of independent task completions in both participants.

Lancioni et al. (1993) drew similar conclusions in a study that examined the use of an AT device consisting of a Casio watch, a box of cards showing pictures of activities, and reinforcement items. The watch was effective in increasing the independent activity engagement time of two subjects with severe ID at a workshop in a residential unit. Maintenance of productivity levels occurred during the maintenance phases, but generalization of the skills was not reported. In contrast, a study by Steed et al. (1997) reported that maintenance of skills occurred up to six months and generalization of the intervention and improved productivity levels occurred across settings. They focused on improving productivity levels for one participant with profound ID at a local senior community center and found that picture prompts in a picture book were successful in increasing the percentage of steps completed for each of the custodial tasks required of the participant.

Although the above studies used AT devices to improve the task engagement time and productivity levels of people with moderate and severe ID, little is known about how well the interventions assisted their participants to maintain and generalize the improved task engagement and productivity levels. This study examined the relative effectiveness of different intervention components and also the generalizability of the most effective intervention, i.e., how well the intervention was generalized by an individual and how well the individual maintained task engagement and productivity levels in a new setting.

### *The Present Study*

The traditional path of intervention studies with individuals with intellectual disability is to place emphasis on intervening to improve performance. This study

considered the prerequisite skills (i.e., the ability to self-control, self-monitor and self-evaluate) in the development of the interventions used to support people with ID to improve their work performance. Participants were those who had been identified by supervisors as having poor attention and low productivity. In the current study motivational factors were included in the design of the metamotivational vocational interventions to motivate the participants to stay on task. According to Zigler (2001) and Switzky (2001), a motivational approach holds the promise of informing practitioners how to assist people with ID to use their intellectual capacity to the fullest potential.

Moreover, the majority of studies on assistive technology have focused on improving task engagement or improving productivity, but few studies have examined both of these constructs in one investigation. The metamotivational vocational interventions used in this study incorporated motivational factors that were examined in relation to their impact on both task engagement and productivity levels. Furthermore, few intervention studies that have used AT devices have examined generalization. In the current study, the impact of an AT device and training strategies (i.e., informed and self-control training) on both generalization and maintenance of the desired behaviors were examined.

*Informed and self-control training.* According to Brown, Campione, and Day (1981) there have been various investigations that have looked at the use of instructional routines to help students learn to learn. Informed training is one of those instructional routines that have helped students improve their own learning (Kennedy & Miller, 1976; Belmont, Butterfield, & Borkowski, 1979; Ringel & Springer, 1980). Informed training

refers to intervention studies in which the students are explicitly told the rationale and significance of the to-be-learned strategy. Self-control training is another type of instructional strategy used to teach students how to monitor and improve their own learning. Self-control training involves explicit instruction in how to use, employ, monitor, check, and evaluate the strategy being used. Few studies have employed the combination of the two strategies to enhance academic or work performance (Brown, Campione, & Day, 1981). Brown, Campione, & Barclay, (1979) found that informed-plus-self-control training was effective in improving recall and readiness skills in children with mild intellectual disability. Informed-plus-self-control training was used to train individuals with ID to control their attention so they could improve their performance. The components in the informed and self-control training were used to help people with ID improve distractibility and vigilance issues that affected their task engagement and productivity levels.

In a study that involved informed and self-control training Brown et al. (1981) used a combination of the strategies to improve academic performance in individuals with ID. The study consisted of two groups of trainees. The older children that received the informed and self-control training improved their performance significantly (from 58 percent correct to almost perfect accuracy), whereas students in the control condition did not. The effects of the training lasted over a year. However, the younger children did not benefit from the training. They improved only on the first post-test, which was prompted (i.e., the experimenter told the children to continue using the strategy they had been taught). Without the prompts their performance did not significantly improve. They

found that the older students who were successful on the recall-readiness study were also able to transfer strategies learned from the laboratory to a school-like situation. Brown et al. (1981) concluded that in order for students to maintain and transfer a learned strategy, they must be aware of the purpose and significance of the training, the relationship between the learned strategy, and the possible applications of the strategy. Based on evidence that informed plus self-control training can enhance performance and improve generalization to another setting, the current study evaluated the effectiveness of interventions that not only utilized an AT device embedded with music and/or auditory prompts but also incorporated components of informed and self-control training.

Verbal mediation has been shown to be effective in improving behavior in people with ID. Verbal mediation, or the relationship between verbal (i.e., what a person says) and nonverbal behavior (i.e., what a person does), was described more than forty years ago by Risley and Hart (1968). Risley and Hart (1968) studied the effects of altering non-verbal behavior by reinforcing related verbal behavior. Risley et al. (1968) found that there was a high correspondence between what children said and what they did when the children were reinforced for the non-verbal behavior that followed the verbal behavior. More recently, the procedures involved in verbal mediation have been investigated by several researchers (e.g., Baer, 1990; Lloyd, 2002; Paniagua, 1990). Verbal mediation can be used as a strategy to direct future non-verbal behavior by what a person initially verbalizes. Research has shown that there is a positive correlation between saying and doing (Lloyd, 2002). Based on these findings verbal mediation was incorporated into the self-control training of the interventions.

### *Study Objectives*

The goal of the study was to determine whether a low cost, low tech AT device that is familiar to adults with and without ID can increase their productivity and task engagement performance in the workplace. The interventions in this study that utilized an Assistive Technology (AT) device are based on empirical studies reviewed in this chapter, including music, auditory prompting, and a combination of music and prompting. The study design made it possible to examine the relative impact of music or auditory prompts, or a combination for each participant. Environmental control included an assistive technology device that was intended to assist participants with ID to improve their work performance. The current study utilized a single subject design that examined three interventions that were administered to all participants over three months. The effects of coupling the use of an AT prompting device that was embedded with music and/or interspersed with auditory prompts and informed and self-control training on the task engagement time and productivity levels of nine individuals with moderate and severe ID are presented in the succeeding chapters. The design made it possible to address both maintenance and generalization and to determine whether there were individual differences in the effectiveness of the different interventions.

## Chapter 3: Method

### *Sample*

Participants were identified from a population of 170 clients at a public work activity center in Southern California. The Center is one of five work activity centers operated by a non-profit organization that provides vocational services (i.e., job training) to adults with intellectual disabilities (ID). The organization also operates adult developmental centers for adults with ID who are just beginning to learn vocational skills. The overall goal of the organization is to prepare adults with ID for employment and community integration.

The Center serves adults with ID that are age 18 and older. Because California requires public school districts to offer vocational programs for students that are between the ages of 18 and 22, many students with ID choose to stay in the public school programs until they turn 22. As a result, the majority of clients at the Center are older than 22 years old.

The Center clients are supervised by production supervisors and production aides. The production supervisors and their aides ensure that the job tasks are followed according to the task description provided by the contracting agency. It is also their responsibility to make sure that required supplies are available at all times. The production supervisors and the aides control for the quality and quantity of products produced by each client. They assist with preparing the jigs used to help the clients count out the pieces they need to complete a task, and they track the start and end times of work sessions for each client. Production supervisors are also responsible for calculating how

much clients earn each day. This information is submitted to case managers and the accounting office.

Each client is assigned to one of five case managers that work at the Center. The case managers also keep track of the clients' daily work performance (i.e., productivity levels) by inputting and tracking the progress on their daily productivity levels in their respective electronic files. Clients are expected to maintain a certain level of productivity that is determined according to the client's level of ability. This is one way for Center staff to see whether clients are maintaining, accelerating, or falling below their average rate of production, and whether a client might need assistance in improving his/her production levels. The case managers also assist the clients and their respective individualized transition teams with developing vocational goals and tracking their progress on these goals. Lastly, case managers assist clients with vocational or personal issues.

The Center's principal funding sources are from the State Department of Rehabilitation, Habilitation Services, the Regional Center that serves the area, United Way, contracted work, and private donations. Center clients are paid for each piece they produce. Most clients work 7.5 hours a day, five days a week.

A typical work day at the Center starts at 8:30 a.m. when information is provided on how to complete the day's jobs and work assignments are made. Clients are grouped by ability levels and preference for job supervisors. Work begins as soon as all materials have been set up for the assembly process by the production managers and aides. The



Center has a large room for clients to have lunch and breaks. At 3:00 p.m. they wrap up their tasks and end the day at 3:15 p.m.

Permission to conduct the study at the Center was acquired from the executive director of the organization and the director of the Center. Once permission was granted to conduct the study, a list of clients who met the following criteria was provided by the case managers.

*Eligibility criteria*

Study participants met the following criteria:

- a diagnosis of moderate (IQ 35-55) or severe (IQ 20-40) mental retardation (American Psychiatric Association, 2000),
- evidence of poor task engagement (defined as exhibiting difficulty in staying on task) as indicated by Center staff records and observations,
- evidence of poor work productivity (defined as low levels of task completion) as indicated by Center staff records and observations,
- no known diagnosis of Autism Spectrum Disorder or auditory or visual impairment,
- ability to interact without a pattern of persistent or chronic behavior issues as indicated by Center staff records (i.e., absence of Behavior Plan),
- speaks English,
- tests at an age equivalent of 3-5 years old or higher on the Peabody Picture Vocabulary Test (PPVT-4).

After age 20, full psychological examinations are completed at the initial entry into the regional center and when a client needs to be re-evaluated to see if he or she still qualifies for services. IQ scores for this study were obtained from the latest psychological report in the Center files that had been provided by the regional center.

Of the 40 clients who met the above criteria, thirteen were randomly selected and invited by the investigator to participate in the study. They received information letters and consent forms requesting their participation in the study and permission to review their records at the Center. The information letter indicated that participants would receive the MP3 players used during the study once they completed the study. In cases where eligible clients had conservators, the conservators also received the information letter and consent forms were provided (i.e., conservator would give permission on behalf of the adult with ID) and permission to review the adult with ID's Center records. All 13 adults who were invited to participate in the study (and their conservators where relevant) agreed to participate.

Participants who had provided consent were administered the PPVT-4 scale (described in Measures below). Two participants scored below the age-equivalent criterion for the PPVT-4. After the investigator observed the remaining participants for fifteen minutes a day for five days during the regular workshop sessions in the warehouse, four other participants were judged to have task engagement and productivity levels that were not low enough to benefit from an effective intervention. Thus, six people who had agreed to participate were dropped from the study. Initially, thirteen participants were recruited because the investigator wanted to have extra participants in

case some participants chose to discontinue participation in the study. Only three additional participants were recruited to meet the Applied Behavioral Analysis (ABA) requirement of nine participants in a single subject study with one extra participant in case another participant decided to discontinue participation in the study. Therefore, three additional Center clients who met the initial screening were randomly selected, invited, and consented to participate in the study. Once consents were received, they were administered the PPVT-4 scale. These three participants met the PPVT-4 age equivalent criterion and were invited to continue to participate in the study. After the baseline phase one participant decided not to continue with the study. Nine participants (4 females and 5 males), ages 35 to 61 (M age = 44 years), with moderate to severe ID ultimately completed all phases of the study. Table 1 provides a summary of characteristics of the participants who completed the study.

Table 1

*Participant Characteristics*

Participant (pseudonyms)	Age	Gender	IQ	Secondary Diagnosis
Dave	38.3	Male	45	Mild Scoliosis/ Hypothyroid/Diabetic
Greg	60.1	Male	54	Adjustment Disorder/ Depressed Mood Disorder
Lana	35.4	Female	48	Epilepsy
Michelle	43.7	Female	45	None
Max	49.2	Male	37	Down's Syndrome
Rosie	39.1	Female	55	Bi-polar Disorder
Roy	35.5	Male	48	None
Tanaka	38.1	Female	48	Cerebral Palsy/ Epilepsy
Timothy	61.2	Male	51	Cerebral Palsy/ Epilepsy

### *Intervention Settings*

The study occurred in two areas of the work activity center. The first four phases of the study (i.e., training, baseline, comparison, and final) took place in the conference room while the last phase (i.e., generalization phase) took place in the warehouse. The Center is managed by a director, production supervisors, production aides, and administrative and warehouse staff. The Center receives contract jobs that require assembly work and the clients receive piecework remuneration. The Center also provides vocational training at community job sites (e.g., Lowe's) and they operate their own thrift store.

### *Materials*

The materials for the intervention included MP3 players that play digital files, stereo earphones or headphones that were selected by the participant and the investigator, and USB adapters. Participants chose the set that was easiest for them to use. Free Audio Editor and Music Match Jukebox software programs were used to create the digital audio files used in the treatments. Two Flip video camcorders and two tripods were used to record the sessions in each phase. The materials used in the practice task were pamphlets, information cards, and polyurethane bags. The materials used in the task during the four experimental phases were instruction sheets, wood bases, and polyurethane bags.

The job used in the study was expected to last the length of the study. During the baseline phase of the study, participants received compensation for the products they completed. However, due to a problem with supplies not being delivered by the

contracting agency, the materials needed to complete the job ran out at the end of the baseline phase. Thus, participants were informed that they would not receive compensation for Phases III through V of the study. For this reason participants were given the opportunity to discontinue their participation in the study. Nine of the ten participants agreed to complete the intervention.

Fortunately, additional supplies were made available by the director's assistant for the participants to use during the study. Because supplies were still limited, finished products were disassembled by the investigator after every session to ensure that there would be enough supplies for the remaining sessions. The process of disassembling the finished products was critical to maintaining procedural integrity and ensuring that participants did not have to change to a new product that could potentially influence their task engagement and productivity levels.

### *Task*

The task the participants were expected to complete during the experimental phases was a job they had been working on prior to the intervention. It was not a task that was specifically targeted by the investigator but it was a task that was assigned by the respective production supervisors of each participant. Therefore, the task utilized in the study would have been completed by the participants regardless if they were or were not involved in the study. It was the second step of a six step assembly process to produce Flag Desk Kits for an organization called Helping Hospitalized Vets. Once completed, the kits produce patriotic and ornamental pieces that can be used to embellish a desk. The first step of the assembly process included material handling. This step required

clients to sort through product materials to make sure they were not defective. The second step, which was the step used in the current study, consisted of inserting the instruction sheet and the wood base into a poly bag. Steps three through six involved adding additional materials to the bag, labeling and sealing the bags. The kits are used by hospitalized veterans to work on fine motor skills.

Step two (performed for this study) required each participant to obtain a poly bag and an information sheet from a small box located in their work area. Then they placed the information sheet in the poly bag with the front side facing up. Next, the participant obtained a wooden base from a large box next to the client's chair. The wooden base was placed flat side down in the poly bag on top of the information sheet. Lastly, the participant set the bag with the two items to the side of their work space. The investigator provided more supplies as needed. At the end of the sessions the investigator would count the pieces that each participant completed.

### *Measures*

*Peabody Picture Vocabulary Test, Fourth Edition (PPVT-4)*. The PPVT-4 scale (Dunn & Dunn, 2007) is a norm-referenced instrument for measuring the receptive vocabulary of children and adults. The PPVT-4 scale measures understanding of the spoken word in standard American English and assesses vocabulary acquisition. The PPVT- 4 has many uses but for the purposes of the current research study the scale was primarily used to measure the participant's response to verbal instructions. This test was administered to ensure that participants had the ability to understand the instructions they received during the study.

The PPVT-4 was normed on 5,500 individuals. The PPVT-4 uses two parallel forms (Form A and Form B). Split-half coefficients are .94 for Form A and .94 for Form B. The two forms can be used with individuals from ages 2.6 to 90+. The administration is untimed but requires an average of 10 to 15 minutes to administer.

The PPVT-4 offers four types of deviation-type normative scores: standard-score, percentiles, normal curve equivalents, and stanines. The test also provides developmental-type normative scores: age equivalents and grade equivalents. An age equivalent score of 3-5 years old or higher was considered a passing score for clients to participate in the study.

#### *Dependent Variables*

The dependent variables were task engagement time (i.e., the number of on-task occurrences observed in a fifteen minute span of time) and productivity levels (i.e., number of products completed within a fifteen minute span of time). Task engagement time and productivity levels were measured and collected by five coders who viewed the recorded sessions.

*Task Engagement.* Task engagement was operationally defined as an individual who is engaged in his or her task that: (a) directs his or her eyes toward the vocational task; (b) performs steps of the task (i.e., picks up the instruction sheet, etc.); and (c) manipulates task materials (i.e., checks for defects in the wood base).

Time sampling recording was used to collect the data on task engagement time. Each minute of a fifteen minute session was divided into fifteen second intervals. At the end of each fifteen second interval the coder would check a box only when the respective

participant had been observed actively working on the task according to criteria a-c listed above.

*Productivity.* The number of finished products completed within each fifteen minute session represented the data for the productivity levels. Coders were instructed to give the participants credit (i.e., tally mark) for a finished product each time the participants were observed completing a product (i.e., placing both the instruction sheet and wood base in the poly bag in the proper order) within the fifteen minute session. Incomplete products (e.g., bags missing one of the pieces) were not scored.

Data on the number of on-task occurrences and the number of products completed during the four experimental phases (i.e., baseline, comparison, final, and generalization) were coded, analyzed, and were presented graphically.

### *Research Design*

An alternating treatments design (ATD) was used to evaluate the effectiveness of three metamotivational vocational interventions on the task engagement time and productivity levels of nine adults with moderate and severe ID. The basic feature of the alternating treatments design is the rapid alternation of two or more treatments or conditions with a subject or a group. Rapid does not necessarily mean rapid within a fixed period of time such as every hour or every day. It could mean that each time the participant is seen he or she will receive an alternative treatment (Franklin, Gorman, Beasley, & Allison, 1997).

There are numerous strengths to the ATD. First, ATD does not require the baseline condition to stabilize before introducing the interventions. Therefore, target



behaviors can be treated immediately. Secondly, the ATD does not depend on a reversal of conditions to demonstrate experimental control, which is required in the ABAB designs. Therefore, problems of behaviors failing to reverse or reversing a behavior that was not planned are avoided. The ATD also does not depend on temporarily withholding a treatment. In the ATD, the interventions are applied and continued throughout the investigation (Kazdin, 1982). The ATD also permits rapid comparison of several interventions and allows the investigator to conduct a component analysis of a complex procedure (i.e., to separate out the effects of a single component of an intervention package). Three treatments were utilized in the current study: Treatment B (music only), Treatment C (auditory prompts only), and Treatment BC (music and auditory prompts.) Treatments B and C were included in the study to parcel out the effects of the various intervention components.

Another strength of the ATD is that it minimizes sequencing problems associated with the multi-treatment design by rapidly alternating the interventions. Moreover, early termination of a study is less critical with an ATD than it is with other single subject designs because if differences in intervention effects are going to occur, they typically are evident early in the investigation. Lastly, trends that are extremely variable or rapidly rising or falling present some problems for other single-case designs where interpretation of results is based on levels and trends in behavior. However, the ATD design is relatively insensitive to background trends in behavior because one is comparing the results of two or more treatments or conditions in the context of whatever background trend is occurring.

A limitation of the ATD is that it requires a high level of consistency across individuals administering the different interventions. Thus, high procedural reliability is of critical importance when evaluating the data. Another limitation is that, ATD is somewhat artificial compared to natural instructional conditions. A typical classroom program rarely introduces two different interventions during the same time period in a rapidly alternating pattern to address the same behavior. Therefore, the results of an ATD may be difficult to generalize to general situations. One other limitation is that multiple-treatment interference (i.e., the influence one intervention has on the apparent effectiveness or ineffectiveness of a second intervention) cannot be easily determined. In order to minimize multiple treatment interference, the following precautions were taken in this study: (a) counterbalanced the order of the treatments, (b) separated treatment sessions with a time interval, (c) presented one treatment per session, (d) reduced the speed of alternation, and (e) informed the participant which treatment was in effect (Kazdin, 1982).

#### *Internal and External Validity*

Internal validity in the ATD is demonstrated when one treatment is consistently associated with a different level of responding when compared to the other treatment. Internal validity of the ATD is usually good because the rapid alternation of two or more treatments control for the maturational (i.e., changes that occur in subjects during the course of an experiment) and historical (i.e., events that occur during an experiment that may influence the outcome) threats that may occur in a multiple-treatment design. The

rapid alternation also reduces sequencing problems because no single intervention is consistently introduced first and maintained for an extended period of time.

External validity is demonstrated when the differential effects of the interventions are replicated across a different population or group of subjects, across different behaviors, and/or across different conditions (e.g., investigators, settings, instructional arrangements).

### *Vocational Interventions*

The effectiveness of three vocational interventions on the task engagement time and productivity levels of individuals with moderate and severe ID was evaluated in this study. All three interventions used a “low tech” assistive technology (AT) device (i.e., MP3 player) where participants listened to pre-recorded audio files during fifteen minute work sessions. In the first intervention (Treatment B), only classical music was used. In the second intervention (Treatment BC), classical music that was interspersed with auditory prompts that encouraged the participants to be productive were used. In the third intervention (Treatment C), auditory prompts alone were used.

*Treatment B.* The first intervention was Treatment B. This treatment used a MP3 player embedded with only classical music. Music pieces were approximately four and a half minutes long and the music looped back to the beginning every time it ended. The music looped approximately four times during each fifteen minute intervention session.

*Treatment BC.* The second intervention was Treatment BC. This treatment used a MP3 player embedded with classical music interspersed with auditory prompts to

encourage productivity. This treatment also included informed and self-control training which involved a three part process. The parts are described in the following sections.

*Part 1.* Prior to receiving the device, participants would receive “informed-plus-self-control” training from the investigator. The “informed” training required the investigator to share the rationale and significance of using the device with the participants. While providing the rationale, the investigator would inform the participants that they were going to learn how to use a MP3 player and another skill (e.g., verbal mediation) to make their job more fun and help them become better workers. It would then be explained to them that this meant that better workers generally produced more products and therefore, earned more money.

*Part 2.* The “self-control” training involved direct instruction on how to use the device, how to use the strategy (i.e., advising them to listen to verbal prompts that would help them monitor and evaluate their work performance), and assistance in setting goals. Participants would practice using the device and the strategies (i.e., verbal mediation) before initiating the intervention. Participants were considered ready to begin the intervention once they were able to use the device independently and they verbally acknowledged that they heard their production supervisor’s voice by repeating what they said or by saying their production supervisor’s name.

The ability of the participants to use the device was matched against a checklist designed by the investigator. The device operation checklist included: (a) turn on device (i.e., push and hold down the silver button for three seconds); (b) play (i.e., push the

silver button once); (c) stop device (i.e., push the silver button once); and (d) turn off device (i.e., push and hold down the silver button for three seconds).

The items on the checklist to put on and remove the equipment included: (a) plug in ear phones into the MP3 player; (b) clip MP3 player to your clothing; (c) put ear phones in your ears; (d) remove ear phones from your ears; and (e) unclip device.

*Part 3.* Following the training sessions but prior to starting the task (initiating the intervention), the participants would be given the opportunity to use the device. They would listen to a portion of the music and auditory prompts in order to prime task related cognitive schema. The auditory prompts primed the participant by activating knowledge about how the participant was expected to work and therefore, guide the participant's attention toward the task at hand instead of utilizing attentional resources on peripheral items (e.g., what they did or talked about during break). The music and auditory prompts automatically looped back around after four and a half minutes and the music looped back around four times during each fifteen minute session. Four different auditory prompts were delivered once every thirty seconds.

*Treatment C.* The third intervention used an MP3 Player embedded with only auditory prompts that encouraged the participants to stay on task. The prompts were delivered every thirty seconds using the voice of the person that each participant selected (described in Auditory Prompting Strategy below). Treatment C also included the "informed and self-control" training and the music variable was removed from this intervention.

Lastly, during all three interventions, positive feedback was provided to the participants by the investigator. They would receive specific verbal praise (e.g., “Good job staying on task”) from the investigator during and after each session. This was a practice that the production supervisors and aides were already using with the participants.

#### *Auditory Prompting Strategy*

During the pre-training phase (Phase I), participants were given the opportunity to select the voice of the person they wanted to hear in the auditory prompts. Each participant was given a choice of four individuals (i.e., production supervisor, production aide, case manager, or investigator). Eight of the nine participants selected their production supervisors and one participant chose the investigator’s voice for the auditory prompts.

Auditory prompts used in the training phase included the following: (a) questions related to his or her work (e.g., “How will I work today?”), (b) answered those questions (e.g., “I will stay focused.”), (c) asked self-evaluation questions (e.g., “Am I working hard?”), and (d) used self-reinforcement statements at the end of the task (e.g., “I did a good job”).

#### *Procedures*

In this alternating treatments design Treatments B, BC, and C were alternated and counter balanced session by session with each participant. Treatments took place each day at 8:30AM, 11:00AM, and 1:30PM during the comparison phase. The study consisted of five phases: the training phase (Phase I), the baseline phase (Phase II), the

comparison phase (Phase III), the final phase (Phase IV), and the generalization phase (Phase V).

### *Phase I (Training)*

Before beginning Phase I, participants who met the initial screening were individually administered the PPVT-4. The age equivalent score was used to select the participants. The test was manually scored by the investigator and participants that tested below the preschool level or the age equivalent of 3-5 years old on the PPVT-4 were not invited to continue participation in the study. Each administration required approximately fifteen minutes. After the participant selection process was finalized, the investigator began Phase I.

*Music Assessment.* In the first phase of the study (consisting of seven days), each participant was given a music preference assessment to determine which piece of classical music the participant preferred the most. The investigator met with each participant individually. The participants were informed that they were going to listen to three Mozart pieces and choose the one they enjoyed the most. Only one minute of the four and a half minute pieces were played for each participant using the investigator's laptop. Three index cards with the numbers 1, 2, 3 written on them were placed on a table in front of each participant. The participants were informed that card #1 with the number 1 written on the card represented the first music piece, card #2 represented the second piece and card #3 represented the third piece. The participants were instructed to listen to each of the three pieces. The investigator paused for five seconds at the end of the first piece and informed the participant "This is song #1" and the investigator pointed

to card #1 before moving to the next piece. The investigator completed the same actions with songs #2 and #3. The investigator played the pieces a second time and invited the participant to listen to the pieces again and asked them to choose the card that matched the piece they enjoyed the most. For some of the participants, music pieces were played multiple times before a participant selected the piece he or she preferred the most.

*Work Assessment.* Next a work assessment was administered. The task performance of each participant was examined by the investigator. She designed and used a task analysis that was based on the task description written by the contracting agency. The client was first supplied with poly bags, wooden bases, and information sheets. The task analysis included the following steps: (a) place information sheet on top of the wooden base, (b) slip both items into the poly bag, and (c) set completed work aside for quality control and count. The investigator checked for quality, counted the completed pieces, and re-supplied as needed. The investigator checked off the steps on the task analysis if the participant was observed completing these steps in the proper order without assistance. This assessment was primarily used to ensure that the poor work performance was not a result of the participant's lack of skill in completing the task.

*Device Training.* The participants were trained in pairs by the investigator on how to physically put on and take off the AT (i.e., assistive technology) device and how to operate the device. The investigator compared the participants' performance against the checklist on how to put on, take off, and operate the device. Seven of the nine participants were proficient in putting on, taking off, and operating the device. Two participants (i.e., Michelle and Timothy) continued to need assistance in putting on and



taking off the headphones and clipping the device to their clothing. One of the participants (i.e., Timothy) was somewhat independent with operating the device during the experimental phases. He could turn the device on and off on some days and on other days, he needed the investigator to help him turn on the device and properly position his headphones over his ears. He usually could turn off the device and take off the headphones himself. Once participants were shown how to operate the device the recorded auditory prompts were introduced. Auditory prompts were also introduced to the two participants that continued to need assistance in putting on and operating the device.

*Informed and Self-Control Training.* Before training and instruction on how to use the “informed and self-control” training (e.g., verbal mediation) occurred, the investigator created the auditory prompts that the participants would use in Treatments BC and C. Once the preferred individuals for the auditory prompts were identified by the participants, the investigator met with each production supervisor. During these meetings, scripts following the auditory prompts listed under the auditory prompting section were produced and personalized for each participant (e.g., “Michelle, stay focused.”). The scripts were then rehearsed and made into recordings for each participant. Once the recordings were completed, they were digitally manipulated to be interspersed within the classical music pieces for Treatment BC or without the music pieces for Treatment C.

When the investigator provided the “informed” portion of the training, she provided the rationale for learning how to use the device and the verbal mediation

strategy. The investigator explained to the participants in pairs that they were going to learn to use a MP3 player and a few skills (i.e., verbal mediation) that would help them become better workers. They were also informed that by becoming better workers, they would likely be able to earn more money by increasing their production rate.

The investigator taught the participants in pairs during the instruction for the verbal mediation strategy. Each time the participants heard an auditory prompt they were instructed by the investigator to repeat it to themselves either out loud or silently. During guided practice, the participants performed practice tasks (i.e., placed pamphlets and information cards in the poly bags) while they used the MP3 players, listened to the music and/or verbal prompts, and practiced using the verbal mediation strategy. While they practiced using the verbal mediation strategy during the guided practice sessions, many of the participants exclaimed that they heard their production supervisor's voice instead of repeating what the auditory prompts were saying. Participants were reminded to repeat what was being heard. In the end, participants were considered ready for the intervention phase when the investigator heard them consistently verbalize their production supervisor's name or repeated what they heard either out loud or mouthed the words silently.

#### *Phase II (Baseline)*

In the second phase of the study, baseline data on task engagement time and productivity levels were recorded, collected, and analyzed. Participants were recorded in pairs in the conference room every morning for fifteen minute sessions for four days. No intervention was provided to the participants during this phase.

The camcorders and the tripods were set up and taken down every day of each phase by the investigator. The camcorders recorded the participants working in pairs in the conference room. When seen through the lens of the camcorder, one could see a large rectangular table with two chairs sitting behind the table. A small cardboard box that contained the poly bags and the instruction sheets sat on the table in between each pair of participants. A large cardboard box that contained the wooden bases was placed between the two chairs.

#### *Phase III (Comparison)*

In the third phase the data on task engagement and productivity levels were collected for Treatments B, BC, and C. Treatments B, BC, and C were randomly alternated within each day and between each day. Each session consisted of fifteen minutes of treatment time and each treatment was presented an equal number of times during this phase. Participants were recorded in pairs in the conference room for three fifteen minute sessions a day for six days. The participant pairs were also altered throughout the different sessions. Results of these comparisons were used to identify which treatment that was most effective for each participant.

#### *Phase IV (Final)*

A fourth phase was implemented once one treatment established its overall effectiveness over the other treatments for the participant. During this phase the most effective treatment was administered alone. The purpose of this phase was to determine the treatment's effectiveness on the target behaviors when it was presented in isolation. This phase was also necessary to ensure that positive or negative carry over effects did

not exist. Positive carryover effects occur if Treatment BC is found to be more effective than Treatment B because it was alternated with Treatment B. Negative carry over effects occur if Treatment BC is found to be less effective than Treatment B because it was alternated with Treatment B. (Franklin, Gorman, Beasley, & Allison, 1997).

Participants were recorded in pairs for fifteen minutes in the conference room every morning for six days.

#### *Phase V (Generalization)*

The generalization phase was administered using the most effective treatment for each participant in a new setting (i.e., warehouse) to assess if the target behaviors would generalize to the new setting. Participants were recorded in pairs for fifteen minutes in the warehouse every morning for six days. The total intervention period including: the training phase, the baseline phase, the comparison phase, the final phase, and the generalization phase totaled twenty-nine business days for each participant.

#### *Coding Reliability*

All sessions were videotaped using a Flip video camcorder. Five independent raters collected the data on task engagement and productivity levels by watching 75 pre-recorded fifteen minute digital videos (includes make up sessions). They coded task engagement and productivity levels for each participant in each session.

Inter-rater agreement was assessed in half of all the sessions and across participants. Five research assistants acted as the first rater and the investigator was the second rater. The investigator trained the research assistants to code the target behaviors using the respective coding forms provided in Appendix A and Appendix B. Training

consisted of individually training the research assistants on how to fill out the form, discussing specific incidences where one would or would not code a behavior, and answering questions. Inter-rater agreement on the dependent measures was calculated by using the formula agreements divided by the number of agreements plus disagreements, multiplied by 100.

Inter-rater agreement fell just below 80% during the baseline phase. To remedy this, the investigator provided additional training for the raters prior to coding the subsequent phases. The investigator met with each rater individually and provided detailed information on when to code and when not to code a certain way while viewing some of the videos. The investigator also answered their questions. The inter-rater agreement for the final and generalization phases were 96%.

## Chapter 4: Results

An alternating treatments design was used to evaluate the effectiveness of three interventions on two target behaviors (i.e., task engagement time and productivity level). Three methods were used to analyze the data collected from the recorded sessions. The changes in mean, level, slope, and the rapidity of changes in task engagement and productivity levels observed in the line graphs were the first way the data was evaluated. The split-middle technique was the second method and the mean percentage of time on task and the mean frequency of products completed was the third method used to examine the data. These data evaluation methods provided the information necessary to examine the effects of the interventions on the target behaviors.

### *Graphic Display*

Line graphs were used to organize the data to facilitate evaluation of the effectiveness of the interventions on the target behaviors. Line graphs were chosen because they are used to present serial data or data that are continuously collected at regular intervals (Tawny & Gast, 1984). These graphs provided a detailed numerical summary and description of the effect the interventions had on the participants' target behaviors. One line graph displaying four experimental phases for each participant was used to summarize the participants' task engagement time (i.e., number of on-task occurrences) and productivity levels (i.e., number of products completed).

### *Analysis of Graphic Data*

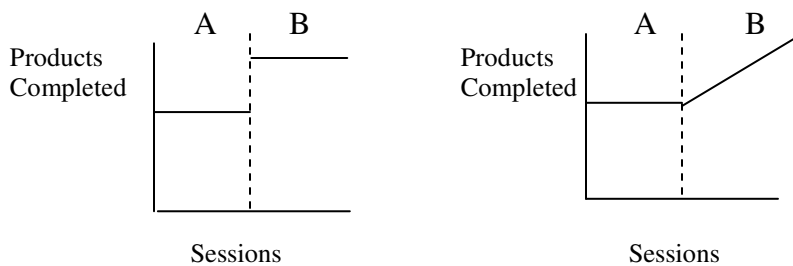
The data was examined visually to determine if consistent patterns of responding were found for the different interventions. In order to analyze the data, the magnitude of

the changes across phases and the rate of these changes were examined. The two characteristics related to magnitude are changes in mean and level and the two characteristics related to rate are changes in trend and latency of the change. These characteristics were examined in each graph (Tawney & Gast, 1984).

*Mean.* Changes in means or shifts in the average rate of performance were examined. Consistent changes in means across phases served as a basis for deciding whether the data pattern met the requirements of the alternating treatments design.

*Level.* Changes in level refer to the shift or discontinuity of performance from the end of one phase to the beginning of the next phase. Changes in level are important because they allow the investigator to determine through visual inspection whether the intervention produced reliable effects. Change in level across phases should be seen whenever the phase is altered, and the behavior assumes a new rate, (i.e., it shifts up or down quickly).

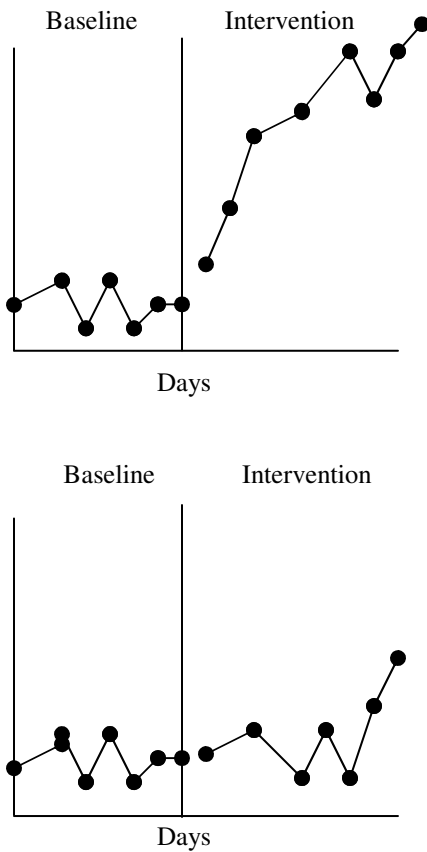
*Trend.* Changes in trend or slope are important because it refers to the tendency for the data to show systematic increases or decreases over time. Figure 1 shows an example of the change in trend and level.



*Figure 1.* The graph on the left shows a change in level and no change in the trend. The graph on the right shows a change in the trend and no change in level.

*Latency of the change.* The latency of the change occurs when phases are altered.

Latency of the change refers to the period between the onset or termination of one condition and changes in performance. The more immediate the change is after the experimental conditions have been altered, the clearer the intervention effect. An example of this is shown in Figure 2.



*Figure 2.* The top panel shows that when the intervention was introduced, behavior changed rapidly. The bottom panel shows that when the intervention was introduced, behavior change was delayed.

Ultimately, when the level of responding varies by the alternating conditions, experimental control is demonstrated. The magnitude of the difference between the



experimental conditions was determined by examining the vertical distance between the data paths of the conditions being compared. The greater the vertical distance between condition trend lines, the greater the difference between experimental conditions.

### *Fitting a Linear Trend*

The split-middle method provides a systematic way to describe and to summarize the rate of behavior change across phases for a single individual or group. This technique shows the quality of the trend in the data and can be used to make and test predictions about changes in performance over time. This method was used to draw a robust trend line in order to evaluate the performance of the interventions (Kazdin, 1982). The split-middle method encompasses the following steps:

*Step 1.* Divide the data to be summarized in two equal parts in the phase. If there is an even number of data points, the dividing line will fall halfway between two of the rates. If there are an odd number of data points, the dividing line will fall on one of the data points.

*Step 2.* Find the intersections of the mid-rate and mid-date for each half. (A) Obtain the mid-date by dividing each half in half. (B) Obtain the mid-rate by finding the middle (median) value (mid-rate) for each half of the data series (Step 1) and draw a line parallel to the x-axis that intersects the mid-date line.

*Step 3.* Draw a line through the data which passes through both of the intersections found in step two. At this point one has found the quarter-intersect line.

*Step 4.* Count the number of data points which fall above and below the line drawn in step three. There should be the same number of data points falling on and

above the line as there are falling on and below the line. If not, one should move the line up or down (keeping it parallel to the original line) until a balance is achieved. This is the split-middle line or the best linear trend. No adjustment is necessary in the baseline phase. The analysis of the graphic displays answered the following questions:

Question 1. Was Treatment BC (i.e., an assistive technology device embedded with music interspersed with auditory prompts) more effective than Treatment B (i.e., an assistive technology device embedded with music alone) in improving the target behaviors in individuals with ID?

Question 2. Was Treatment BC more effective than Treatment C (i.e., an assistive technology device interspersed with auditory prompts alone) in improving the target behaviors in individuals with ID?

Question 3. If administered alone, was Treatment BC effective in improving the target behaviors in individuals with ID?

Question 4. By using Treatment BC, did the improved target behaviors generalize to a new setting with the same task?

A completed analysis of the data properties (i.e., magnitude and rate) is presented in the following graphs. The participants were given pseudonyms to maintain confidentiality.

*Dave*

Figure 3 displays Dave's productivity levels for the experimental phases. During baseline, the mean frequency of products completed was 26, with a range of 24 to 28. A

visual inspection of the graphic display revealed that as the treatments were alternatively implemented in the comparison phase, the number of products completed increased the most ( $M = 28$ ) when Treatment C was implemented. The magnitude (i.e., mean and level) and the rate (i.e., trend and latency) of change in the data for Treatment C were greater than they were for Treatments B or BC.

According to the split-middle method, the magnitude and the rate of change in the data for all three treatments increased, which translated into an increase in the number of products completed. However, the magnitude and the rate of change in the data for Treatment C was the greatest, and the number of products completed was the highest ( $M = 28$ ) when Treatment C was implemented. Nevertheless, when it was presented in isolation, Treatment C was unable to replicate these results during the final ( $M = 24$ ) or the generalization ( $M = 24$ ) phases. The productivity results revealed in the last two phases failed to exceed baseline levels when Treatment C was implemented.

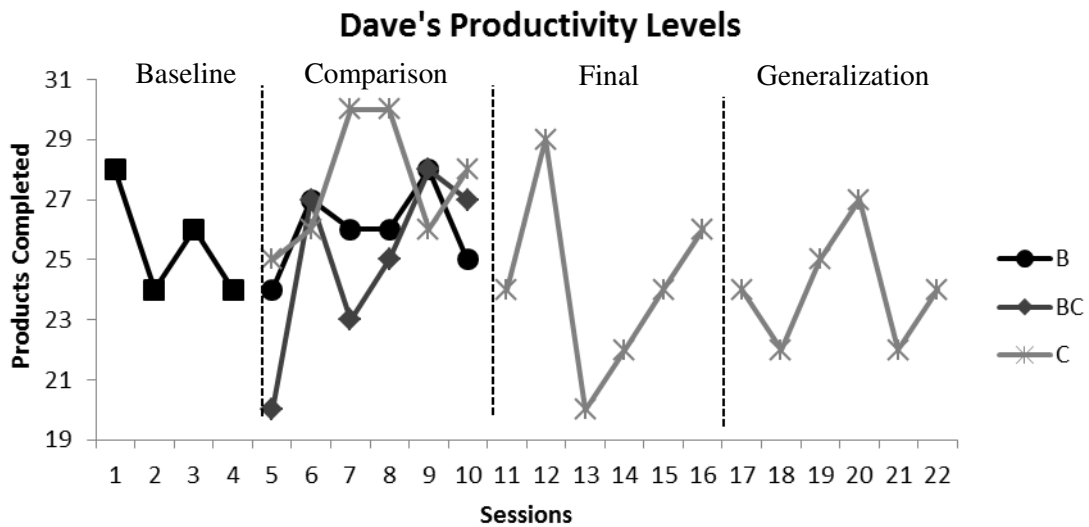


Figure 3. Dave's productivity levels.

Figure 4 displays Dave's task engagement times for the experimental phases. During baseline, the mean percentage of on-task occurrences was 92%, with a range of 85% to 95%. A visual inspection of the comparison phase revealed that the magnitude of change in the data for Treatment B was slightly elevated ( $M = 94\%$ ) over baseline levels, and the rate of change in the data for the treatment showed a high level of latency with a moderately increasing trend.

Using the split-middle method, the magnitude and the rate of change in the data for Treatments BC and C showed an increasing number of on-task occurrences. However, the most improvement in task engagement times occurred when Treatment B was implemented ( $M = 94\%$ ). Although, Dave's number of on-task occurrences did not improve with the use of Treatment C ( $M = 83\%$ ), Treatment C was used in the last two phases because this treatment was associated with the greatest number of products produced.

The results associated with Treatment B in the comparison phase were approximately replicated when Treatment C was implemented during the final and generalization phases. The mean percentage of on-task occurrences during the final phase was 93%, with a range of 85% to 97%. The mean percentage of on-task occurrences during the generalization phase was 94%, with a range of 87% to 98%. The task engagement results for the last two phases exceeded baseline levels when Treatment C was implemented.

Previously, it was hypothesized that one treatment would affect both productivity levels and task engagement times similarly. However, Dave's use of

Treatment C was associated with improved productivity levels while Treatment B was associated with improved task engagement times. During the final and generalization phases, only one treatment could be administered, and Treatment C was selected for that phase.

Treatment C was selected as the most effective treatment for two reasons. Ultimately, employers are interested in the number and quality of products produced and individuals who are able to meet that demand will have more job stability than an individual who has high levels of task engagement but low levels of productivity. Secondly, when Dave was asked to choose between Treatments B and C, he chose Treatment C because he enjoyed hearing his production manager’s voice through the auditory prompts more than he enjoyed listening to the classical music.

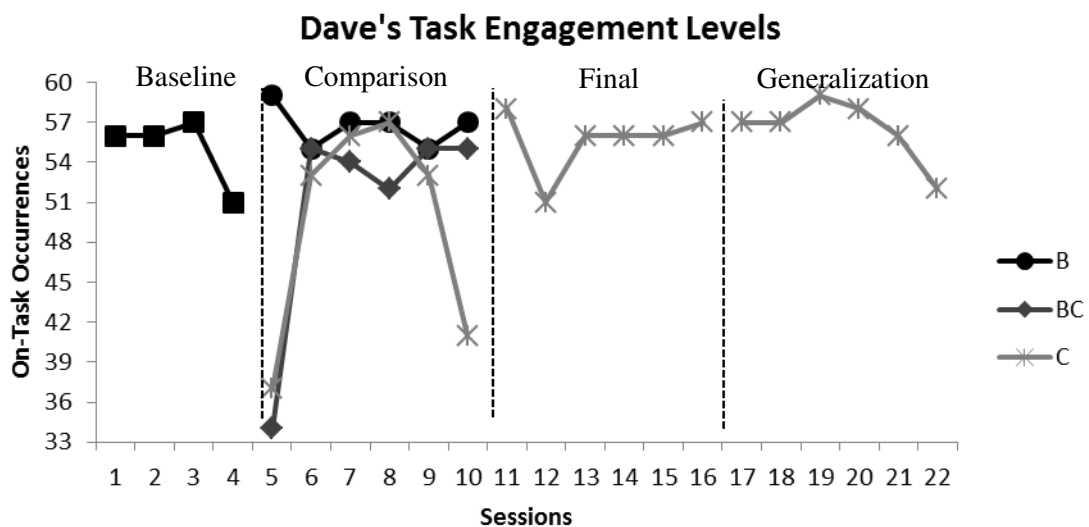


Figure 4. Dave’s task engagement levels.

## *Greg*

Figure 5 displays Greg's productivity levels for the experimental phases. During baseline, the mean frequency of products completed was 14, with a range of 13 to 14. As the treatments were alternatively implemented in the comparison phase, a visual inspection of the graphic display revealed that the number of products completed increased with all three treatments. However, the magnitude and rate of change in the data for Treatment BC was the greatest ( $M = 17$ ).

According to the split-middle method, the magnitude and the rate of change in the data for Treatments B, BC, and C exceeded baseline levels. However, while the magnitude of change in the data for Treatment BC increased, the rate of change showed a decreasing trend with a high level of latency. Nevertheless, Greg produced the greatest number of products ( $M = 17$ ) when Treatment BC was implemented. The more immediate the change is after the experimental conditions have been altered, the clearer the intervention effect (Tawney & Gast, 1984) and therefore, Treatment BC was implemented in the last two phases.

When Treatment BC was implemented in the final phase, similar results from the comparison phase were replicated in this phase. High levels of the magnitude and the rate of change in the data for Treatment BC were revealed. The mean frequency of products completed for the final phase was 17, with a range of 13 to 18. In the generalization phase, lower levels of productivity were observed. A high magnitude of change in the data for Treatment BC was observed, but the rate of change in the data revealed a decreasing trend with a high level of latency. The mean frequency of products

completed for the generalization phase was 16, with a range of 13 to 18. The productivity levels for the last two phases surpassed baseline levels when Treatment BC was implemented.

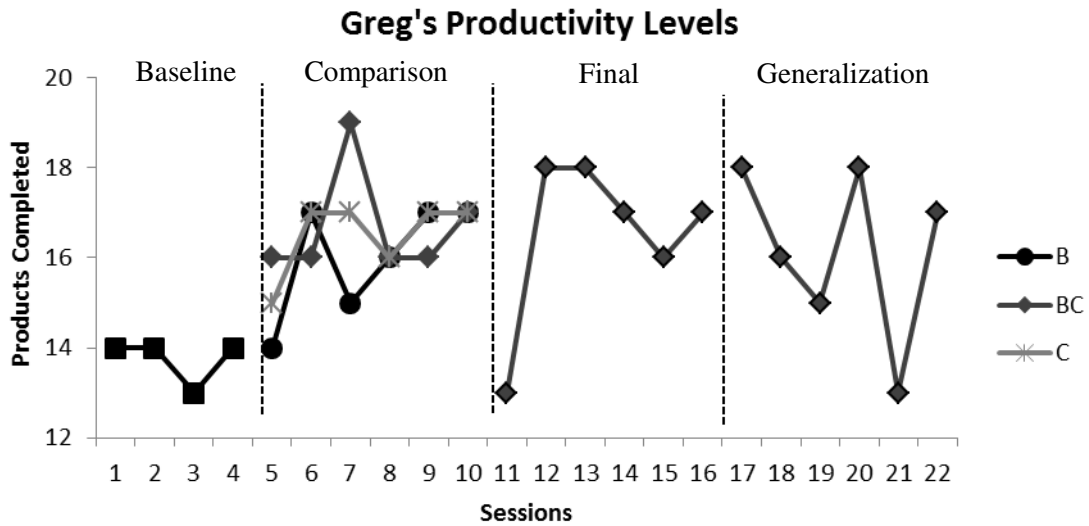


Figure 5. Greg's productivity levels.

Figure 6 displays Greg's task engagement times for the experimental phases. During baseline, the mean percentage of on-task occurrences was 99%, with a range of 97% to 100%. A visual inspection of the graphic display during the comparison phase revealed that Greg's task engagement times improved slightly from the baseline results when Treatment B (M = 100%) was implemented. There was a slight increase in the magnitude and rate of change in the data when Treatment B was implemented.

Using the split-middle method, the magnitude and the rate of change in the task engagement data revealed that all three treatments failed to surpass the baseline results. Although improved task engagement times were not observed when Treatment BC was

implemented, Treatment BC was associated with improved productivity levels.

Treatment BC was implemented in the last two phases. A visual inspection of the graphic display revealed that Treatment BC was associated with high task engagement times in the final (M = 99%) and generalization (M = 100%) phases. Therefore, on-task occurrences during the final phase matched the baseline results, while the on-task occurrences during the generalization phase exceeded baseline levels when Treatment BC was implemented.

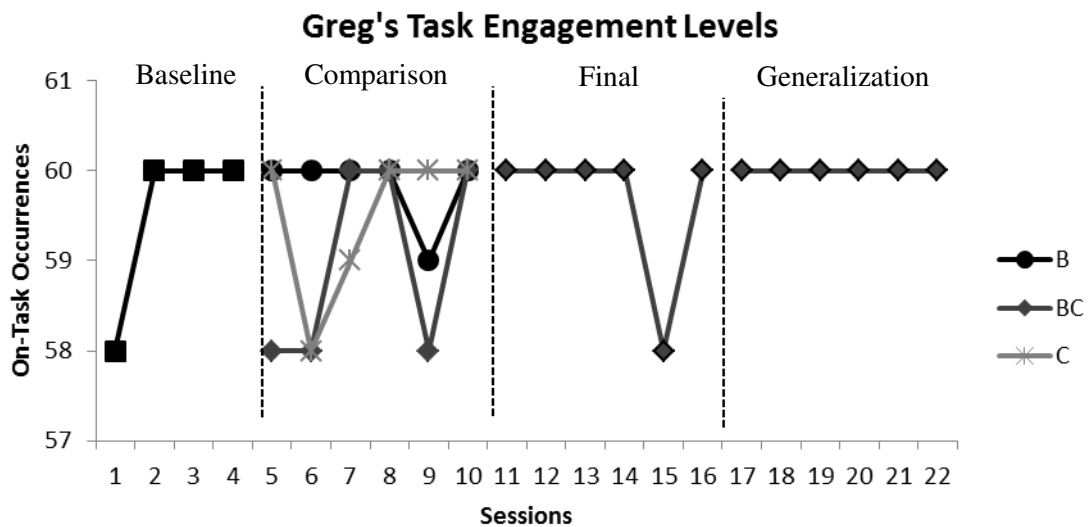


Figure 6. Greg's task engagement levels.

### Lana

Figure 7 displays Lana's productivity levels for the experimental phases. During baseline, the mean frequency of products completed was 22, with a range of 19 to 24. A visual inspection of the graphic display showed that as the treatments were implemented



in the comparison phase, the rate of change in the data for Treatment BC had the highest level of latency but with a decreasing trend. The magnitude of change in the data for Treatment BC showed a slightly higher mean and level.

Using the split-middle method, Treatment BC was associated with slightly improved productivity levels with a good magnitude of change in the data. Although the rate of change in the productivity data revealed a decreasing trend, the data also exhibited a high level of latency which resulted in the greatest number of products completed ( $M = 23$ ). Treatment BC was implemented in the last two phases. Lana's productivity levels declined in the final ( $M = 16$ ) and generalization ( $M = 19$ ) phases when Treatment BC was implemented. The productivity levels of the last two phases did not exceed baseline levels when Treatment BC was implemented.

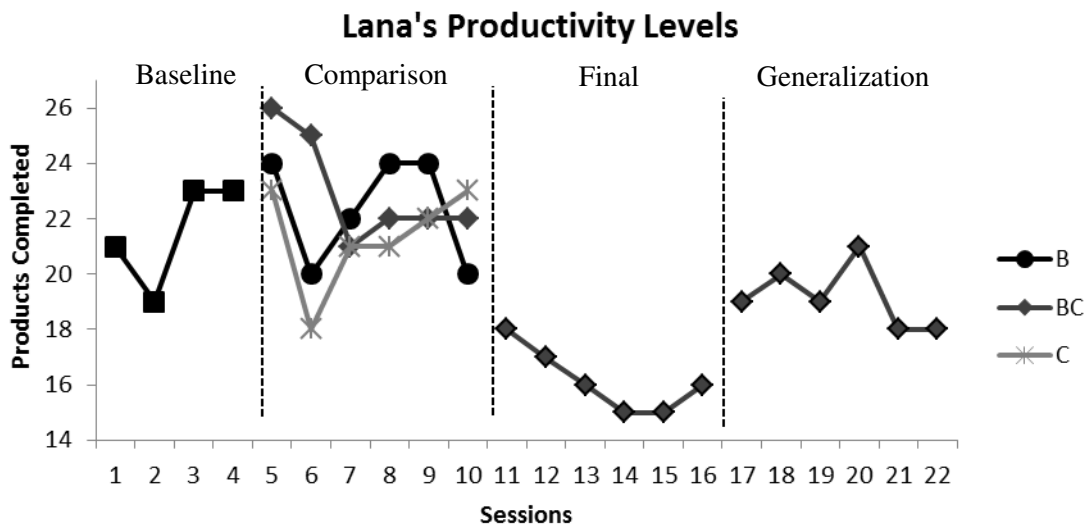


Figure 7. Lana's productivity levels.

Figure 8 displays Lana's task engagement times for the experimental phases. During baseline, the mean percentage of on-task occurrences was 94%, with a range of 88% to 97%. A visual inspection of the graphic display during the comparison phase showed that Treatment C was associated with a decrease in on-task occurrences ( $M = 88\%$ ), and the magnitude and rate of change in the data for Treatments B and BC presented similar results ( $M = 94\%$ ) to the baseline performance.

According to the split-middle method, a good magnitude of change in the data for both Treatments B and BC was observed. However, the rate of change in the data for both treatments revealed a decreasing trend with a high level of latency. Treatment BC was implemented in the last two phases because this treatment was associated with the greatest number of products completed.

A visual inspection of the graphic display revealed that the on-task occurrences in the final phase was similar ( $M = 94\%$ ) to on-task occurrences in the comparison phase when Treatment BC was implemented. However, a decline in the number of on-task occurrences was observed in the generalization phase ( $M = 90\%$ ). The task engagement levels in the final phase was similar to baseline levels but the task engagement levels in the generalization phase fell below baseline levels when Treatment BC was implemented.

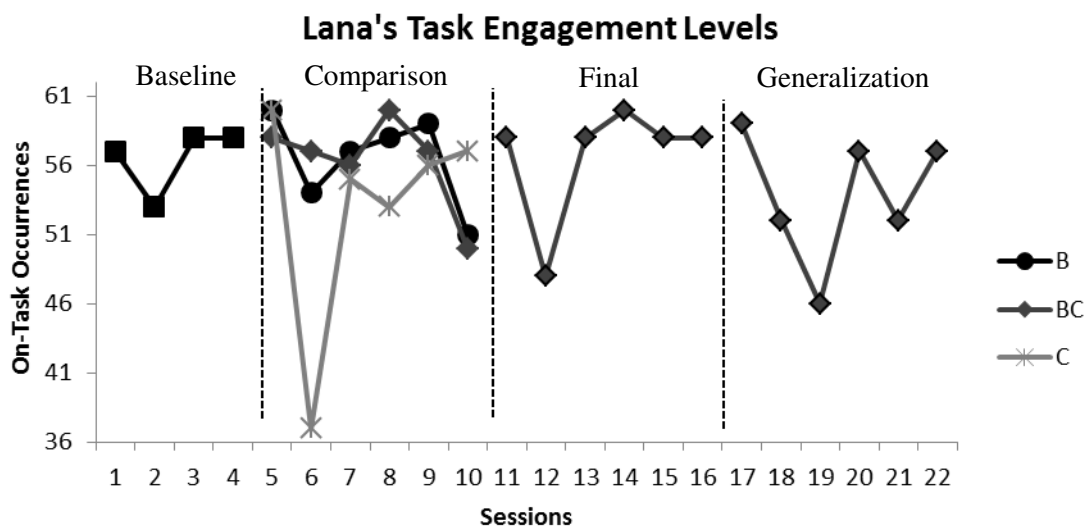


Figure 8. Lana's task engagement levels.

*Michelle*

Figure 9 displays Michelle's productivity levels for the experimental phases. During baseline the mean frequency of products completed was 15, with a range of 10 to 21. A visual inspection of the graphic display revealed that when the treatments were implemented in the comparison phase, all three treatments were associated with low levels of the magnitude and the rate of change in the data.

With respect to the split-middle method, Treatment B had a good magnitude of change and a fair rate of change in the data during the comparison phase ( $M = 12$ ) when it was compared to Treatments BC and C. Michelle indicated that she enjoyed listening to the classical music alone more than she enjoyed listening to the auditory prompts or the classical music embedded with the auditory prompts. Therefore, Treatment B was implemented in the last two phases.

A visual inspection of the graphic display showed that Michelle's productivity levels increased ( $M = 14$ ) in the final phase. Her productivity levels dropped ( $M = 12$ ) in the generalization phase when Treatment B was administered. Michelle's productivity levels in the last two phases did not exceed baseline levels when Treatment B was implemented.

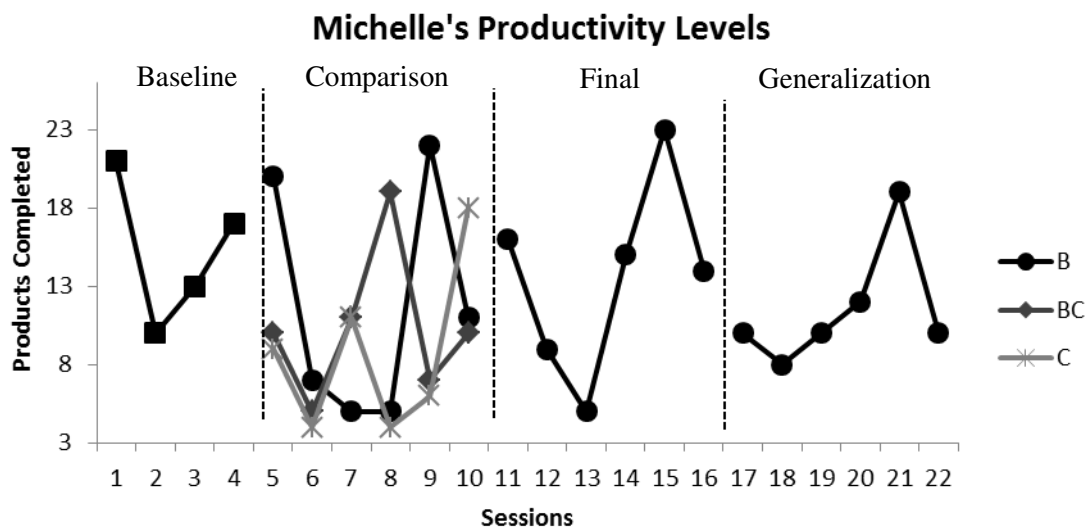


Figure 9. Michelle's productivity levels.

Figure 10 displays Michelle's task engagement times for the experimental phases. During baseline, the mean percentage of on-task occurrences was 59%, with a range of 32% to 78%. A visual inspection of the graphic display showed that as the treatments were implemented in the comparison phase, Michelle's task engagement times decreased with all three treatments. The magnitude and the rate of change was the highest ( $M = 53\%$ ) when Treatment B was implemented. Therefore, Treatment B was implemented in the last two phases.

Using the split-middle method, a fair magnitude and rate of change in the task engagement data were observed when Treatment B was administered. These results were associated with an increase in the number of on-task occurrences ( $M = 57\%$ ) for the final phase. The task engagement time observed in the generalization phase decreased ( $M = 49\%$ ) when Treatment B was implemented. Michelle's on-task occurrences in the last two phases did not exceed baseline levels when Treatment B was implemented.

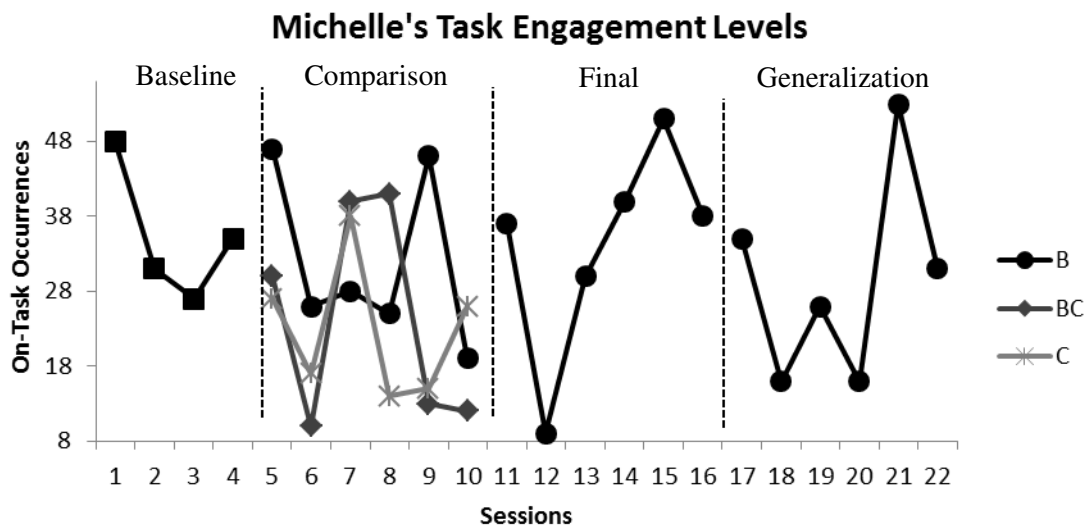


Figure 10. Michelle's task engagement levels.

Michelle was one of the two participants that needed assistance throughout the research study with putting on her headphones and turning on the device. Although, she did not have a secondary diagnosis, it appeared to the investigator that she had issues of inattention and hyperactivity. She was often distracted by irrelevant stimuli and frequently interrupted her tasks to attend to trivial noises or events that were usually ignored by others. She seemed to have an inability to sustain attention on tasks or

activities. She would frequently shift from one incomplete activity to another and she frequently shifted in conversation. She did not listen to her co-workers and she did not follow the details or rules of activities in social situations. Michelle also fidgeted and squirmed when she was seated. She often talked excessively and disturbed her co-workers. She also got up frequently to walk to the restroom. Her file did not state she was taking any type of medication. It is uncertain what the treatment effects would be if she had been diagnosed with the Attention-Deficit/Hyperactivity Disorder.

### *Max*

Figure 11 displays Max's productivity levels for the experimental phases. During baseline, the mean percentage of products completed was 16, with a range of 13 to 20. As the treatments were alternatively implemented in the comparison phase, a visual inspection of the graphic display revealed that the number of products completed increased. There was a high magnitude and a high rate of change in the data for all three treatments.

Similarly, according to the split-middle method, the magnitude and the rate of change in the data for all three treatments increased. The magnitude and the rate of change in the data for Treatment BC increased the most ( $M = 19$ ). Therefore, Treatment BC was implemented in the last two phases. A visual inspection of the graphic display revealed that similar results to the comparison phase were replicated during the final and generalization phases ( $M = 19$ ). The productivity levels for the last two phases surpassed baseline levels when Treatment BC was implemented.

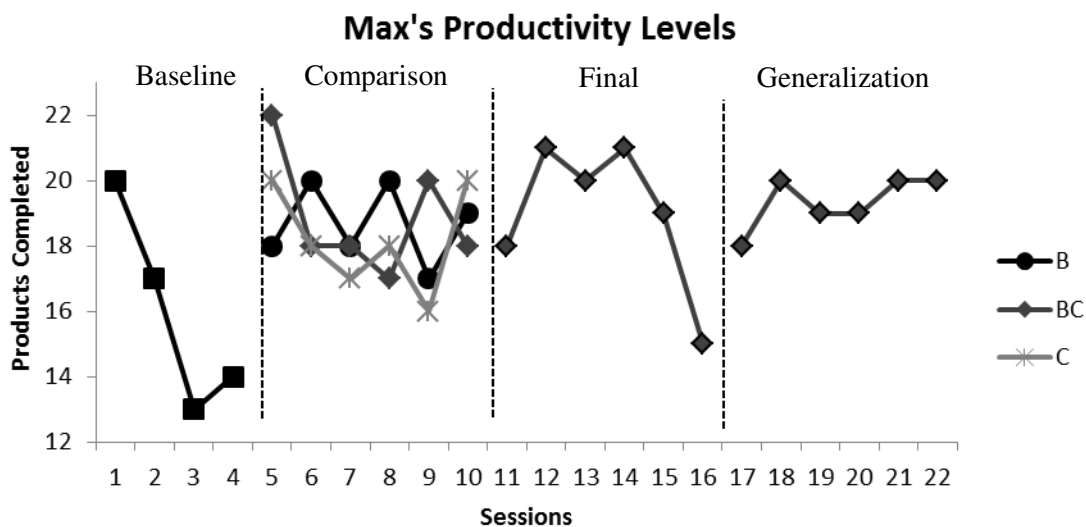


Figure 11. Max's productivity levels.

Figure 12 displays Max's task engagement times for the experimental phases. During baseline, the mean percentage of on-task occurrences was 90%, with a range of 87% to 93%. A visual inspection of the graphic display during the comparison phase revealed that Max's task engagement times improved when Treatments B and BC were implemented. The mean percentage of on-task occurrences with Treatment B was 94%, with a range of 90% to 98%. The mean percentage of on-task occurrences with Treatment BC was 93%, with a range of 88% to 98%. The magnitude and the rate of change for Treatments B and BC were slightly higher than baseline levels. His task engagement times did not improve with Treatment C (M = 90%).

The split-middle method revealed that the data for Treatments B and BC had a fair magnitude of change, but the rate of change for Treatment BC was higher. Thus, Treatment BC was implemented in the last two phases. A visual inspection of the

graphic display revealed that Treatment BC was associated with elevated (i.e., high magnitude and rate of change in the data) task engagement times in the final and generalization phases. The mean percentage of on-task occurrences for the final phase was 97%, with a range of 93% to 100%. The mean percentage of on-task occurrences for the generalization phase was 97%, with a range of 92% to 100%. The task engagement levels in the last two phases surpassed baseline levels when Treatment BC was implemented.

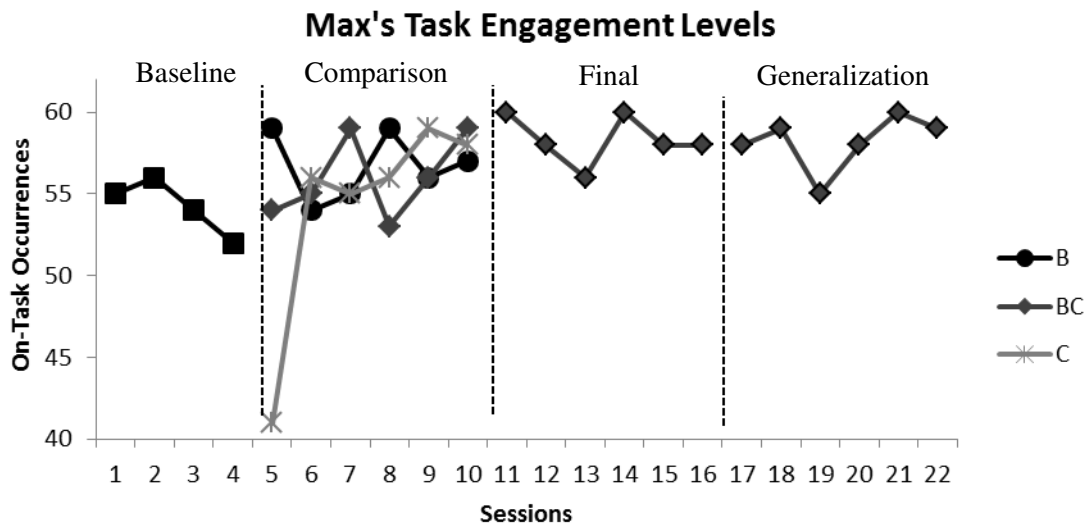


Figure 12. Max's task engagement levels.

Rosie

Figure 13 displays Rosie's productivity levels for the experimental phases. During baseline, the mean frequency of products completed was 12, with a range of 10 to 13. As the treatments were alternatively implemented in the comparison phase, a visual inspection of the graphic display revealed that the number of products completed



increased when all three treatments were administered. The magnitude and the rate of change for all three treatments ranged from fair to good. The mean frequency of products completed with Treatment B was 15, with a range of 10 to 18. The mean frequency of products completed with Treatment BC was 17, with a range of 14 to 18. The mean frequency of products completed with Treatment C was 16, with a range of 13 to 18.

Using to the split-middle method, the magnitude and the rate of change in the data for all three treatments increased. The magnitude and the rate of change in the data for Treatment BC increased the most ( $M = 17$ ). Therefore, Treatment BC was implemented in the last two phases. A visual inspection of the graphic display revealed that significant increases (i.e., high levels in the magnitude and rate of change in the data) in the number of products completed were observed in both the final and generalization phases when Treatment BC was administered. The mean frequency of products completed for the final phase was 20, with a range of 17 to 23. The mean frequency of products completed for the generalization phase was 20, with a range of 19 to 21. The productivity levels in the last two phases surpassed baseline levels when Treatment BC was implemented.

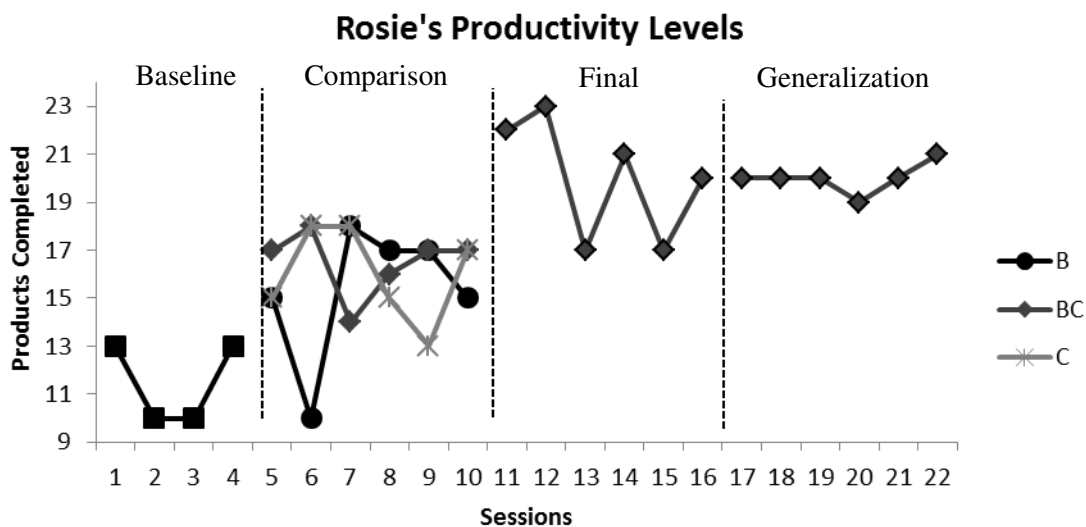


Figure 13. Rosie's productivity levels.

Figure 14 displays Rosie's task engagement times for the experimental phases. During baseline the mean percentage of on-task occurrences was 88%, with a range of 82% to 92%. A visual inspection of the graphic display revealed that there was a high magnitude and rate of change in the data for all three treatments. Therefore, Rosie's task engagement times improved with all three treatments.

Likewise, the split-middle method showed that there was a high magnitude and rate of change for all three treatments. The greatest task engagement time was associated with Treatment B ( $M = 97\%$ ). Compared to the other two treatments, the magnitude and the rate of change in the data for Treatment B was the greatest. Nevertheless, Treatment BC was associated with the greatest number of products produced. Rosie indicated that she preferred listening to the music embedded with the auditory prompts more than

listening to music alone or listening to the auditory prompts alone. Treatment BC was implemented in the last two phases.

A visual inspection of the graphic display revealed that Treatment BC was associated with highly elevated (i.e., a high level of magnitude and rate of change in the data) task engagement times in the final and generalization phases. The mean percentage of on-task occurrences during the final phase was 100%, with a range of 98% to 100%. The mean percentage of on-task occurrences during the generalization phase was 98%, with a range of 93% to 100%. The level of on-task occurrences during the last two phases surpassed baseline levels when Treatment BC was implemented.

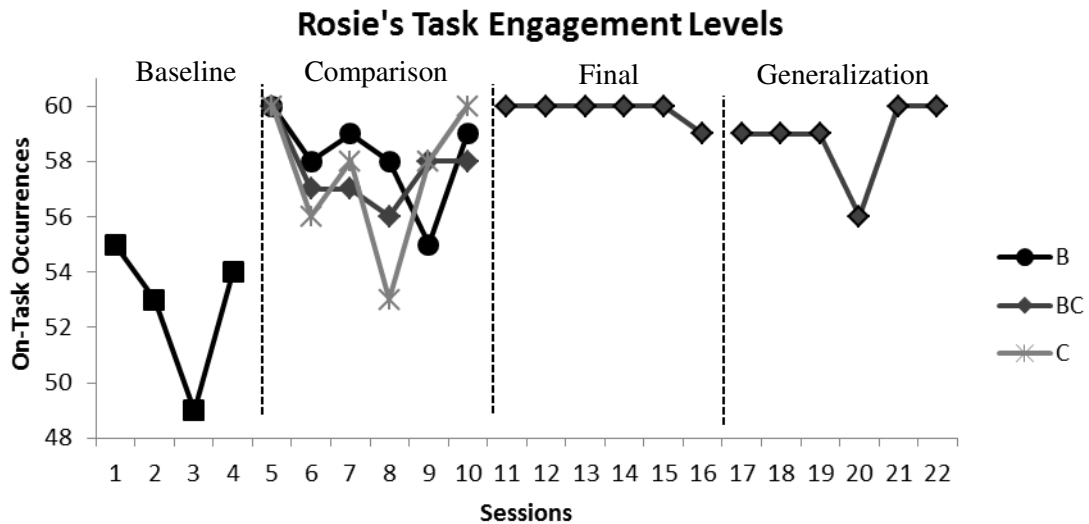


Figure 14. Rosie's task engagement levels.

Roy

Figure 15 displays Roy's productivity levels for the experimental phases. During baseline, the mean frequency of products completed was 33, with a range of 31 to 38. A

visual inspection of the graphic display revealed that when the treatments were alternatively implemented in the comparison phase, there were low levels of the magnitude and the rate of change in the data for all three treatments. All three treatments were associated with decreased productivity levels.

Using the split-middle method, a fair magnitude and rate of change in the data was found only when Treatment C was implemented ( $M = 29$ ). Although Treatment BC was associated with a slightly lower mean frequency of products completed ( $M = 28$ ), Treatment BC was implemented in the last two phases because Roy indicated that he preferred to use that treatment over Treatment C.

A visual inspection of the graphic display revealed that Roy's productivity levels decreased when Treatment BC was implemented in both the final and generalization phases. The mean frequency of products completed during the final phase was 28, with a range of 20 to 33. The mean frequency of products completed during the generalization phase was 28, with a range of 20 to 32. The productivity levels in the last two phases failed to surpass baseline levels when Treatment BC was implemented. It is possible that Roy's productivity levels may have improved with Treatment C, but the treatment that the participant preferred was selected over the treatment that was associated with the best results.

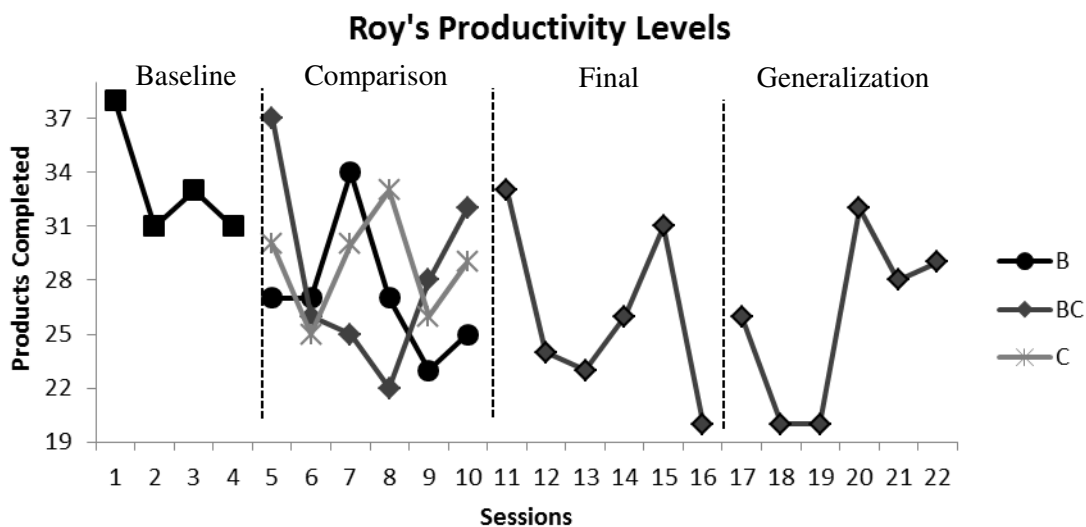


Figure 15. Roy's productivity levels.

Figure 16 displays Roy's task engagement times for the experimental phases. During baseline, the mean percentage of on-task occurrences was 94%, with a range of 83% to 98%. A visual inspection of the graphic display showed that as the treatments were implemented in the comparison phase, low levels of the magnitude and rate of change in the data for all three treatments were observed. Roy's task engagement times decreased with all three treatments with the highest task engagement time (M = 93%) only occurring when Treatment BC was implemented. Once more, Treatment BC was implemented in the last two phases.

Using the split-middle method the magnitude and rate of change in the data for Treatment BC was low. This was associated with a decrease in the task engagement times for both the final and generalization phases. The mean percentage of on-task occurrences during the final phase was 86%, with a range of 62% to 97%. The mean

percentage of on-task occurrences during the generalization phase was 87%, with a range of 78% to 95%. The task engagement levels during the last two phases failed to surpass the baseline levels when Treatment BC was implemented.

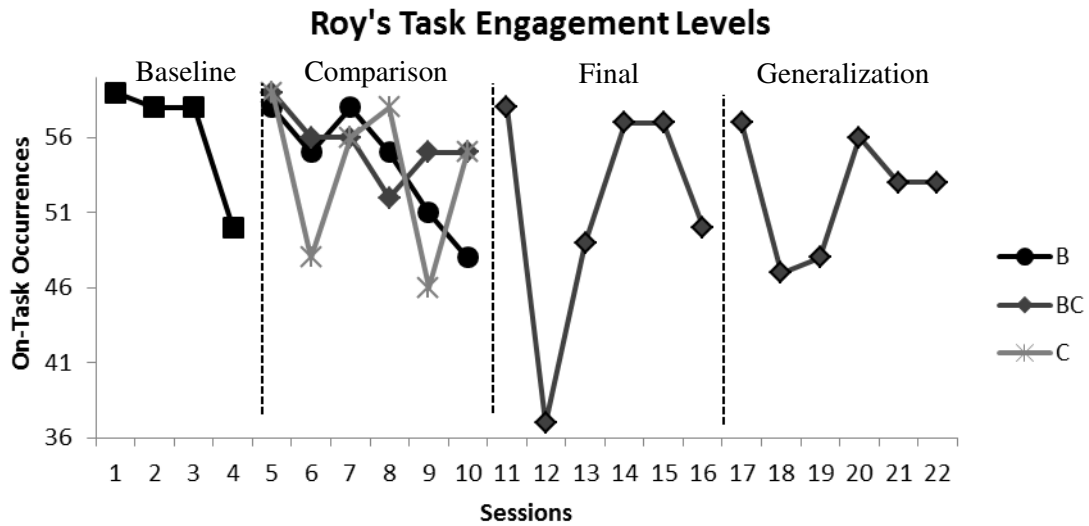


Figure 16. Roy's task engagement levels.

### Tanaka

Figure 17 displays Tanaka's productivity levels for the experimental phases. During baseline, the mean frequency of products completed was 14, with a range of 13 to 15. As the treatments were implemented in the comparison phase, a visual inspection of the graphic display revealed that there was a high magnitude and rate of change in the data for all three treatments. These results translated into an increased number of products completed when all three treatments were administered.

According to the split-middle method, the magnitude and the rate of change in the data for all three treatments increased. The magnitude of change increased the most with

Treatment BC. The mean frequency of products completed with Treatment BC was 16, with a range of 13 to 18. Although, the latency was high in the rate of change in the data for Treatment BC, it showed a descending trend. Tanaka indicated that she preferred listening to the music alone more than using the other two treatments. Treatment B was implemented in the last two phases.

A visual inspection of the graphic display revealed that elevated (i.e., high levels of the magnitude and the rate of change) levels of productivity were observed in both the final and generalization phases. The mean frequency of products completed during the final phase was 17, with a range of 12 to 22. The mean frequency of products completed during the generalization phase was 18, with a range of 13 to 22. Tanaka's productivity levels in the last two phases exceeded baseline levels when Treatment B was implemented.

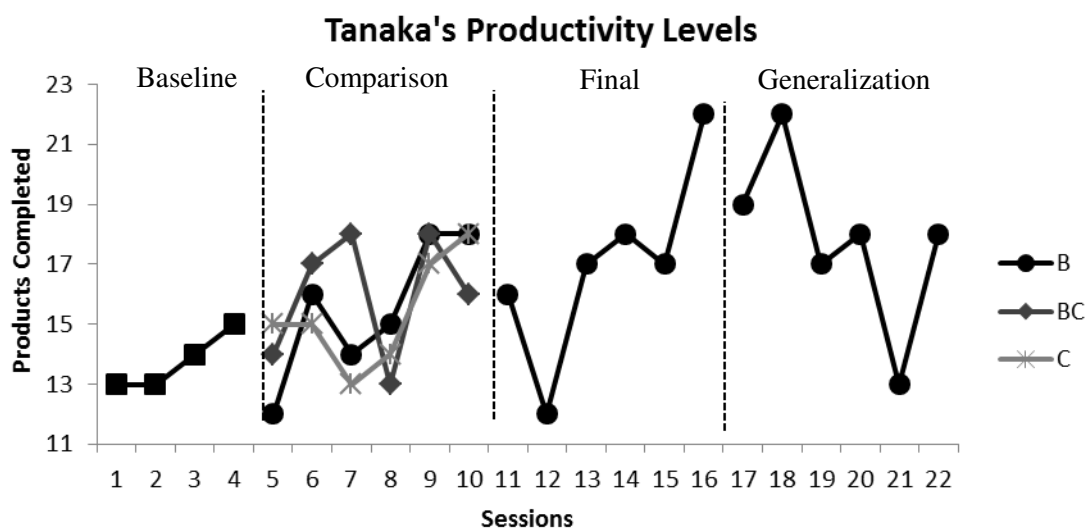


Figure 17. Tanaka's productivity levels.

Figure 18 displays Tanaka's task engagement times for the experimental phases. During baseline the mean percentage of on-task occurrences was 100%, with a range of 98% to 100%. A visual inspection of the graphic display during the comparison phase revealed that Tanaka's task engagement times decreased when Treatments BC and C were implemented, and her task engagement times were similar to baseline levels when Treatment B was implemented. The magnitude and the rate of change for Treatment B (M = 100%) were similar to baseline levels.

In contrast, the split-middle method revealed that the magnitude and the rate of change in the data for all three treatments failed to surpass the task engagement times observed during the baseline phase. Tanaka's stated preference for Treatment B was used for the last two phases because none of the treatments revealed positive results in the graphic display or in the split-middle examinations of the data. A visual inspection of the graphic display revealed that Treatment B was associated with slightly lower (i.e., slightly lower levels of the magnitude and rate of change) task engagement times in both the final and generalization phases. The mean percentage of on-task occurrences during the final phase was 99%, with a range of 93% to 100%. The mean percentage of on-task occurrences during the generalization phase was 99%, with a range of 97% to 100%. The task engagement levels for the last two phases failed to match baseline levels when Treatment B was implemented.



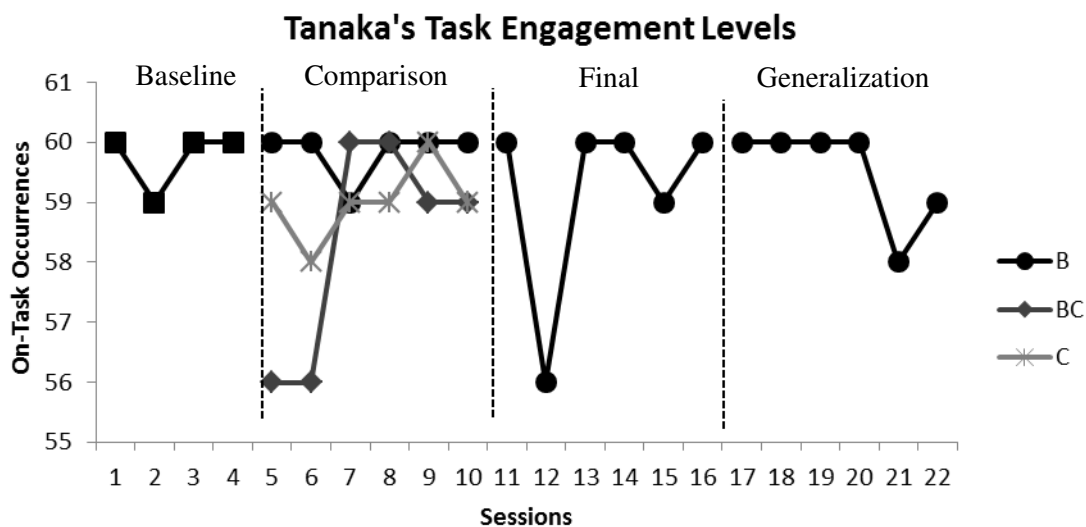


Figure 18. Tanaka's task engagement levels.

### Timothy

Figure 19 displays Timothy's productivity levels for the experimental phases. During baseline, the mean frequency of products completed was 7, with a range of 4 to 10. A visual inspection of the graphic display revealed that the magnitude and the rate of change for Treatments B and BC were good. The number of products completed increased when Treatments B and BC was implemented. Timothy's productivity levels did not improve with Treatment C.

The use of the split-middle method revealed that the magnitude and the rate of change in the data for Treatments B and BC were good. The magnitude of change in the data for Treatment BC increased the most ( $M = 9$ ). The rate of change in the data for Treatment BC showed a high level of latency but a relatively flat trend. Timothy also indicated that he preferred listening to the music embedded with the auditory prompts

more than using the other two treatments. Therefore, Treatment BC was implemented in the last two phases.

A visual inspection of the graphic display revealed that slightly lower (i.e., lower magnitude and rate of change) levels of productivity were observed in both the final and generalization phases. The mean frequency of products completed during the final phase was 7, with a range of 6 to 10. The mean frequency of products completed during the generalization phase was 8, with a range of 6 to 10. Although, Timothy's productivity levels in the final phase equaled baseline levels, the productivity levels in the generalization phase surpassed baseline levels when Treatment BC was implemented.

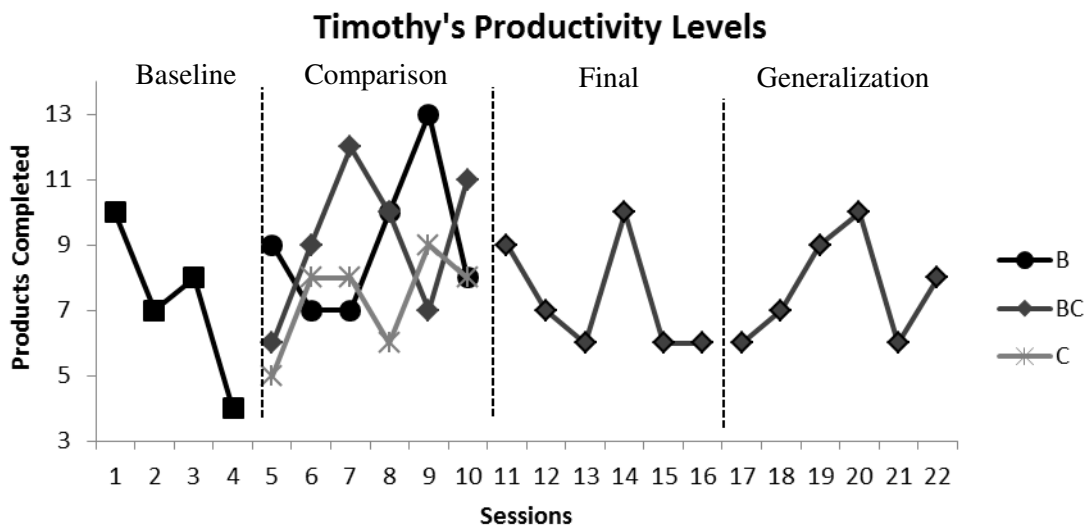


Figure 19. Timothy's productivity levels.

Figure 20 displays Timothy's task engagement times for the experimental phases. During baseline, the mean percentage of on-task occurrences was 52%, with a range of 27% to 67%. A visual inspection of the graphic display revealed that there was a good

magnitude and rate of change in the data for Treatments B and BC. Timothy's task engagement times increased when Treatments B and BC were implemented. Timothy's task engagement time did not improve with Treatment C. The magnitude and the rate of change in the data for Treatment BC were the greatest ( $M = 63\%$ ). His task engagement times were the highest when Treatment BC was implemented.

The split-middle method revealed that there was a high magnitude of change in the data for Treatment BC. The rate of change in the data showed high latency levels but a descending trend. Because Treatment BC was associated with the highest number of completed products Treatment BC was implemented in the last two phases. A visual inspection of the graphic display revealed that the increased levels of on-task occurrences observed in the comparison phase carried over into the final phase. The mean percentage of on-task occurrences in the final phase was 61%, with a range of 48% to 80%. The level of on-task occurrences in the generalization phase was slightly lower than the final phase, but they still exceeded baseline levels. The mean percentage of on-task occurrences during the generalization phase was 59%, with a range of 30% to 95%. The task engagement levels during the last two phases surpassed baseline levels when Treatment BC was implemented.

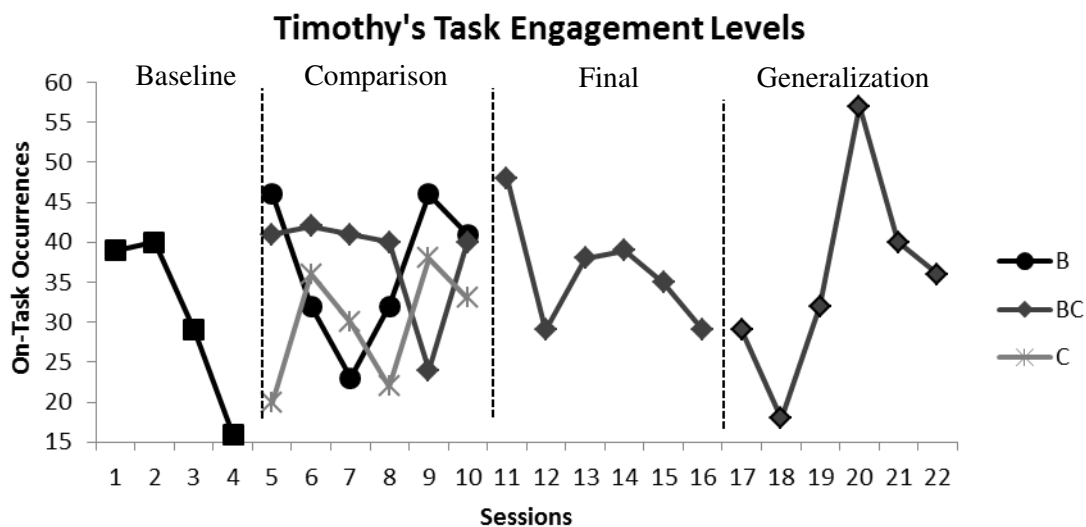


Figure 20. Timothy's task engagement levels.

Timothy was the other participant that needed assistance putting on the headphones and turning on the device throughout the research study. Towards the end of the study he was able to turn off the device independently. This suggests that with more practice, Timothy might have been able to operate the device independently.

The productivity data for the nine participants are summarized in Table 2. During the comparison phase, the productivity levels for five participants improved when Treatment BC was implemented, one participant improved with Treatment B, one participant improved with Treatment C, and two participants did not improve with any of the treatments.

When Treatment BC was administered alone, three participants were able to maintain or accelerate their improved productivity levels. When Treatment C was administered alone, no participants were able to improve their productivity levels. When

Treatment B was administered alone, one participant was able to maintain or accelerate her productivity levels. Five participants did not improve their productivity levels when any of the treatments were administered alone.

During the generalization phase, four participants generalized the treatments to a new setting and maintained or enhanced their productivity levels in the new setting when Treatment BC was administered. One participant exhibited similar results with Treatment B and no participants improved their productivity levels with Treatment C. Four participants were unable to generalize the treatments and maintain high productivity levels in the new setting when any of the treatments were implemented.

Table 2

*Summary of Productivity Data*

Participants	Baseline	Comparison	Improved	Final	Effective	Generalize	Carry Over	
Dave	26	C	28	Yes	24	No	24	No
Greg	14	BC	17	Yes	17	Yes	16	Yes
Lana	22	BC	23	Yes	16	No	19	No
Michelle	15	B	12	No	14	No	12	No
Max	16	BC	19	Yes	18	Yes	19	Yes
Rosie	12	BC	17	Yes	20	Yes	20	Yes
Roy	33	BC	28	No	26	No	26	No
Tanaka	14	B	16	Yes	17	Yes	18	Yes
Timothy	7	BC	9	Yes	7	No	8	Yes

The productivity results for the nine participants are presented in Figure 21.

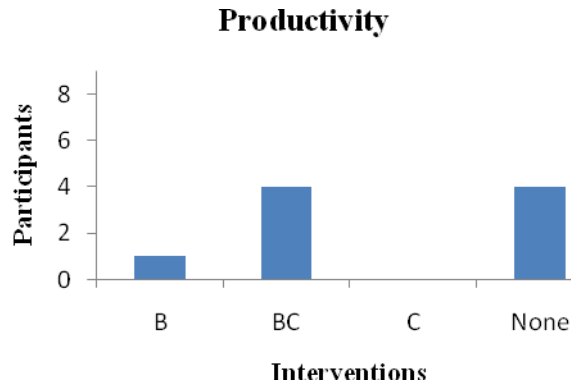


Figure 21. Productivity results.

The task engagement data for the nine participants are summarized in Table 4. During the comparison phase, the task engagement times for five participants improved. Four improved when Treatment B was implemented, one participant improved with Treatment BC, and four did not improve with any of the treatments. When Treatment BC was administered alone during the final phase, three participants enhanced their task engagement times. One participant improved task engagement levels when Treatment C was administered alone, and five participants did not improve their task engagement times when any of the treatments were administered alone.

During the generalization phase, four participants were able to maintain improved task engagement times and generalize the treatments to a new setting. Four participants generalized Treatment BC and maintained high task engagement levels in the new setting. One participant generalized Treatment C to a new setting and four participants

were unable to generalize any of the treatments to a new setting and maintain high task engagement levels.

Table 3

*Summary of Task Engagement Data*

Participants	Baseline	Comparison	Treatment Used	Improved	Final	Effect	Generalize	Carry Over	
Dave	92%	B	C	83%	Yes	93%	Yes	94%	Yes
Greg	99%	B	BC	98%	Yes	99%	No	100%	Yes
Lana	94%	B	BC	94%	No	94%	No	90%	No
Michelle	59%	B	B	53%	No	57%	No	49%	No
Max	90%	B	BC	93%	Yes	97%	Yes	97%	Yes
Rosie	88%	B	BC	96%	Yes	100%	Yes	98%	Yes
Roy	94%	BC	BC	93%	No	86%	No	87%	No
Tanaka	100%	B	B	100%	No	99%	No	99%	No
Timothy	52%	BC	BC	63%	Yes	61%	Yes	59%	Yes

The task engagement results for the nine participants are presented in Figure 22.

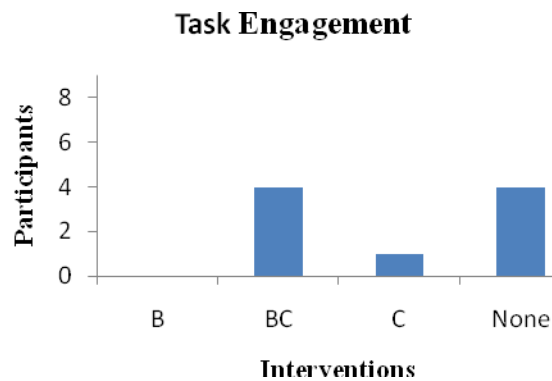


Figure 22. Task engagement results.

The effects of the interventions on both the productivity and task engagement levels for the nine participants are presented in Figure 23. When the results for the productivity and task engagement levels were observed together, four participants were able to generalize the use of Treatment BC to a new setting without additional training and sustain or accelerate their productivity and task engagement levels in the new setting. No participants were able to generalize the use of Treatments B or C to a new setting and five participants were unable to generalize the use of any of the treatments to a new setting.

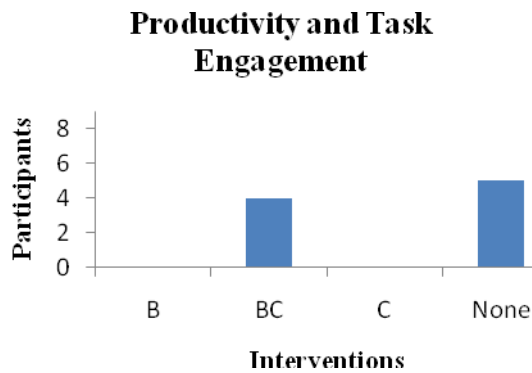


Figure 23. Productivity and task engagement results.



## Chapter 5: Discussion

New strategies to improve job performance among adults with intellectual disability are needed. Research, policy and practice have made great strides in improving employment opportunities among adults with ID. However, individuals with ID continue to experience high rates of unemployment and underemployment. Adults with the most severe degrees of ID are particularly overrepresented (Mank, 2007). The poor employment statistics of persons with ID necessitate the development of low cost, evidence-based interventions that can be utilized in real work settings. The current study was conducted in response to the need to support adults with ID in improving their vocational performance. The availability of low cost, low technology MP3 players that can be used during work activities presented an opportunity to deliver music and auditory prompts to assist adults with ID improve their work performance. It was hypothesized that the combination of classical music and auditory prompts would be more effective than either music or prompts alone, because both have shown to be effective in isolation. This hypothesis was tested by examining the relative effectiveness of three interventions and determining which intervention would have the greatest improvement in task engagement and productivity in a work setting for adults with moderate and severe intellectual disability. The hypothesis was confirmed for four participants. For two participants music or auditory prompts alone was most effective. There are several possible explanations of the results.

### *Productivity*

Previous research has shown that low tech AT devices can improve work productivity in individuals with ID (Graff et al 2006; Ackerman et al. 1984; Copeland et al. 2000; Davies et al. 2002; Steed et al. 1997). These investigations used various AT devices such as picture prompts (Steed et al. 1997; Copeland et al.; Graff et al. 2006), a grocery store counter (Ackerman et al. 1984), and a portable palmtop computer program (Davies et al. 2002). Previous research had also shown that music and auditory prompts were effective in improving academic, behavioral, and work performance (Hallam & Price, 1998; Savan, 1996; Oldham et al. 1995; Cihak et al. 2007; Grossi, 1998; Mechling, 2007). In the current study the low tech AT device used in the intervention was a MP3 player embedded with music and/or auditory prompts. The study found that more participants improved their productivity levels when they listened to the combination of music and auditory prompts than with music alone. Tanaka improved her productivity levels when she listened to music alone. Her task engagement levels were close to 100% throughout the experimental phases when she listened to music alone and therefore, she could not improve her task engagement levels any further. Tanaka was the only participant that had used an iPod at work before the study began. It is possible that Tanaka performed well using this treatment because she was accustomed to listening to music while she worked. However, Tanaka had listened to contemporary rock music on her personal iPod while she listened to classical music during the study. This suggests that music type can also influence productivity and the effectiveness of different music may differ across individuals. Tanaka's results are consistent with past investigations that

found that music is effective in improving productivity (Oldham et al. 1995). No participants improved productivity when they listened to auditory prompts alone. One reason why these treatments may have been effective in improving productivity levels for the participants is that the auditory prompts in the treatment that utilized both music and auditory prompts served as reminders to the participants to keep working and complete the tasks they were working on.

For the participants that did not improve productivity levels during the study, it is possible that the classical music was not a motivating factor for them. It may also have been that the simplicity and repetitiveness of the task was resistant to improved motivation and productivity. During some of the work sessions, one of the participants exhibited symptoms similar to an individual with ADHD. She may have had characteristics that required a different kind of support than what the interventions provided.

### *Task Engagement*

Previous research has shown that AT devices are effective in improving task engagement levels in individuals with ID (Cihak et al. 2007; Grossi, 1998; Lancioni et al. 1998; Lancioni et al. 1999). The AT devices used in these studies have included self-operated auditory prompting systems that included a low tech AT device and auditory prompts (Cihak et al. 2007; Grossi, 1998) and palm-top computer systems with auditory, visual, and vibration prompts (Lancioni et al. 1998; Lancioni et al. 1999). In the current study more participants improved task engagement levels when they listened to the combination of auditory prompts and music than when listening to auditory prompts

alone. One participant improved his task engagement levels when he listened to auditory prompts alone. This finding is consistent with some of the previous studies (Cihak et al. 2007). However, other investigations (Lancioni et al. 1998; Lancioni et al. 1999) that were successful in improving task engagement levels in individuals with ID combined the use of auditory prompts with either visual prompts and/or tactile prompts. The finding that listening to the combination of music and auditory prompts was more effective than listening to auditory prompts alone is consistent with the literature, which suggest that auditory prompts may be more effective when combined with another type of sensory prompt or another kind of prompt that addresses the same sense.

The data in the current study also revealed that listening to the combination of auditory prompts and music was more effective than listening to music alone in the improvement of task engagement in individuals with ID. Studies that have used music to effectively improve task engagement (Hallam & Price, 1998; Savan, 1996; Oldham et al. 1995) have not included auditory prompts as part of their treatments. In the present study there were no participants that improved their task engagement levels when they listened to music alone. Additional research is needed to evaluate whether music would be more effective if combined with another sensory component or to investigate whether different types of music might have different outcomes.

For three participants the investigator used the participants' preference as the deciding factor to select which treatment would be implemented during the maintenance and generalization phases, rather than having a clear "winner" from the comparison phase. These decisions to change the way the treatment was selected for the final and

generalization phases may have altered how well the participants performed in those phases. The decision to use the preferred treatment was made only when differences between treatment results in the comparison phase were negligible or not different. When this occurred, the treatment that was preferred by the participants was chosen for the last two phases.

### *Productivity and Task Engagement*

When the results for the productivity and task engagement levels were combined, the data showed that there were more participants that improved both of these target behaviors when they listened to the combination of music and auditory prompts than when they listened to either music alone or auditory prompts alone. These findings are consistent with other studies that used AT devices with multiple sensory prompts to improve task engagement (Grossi, 1998; Lancioni et al. 1998; Lancioni et al. 1999). However, these studies did not include productivity levels as a target behavior when they were evaluating the effectiveness of their respective interventions. It is possible that when the goal is to simultaneously improve productivity and task engagement levels in individuals with ID, treatment packages that contain multiple types of prompts may be more effective than one type of prompt. More research is needed to evaluate whether multiple sensory prompts or varying types of prompts addressing the same senses are effective in simultaneously improving task engagement and productivity levels in individuals with ID.

The results for the productivity levels differed from the task engagement levels in the current study. In a study by Savan (1996), ten students with ID became calm and

cooperative when classical music was played in the classroom. In another study, Oldham et al. (1995) found that employees (n = 75) who used stereo headsets to listen to instrumental music made significant improvements in performance, organization satisfaction, and mood states. The employees became more relaxed and the investigators found that employees in relatively simple jobs responded most positively to the stereo headsets. In the present study administering the music component in isolation may have encouraged the four participants that improved their task engagement levels to stay on-task because the classical music provided a calming effect for them or provided a form of entertainment while they completed tasks that were repetitive and probably uninteresting. Moreover, the same four participants that improved their task engagement levels also improved their productivity levels when they listened to music interspersed with auditory prompts. Since the music component was present in both treatments that increased task engagement and productivity levels, the music component is likely to have been a positive influence on the outcomes.

Some of the participants that did not improve either target behavior might have benefitted from an increased frequency of prompt delivery. Investigations by Davis et al. (1992) and Taber, Seltzer, Heflin, and Alberto (1999) found that by increasing the frequency of prompt delivery, participants were able to increase their task fluency and work performance. Future studies of prompts delivered via low tech MP3 players should investigate the timing and frequency of prompts delivered with and without musical background.

### *Generalization*

Few studies that have used AT devices to deliver auditory prompts have examined generalization of the treatments to new settings, with a new task or condition and sustained improved task engagement or productivity levels. However, Alberto, Sharpton, Briggs, and Stright (1986) found that participants who used auditory prompts to increase task acquisition could generalize across settings without additional training. In the current study more participants were able to generalize treatments to a new setting and maintain improved task engagement and productivity levels when the treatment consisted of combined music and auditory prompts than when they listened to music or auditory prompts alone.

In addition, Davis et al. (1992) found that auditory prompts served to filter out distractors, allowing students with severe intellectual disabilities to better focus on targeted tasks. For students with moderate and severe ID who can struggle with distractibility, filtering may not only increase the focus on targeted tasks, but may also reduce the amount of incoming stimulation. Participants who performed well on the target behaviors and were able to generalize the intervention to a new setting may have been able to generalize the treatment and maintain improved performance because the auditory prompts helped them focus their attention on the task. Furthermore, one participant (Dave) who improved his task engagement levels when he listened to auditory prompts alone was also able to generalize the treatment to a new setting without further training. It's possible that the voice used to record the auditory prompts on Dave's MP3 player may have contributed to his improved engagement. Because Dave responded

positively to his production supervisor, her voice was used in recording the auditory prompts. Dave was the only participant that chose to listen to auditory prompts alone as he worked and he was the only participant that improved his task engagement levels and generalized the treatment when he listened to auditory prompts alone. In a previous investigation, Davis et al. (1992) found that by changing the voice on a self-operated auditory prompting system and altering the frequency of prompt delivery, students with severe intellectual disabilities increased their vocational performance. Thus, the study findings suggest that future studies with low tech MP3 players in work settings should investigate the possible influences of different voices, especially those the worker knows, on productivity and engagement. One participant was able to generalize the music only treatment to improve productivity and one participant was able to generalize the auditory prompts only treatment to improve task engagement to a new setting. These results indicate that different interventions worked for different individuals and for different outcomes (productivity and task engagement). The single case design allowed these individual differences to be highlighted.

#### *Limitations*

Participants in this study were only exposed to classical music. Three classical pieces by Mozart were recorded on the MP3 players. Although one participant who had previously listened to rock music while working improved her performance with classical music on the MP3 player, this finding suggests that the type of music can affect outcomes. It is possible, for example, that more upbeat music might motivate workers to



work faster, or that the workers' favorite type of music might improve performance. The benefits of different types of music on the MP3 player should also be examined.

The study phases were conducted in the conference room of the organization which simulated a "lab" like environment. This type of environment where various variables are controlled are not representative of actual work place settings. However, the last phase of the study was conducted in the warehouse which is where the participants currently work.

It is possible that there were carryover effects associated with the alternating treatments design. Carryover effects occur when a change is observed while the second treatment is in place and the change is actually due in part to the effect of the first treatment or to a combination of the first and second treatments. According to Tawny and Gast (1984), carryover effects are almost always due to the inability of the participant to differentiate between two treatments. Some of the precautions that were taken to minimize carryover effects were counterbalancing the order of treatments, separating treatment sessions with a time interval, slowing down alternations, and just informing the participant which treatment was in effect at the beginning of each session. In spite of these precautions carryover effects may have had an impact on outcomes.

It was unfortunate that participants were informed midway through the study that they would no longer be compensated for completed work pieces, although they did receive the promised MP3 player. The effect of this change on participants' motivation to be productive is unknown.

### *Future Directions*

Several areas of future study have been mentioned, including examining the effects of different types of music, different voices for auditory prompts, and different delivery frequencies of auditory prompts. Future studies might also include participants with different disabilities such as autism or dual diagnosis. In the current study, there were two participants who improved their productivity and task engagement levels who also had mental health related disorders as their secondary diagnoses.

In this study the verbal prompts were general words of encouragement. In order to improve performance in individuals with ID, future research might also examine the relative effects of specific versus general instructions in the auditory prompts. In a study by Bouxsein, Tiger, and Fisher (2008), specific instructions pertaining to the task elicited higher levels of task completion than did general instructions in young children with ID. These specific instructions could be incorporated in the auditory prompts in order to guide behavior. Future research also needs to be conducted to determine how attention relates to motivation so that this relationship can truly be understood and the vocational implications can be more fully explored.

This study addressed the need to identify new interventions that can foster success in vocational settings for adults with intellectual disabilities. Previous intervention studies have focused primarily on improving vocational behaviors that impede competent vocational performance (Cihak et al. 2007; Grossi, 1998; Lancioni et al. 1998; Lancioni et al. 1999; Graff et al. 2006; Ackerman et al. 1984; Copeland et al. 2000; Davies et al. 2002; Steed et al. 1997). The current study was designed to use treatments that focused

on increasing attention and motivation, which are necessary to improve task engagement and productivity. The interventions examined in the study utilized low cost, low tech devices that most workers with moderate and severe intellectual disability were able to use independently with minimal training in a workshop setting and all could use during their work activity. Another advantage of the assistive technology device used in this study is that such devices (MP3 players) are used recreationally by individuals with or without ID. The intervention also provides a socially acceptable and unobtrusive way of receiving constant prompting to encourage the participants to be productive. This method of prompting reduces the need for constant supervision and monitoring by other staff.

In summary, the results indicate that individuals with moderate and severe ID can be taught to use MP3 players embedded with music and/or interspersed with auditory prompts to improve task engagement and productivity levels in work settings. It is clear that different strategies work for different individuals with ID. More individuals improved their task engagement and productivity levels with a low tech MP3 player and when they listened to the combination of music and auditory prompts than workers who listened to music alone or auditory prompts alone. Furthermore, more participants were able to generalize the use of the treatment to a new setting and maintain improved task engagement and productivity levels when they listened to the combination of music and auditory prompts than when they listened to music alone or auditory prompts alone. Overall, these findings provide optimism that low cost, low tech MP3 players with music and auditory prompts can improve the task engagement and productivity of adults with

intellectual disability in vocational settings. Effective interventions that increase task engagement and productivity can have positive effects on employability, independence, and feelings of self-worth for adults with moderate and severe ID.

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Appendix A

Table A

Event Recording (Frequency Data)			
S's Name	_____	Date	_____
T's	_____	Behavior	_____
Session #	_____	Condition	_____
Start Time	_____	Stop Time	_____
		Total Time	_____
Directions: Tally number of products			
Summary:	1. Total number of products	_____	
	2. Rate (Rs/minute)	_____	
	3. Reliability percentage	_____	%

Appendix B

Table B

Time Sampling Recording

S's Name \_\_\_\_\_ Date \_\_\_\_\_

O's Name \_\_\_\_\_ Behavior \_\_\_\_\_

Condition \_\_\_\_\_

Start time \_\_\_\_\_ Stop time \_\_\_\_\_ Total time \_\_\_\_\_

(Code: √ occurrence; – nonoccurrence)

1'				2'				3'				4'			
15"	15"	15"	15"	15"	15"	15"	15"	15"	15"	15"	15"	15"	15"	15"	15"
5'				6'				7'				8'			
15"	15"	15"	15"	15"	15"	15"	15"	15"	15"	15"	15"	15"	15"	15"	15"
9'				10'				11'				12'			
15"	15"	15"	15"	15"	15"	15"	15"	15"	15"	15"	15"	15"	15"	15"	15"
13'				14'				15'							
15"	15"	15"	15"	15"	15"	15"	15"	15"	15"	15"	15"	15"	15"	15"	15"

Summary: Number of Nonoccurrences \_\_\_\_\_

Percentage of Nonoccurrences \_\_\_\_\_%

Number of Occurrences \_\_\_\_\_

Percentage of Occurrences \_\_\_\_\_%