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Causal Agency Theory: Reconceptualizing a Functional Model of Self-Determination

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Abstract: This paper introduces Causal Agency Theory, an extension of the functional model of self-determination. Causal Agency Theory addresses the need for interventions and assessments pertaining to self-determination for all students and incorporates the significant advances in understanding of disability and in the field of positive psychology since the introduction of the functional model of self-determination. Causal Agency Theory provides a theoretical framework for developing and enhancing supports to enable youth to engage in agentic action through instruction in goal setting and attainment strategies, to influence self-determination, causal agency, and overall well-being across diverse social-contextual contexts.

In the December 1992 issue of (the then-named) Education and Training in Mental Retardation, Wehmeyer introduced what eventually came to be referred to as the "functional model of self-determination," and discussed its application to students with intellectual disability (Wehmeyer, 1992, 1999). That article (and the functional model) was one of the outcomes of a U.S. Department of Education, Office of Special Education Programs (OSEP) model demonstration project that was one of more than 25 such projects funded by OSEP between 1990 and 1996 (Ward & Kohler, 1996).

Prior to the OSEP model demonstration project initiative, there were only two references to self-determination and students with disabilities in the literature. In 1972, Swedish philosopher Bengt Nirje published a chapter in a text on the Normalization Principle (Wolfensberger, 1972) titled The Right to Self-Determination, which discussed the human rights basis for supporting people with intellectual disability to make decisions about and be actively involved in their lives. In 1986, Deci and Chandler published an article discussing the importance of internal motivation (based upon Self-Determination Theory, discussed briefly in a subsequent section) to students with learning disabilities. The OSEP initiative and a parallel competition (1992–1994) funding five projects to develop assessments of self-determination served as the catalyst for a focus on promoting self-determination for students with disabilities during the transition process.

Much in special education and psychology has changed since 1990 when those initial self-determination model demonstration projects were funded, including the emergence of the discipline of positive psychology and a strengths-based focus on understanding disability, the former of which includes a focus on self-determination and the latter in which self-determination plays a leading role. Given these changes, discussed subsequently, in the intervening quarter century, we believe it is time to revisit how self-determination is conceptualized and defined in the context of the education of students with (and without) disabilities. We begin with a brief summary of self-determination, the functional model and its iterative changes over time, and how self-determination is currently conceptualized in

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research and practice in special education and in positive psychology. We then articulate the reasons for a reconceptualization of the functional model and describe the parameters under which such a reconceptualization should occur. Finally, we propose Causal Agency Theory as a way to understand self-determination that addresses the reasons for a reconceptualization.

Self-Determination and the Functional Model of Self-Determination

What is Self-Determination?

Self-determination is a noun referring either to the determination of one’s own fate or course of action (a personal sense of the term) or to the rights of nations or groups of people to autonomy and self-governance (American Heritage Dictionary, 1992). The latter is the most common use of the term in the modern era, but the former is the oldest and, for our purposes, the most relevant. It refers, in some sense, to a quality or characteristic within a person who determines his or her own fate or course of action. The personal sense of the term emerged from the philosophical doctrine of determinism, which suggests that all action (including human behavior) is in some way “caused.” In the early 20th century, as psychology emerged as a discipline distinct from philosophy, the notion of self-determinism was coopted to begin to understand personality development. Angyal (1941), in proposing the foundations for a science of personality, suggested that an essential feature of a living organism is its autonomy, where autonomous means self-governing or governed from inside. According to Angyal, an organism “lives in a world in which things happen according to laws which are heteronomous (e.g., governed from outside) from the point of view of the organism” (p. 33). Autonomous-determinism, or as it subsequently became, self-determination, refers to self-versus other-caused action.

The Functional Model of Self-Determination

Wehmeyer (1992) canvassed the psychological and educational literature to propose an initial definition of self-determination for use in special education, suggesting that self-determination “refers to the attitudes and abilities required to act as the primary causal agent in one’s life and to make choices regarding one’s actions free from undue external influence or interference” (p. 305). Wehmeyer reasoned that self-determination involves “autonomy (acting according to one’s own priorities or principles), self-actualization (the full development of one’s unique talents and potentials) and self-regulation (cognitive or self-controlled mediation of one’s behavior)” (1992; p. 395). The notion of causal agency reflected the links of the constructs to determinism: people who are causal agents are people who make or cause things to happen in their lives, rather than others (or other things) making them act in certain ways.

In 1996, Wehmeyer, Kelchner, and Richards published an empirical evaluation of what by then had become known as the functional model of self-determination which provided both a refinement of the definition and a theoretical structure within which the development of the construct could be framed. This was called the “functional” model of self-determination because one could not define self-determination in a response-class manner (e.g., by a list of specific behaviors), but instead had to consider the “function” that the action served for the person. Self-determination, at this juncture, was defined as “acting as the primary causal agent in one’s life and making choices and decisions regarding one’s quality of life free from undue external influence or interference” (p. 632).

The current iteration of the definition shares much with the Wehmeyer (1992) version, but moved toward a more action-oriented focus . . . self-determination is “acting” as the primary causal agent in one’s life. People who acted in such a way—that is, to be causal agents in their lives—were said to have the dispositional characteristic (e.g., an ongoing quality or characteristic of the person) of self-determination. The notion of causal agency remained at the heart of the definition, and in many ways, the second half of the definition in both 1992 and 1996 (e.g., . . . making choices and decision regarding . . . etc.) simply was intended to more explicitly define what it meant to be a causal agent, since that term was not as widely understood.
at that time. Further, Wehmeyer and colleagues (1996) conducted a series of discriminant function analyses that identified four “essential characteristics” of self-determined behavior: autonomous functioning, self-regulation, psychological empowerment, and self-realization. As the term “essential” suggests, to be self-determined, one had to act autonomously, self-regulate behavior, and act from a basis of psychological empowerment and self-realization. These essential characteristics became the domains that were measured by The Arc’s Self-Determination Scale (Wehmeyer & Kelchner, 1995), which operationalized the functional model’s structure to measure personal self-determination.

In 2005, Wehmeyer addressed ongoing issues that were impacting the understanding (or misunderstanding) of the self-determination construct, particularly as it pertained to people with more severe intellectual impairments. By and large, people with the most extensive support needs were deemed not to be able to be self-determined because the term was interpreted to mean having control over one’s life. What was missing from discussions in the field up to that point, Wehmeyer argued, was the importance of self-determination as volitional action; where volition refers to the act of making a conscious choice. Thus, he proposed a refinement to the functional model’s definition of self-determination, suggesting that self-determined behavior “refers to volitional actions that enable one to act as the primary causal agent in one’s life and to maintain or improve one’s quality of life” (p. 117). Again, this refinement emphasizes the role of acting and, in this iteration, the fact that one acts volitionally as a causal agent.

As noted previously, the functional model has been empirically validated (Shogren et al., 2008; Wehmeyer et al., 1996); operationalized by the development of an assessment linked to the theory (Wehmeyer & Kelchner, 1995); served as the foundation for intervention development, particularly with regard to the development of the Self-Determined Learning Model of Instruction and related efforts (Shogren, Palmer, Wehmeyer, Williams-Diehm, & Little, 2012; Wehmeyer, Palmer, Agran, Mithaug, & Martin, 2000; Wehmeyer et al., 2012); and provided impetus for a variety of research activities (see Wehmeyer et al., 2007).

Self-Determination in Special Education

Since the introduction of the self-determination construct to special education through the OSEP model demonstration initiative and early publications such as Wehmeyer (1992), promoting the self-determination of adolescents with disabilities has become a best practice in secondary education and transition services (Field, Martin, Miller, Ward, & Wehmeyer, 1998; Shogren, 2013a; Wehmeyer, Abery, Mithaug, & Stancliffe, 2003; Wehmeyer et al., 2007) for several reasons. Before recounting these, it is worth noting that this article focuses on revisions and reconceptualizations to the functional model of self-determination, but we would be remiss if we did not acknowledge that the theoretical and intervention frameworks of Abery, Field, Martin, Mithaug, and Powers, among others (see Wehmeyer et al., 2003), have contributed significantly to establishing the importance of self-determination to youth with disabilities.

First, self-determination status has been linked to the attainment of more positive academic (Konrad, Fowler, Walker, Test, & Wood, 2007; Fowler, Konrad, Walker, Test, & Wood, 2007; Lee, Wehmeyer, Soukup, & Palmer, 2010; Shogren et al., 2012) and transition outcomes, including more positive employment and independent living (Martorell, Gutierrez-Rechacha, Pereda, & Ayuso-Mateos, 2008; Shogren, Wehmeyer, Palmer, Rifenbark, & Little, in press; Wehmeyer & Palmer, 2003; Wehmeyer & Schwartz, 1997) and recreation and leisure outcomes (McGuire & McDonnell, 2008), and more positive quality of life and life satisfaction (Wehmeyer & Schwartz, 1998; Lachapelle et al., 2005; Nota, Ferrari, Soresi, & Wehmeyer, 2007; Shogren, Lopez, Wehmeyer, Little, & Pressgrove, 2006).

Second, research across special education disability categories has established the need for intervention to promote self-determination (Shogren, Kennedy, Dowsett, & Little, in press) documenting that students with intellectual disability (Wehmeyer & Metzler, 1995), learning disabilities (Field, 1996; Field, Sarver, & Shaw, 2003; Pierson, Carter, Lane, & Glaeser, 2008), emotional and behavioral disorders (Carter, Lane, Pierson, & Glaeser, 2006; Pierson et al., 2008) and autism (Chou, Palmer, Wehmeyer, & Lee, 2013; Wehmeyer &
Shogren, 2008) are less self-determined than their non-disabled peers.

Third, there is clear evidence that if provided adequate instruction, students with disabilities can become more self-determined. In a meta-analysis of single subject and group subject design studies, Algozzine, Browder, Karvonen, Test, and Wood (2001) found evidence for the efficacy of instruction to promote component elements of self-determined behavior, including interventions to promote self-advocacy, goal setting and attainment, self-awareness, problem-solving skills, and decision-making skills. Cobb, Lehmann, Newman-Gonchar, and Morgan (2009) conducted a narrative metasynthesis—a narrative synthesis of multiple meta-analytic studies—covering seven existing meta-analyses examining self-determination and concluded that there is sufficient evidence to support the promotion of self-determination as effective. Also, research documents the positive impact of efforts to promote student involvement in educational and transition planning (Martin et al., 2006; Mason, Field, & Sawilowsky, 2004; Test et al., 2004) and more positive transition outcomes and self-determination (Williams-Diehm, Wehmeyer, Palmer, Soukup, & Garner, 2008).

Recently, researchers at the University of Kansas (Wehmeyer, Palmer, Shogren, Williams-Diehm, & Soukup, 2012) conducted a randomized trial control group study of the effect of interventions to promote self-determination in high school students receiving special education services under the categorical areas of intellectual disability and learning disabilities. Students in the treatment group (n = 235) received instruction using a variety of instructional methods to promote self-determination and student involvement in educational planning meetings over three years—which will be detailed in a subsequent section—while students in the control group (n = 132) received no such intervention. The self-determination of each student was measured using two instruments, The Arc’s Self-Determination Scale (Wehmeyer & Kelchner, 1995) and the AIR Self-Determination Scale (Wolman, Campeau, Dubois, Mithaug, & Stolarski, 1994) across three measurement intervals (Baseline, After 2 Years of Intervention, After 3 Years of Intervention). Using latent growth curve analysis, Wehmeyer and colleagues (2012) found that students with cognitive disabilities who participated in interventions to promote self-determination over a three-year period showed significantly more positive patterns of growth in their self-determination scores than did students not exposed to interventions to promote self-determination. Subsequently, in a follow-up study of the treatment and control group students from Wehmeyer et al. (2012), Shogren et al. (in press) investigated adult outcomes one and two years after leaving school. The study measured employment, community access, financial independence, independent living, and life satisfaction outcomes. Results indicated that self-determination status at the end of high school predicted significantly more positive employment, career goal, and community access outcomes. Students who were self-determined were significantly higher in all of these areas. These two studies provided causal evidence that promoting self-determination results in enhanced self-determination, and that enhanced self-determination results in more positive adult outcomes, including employment and community inclusion. A recent randomized-trial study by Powers et al. (2012) also provided causal evidence of the effect of promoting self-determination on community inclusion.

One could argue, and we would be inclined to do so, that we know as much about the importance of promoting self-determination as any transition-related topic. It is with this in mind, then, that we describe the reasons for a reconceptualization of how we understand the self-determination construct.

**Reasons for Reconceptualizing the Functional Model of Self-Determination**

Given the aforementioned evidence of the importance of promoting self-determination and the efficacy of the functional model to drive research, assessment development, and intervention design and evaluation, one might question why a reconceptualization is needed. As should be evident from the previously described changes over time in how self-determination has been defined and operationalized within the functional model, conceptualizing
a complex construct like self-determination is not a static process: It is a process that is impacted by research on the construct, the context in which the construct is hypothesized to exert its effects, and changing understandings of human behavior. We have a number of reasons that we have chosen to revisit the functional model at this point in time, but perhaps most importantly has been the emergence of the discipline of positive psychology. Positive psychology involves the pursuit of understanding optimal human functioning and well-being and a prominent construct in positive psychology is self-determination (Ryan & Deci, 2000). As described subsequently, research in self-determination in positive psychology has focused on the construct in the context of motivational psychology, and while research and theory in self-determination in special education was derived from Deci and Ryan's early work, most of the theoretical perspectives within special education have focused more broadly on self-determination as, in essence, a personality construct and less specifically on motivational aspects pertaining to self-determination.

Additionally, how disability itself is understood is changing, and those changes are affecting practice in the field, including special education practices. These changing understandings of disability are strengths-based and focus on improving the fit between the person's capacities and the demands of the environment or context (Shogren, 2013b). It will be of benefit if issues pertaining to self-determination and students with disabilities are seen through the lens of these strengths-based conceptualizations, and to achieve this, we need a common language and understanding between the use of the self-determination construct in both special education and positive psychology. The functional model was developed incorporating knowledge from early work in motivational psychology and shares common understandings of self-determination as a construct, but there is a need to reconsider the ways in which the construct is conceptualized within a functional model to better align with research and practice in positive psychology.

Not only is there a need to align with research and practice in positive psychology, but also the knowledge about issues relevant to self-determination has exploded as the field of positive psychology has begun to investigate constructs such as optimism, hope, well-being, lifestyle satisfaction, and so forth. Knowledge exists today in areas relevant to self-determination that simply didn’t exist in the early 1990s and a reconceptualization of the functional model would benefit from that progress. Further, the functional model conceptualizes self-determination within a person-environment interaction framework, so it is relevant to the social-ecological approaches prevalent in positive psychology.

Further, the context in which special education “happens” has changed dramatically over the past quarter century. With the emphasis on inclusive practices, access to the general education curriculum, and multi-tiered systems of supports, there is a need to design and test interventions for students with disabilities within the context of school-wide interventions that focus on all students. Indeed, all students can benefit from interventions to promote self-determination and interventions developed through the auspices of the functional model, particularly the Self-Determined Learning Model of Instruction, discussed previously, are applicable for all students and as school-wide interventions. To evaluate the efficacy of such interventions, however, we need measures that are not disability-specific. Just as the OSEP self-determination model demonstration projects served as a catalyst to the development of the functional model in the early 1990s, so too is a similar event providing impetus for us to revisit the functional model’s conceptualization. Specifically, we are engaged in the development of a new assessment of self-determination that will, importantly, be normed with adolescents and young adults with and without disabilities and therefore, can be used to measure the efficacy of interventions for all students in schools.

The confluence of a need for interventions and assessments pertaining to self-determination for all students and the expansion of knowledge in the field of positive psychology along with the opportunity to develop a new assessment to meet this need has led us to revisit the functional model. In doing so, however, we sought to retain the basic understanding and framework of the functional model, so as not to abandon the progress using the
model to this point. In 2006, Wehmeyer and Mithaug proposed “Causal Agency Theory” as a means to move beyond simply conceptualizing the self-determination construct, and to better understand how a person becomes self-determined. Given the centrality of casual agency to the functional model, we have combined aspects of the original version of Causal Agency Theory with the framework of the functional model of self-determination to propose Causal Agency Theory as an extension and revision of the functional model. This is described in the following section.

Causal Agency Theory: A Reconceptualization of the Functional Model of Self-Determination

Causal agency theory conceptualizes self-determination as a general psychological construct within the organizing structure of theories of human agentic behavior. Human agentic theories “share the meta-theoretical view that organismic aspirations drive human behaviors” (Little, Snyder, & Wehmeyer, 2006, p. 61). An organismic perspective views people as active contributors to, or agents of, their behavior. An agentic person is the “origin of his or her actions, has high aspirations, perseveres in the face of obstacles, sees more and varied options for action, learns from failures, and overall, has a greater sense of well-being” (Little, Hawley, Henrich, & Marsland, 2002, p. 390). An agentic person engages in self-regulated and goal-directed action, they “plot and navigate a chosen course through the uncertainties and challenges of the social and ecological environments . . . continuously interpreting and evaluating actions and their consequences” (Little et al., 2002, p. 390). This continually evolving and actively monitored self-system gives rise to a sense of personal agency, or of the agentic self. The agentic self has a “sense of personal empowerment, which involves both knowing and having what it takes to achieve one’s goals” (Little et al., 2002, p. 390). Figure 1, which will be referenced throughout this section, represents this conceptualization of the agentic self as the highest “layer” of human agency.

Unlike stimulus-response accounts of behavior, human agentic action is understood to be: (a) motivated by biological and psychologica

 Foundations for Causal Agency Theory

Self-determination in philosophy. As noted previously, the self-determination construct’s origins lie in the philosophical doctrines of determinism and free will. Determinism is the philosophical doctrine positing that events, such as human behavior, are effects of preceding causes. Free will is conceptualized as the human capacity to act (or not) as we choose or prefer, without external compulsion or restraint. According to philosophers like John Locke, though, human behavior can be both caused and free, as long as the distinction is made between the agent, as actor, and the action, as caused. That is, a person (the agent) is free to act or not, as one chooses, even if the action itself is caused by some deterministic factor.

Self-determination in personality psychology. In Foundations for a Science of Personality (1941), Angyal proposed that an essential feature of a living organism is its autonomy, where autonomous means self-governing or governed from inside. According to Angyal, an organism “lives in a world in which things happen according to laws which are heteronomous (e.g., governed from outside) from the point of view of the organism” (p. 33), and that “organisms are subjected to the laws of the physical world, as is any other object of nature, with the exception that it can oppose self-determination to external determination” (p. 33).
Angyal (1941) suggested that the **science of personality** is the study of two essential determinants to human behavior, autonomous-determinism (self-determination) and heteronomous-determinism (other-determined). Angyal placed primary importance for laying the foundation for a science of personality in the fact that a central process of an organism is the movement toward autonomous determination, noting that “without autonomy, without self-government, the life process could not be understood” (p. 34).

**Self-determination in motivational psychology.** The most visible application of self-determination as a psychological construct has been *Self-Determination Theory* (SDT; Deci & Ryan, 2002), which integrates conceptualizations of innate human tendencies, social contexts, and motivators for human action to illustrate how congruence between one’s basic needs and social contexts spur personal agency that, ultimately, results in improved overall well-being. Specifically, SDT proposed three basic psychological needs—competence, autonomy, and relatedness—that are either supported or challenged by social contexts (see Little et al., 2002, for a discussion of how these psychological needs mesh with evolutionary-based biological needs). These basic psychological and biological needs are represented as the foundation in Figure 1, as meeting these basic needs is necessary to progress to the other layers of human agency and to improve overall well-being, one of the key outcomes and influences of the layers of human agency, demonstrated on the right side of Figure 1.

SDT research has demonstrated that social environments can facilitate or create barriers to the integration of these psychological needs, which can help or harm overall well-being (Ryan & Deci, 2000). This perspective views the process of self-regulation as an organizational function that “coordinates” systemic behaviors and serves as a foundation for autonomy and the sense of self (Ryan & Deci, 2004). Essentially, SDT holds that people’s
basic needs for competence, autonomy, and relatedness drive them toward action, and when environments are supportive of such action, overall well-being is improved.

Causal Agency Theory

Drawing on the foundational understanding of self-determination as (a) self-caused action from philosophy, (b) a central process of an organism in the movement toward autonomous determination, from personality psychology, and (c) motivated by the basic psychological needs of competence, autonomy, and relatedness from SDT, we propose Causal Agency Theory to explain how people become self-determined, that is how they define the actions and beliefs necessary to engage in self-caused, autonomous action that addresses basic psychological needs. Causal Agency Theory represents the “layers” of human agency that fall in between the drive to meet basic psychological and biological needs and the agentic self. This is represented in the four shaded circles in Figure 1. Causal agency (top right box) is the outcome (and an influencer) of the agentic self, and there are three essential characteristics that lead to causal agency: volitional action, agentic action, and action-control beliefs (shaded boxes in the middle of the layers of human agency). We argue that it is at the level of promoting volitional action, agentic action, and action-control beliefs through which instructional and environmental supports can be created to promote the growth of causal agency and ultimately the agentic self.

Definition of Self-Determination

Within the context of Causal Agency Theory, which represents specific layers of human agency, we define self-determination as a dispositional characteristic manifested as acting as the causal agent in one’s life. Self-determined people (i.e., causal agents) act in service to freely chosen goals. Self-determined actions function to enable a person to be the causal agent is his or her life.

Key Terms and Assumptions

Dispositional characteristic. A dispositional characteristic is an enduring tendency used to characterize and describe differences between people; it refers to a tendency to act or think in a particular way, but presumes contextual variance (i.e., socio-contextual supports and opportunities and threats and impediments). As a dispositional characteristic, self-determination can be measured, and variance will be observed across individuals and within individuals over time, particularly as the context changes (e.g., supports and opportunities are provided for self-determined action).

Causal agency. Broadly defined, causal agency implies that it is the individual who makes or causes things to happen in his or her life. Causal agency implies more, however, than just causing action; it implies that the individual acts with an eye toward causing an effect to accomplish a specific end or to cause or create change. Self-determined actions enable a person to act as a causal agent.

Volitional Action vs. Control. Organismic theories differentiate between self-determination as self-caused action and self-determination as controlling one’s behavior. As Deci (2004) observed, “the concept of personal control . . . refers to having control over outcomes” (p. 23). Control is defined as “authority, power, or influence over events, behaviors, situations, or people” (VandenBos, 2007, p. 228). Self-determined action does not imply control over events or outcomes. Instead it refers to the degree to which action is self-caused; that is the degree to which behavior is volitional and agentic, driven by beliefs about the relationships between actions (or means) and ends.

Essential Characteristics of Self-Determined Actions

Self-determined action is characterized by three essential characteristics – volitional action, causal action, and action-control beliefs. These essential characteristics refer not to specific actions performed or the beliefs that drive action, but to the function the action serves for the individual; that is, whether the action enabled the person to act as a causal agent:

Volitional Action. Self-determined people act volitionally. Volition refers to making a conscious choice based upon one’s preferences. Conscious choice implies intention-
ality; self-determined actions are intentionally conceived, deliberate acts that occur without direct external influence. As such, volitional actions are self-initiated and function to enable a person to act autonomously (i.e., engage in self-governed action). Volitional actions involve the initiation and activation of causal capabilities—the capacity to cause something to happen—and something to happen in one’s life.

**Agentic Action.** An agent is someone who acts; a means by which something is done or achieved. Agency refers to self-directed action in the service of a goal. Self-determined people act to identify pathways that lead to a specific end or cause or create change. The identification of pathways, or pathways thinking, is a proactive, purposive process. As such, agentic actions are self-regulated and self-directed. Such actions function to enable a person to make progress toward freely chosen goals and to respond to opportunities and challenges in their environments. Such actions involve agentic capabilities—the capacity to direct action to achieve an outcome.

**Action-Control Beliefs.** Self-determined people have a sense of personal empowerment; they believe they have what it takes to achieve freely chosen goals. There are three types of action-control beliefs: beliefs about the link between the self and the goal (control expectancy; “When I want to do ____, I can”); beliefs about the link between the self and the means for achieving the goal (capacity beliefs; “I have the capabilities to do ____”); and beliefs about the utility or usefulness of a given means for attaining a goal (causality beliefs; “I believe my effort will lead to goal achievement” vs. “I believe other factors – luck, access to teachers or social capital – will lead to goal achievement”). Positive action-control beliefs function to enable a person to act with self-awareness and self-knowledge in an empowered, goal-directed manner.

**Socio-Contextual Influences**

People who are causal agents respond to challenges (opportunities or threats) to their self-determination by employing causal and agentic actions, supported by action-control beliefs. This leads to self-determined action that allows them to initiate and direct their behavior to achieve a desired change or maintain a preferred circumstance or situation. In response to challenges, causal agents use an iterative goal generation process leading to the identification and prioritization of needed actions. The person frames the most urgent action need in terms of a goal state, and engages in a goal discrepancy analysis to compare current status with goal status. The outcome of this analysis is a goal-discrepancy problem to be solved. The person then engages in a capacity-challenge discrepancy analysis in which capacity to solve the goal discrepancy problem is evaluated. The person maximizes adjustment in capacity (e.g., acquires new or refines existing skills and knowledge) or adjusts the challenge presented to create a “just-right match” between capacity and challenge to optimize the probability of solving the goal discrepancy problem.

Next, the person creates a discrepancy reduction plan by setting causal expectations, making choices and decisions about strategies to reduce the discrepancy between the current status and goal status. When sufficient time has elapsed, the person engages in a second goal discrepancy analysis, using information gathered through self-monitoring to self-evaluate progress toward reducing the discrepancy between current and goal status. If progress is satisfactory, they will continue implementing the discrepancy reduction plan. If not, the person either reconsiders the discrepancy reduction plan and modifies that or returns to the goal generation process to re-examine the goal and its priority and, possibly, cycle through the process with a revised or new goal. This process can be explicitly taught, and becomes increasingly internalized with repeated opportunities to engage in self-determined action.

**Development of Self-Determination**

Self-determination develops across the life span, emerging as adolescents develop and acquire multiple, interrelated skills, referred to as component elements of self-determined action that enable the expression of the essential characteristics, including learning to make choices and express preferences, solve prob-
lems, engage in making decisions, set and attain goals, self-manage and self-regulate action, self-advocate, and acquire self-awareness and self-knowledge.

Self-determination is also an important contributor to the individuation process during adolescent development. Individuation refers to the process of moving from being primarily dependent upon others (for a child, typically his or her family), to being primarily dependent upon oneself; the “physiological, psychological, and sociocultural processes by which a person attains status as an individual human being and exerts him- or herself as such in the world” (VandenBos, 2007; p. 477).

Layers of the Agentic Self

To summarize, self-determination is a general psychological construct within the organizing structure of theories of human agentic behavior. Figure 1 describes the multiple layers of human agency described through this paper and their reciprocal influence on each other. The agentic self is the overarching layer. Basic psychological and biological needs represent a foundational layer as the motivation to meet these needs promotes overall well-being and also creates the conditions for volitional action, agentic action, and action-control beliefs which define self-determined action, lead to causal agency, and ultimately the development of the agentic self. Within Causal Agency Theory, the expression and development of the three essential characteristics of self-determined action are shaped by socio-contextual supports and opportunities and threats and impediments and people use a goal generation process and goal discrepancy analysis to identify the component elements that must be used to enable self-determined action.

The motivation to address basic psychological and biological needs described in SDT also influences each of these essential characteristics as well as responses to socio-contextual supports and opportunities and threats and impediments. As people have opportunities to engage self-determined action, they become causal agents, which then influence the degree to which basic needs are met and overall well-being flourishes. Together, each of these elements leads to the overall agentic self. Figure 1 both organizes these patterns of relationships but also demonstrates the that reciprocal influence of each of these layers of human agency on the agentic self, and even the relationship of the agentic self, with each of the elements that contribute to it. Further, it highlights how Causal Agency Theory and the elements associated with it can be used to promote causal agency by creating opportunities for people to learn and use skills associated with self-determined action (the component elements of Causal Agency Theory). For example, as youth learn to engage in agentic action through instruction in goal setting and attainment strategies, this will likely influence not only their agentic actions and causal agency, but also overall well-being, as these beliefs lead to increases in the ability to meet basic psychological needs described by SDT. Further, they may also have greater access to supports and opportunities, and be able to

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better address threats and impediments. All of which influences one’s agentic self.

Conclusion

Causal Agency Theory extends previous work on the functional model of self-determination, integrating the need for interventions and assessments pertaining to self-determination for all students and the expansion of knowledge in the field of positive psychology. Causal Agency Theory situates self-determination within the context of the multiple layers of human agency, and places significant emphasis on self-determined action, rather than self-determined behavior, as the concept of action represents a broader understanding of what contributes to causal agency. Research on self-initiation and self-direction, as well as on the role of beliefs regarding the relationship between actions and goals has provided an additional context for understanding both how to define and support self-determined action. The essential characteristics defined in the functional model of self-determination—autonomy, self-regulation, psychological empowerment, and self-realization - remain part of Causal Agency Theory. These characteristics are merged, however, into newly defined essential characteristics, representative of emerging knowledge in the field of positive psychology – volitional action, agentic action, and action-control beliefs. Table 1 highlights the essential characteristics of self-determined action under Causal Agency Theory, the associated essential characteristics from the functional model of self-determination and additional elements that now define each of the essential characteristics of Causal Agency Theory.

Overall, Causal Agency Theory provides a theoretical framework for developing and enhancing supports to enable youth to engage in agentic action through instruction in goal setting and attainment strategies, this will likely not only influence their agentic actions and causal agency, but also overall well-being. Further work is needed to develop tools to measure these new essential characteristics and to identify effective interventions to support their development. Such work has the potential to build on the existing foundation of knowledge on promoting self-determination in the transition field, while addressing the need to broaden our perspective to include students with and without disabilities, the tenants of positive psychology, and changing understandings of disability, leading to more positive outcomes for all.

References


Fowler, C. H., Konrad, M., Walker, A. R., Test,


Shogren, K. A., Wehmeyer, M. L., Palmer, S. B.,
Abstract: This study examined the effectiveness, generalization, and maintenance of a multi-element intervention consisting of brief direct instruction social skill lessons, a prompting procedure, and a fading procedure to promote social engagement in an integrated lunchroom and playground setting for three elementary age students with developmental disabilities. Results demonstrate that the level of social engagement improved for all three participants with high levels of generalization and maintenance. Social validity ratings by teachers revealed the social skills intervention was considered appropriate and effective. Implications, limitations, and directions for future research are presented.

The inclusive school setting has been cited as a benefit for children with social deficits because it allows them to cultivate a higher level of play and social interaction. Bauminger et al. (2008) and Sigman and Ruskin (1999) found that children with autism who had exposure to play activities with their typically developing peers tended to engage in more complex interactions than children who lacked social exposure to their typically developing peers. Bauminger, Shulman, and Galit (2003) stressed the importance of spontaneous peer interaction in natural settings; children with autism may be able to decipher social situations under laboratory settings, but they struggle to generalize that knowledge in unstructured settings. Their conclusion was that it would be best for students with autism to receive some mediation in the natural setting to assist in the day-to-day interactions with their typically developing peers (Bauminger et al., 2003).

However, Kaufman and Hallahan (1995) have warned that inclusion itself does not guarantee students with developmental disabilities a completely inclusive experience. Girli (2013) noted that while inclusive education may appear to help the social acceptance of students with intellectual disabilities, these students are often shunned by their peers. Typically developing peers may see students with developmental disabilities as outsiders (Schnorr, 1990). To deal with this issue, Girli (2013) advocates the need for social skills instruction to take place in the natural environment to assist the social interactions of children with developmental disabilities with their typically developing peers.

Social Skills Instruction Models

Researchers have evaluated the effectiveness of some models of social skills intervention that do combine the elements of naturalistic settings, peer integration, and adult mediation or prompting. Kohler, Anthony, Steighner, and Hoyson (2001) described a form of “naturalistic teaching” in which the teacher followed the lead of the student in a specific activity by helping the child to augment his social interaction during free-play. The study resulted in improved social interactions and high levels of maintenance in two of the four students included in the study. Bass and Mullick (2007) used an “integrated peer group” model in which children with disabilities interacted with typically developing peers under the guidance of an adult. This model was found to double the amount of interaction of...
its subjects, but failed to maintain following the withdrawal of the intervention. Weiss and Harris (2001) also evaluated peer-mediated social interventions in the natural setting with minimal adult guidance. While positive effects were achieved, the authors recommended adding more specific adult direction, such as prompting, to improve maintenance and generalization.

Prompting

Prompting is a common form of adult guidance used in teaching new skills in natural settings to children with disabilities. Prompting has been used to increase desired behaviors such as life skills (e.g., Ault & Griffen, 2013), communication skills (e.g., Humphreys, Polick, Howk, Thaxton, & Ivancic, 2013), and general hygiene skills in participants with moderate to profound disabilities (e.g., Demchak, 1990). Prompting has also been used to increase social interactions among children with disabilities (e.g., Craig-Unkefer & Kaiser, 2002; Goldstein & Wickstrom, 1986; Sarokoff, Taylor, & Poulson, 2001; Strain, Kerr, & Ragland, 1979; Thomas, Lefasakis, & Sturmey, 2010). Goldstein and Wickstrom (1986) effectively used prompting to facilitate peer interaction of preschool students with developmental disabilities, specifically social elements such as eye contact, joint attention, initiating requests, responding, imitation, and redirection. Craig-Unkefer and Kaiser (2002) used a peer-mediated approach with six preschool children at risk for language delays or behavior problems. In their study, a plan was developed with typically developing peers to facilitate a scripted interaction with at-risk students. During the play session, a type of prompting called “redirection” was used to refocus, instruct, and help facilitate the scripted interaction. For five of the six children, there was an increase in descriptive and request utterance. Studies such as these have demonstrated the effectiveness of interventions that employ a prompting component to increase positive social interaction skills.

Generalization and Maintenance

One limitation of these prompting studies is the overall lack of generalization and maintenance of learned social skills. For example, prompting was used by Strain et al. (1979) to increase the social interactions of four children with autism through a prompting and reinforcement strategy but the social behaviors did not generalize. Specifically within single subject research, initial responses to interventions are well documented; however, maintenance of these effects is rarely documented. This may be due to the necessary investment of time and resources required to collect maintenance data (Sturmey, 1997). For instance, neither generalization nor maintenance data were collected in the study conducted by Craig-Unkefer et al. (2002). With this being said, generalization and maintenance effects were documented in studies conducted by Thomas et al. (2010) and Sarokoff et al. (2001). Generalization effects were apparent in the study conducted by Sarkoff et al. (2001) when effects from a prompting treatment implemented to increase communication generalized to a novel peer in a treatment center for children with autism. Thomas et al. (2010) implemented an intervention that combined prompting, fading, and differential reinforcement to increase the vocal mands and appropriate responses and decrease the immature mands of three children with autism. In this study, generalization was reported and effects were maintained two-months after the intervention phase.

The main purpose of this study was to examine the effectiveness of a social skills intervention that employed brief social lessons with a prompting and fading procedure for social engagement in the natural integrated lunchroom setting for three elementary age students with developmental disabilities. A second purpose of this study was to extend the literature by providing more robust measures of generalization and maintenance.

Method

Participants

Three first grade students with developmental disorders and social deficits were chosen for this
study. To be included in the study, participants were required to be: (a) recognized by a classroom teacher as displaying chronic social interaction deficits; (b) officially referred by a teacher for additional social support; (c) diagnosed with a developmental disorder (i.e., autism or Down syndrome); (d) included with typically developing peers in the school setting; and (e) rated as exhibiting a deficit in functional social skills (i.e., a score below 85 on the Teacher Form – Elementary Level of the Social Skills Rating System (SSRS; Gresham & Elliott, 1990).

Mary. Mary was an eight-year-old female diagnosed with Down syndrome. She was referred to this study by her teachers due to unsuccessful attempts at social interaction with peers. Her teachers reported that Mary would often avoid social interactions with her peers. When Mary did attempt to interact with her peers, she would often display aggressive behaviors toward her peers such as scratching, hitting, and pushing. Her teachers also reported that non-familiar listeners found it difficult to understand Mary due to speech and language deficits. In observations during outdoor recess periods, she would climb on the equipment or wander in the grass. On the rare occasion she was seen interacting with others, it was with the adult playground staff. During observations in the lunchroom, Mary chose to sit with the special education staff and two non-verbal students rather than with her typically developing peers. During her time at that table, she was never observed interacting with the students and rarely interacted with the staff. Mary’s standard score of 79 on the SSRS Social Skills subscale was below average as compared to same-age peers.

Chantelle. Chantelle was a seven-year-old female student educated in a mainstream first grade classroom. During the course of this study, she was being evaluated for Autism Spectrum Disorder by a multidisciplinary team. Chantelle often avoided social interaction with her peers by separating herself physically from her cohort group. When peers attempted to communicate with her, she would typically respond as quickly and concisely as possible, ending the interaction directly following her response. When she did speak, she would put her head down and speak in a tone so soft that listeners had difficulty understand-
passed the rows of tables, and into the kitchen to receive their lunch trays. Once they were seated, permission was needed to leave their assigned area to get any additional food or condiments.

Playground. Generalization data was collected on the playground during typical recess activities such as: playing on the equipment, playing with balls and jump ropes, or digging in a sand pit. The playground was a large area with a soccer field, jungle gym with connected slide, swings in a separate area, paved pavilion for jumping rope, and shaded sand pit.

Inclusion. Chantelle spent 100% of her day with typically developing peers in the regular classroom, while Mary and Beatrice spent less than half of their day with typically developing peers. Mary and Beatrice received core academic instruction in the special education setting while attending classes such as music, art, PE, recess and lunch alongside typically developing peers.

Dependent Variable

The target behavior in this study was social engagement. Social engagement was defined as verbal interaction or active listening with peers utilizing eye contact, body language, and audibility. Furthermore, verbal interactions were required to be on topic and within a conversational turn. The qualifiers of eye contact, body language, and audibility were added to the behavioral definition to ensure that social engagement was appropriate for the situation. For example, verbal interactions that occurred in quiet tones to no one in particular while looking in a random direction would not constitute social engagement. In order to be socially engaged, the student needed to be looking at a peer while verbally interacting, her voice audible enough for the typically developing peer to hear the verbalization, and the participant needed to be facing the peer, leaning into the peer, or moving her body to indicate interaction with a peer (i.e., looking at a sticker together, pointing at a poster, or showing an object in her lunch).

Independent Variable

The independent variable in this study was a multi-element intervention consisting of a limited number of brief direct instruction social skill lessons, a prompting procedure, and a fading procedure.

Social skills lessons. The social skills lessons followed a direct instruction format. The social skills lessons were conducted during transition to lunch in a one-to-one format with the first author. There were five specific social skills lessons, each focused on an element of the social skill (“talking with friends”). Each social skills lesson took approximately five minutes. During subsequent transitions, the researcher and participant briefly reviewed the elements of the social skill. The content of each lesson is described in detail in the following paragraphs.

Session one. As a participant began the intervention phase, the first author would meet the participant a few minutes before transition to lunch. The researcher began by explaining to the participant the expectation that lunch is “a time to talk with our friends”. The researcher asked the participant the following questions:

- How do you feel about talking with friends at recess or lunch?
- Is it hard to talk with your friends?
- What stops you from talking with your friends?
- Why do you think it might be important to talk to friends?
- Why is it important to listen to friends?
- Would you like to learn how to talk better with your friends?

Next, the researcher explained that several important elements comprise effective “talking” with peers, such as “looking at our friends,” “facing our friends when we talk,” “speaking loudly enough for our friends to hear us,” and “talking to our friends about things they like to talk about.” During the first session of the intervention, the researcher only gave an overview of the expectations; specificity regarding each skill was added during successive sessions. In the first session, the researcher also presented the participant with a piece of paper called a “friend paper,” explaining that each time the participant talked with her peers, she would receive a sticker on her “friend paper” to show how many times she had talked with a friend that day.
Session two. On the second day of the intervention, the researcher met with the participant during the transition to lunch and led a brief lesson on eye contact. The researcher explained eye contact by using visible examples. The researcher gave examples and non-examples of eye contact, and asked the student to identify examples of correct or incorrect eye contact. The researcher then asked the participant to show correct and incorrect examples of eye contact. Once the researcher could see that the student was confident in her understanding of eye contact, the researcher reminded the student to use eye contact while talking with her friends at lunch that day. The researcher presented the student with the sticker paper and challenged the student to talk with her peer as much as she could that day.

Session three. On the third day of the intervention, the researcher met the student before the lunch transition and led a brief lesson on body language. Body language was defined as facing a peer when talking. The researcher explained what body language was by using visible examples. The researcher provided examples and non-examples of audibility and encouraged practice of the skill. Once the researcher could see that the student was confident in her understanding of body language, the researcher challenged the student to face her peers when talking at lunch with them that day. The researcher presented the student with the sticker paper and challenged the student to talk with her peer as much as she could that day.

Session four. On the fourth day of the intervention, the researcher met the participant before the lunch transition period and led the student through a brief lesson on audibility. Audibility was defined as talking loudly enough for peers to hear, but without yelling or screaming. The researcher explained what audibility was by using audible examples. Again, the researcher provided examples and non-examples of audibility and encouraged practice of the skill. Once the researcher could see that the student was confident in her understanding of audibility, the researcher challenged the student to speak loud enough when talking at lunch with peers that day. The researcher presented the student with the sticker paper and challenged the student to talk with her peer as much as she could that day.

Session five. On the fifth day of the intervention, the researcher met the student before the transition to lunch and led the student through a brief lesson on subject topics. "Subject topics" were defined as conversation starters that would help start a conversation or how to sustain a conversation by remaining on the topic of the peers’ choosing. The researcher described conversation starters by using audible examples. The researcher provided examples and non-examples and led the participants in practice of the skill. Once the researcher could see that the student was confident in her understanding of remaining on topic or starting a conversation, the researcher challenged the student to utilize this element when talking at lunch with peers that day. The researcher presented the student with the sticker paper and challenged the student to talk with her peer as much as she could that day.

Subsequent sessions. After the fifth day of social skills training, the researcher focused on all elements of engaging with peers: eye contact, body language, audibility, and topic choice. During the transition period before lunch, the researcher quizzed the participant by asking about each topic to make sure that the participant still understood the important elements of successful engagement with peers.

Prompting procedure. During the lunch period, the researcher prompted the participant at the end of each minute to give the friend eye contact, face her peer, use an audible voice, or prompt the peer to discuss a topic with a friend by using a generic conversation starter, or by prompting the participant to say something germane to the subject already in discussion. If the participant was not talking with a peer, the researcher instructed participant to look peer in the eyes and prompt using a generic prompt. Generic prompts were:

- Ask your friend what they will do tonight when they get home
- Ask your friend what they did over the weekend, or what they did last weekend
- Ask your friend what they have for lunch today
• Ask your friend what they are going to do in class today

When the participants engaged in conversation with a peer, either prompted or unprompted, a typically developing peer placed a sticker on the participants “friend paper.”

Fading procedure. When the participant was able to maintain social engagement at or above 50% of session intervals over four sessions, the prompts were faded to one prompt every two minutes. Once the prompts were changed to every two minutes, the participant receiving the intervention no longer received stickers for interacting with peers. Instead, the participant receiving intervention was able to give stickers to a peer that was “being a good friend” during lunch. When the student was able to maintain a level of engagement at or above 50% over four sessions with prompts delivered every two minutes, the researcher reduced prompting to every four minutes. Finally, prompting ceased after the participant maintained social engagement at or above 50% for four consecutive sessions with prompts received every four minutes. After prompting ceased, the researcher simply patted the participant on the back after successful engagements with peers during lunch.

Research Design

This study employed a multiple baseline design across participants. This design was chosen because the intervention involved teaching social engagement skills that were not functionally reversible. The study consisted of three phases: baseline, intervention, and maintenance. Baseline data were taken continuously across all three students. The first participant (Mary) moved from baseline to intervention session once a minimum of five consecutive data points demonstrated a stable and level or non-therapeutic trend. Intervention was implemented with the next participant once the previous participant demonstrated a therapeutic trend and/or increase in level across at least three data points. The authors determined the order of implementation across participants. Beatrice had frequent absences during baseline; to ensure sufficient baseline data, she was the last participant to enter the intervention phase. Data were collected four days per week and a minimum of 15 data points were collected during intervention for each participant.

Measurement

Social engagement was measured using 15-second momentary time sampling for 20-minute sessions in the lunchroom setting. At the end of each interval, a plus was scored if the participant was engaged in the target behavior. A minus was scored if the participant was not engaged in the target behavior at the end of the 15-second interval. Generalization data was collected on the playground during recess using the same 15-second momentary time sampling method during 20-minute sessions. Inter-observer reliability is described under the Reliability section of this study.

Procedure

Baseline sessions. During baseline sessions, the participants transitioned as usual to lunch. The researchers maintained a distance from the student and collected data on participant social engagement. Researchers did not interact with the participants or peers during baseline sessions.

Intervention sessions. During intervention sessions, the first author implemented the multi-element intervention (social skills lesson during transitions, prompting and fading during lunch) as described in the Independent Variable section of this manuscript. The researchers collected data on participant social engagement using the same methodology as during the baseline session.

Maintenance sessions. Follow-up sessions were conducted after the summer break. As conducted during the original baseline sessions, researchers sat apart from the participants in the cafeteria and on the playground to collect data on social engagement.

Treatment Integrity

Treatment integrity data were collected to verify the presence or absence of intervention elements. Treatment integrity data were collected on the social skill lesson intervention using event recording; during 100% of sessions, the researcher self-documented the oc-
currence or non-occurrence of a social skills lesson. A second observer documented the occurrence or non-occurrence of the social skills lessons during 33% of intervention sessions. Treatment integrity data were collected on the prompting procedure using one-minute partial-interval recording during 100% of intervention sessions. A second observer also documented the treatment integrity of the prompting procedure during 33% of intervention sessions.

**Reliability**

*Inter-observer agreement.* A second observer independently collected social engagement and treatment integrity data to assess interobserver agreement (IOA). Prior to baseline data collection, the two observers conducted two complete data collection sessions to ensure IOA across social engagement, verbalizations, and treatment integrity met or exceeded 85% agreement. For the interval data (social engagement and treatment integrity data), IOA was determined by dividing the number of agreements (i.e., intervals scored identically) by the total number of intervals and then multiplying the results by 100 (Kazdin, 1982).

For social engagement and treatment integrity, IOA data were collected across 33% of all sessions with average agreements of 95.6% (range = 91 to 100%) and 97% (range = 96 to 98%), respectively. For generalization, IOA data was collected across 27% of all sessions with average agreements of 98.6% (range = 95 to 100%).

**Social Validity**

Social validity was measured using the Intervention Rating Profile-15 (IRP-15; Martens, Witt, Elliott, & Darveaux, 1985). The IRP-15 was completed by each participant’s teacher prior to baseline and following intervention to assess whether the intervention elements in place at the time were perceived to be warranted, acceptable, appropriate, and effective for each participant. This measure consists of fifteen items to evaluate the teachers’ perception on the success or lack of success of the intervention. Teachers rate each item on a Likert scale ranging from one (strongly disagree) to six (strongly agree) for such items as “most teachers would find this intervention suitable for the behavior problem described,” and “I like the procedure used in this intervention.” Scores higher than 52 indicate that the teacher finds the intervention to be acceptable (Scattone, Tingstrom, & Wilczynski, 2006).

**Results**

**Social Engagement**

*Mary.* Mary’s social engagement averaged 1% (range = 0 to 2%) of intervals during the baseline condition. When intervention began with Mary on Day 6, social engagement increased to an average of 62% (range = 20 to 93%) of intervals. When the intervention fading was implemented and prompts were delivered every two minutes instead of every four minutes, social engagement averaged 70% of intervals (see Figure 1). There were no overlapping data points between baseline and intervention conditions. Treatment integrity remained high with levels averaging 98%.

*Chantelle.* During baseline, Chantelle’s social engagement averaged 2% (range = 0 to 7%) of intervals and increased to an average of 73% (range = 50 to 97%) of intervals following implementation of intervention on Day 11. When intervention fading was implemented and prompts were delivered every two minutes, social engagement averaged 81% of intervals. When prompts were delivered at four-minute intervals, social engagement averages dropped to 66% of intervals. Finally, when the intervention was withdrawn and no prompts were delivered to Chantelle, social engagement averaged 69% of intervals. There were no overlapping data points between baseline and intervention conditions and treatment integrity remained high with levels averaging 98%.

*Beatrice.* Beatrice’s social engagement averaged 1% (range = 0 to 3%) of intervals and increased to an average of 36% (range = 17 to 72%) of intervals following the implementation of intervention on Day 17. Because Beatrice’s social engagement levels did not reach a level of 50% of intervals for four consecutive days, intervention elements were not faded and prompts continued to be delivered at one-minute intervals during the course of the entire study. There were no overlapping data
points between baseline and intervention conditions. Like the other participants in this study, treatment integrity remained high with levels averaging 98%.

**Generalization**

Generalization data was collected during both the baseline and intervention conditions of the study. Concurrent with baseline, Mary’s social engagement generalization data averaged 1% (range 0 to 3%) of intervals during typical playground activities. After intervention was implemented, generalization data increased to an average of 26% (range 0 to 58%) of intervals socially engaged (see Figure 2). Chantelle was socially engaged on the playground during 1% (range 0 to 3%) of inter-
vals concurrent with the baseline condition. Social engagement increased to an average of 51% (range = 3 to 100%) of intervals following intervention implementation. For Beatrice, generalization levels increased, though the increase was smaller than that of Mary and Chantelle. Concurrent with the baseline condition, Beatrice’s social engagement levels averaged 3% (range = 0 to 8%) and increased to 15% (range = 0 to 38%) following implementation of intervention elements.

**Maintenance**

Maintenance data were collected after summer break to evaluate the lasting effects of the intervention. Chantelle’s family planned on moving prior to the beginning of the new
school year, so maintenance data were collected during the morning mealtime during summer school (Day 85 to 89). Data was collected for Mary and Beatrice several weeks into the new school year (Day 123 to 127). Mary’s social engagement maintenance data averaged 47% (range = 30 to 68%) of intervals during the maintenance phase. For Chantelle, social engagement data averaged 50% (range = 40 to 62%) of intervals during mealtime in summer school. Finally, Beatrice maintained an average of 25% (range = 16 to 37%) of intervals the following school year. For Mary and Beatrice, maintenance data were also collected on the playground to evaluate how generalization effects were maintained the following school year. Mary’s level of generalization maintained at an average of 55% (range = 30 to 75%) of intervals while Beatrice averaged 44% (range = 33 to 58%) of intervals socially engaged during recess three months after the conclusion of the intervention phase.

Social Validity

The teachers’ social validity rating measured with the IRP-15 averaged 38 (range = 30 to 53) prior to the intervention condition and 75 (range = 75 to 76) following implementation. Teachers rated the practices prior to intervention with a score of 30 and the intervention practices with a score of 75 following implementation. Chantelle’s teacher rated the practices pre-intervention with a score of 53, one point above acceptable; her teacher indicated willingness to use the pre-intervention practices in her classroom and felt these practices were consistent with those she had used in the past. Further, she felt the practices were appropriate for a variety of children. Following implementation, Chantelle’s teacher rated intervention practices with a score of 76. Finally, Mary and Bailey’s teacher rated the practices pre-intervention with a score of 30 and following intervention rated the practices with a score of 75.

Discussion

This study evaluated the use of a multi-element social skills intervention that employed brief social lessons with a prompting and fading procedure for social engagement in an integrated lunchroom setting for three elementary age students with developmental disabilities. Prior to the intervention, each of the participants exhibited deficits in functional social skills as compared to their same-age peers as measured by the SSRS (Gresham & Elliott, 1990). The social skills intervention incorporated brief social skills instruction, inclusive practices, prompting procedures, and positive reinforcement. As a result, each of the participants’ social engagement improved in both the intervention and generalization setting. Further, the effects of the program maintained following a break in the school year for summer vacation. Overall, the teachers perceived this intervention as acceptable for the participants involved in the study.

Extending the Literature

These findings extended previous research on social skills training in a few important respects. First, the authors were unable to locate previous studies that combined the elements utilized in this intervention within an integrated, non-academic setting like the lunchroom. The multi-element intervention procedure used in this study could provide a viable option for school districts that struggle to meet social skills minutes on students’ IEPs. Second, this intervention addresses the need for social skills instruction to be taught in social settings (Hauck, Fein, Waterhouse, & Feinstein, 1995). Bauminger et al. (2008) determined that children with high functioning autism were able to develop friendships similar to their typically developing peers when they were exposed to the model of typically developing peers. This intervention confirms those findings. It may be that participants were able to increase their social engagement and generalize and maintain the results because the intervention was conducted in a setting where they were able to model their behavior after their typically developing peers. Third, this intervention demonstrates the effectiveness of prompting in a setting where the participants are at different levels of proficiency. All of the participants in this intervention were at different levels of social communication. Prompting was an important element that allowed the intervention to be tailored to the social needs of each partici-
“Naturalistic teaching” (Kohler et al., 2001) was used to follow the lead of the students in the intervention, and the researcher was able to prompt the student in a real situation as to possible ways to augment her social interactions with her typically developing peers.

Finally, this study demonstrated generalization and maintenance effects that are not commonly seen in social skills studies. Many social skills interventions have poor generalization and maintenance (McIntosh & MacKay, 2008). This may be because the intervention is conducted in a setting that does not resemble an actual social setting at school (Gresham, Sugai, & Horner, 2001). This study was conducted in the actual environment in which social interaction would be expected in the school setting. The degree to which peers were involved in this intervention may also have assisted in the continued support for social engagement in non-trained settings and during the following school year. In other words, rather than putting social behaviors on extinction due to the type of social exclusion by peers described by Girli (2013), the continued involvement of peers allows for the natural reinforcement of social skills and thus the maintenance and generalization of those skills.

Additional Improvements

The authors and teachers anecdotally noted other improvements in related student behaviors throughout the duration of this study. For Chantelle, the social skills improvements in the lunchroom setting also generalized to the academic setting. Her improved social interactions generalized in the classroom as noted by her teacher in an email sent to the principal: “[Chantelle] has made wonderful improvement in her behavior. I see a happy and laughing child with zero temper tantrums. [Chantelle] is now participating in cooperative groups and laughs with her peers.” Classroom teachers also noted that Mary demonstrated improved behavior in the classroom by increases in the duration and frequency of her interactions with peers during group projects and field trips. Her social interactions were also seen as more appropriate with her typically developing peers. Beatrice’s teachers and paraprofessionals reported that she stopped having daily tantrums, became more productive in class, and was more appropriate with her peers. Prior to the intervention, Beatrice needed to be given an incentive to go to recess. After the intervention, her paraprofessionals would say, “Let’s go play with our friends” and Beatrice would promptly leave her activity to go to recess. In addition, both Mary and Beatrice were more integrated in the general education setting for the following school year.

The intervention was also successful in developing a peer group of friends for one of the students in the study. Chantelle was able to develop a group of friends that allowed her to improve her social interaction without the need for additional incentives after the initial fading of prompts to every two minutes. Chantelle was significantly higher functioning than the other two participants, which may support the findings of Bauminger et al. (2003) who found that children with low-functioning autism were much less likely to interact with their peers than the children with higher functioning autism. This study found that Chantelle required less prompting, and peers did not require incentives to maintain interaction with Chantelle. However, peers did require incentives to remain invested in the social attempts of Mary and Beatrice. It should be noted that Chantelle spent the entire day with her typically developing peers, while Mary and Beatrice spent less than half the day with their typically developing peers. This may have made it easier for Chantelle to integrate socially with her peers.

Influence of Unexpected Issues

While all of the participants made gains in social engagement, there were unexpected issues that likely influenced the results of the study. Some of these variables were within control of the researchers, while others were not. During baseline observations, Beatrice would wander the lunchroom and often leave fifteen minutes early. Therefore, during the initial phase of the intervention, most of the prompting was focused on directing Beatrice to sit with her peers the entire lunch period. More immediate improvement of Beatrice’s social behavior may have oc-
curred if this wandering behavior had been dealt with prior to initiating the intervention. However, it could also be argued that the Beatrice’s new social engagement skills provided a reason for her to stay seated with peers at lunch.

In addition, school attendance interfered with Chantelle’s intervention. This unexpectedly may have resulted in the lower levels of interaction during playground generalization. During the 20–25 days of the intervention, Chantelle often did not arrive at school on time. The result of her tardiness was that Chantelle was placed in lunch detention. After conferring with the administration, the first author was permitted to retrieve Chantelle from lunch detention and escort her to the playground. However, by the time Chantelle arrived at recess, her peers were already playing and Chantelle had difficulty interjecting with her group of friends and chose, instead, to return to her baseline behavior of sitting on the wall.

Finally, during the new school year, changes were implemented in the lunchroom that limited social interaction among all students. These changes were made to focus on a “quiet time” and involved spreading out the lunchroom tables and admonishing talking students. This may account for the lower levels of maintenance data for Beatrice and Mary in the lunchroom in comparison to the playground.

Taken together, these challenges suggest that researchers and practitioners may encounter both predictable and unforeseen impediments to realizing the benefits of social skills intervention. Researchers and practitioners should carefully consider the possible impact of associated behavior problems on the development of social skills and determine whether to deal with these behaviors in advance or as part of the intervention. They should also be aware that current administrative rules and changes in administrative policy may impede the benefits of social skills intervention.

Limitations

Certain factors limit the interpretation and generalization of the results of this study. Complete fading of the prompts could not be achieved with the final two subjects due to the ending of the school year. To compound the concerns, each time a fade was implemented, there was a drop in social interactions by the participants. Generally, studies have not substantiated that children will continue to socially engage without adult prompting (Stanton-Chapman, Kaiser, & Wolery, 2006). It would be important to evaluate whether social interactions could be maintained once prompts have been completely faded in various settings.

Future Research

This study was implemented with one participant who was fully integrated with peers during the day and two participants who were not fully integrated. It is very possible that the degree to which students are integrated with peers could affect the outcomes of the multi-element intervention used in this study. Future research should consider examining the use of this intervention across both limited and full inclusion settings, possibly to determine whether the setting type has a significant effect on the development of social skills. Additionally, this study had findings that concur with previous research showing that high functioning students benefitted more from social skills intervention than low functioning students. Future research should be directed at discovering how to improve outcomes for low functioning students.

In developing the prompting procedure, it was difficult to determine the appropriate level of interaction before moving the participant to the next fade in the prompting procedure. Therefore, we collected comparison data to assist in determining typical levels of social engagement at lunch. In order to effectively compare the participants in this study to their same-age peers, 30 comparison group participants were randomly selected from among typically developing students who attended the same lunch period as the participants. Social engagement data was collected using 15-second momentary time sampling procedures for 20-minute sessions. Control group participants’ social engagement data averaged 44% of intervals (range = 7 – 70%). This information assisted in developing appropriate levels of engagement required to...
begin the fading of the prompting of the procedure. Future studies should consider the importance of collecting comparison data to develop appropriate expectations and goals for participants in the study.

Conclusions

This study demonstrates the efficacy of a multi-element intervention employing brief social skills lessons and prompting procedures in the lunchroom setting. Additionally, the study demonstrated that the skills learned by students were generalizable to other settings and maintained over long periods of time. Teaching social skills in the inclusive setting can provide children with disabilities the opportunity to engage with typically developing peers and help students navigate the labyrinth of social interactions. By employing social skills interventions within naturally social situations, both children and educators are able to embrace the promise of inclusive education.

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Use of a Proximity Sensor Switch for “Hands Free” Operation of Computer-Based Video Prompting by Young Adults with Moderate Intellectual Disability

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Abstract: In this study, the effectiveness of a “hands free” approach for operating video prompts to complete multi-step tasks was measured. Students advanced the video prompts by using a motion (hand wave) over a proximity sensor switch. Three young adult females with a diagnosis of moderate intellectual disability participated in the study. Effectiveness of the intervention was determined using a multiple probe design across three craft activities and replicated with the three young adults. Results indicate all three students demonstrated the ability to: master operation of the proximity sensor switch to operate the video prompts; independently complete the craft activities and; maintain their performance using the “hands free” approach.

Research supports the use of video prompting as a means for providing information to persons with intellectual disability in order for them to independently complete tasks (Banda, Dogoe, & Matuszny, 2011). When using video prompting, tasks are broken down into their component steps and each step, or cluster of steps, is presented via a video clip. The user watches a video clip (prompt), completes the corresponding task step, returns to the video player, watches and performs the next step and so forth until all of the steps of the task are completed. Video prompts have been used to teach a variety of daily living skills including: setting a table (Goodson, Sigafoos, O’Reilly, Cannella, & Lancioni, 2007); cooking (Graves, Collins, Schuster, & Kleinert, 2005; Johnson, Blood, Freeman, & Simmons, 2013; Mechling, Gast, & Fields, 2008; Mechling, Ayres, Foster, & Bryant, 2013; Mechling, Gast, & Seid, 2009; Payne, Cannella-Malone, Tullis, & Sabelny, 2012); washing tables (Cannella-Malone, Brooks, & Tullis, 2013; Cannella-Malone, Wheaton, Wu, Tullis, & Park, 2012); sweeping and vacuuming (Cannella-Malone et al., 2012; 2013); cleaning a sink and folding towels (Mechling, Foster, & Ayres, 2013); washing dishes (Sigafoos et al., 2007); and doing laundry (Horn, Miltenberger, Weil, Mowery, Conn, & Sams 2008); vocational skills (Van Laarhoven, Johnson, Van Laarhoven-Myers, Grider, & Grider, 2009), and recreational skills (Chan, Lambdin, Van Laarhoven, & Johnson, 2013; Edrisinha, O’Reilly, Choi, Sigafoos, & Lancioni, 2011).

When using video prompting to complete such tasks, video has been presented on desk top computers (Cannella-Malone et al., 2006; Sigafoos et al., 2005; 2007; Zisimopoulos, Sigafoos, & Koutromanos, 2011); laptop computers (Edrisinha et al., 2011; Goodson et al., 2007; Horn et al., 2008; Mechling, Ayres, et al., 2013; Van Laarhoven, Kraus, Karpman, Nizzi, & Valentino, 2010; Van Laarhoven, & Van Laarhoven-Myers, 2006); tablet PCs and notebooks (Cannella-Malone et al., 2011; Mechling, Foster et al., 2013); portable DVD players (Mechling et al., 2008; Mechling &
Stephens, 2009); hand held devices such as personal digital assistants (Mechling et al., 2009; 2010), iPhones (Bereznak, Ayres, Mechling, & Alexander, 2012) and iPads (Cannella-Malone et al., 2012; 2013; Chan et al., 2013; Johnson et al., 2013; Payne et al., 2012; Van Laarhoven et al., 2009). Operation of these formats of video presentation require the person with an intellectual disability to manipulate a computer mouse or touch screen (Bereznak et al.; Cannella-Malone et al., 2012; 2013; Kellem & Morningstar, 2012; Mechling et al., 2009; 2010; Van Laarhoven et al., 2009; 2010; Mechling & Seid, 2011) or another adult to advance the video clips (Cannella-Malone et al., 2006; 2011; Edrisinha et al., 2011; Goodson et al., 2007; Mechling, Ayres et al., 2013; Payne et al., 2012; Sigafos et al., 2005; 2007). While these means of manipulating the video are effective, use of an adult to advance the program reduces the level of independence experienced by the user and there are times when the ability of the person with a disability to operate a computer or handheld device may be impeded. When a person’s hands are wet (i.e., cleaning tasks), soiled (i.e., cooking), or occupied (i.e., holding a spoon and stirring) they may find it difficult to touch a screen or computer mouse or they may be hesitant to contact a surface which might result in damage to the device. This concern for operation of video players when the user’s hands are dirty or occupied has implications for a hands-free means to operate video prompting (Mechling, Ayres, Bryant, & Foster, 2014a, b).

The purpose of this study was to extend the research on video prompting by addressing the need for “hands free” operation of video players (i.e., laptop computers, tablet PCs and portable devices with touch screens) when completing tasks which require the user’s hands to be occupied (i.e., holding materials needed for task completion) or when the user’s hands may be wet (i.e., washing dishes) or soiled (i.e., gluing a craft). While other forms of video instruction such as video modeling (video is provided in advance of the task), simultaneous video modeling (automatic playing of the video in sync with task completion), and continuous video modeling (automatic and ongoing playing of the video, over and over), these forms may not be appropriate when the student finds it difficult to: keep up with the pace of the video (simultaneous video modeling); relocate the target step in the video (continuous video modeling); or for lengthy tasks with multiple steps (Mechling et al., 2014a, b). or and when students find it difficult or Timing with continuous video modeling, much like simultaneous video modeling, is provided which may assist with the flow of the task, but may be difficult to use across complex tasks with numerous steps. The specific research questions included can persons with moderate intellectual disabilities: (a) operate a tablet computer “hands-free” (without touching the screen or use of a computer mouse) through use of a proximity sensor switch; and (b) complete multi-step tasks using video prompting operated via the proximity sensor switch.

Method

Participants

Three female adolescents with moderate intellectual disability were selected to participate in the study due to their need to independently complete multi-step tasks and expressed interests in completing craft activities. Teresa was the only student who had previous experience with video instruction, but all three students used computers for recreation and instruction. Students attended a high school transition program housed on a university campus. The program focused on teaching daily living, community, and vocational skills.

Teresa was 20 years and 9 months old with a diagnosis of moderate intellectual disability and cerebral palsy with left hemi-plegia. Her full scale IQ score on the Wechsler Intelligence Scale for Children – Fourth Edition (WISC-IV: Wechsler, 2003) was 45. Her permanent record contained no measurement of adaptive behavior skills however, she completed all of her personal care needs (including use of makeup and clothing selection), completed her own laundry, cleaned her room and completed basic household and cooking tasks. She was competitively employed part time at a hair salon. She spoke in complete sentences and was socially interactive with male and female peers although she
engaged in disagreements with female peers that had to be settled by the teaching staff and did not always recognize the consequences of her decisions such as trusting others and interacting with males. In the community she was working on using the next dollar strategy to independently make purchases, following a picture/text based shopping list, and identifying public bus routes to and from frequently used sites. She could read basic sight words and community words and was working on increasing her decoding skills. She completed simple demographic information on job applications and copied additional information on such forms (i.e., work references). She enjoyed spending time with friends and family, playing board games, and completing basic arts and crafts activities.

Qianna was 19 years and 11 months old with a diagnosis of moderate intellectual disability. Her full scale IQ score was 52 on the Stanford-Binet Intelligence Scale – Fifth Edition (Thorndike, Hagan, & Sattler, 1986) and her composite score on the Adaptive Behavior Assessment System – Second Edition (Harrison & Oakland, 2000) was 55. She spoke in complete sentences, used age appropriate phrases and jargon, and demonstrated a sense of humor. Although she was eager to please others she also demonstrated confrontational behaviors with peers and adults. She enjoyed staying up with the latest fashions, but required reminders to brush her teeth, tie her shoes, bathe/shower, and to use deodorant. She was working on preparing healthy snacks such as fruit salads, and could prepare simple microwave and stove top dishes. She was not permitted to travel independently in the community, but understood pedestrian skills and was working on identifying bus stops when traveling with a group. She could follow simple written instructions and lists to complete shopping and classroom jobs. She read on a third grade level and her needs included recalling events in a story and the order of their occurrence. She wrote legibly, but required verbal cues for spacing and size of letters. She was writing up to four sentences in paragraph forms and her needs included identifying the topic sentence and composing her ideas using a tree map prior to writing. She told time using digital and analog clocks and was learning to manage her time and to predict what time to start a task or leave for an appointment to finish or arrive on time. She counted bill combinations and was learning to count bill and coin combinations with more advanced requirements (i.e., quarter plus dime). She enjoyed shopping, being with friends, listening to music, and drawing.

Lacy was 20 years and 11 months old with a diagnosis of moderate intellectual disability and ADHD. Her full scale IQ score was 54 on the Wechsler Intelligence Scale for Children – Fourth Edition (WISC-IV: Wechsler, 2003) and her composite score on the Adaptive Behavior Assessment System – Second Edition (Harrison & Oakland, 2000) was 72. Lacy was eager to please others and worked independently on familiar tasks. She was impulsive and hasty in her responses, often saying, “I forget” or “I can’t.” She exhibited aggressive and “bullying” behaviors towards peers with disabilities. She took care of her personal care needs with reminders to complete daily grooming tasks. She enjoyed cooking and was learning to prepare simple stove top meals with multiple ingredients while reading and applying recipe abbreviations and cooking terms. She carried her own money and identification card and could count bill and coin combinations when making purchases. Her needs included following a written list in small grocery and convenience stores when shopping. She read and followed a daily agenda and sections of the newspaper using decoding skills and was learning to read words using blends. She navigated the internet to find and read such things as grocery store flyers and advertisements. She used a calculator to solve math problems and was learning to use the calculator to find grocery totals and determining the amount to pay with tax. She enjoyed sports, computers, music, games, and crafts.

Setting
All sessions took place in a separate classroom of a university building where the transition program was located. The room was equipped with large tables and two such tables were moved together to hold all of the task materials, laptop computer, and switches.

Tasks, Materials, and Equipment
Due to the need for studies to focus on teaching leisure skills to adults with disabilities
(Chan et al., 2013) craft activities were selected for the current study. The three tasks were making a holiday wreath, floral centerpiece, and candle centerpiece. Each required students to hold, manipulate, and assemble multiple pieces. Table 1 provides the seven steps required to assemble each task. Materials for all three crafts were present on the table, along with distracting materials not used in any of the craft activities, regardless of the task being performed.

Video prompts were made for each of the task steps using a Sony HDR-CX160 Handycam. Videos were made from the perspective of the user by videotaping an adult model (third author) performing each step of the task. The camera operator provided voice over directions (i.e., "Put the tall candle in the middle of the tray") while recording the step. The videos were then converted to files and a single video was inserted onto a PowerPoint slide. Slides were played on a Lenovo laptop computer. The PowerPoint program was set to play each video automatically when the program advanced to a new slide. Two Candy Corn Proximity Sensor Switches by ablenet, Inc. were attached to a Switch Interface Pro 5.0 by Don Johnston which was in turn attached to the USB port of the laptop. The Candy Corn Proximity Sensor Switch was a motion activated switch and the students operated it by waving their hand in proximity (over) the switch. The interface allowed one switch (positioned on the right side of the laptop) to advance the computer program to the next slide by attaching the switch to the “enter” port on the interface. The second switch (positioned on the left side of the computer) was attached to the interface via the “click” port to allow the video to repeat on the current slide if the student needed to watch the video again in order to complete a step. In addition, the PowerPoint program was put into “slide show” mode and the laptop mouse was positioned over the video icon so that the repeat (click) function would work properly.

**Experimental Design**

The study used a multiple probe across behaviors design (Gast & Ledford, 2010), replicated with three students to demonstrate a functional relationship between the intervention (hands free operation of video prompting) and subsequent changes in students’ behavior (completion of multi-step craft activities). Conditions included a baseline probe without video prompting, hands free operation of video prompting and maintenance probes with hands free operation of video prompting. Introduction of the hands free video prompting intervention was staggered across three craft tasks and a student’s progression across tasks was independent of other students. The order of the tasks was alternated across the students and criteria for starting a new task was set at 100% independent operation of the proximity sensor switch and 100% unprompted correct responses for completing the steps of each task for three sessions. Follow-up, maintenance data using the proximity sensor switch were intermittently collected for mastered tasks and the study concluded with a final condition of three sessions to measure maintenance. Subsequent baseline probe sessions were implemented following mastery of tasks to measure performance by students.

<table>
<thead>
<tr>
<th>Step</th>
<th>Holiday Wreath</th>
<th>Floral Centerpiece</th>
<th>Candle Centerpiece</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Grass stem in bottom</td>
<td>Green foam in vase</td>
<td>Tall stand on middle of tray</td>
</tr>
<tr>
<td>2.</td>
<td>Vine in bottom</td>
<td>Vine in left side of foam</td>
<td>Medium stand on left of tray</td>
</tr>
<tr>
<td>3.</td>
<td>Berries in bottom</td>
<td>Vine in right side of foam</td>
<td>Small stand on right of tray</td>
</tr>
<tr>
<td>4.</td>
<td>Pumpkin on right side</td>
<td>Berries in left side of foam</td>
<td>Three wreaths on stands</td>
</tr>
<tr>
<td>5.</td>
<td>Pumpkin on left side</td>
<td>Berries in right side of foam</td>
<td>Three candles on stands (left to right)</td>
</tr>
<tr>
<td>6.</td>
<td>Grapes top left side</td>
<td>Two pods middle of foam</td>
<td>Greenery on front half of stand</td>
</tr>
<tr>
<td>7.</td>
<td>Grapes top right side</td>
<td>Grass in front/back of vase</td>
<td>Berries on greenery</td>
</tr>
</tbody>
</table>
when the proximity sensor switch was not present.

**Dependent Variable and Data Collection**

The primary dependent measure was the percentage of task steps completed independently in response to hands free operation of the video prompts. Each craft consisted of seven measurable steps for task completion. In addition, data were collected on the percentage of independent switch activations/advancement of the video prompting PowerPoint slides to the next video prompt during the intervention condition. Correct response for completion of task steps during baseline was defined as initiation of the step within 3 s of the task direction or completion of the previous step and completion of the step within 30 s. Correct response for completion of task steps during intervention was defined as initiation of the step within 3 s of the completion of the video prompt and completion of the step within 30 s. The student could also repeat watching of a video prompt and the step was recorded as a correct response if the student independently initiated playing the video within 30 s of the end of the previous video and the step was performed correctly. Individual task steps for assembling the crafts were not considered critical towards the completion of subsequent steps. Therefore incorrect task step responses were ignored by the instructor. An incorrect response was recorded if: (a) the time constraints were not met for initiation and completion of steps; or (b) a step was completed out of sequence.

Correct response for activation of the hands free switch was defined as initiation and advancement of the PowerPoint slide within 5 s of completion of the previous task step. If a student failed to activate the switch, a verbal prompt to, “Try again” was provided followed by the instructor activating the switch if the student was unable to activate the switch following the verbal prompt. Only responses which activated the switch the first time were scored as correct.

**Procedure**

**General procedure.** Prior to introduction of the first baseline condition, the instructor modeled activation of the proximity sensor switch by waving her hand over the switch to advance a random PowerPoint slide followed by the student activating the switch for one trial. All sessions were conducted individually, with only one student present in the classroom. Sessions were conducted three days per week and only one task was completed each day during intervention. Students advanced through the three crafts and conditions independent of other students’ performances.

**Baseline.** Prior to intervention with the proximity sensor switch, baseline data were collected with the three craft tasks with each student. Individual students were brought to the classroom where all of the craft materials were randomly placed on the table. Each session consisted of one trial per task (three total) and the order of the tasks varied across sessions. The student was provided with a verbal task direction to, “Make a wreath,” “Make a candle centerpiece”, or “Make a flower centerpiece.” The instructor then waited 3 s for the student to initiate the first (and subsequent) step of the assembly task and 30 s for the student to complete each step. Students assembled pieces of each craft until they verbally indicated they were finished with the target task. Verbal reinforcement was provided at the end of the task for student efforts and the craft was dis-assembled in order for all materials to be present on the table for assembly of the next craft. Baseline sessions, prior to the start of the first intervention and each subsequent intervention with a new craft, continued for a minimum of three sessions or until data stabilized with no improvement.

**Hands free video prompting.** During intervention sessions, craft materials were randomly spread across the two tables and the laptop computer was positioned in the middle, back of the tables with the two Candy Corn Proximity Sensor switches were positioned in front of the laptop. Students were provided with a verbal task direction to watch the videos to make the target craft (i.e., “Look at the videos and make the flower centerpiece”) followed by the instructor waiting 3 s
for initiation of switch activation. The student then waived her hand in the vicinity of the proximity sensor switch positioned to the right of the laptop to start the first video prompt. When the video prompt ended, the student was given 3 s to initiate the step and 30 s to complete the craft step. If needed, the student could waive her hand in the vicinity of the switch positioned to the left of the laptop to repeat the video prompt. No additional prompts by the instructor were provided. At the completion of each session the student was provided verbal praise for efforts and performance. Maintenance sessions were conducted identically to the intervention sessions.

Social Validity

Informal interviews were held individually with the three students regarding their use of the hands-free prompting switch to complete the three craft activities. Questions focused on whether the switch helped them to watch the videos, advance the slides, and re-watch a video if necessary. In addition they were asked if they would like to use the switch with other tasks.

Inter-Observers Agreement and Procedural Reliability

Reliability data on the correct number of task steps and switch activations (to advance the video prompting slides) were collected by the second or third author across 95.7% of all conditions and students (baseline probe condition: 91.7%, video prompting with the proximity sensor switch: 100%). Inter-observer agreement between the instructor (first author) and the second or third author on the steps performed correctly was calculated on each task session for each student by dividing the number of agreements on each task and switch activation step by the number of agreements plus disagreements and multiplying by 100 (Ayres & Gast, 2010). Resulting mean inter-observer agreement ranged from 71.4–100% with a mean of 99.4% for task and switch activation steps. Mean inter-observer agreement was 99.1% during the baseline condition (Teresa: 99.1%, Qianna: 98.7%, Lacy: 99.6%) and 99.2% during the video prompting intervention condition for task steps (Teresa 98.7%, Qianna: 100%, Lacy: 100%), and 99.8% during the video prompting intervention condition for switch activations (Teresa 100%, Qianna: 100%, Lacy: 99.4%).

The second and third authors also collected procedural reliability data simultaneously with inter-observer agreement on the following instructor behaviors: (a) delivery of task direction for the target craft; (b) adhering to 3 s and 30 s initiation and response times for task steps; (c) adhering to 3 s initiation and response times for switch activation; (d) materials, switches, and laptop computer positioned correctly on the table and in operating condition; (e) providing no prompts for task completion or switch activation except verbal prompts to watch the video; (f) delivery of reinforcement at the end of each session. Reliability was calculated by dividing the number of correct behaviors of the instructor (first author) by the number of assessed behaviors and multiplying by 100 (Billingsley, White, & Munson, 1980). Procedural reliability agreement averaged 99.6% across all conditions and participants. The majority of the errors occurred due to equipment malfunction including the videos on the computer “freezing”, sound not playing, and the PowerPoint slides not advancing when the student activated the switch.

Results

The percentages of correct responding for completing the steps of each craft, across each condition and student are presented in Figures 1–3 along with the percentage of switch activations independently performed during the hands-free video prompting condition. When video prompting, activated with the hands-free switch, was implemented, performance immediately increased across all three crafts and students. Likewise, all three students demonstrated the ability to master operation of the proximity sensor switch to operate the video prompts.

When video prompting was removed Teresa’s performance decreased when making the wreath to 0% correct on the first probe condition, but steadily increased as the video prompts were re-introduced and reached 100% performance by the last probe session.
When completing the second craft, flower arrangement, she was unable to establish criteria performance when the video prompts were not used and her performance with her last craft was deteriorating on the last session prior to re-introduction of the video prompting. Q
Anna likewise had difficulty with all three crafts when the video prompts were removed. Although she performed the crafts 100% correct during 5 of the 6 subsequent sessions when video prompts were removed, her performance deteriorated during later sessions within 4 of the 6 probe conditions. Of the three students, Lacy was the most successful in performing tasks when video prompts were removed although she was unable to put the...
pumpkin decorations on the wreath in the correct left/right position.

When the video prompts operated by the “hands-free” switches were re-introduced, all three students immediately re-gained criteria level performance across all crafts without committing a single error for operating the switch or completing the tasks.

Social Validity

All students reported that they liked using the hands-free switch to operate their laptop and videos and not having to touch the switch. Qianna stated that she sometimes had to remember where to put her hand and Lacy remembered that there were times when the
slides did not advance when, “I moved my hand.” Each reported that they would like to use the switch again, but were unable to state for what types of tasks they would like to use the switch. The three students also reported that they liked the crafts that they learned to make and Lacy reported that she helped to make a candle arrangement for Thanksgiving dinner and Teresa said she wanted to make a wreath for her family’s front door.

Discussion

In this study, a hands free approach for operating video prompts to complete multi-step craft activities was evaluated. A Candy Corn Proximity Sensor Switch by ablenet Inc. was independently used by three adolescent females with a moderate intellectual disability to advance PowerPoint slides containing the video prompts. All three students improved their assembly of the three crafts over baseline performance with the introduction of hands free prompting procedure. Students advanced the video prompts by using a motion (hand wave) over the switch rather than actually touching or pressing the switch. Traditionally, video prompting has been advanced through the use of physical touch and manipulation of a computer mouse or touch screen of the device playing the video (i.e., PDA, iPod). Previous studies (Mechling et al., 2014a, b) have found that some of the physical requirements of tasks such as cleaning and cooking impede such manipulations when a user’s hands are messy (i.e., wet, sticky). In the current study students were required to hold craft items in one hand (i.e., greenery for the flower arrangement) while the opposite hand was needed to stabilize materials (i.e., green foam in the flower arrangement). When this occurred they could hold items if needed while waving their hand over the top of the switch rather than having to put down the items to advance the video prompt. While the current study was limited to evaluation of the hands free method for making three crafts, future researchers should evaluate its use with other tasks such as those requiring the user’s hands to be wet or sticky.

This study evaluated the Candy Corn Proximity Sensor by the company ablenet, Inc. While this was the equipment selected for the current study, other such devices with more advanced capabilities may be available in the future. The switch in the current study still required the student’s hand or body part to be within approximately .5 in. from the top of the switch in order for it to activate. In addition, although referred to as “hands free” the students did use their hands. Although other body parts could be used with the proximity sensor switch it may be more appropriate for future research to evaluate use of sound or voice activated switches when both hands may be completely occupied by the user and it is not appropriate to use another body part.

Although the focus of this study was to evaluate the “hands free” operation of video prompts, results further support the use of video prompting, regardless of the input method used for advancing slides, to prompt independent performance of multi-step tasks. When video prompting was removed in subsequent probe sessions, each student demonstrated differing levels of difficulty completing the three crafts, yet each re-gained criteria level performance and committed no errors when the video prompts were re-instated in subsequent sessions. These results add to the current literature in support of video prompting and apply its use to multi-step leisure skills that can be performed in the user’s home.

Teaching persons with moderate intellectual disability to operate video devices on their own has implications for increasing independent functioning and decreasing the need for external adult prompting (Banda et al., 2011). Continuation of this new line of research, presented in the current study, is recommended across tasks using video prompting in light of the fact that video prompting does required a stop and start process for each video clip which may interrupt the flow of tasks. Further research will help to determine whether the use of a “hands free” device will allow operation of videos without hindering performance and will do so as technology advancements provide further devices that can be used in this manner.

References


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Effects of a Graphic Organizer Training Package on the Persuasive Writing of Middle School Students with Autism

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Abstract: This study examined the effects of a graphic organizer intervention package on the quality and quantity of persuasive writing of three middle school students with Autism Spectrum Disorder (ASD). The intervention included a 3-day training which consisted of explicit instruction on the components of a persuasive essay, modeling and guided practice of graphic organizer completion, and translating graphic organizer notes into a draft. Following training, the students independently completed graphic organizers and wrote persuasive essays throughout the post intervention condition. A multiple baseline across students design demonstrated the intervention package was functionally related to improvements in writing performance as measured by total words written, correct writing sequences, and analytical rubric scores.

Despite the fact that competent writing skills are required by most employers, education in the United States increasingly falls short in preparing students to be successful writers. According to the 2011 NAEP writing report card, only 24% of eighth graders were writing at a proficient level (National Center for Education Statistics, 2012). The NAEP proficient level represents an ability to accomplish the communicative purpose of writing by effectively informing or persuading the audience. These results indicate that writing is an area of need insufficiently addressed by current instructional strategies for a large percentage of U.S. students. In school, weaker writers will have difficulty demonstrating their learning to teachers who assess student progress through writing (Graham, 2006). Students who do not learn to write proficiently are at a disadvantage throughout their education, and without remediation, these deficits persist into adulthood.

In light of new initiatives such as the Common Core State Standards (CCSS), writing has become a focus of educational reform. When states adopt the CCSS, they also assume the responsibility of ensuring student mastery of a variety of writing styles and development of advanced levels of writing sophistication (National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010). For example, students in the eighth grade are expected to write arguments/persuasive pieces, narrative pieces, and informative/explanatory pieces, and these types of texts must include characteristics of refined writing (e.g., formal style, effective technique, varied transitions, and relevant description details).

Students with ASD present unique difficulties in the area of writing (Bieberich & Morgan, 2004; Goldstein, Johnson, & Minshew, 2001; Myles, 2005; Myles et al., 2003). Myles and colleagues (2003) found that students with ASD could produce sentences similar in number to their peers, but sentences generated were brief and not as complex (i.e., fewer morphemes, t-units, and words). Students with ASD may also struggle with abstract thinking and thought processes required for proficient writing such as imagining pretend situations and using figurative language (Myles, 2005). Further, writers with ASD tend to have problems with self-regulation and attention. As compared to their typical peers, children with ASD exhibit lower levels of attention and shorter durations of sustained focus (Bieberich & Morgan, 2004; Goldstein et al., 2001). Writing tends to be an individual activ-
ity requiring sustained attention; therefore, difficulties with focusing in students with ASD may result in lower quality writing than that of their peers.

Graphic organizers are a type of planning tool used with novice writers to help them organize their thoughts and structure their essays correctly. Many studies have used graphic organizers to improve the writing of struggling students (Nussbaum, 2008; Unzueta & Barbett, 2012; Zakas, Browder, Ahlgrim-Delzell, & Heafner, 2013). For example, graphic organizers have been successful in improving counter-argument and argument integration (Nussbaum, 2007), and computer graphic organizers have been used to improve persuasive writing skills (Unzueta & Barbett, 2012).

Research on the use of graphic organizers with students with ASD has been limited to teaching content. For example, Zakas et al. (2013) examined the effects of using a graphic organizer intervention to teach social studies content to students with ASD. In a similar study, Knight, Spooner, Browder, Smith, and Wood (2013) examined the effects of teaching science concepts to students with ASD and intellectual disabilities (ID) using systematic instruction and graphic organizers. Both studies showed that graphic organizers are an effective tool to teach content to students with ASD.

Although research demonstrates that graphic organizers can improve writing and that students with ASD benefit from using graphic organizers in other learning contexts, we could find no published experimental research examining the effects of graphic organizers on the writing performance of students with ASD. The purpose of the current study was to examine the effects of teaching persuasive writing to middle school students with ASD through graphic organizer training. Specifically, this study was designed to address the following research questions. What are the effects of teaching middle school students with ASD to use graphic organizers for writing persuasive essays on the (a) number of correct writing sequences, (b) total number of words written, and (c) analytical writing rubric scores; and what are the students’ opinions of the graphic organizer intervention?

### Method

**Participants and Setting**

The participants in this study were three middle school students diagnosed with ASD who attended a private learning center for students with ASD. All participants had an Individualized Education Program (IEP), and writing/language arts goals were included on two of the students’ IEPs. The students were all male and ranged in age from 12 to 14 years old. Table 1 shows demographic information and standardized writing scores for each participant. These participants were selected for intervention due to writing deficits (e.g., mechanical and content errors) as identified by the teacher’s evaluations of student work samples.

All students in the study had a general understanding of sentence and paragraph structure. Tom and Greg often wrote run-on sentences or fragments, while Oliver more reliably wrote correctly formulated sentences. The participants could all describe the proper structure of a paragraph (i.e., topic sentence, detail sentences, concluding sentence), but none of the participants reliably followed this format in their compositions. Additionally, spelling was a concern for all participants. Prior to this study, none of the participants received instruction on formatting a persuasive essay or writing introduction and conclusion paragraphs.

All baseline, intervention, and post-intervention sessions were conducted in the students’ classroom. The school relocated during the study, and the last three sessions for all participants were conducted in the new classroom. Both classrooms were arranged in a
similar manner; each student sat at his own
desk, forming a U-shape in the center of the
classroom. Each student had ample space on
his desk for all relevant materials. In addition
to the three participants, there was one other
student in the class and one teacher. All stu-
dents attended school from 9:00 AM to 3:00
PM and received instruction in the same class-
room throughout the day. The teacher served
as the interventionist and primary data collector.
The intervention was implemented indi-
vidually with each participant sitting at the
teacher’s desk with her in the back corner of
the room. While intervention was conducted
with one student, the other students in the
classroom worked independently on a variety
of teacher-assigned writing tasks. All sessions
during baseline, intervention, and post-inter-
vention conditions took place between 11:10
and 11:55 AM.

Materials
Materials included a persuasive writing
graphic organizer, a list of persuasive essay
topics, and an analytical rubric (see Table 2).
The persuasive writing graphic organizer was
developed to guide students through the plan-
ning process and was printed on two sheets of
8\[1/2\] by 11 inch paper. There were eight
spaces for the students to complete their plan-
ning on the persuasive writing graphic organi-
zer: a brainstorming box, boxes for three
reasons (i.e., the main paragraphs of the es-
say), a counter-argument box, an introduction
box, and a conclusion box. Students were
given the choice of two topics from a list of
topics each session. The topics were questions
that were applicable to the students’ lives such
as, “Should students have to wear uniforms?”
and “Should students be allowed to have cell
phones in middle school?” The analytical ru-
bric was a scale used to judge the quality of
students’ writing throughout the study.

Definition and Measurement of Dependent
Variables
Three dependent variables were used to eval-
uate intervention effects: correct writing se-
quences (CWS), total words written (TWW),
and analytical rubric scores. Dependent mea-
sures were defined and calculated as follows.

Correct writing sequences (CWS). CWS were
defined according to and calculated using the
AIMSweb guidelines (Powell-Smith & Shinn,
2004). The AIMSweb guidelines define a CWS
as “two adjacent writing units (words and
punctuation) that are correct within the con-
text of what is written” (Powell-Smith & Shinn,
2004, p. 11). A caret is used to mark each
correct unit of the CWS and a dash is used to
mark an incorrect writing sequence (ICWS).
AIMSweb also includes guidelines for scoring
contractions, words with reversed letters, story
titles and endings, abbreviations, hyphens,
numbers, and unusual characters. These rules
were all followed by the scorer. There were
three exceptions that the scorer created to
more accurately reflect the grammar and
punctuation present in each writing sample.
Specifically, where a comma was needed, but
not written, the word sequence was scored as
incorrect; when compound words were incor-
rectly split into two words, each word was con-
sidered an error; and when run-on sentences
were scored, an error was noted where the
period should have been placed as well as
after the first word in what should have been
the second sentence.

Total words written (TWW). TWW was de-
defined as the number of words written in the
student’s persuasive essay in forty minutes.
TWW were calculated by counting the num-
ber of words on each line of student writing
and summing the total for each line. Hyphen-
ated words were counted as one word (e.g.,
daughter-in-law). Words spelled incorrectly,
nonsense words, and illegible words all
counted toward TWW. Story titles and endings
(i.e., “The End”) were not counted as part of
TWW or CWS.

Rubric score. The essays were scored with
an analytical rubric adapted from Alber-Mor-
gan (2010) designed to objectively measure
content and mechanical accuracy (See Table
2). The rubric consisted of six categories in-
cluding introduction, organization, main
ideas and details, sentences, transitions, and
conclusion. Each category was rated on a
5-point scale with each scale increment oper-
tionally defined to distinguish along a con-
tinuum of few elements (1 point) to all cate-
gorical elements addressed (5 points).
<table>
<thead>
<tr>
<th>Skill</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>First paragraph has an effective attention grabber, strong transition to thesis statement, clear thesis statement that presents main ideas that will be discussed in the essay.</td>
<td>First paragraph has an effective attention grabber, a clear attempt at a transition to thesis statement, thesis statement that presents main ideas that will be discussed in the essay.</td>
<td>First paragraph has a somewhat effective attention grabber, an attempt at a transition to thesis statement, thesis statement that presents some of the main ideas that will be discussed in the essay.</td>
<td>An attention grabber is attempted but lacks clarity. No attempt is made at a transition to thesis statement, thesis statement presents some of the ideas that will be presented in the essay.</td>
<td>No attention grabber, incoherent or non-existent thesis statement, and no mention of main ideas that will be presented.</td>
</tr>
<tr>
<td>Organization</td>
<td>Essay is presented in logical order with the presentation of arguments in order of most to least important, including a clear counter-argument with refuting evidence.</td>
<td>Essay presents each argument clearly, but not in the correct sequence. The essay also includes an attempt at a counter-argument, but without clear refuting evidence.</td>
<td>Essay presents each argument with some clarity, but not in the correct sequence. The essay includes an attempt at a counter-argument, but is not clearly stated and lacks refuting evidence.</td>
<td>Essay lacks overall organization. Arguments are presented randomly. The essay includes some evidence of a counter-argument.</td>
<td>No organization detected, arguments are unclear, reads like free association. The essay does not include a counter-argument.</td>
</tr>
<tr>
<td>Main ideas and details</td>
<td>Main ideas are clearly stated and supported by at least three supporting details that are either factual or logical.</td>
<td>Main ideas are stated and supported by three supporting details. Some details may not be factual, logical, or supportive of the main idea.</td>
<td>Main ideas are stated and supported by less than three supporting details. Some details may not be factual or supportive of the main idea.</td>
<td>Main ideas are stated, but no supporting details are provided.</td>
<td>Main ideas are unclear.</td>
</tr>
<tr>
<td>Sentences</td>
<td>Interesting sentences, strong statements, and advanced sentence variation.</td>
<td>Sentences are complete, and show some variation of structure. There is at least one example of a complex or compound sentence.</td>
<td>Most sentences are complete and there is at least one example of a complex or compound sentence.</td>
<td>Sentences show little or no variation. Some sentences are incomplete or incoherent.</td>
<td>Most sentences are incomplete or incoherent.</td>
</tr>
<tr>
<td>Transitions</td>
<td>A variety of thoughtful transitions are used. There is a transition to begin each paragraph after the introduction. The transitions clearly show how ideas are connected.</td>
<td>Transitions show how ideas are connected, but there is little variety.</td>
<td>Transitions are present at the beginning of 3 or fewer paragraphs. Most transitions are effective, but some connections between ideas are unclear.</td>
<td>Some transitions are effective, but most connections between ideas are unclear.</td>
<td>The transitions between ideas are unclear OR nonexistent.</td>
</tr>
<tr>
<td>Conclusion</td>
<td>Thesis statement is restated and reasons are clearly and persuasively outlined. The conclusion culminates in a strong clear statement of the author’s viewpoint.</td>
<td>Thesis statement is restated and reasons are outlined. The conclusion culminates in a statement of the author’s viewpoint.</td>
<td>The opinion is restated and reasons are mentioned, but lack clarity.</td>
<td>A conclusion is attempted, but the thesis statement and reasons are unclear or missing.</td>
<td>No conclusion is provided.</td>
</tr>
</tbody>
</table>
Inter-Observer Agreement

A second trained observer collected data on student writing samples for 37% of sessions across all baseline and post-intervention conditions. IOA for each measure was calculated by dividing the lower number scored by the higher number and multiplying by 100 to yield a percentage that was then averaged across measures for each participant. Mean agreement for CWS was 84% for Greg, 94% for Tom, and 90% for Oliver. Mean agreement for TWW was 97% for Tom, 97% for Greg, and 98% for Oliver. Mean agreement for rubric score was 87% for Greg, 94% for Tom, and 83% for Oliver.

Procedural Integrity

Baseline, intervention, and post-intervention sessions were audio recorded in order to assess the integrity with which the teacher implemented the intervention. Procedural fidelity was measured by an independent observer using checklists that task analyzed each step of the baseline, graphic organizer training (i.e., intervention), and post-intervention procedures. The baseline and post-intervention procedures each consisted of 17 procedural steps and the intervention training consisted of 22 steps. The observer checked off each step that was accurately followed while listening to a recording of the session. Procedural fidelity was calculated for 34% of sessions, and procedures were implemented with 100% fidelity across conditions.

Social Validity

Following completion of the study, parents and students were asked to complete a survey via paper-and-pencil. A Likert-type scale was used to assess the degree of satisfaction with and perceived efficacy of the intervention. Each student took home a parent survey along with a post-intervention sample of his writing. Written directions instructed parents to read and evaluate the writing sample by responding to survey questions related to the goals of the intervention (i.e., effective writing of attention grabbers, transitions, arguments, counter-arguments, main ideas, and supporting details).

Experimental Design

A multiple baseline across participants design was used to evaluate the effects of the graphic organizer intervention on student writing. The experimental conditions were baseline and post-intervention. Prior to collecting post-intervention data, the students were provided with three training sessions on using graphic organizers to write persuasive essays.

Procedure

Baseline. Baseline sessions alternated between the planning stage and the writing stage. The planning stage was conducted during the first baseline session and every odd-numbered baseline session thereafter. The writing stage was conducted during the second baseline session and every even-numbered baseline session thereafter. During the planning stage, the teacher presented the participants with two persuasive essay topics (e.g., “Should kids have homework?” or “Should students be required to wear uniforms?”). The participants were then told to select their topic and were allotted 40-min to write planning notes. During the writing stage, the teacher gave the planning notes back to the participants and instructed them to do their best to write six paragraphs in 40-min. The teacher did not provide any further guidance and responded to student questions with, “Do your best.”

Graphic organizer training. Graphic organizer training was conducted with each participant individually, and it consisted of three, 40-min sessions. During the first intervention session, the student and teacher read a model essay together with the teacher pointing out and defining important persuasive components of the writing (e.g., attention grabber, thesis statement, counter-argument). The teacher then introduced the graphic orga-
nizer and briefly explained each component. She modeled how to write an essay using the graphic organizer to outline the structure. The teacher demonstrated changing phrases into full sentences, and the student helped with providing supporting details and examples.

On the second day of intervention, she demonstrated how to use the graphic organizer to plan and write a persuasive essay. Then, the teacher provided the student guided practice with the steps. First, the student was given two topic questions to choose from and told to record the questions in the planning box of the graphic organizer. Next the teacher told the student to write a “yes” or “no” response to each question and to brainstorm a list of reasons supporting each response. Once the student had written all of the supporting reasons he could think of, he was instructed to choose the response with the strongest or most supporting reasons as the topic for his essay. The teacher then prompted the student to fill in a topic phrase and at least three supporting phrases in each of the three reason boxes, the counter-argument box, and lastly, the introduction and conclusion boxes. In the final step of completing the graphic organizer, the teacher helped the student fill out the introduction and conclusion boxes, as well as to add transitions to the graphic organizer. The intervention also included a brief, 5-min lesson during the graphic organizer training on the use of transitions. The mini-lesson was embedded as the last step of the guided practice with the graphic organizer. The teacher provided explicit instruction on transitional terms and phrases and guided practice for the students with revising their essays to include transitions.

The teacher guided the student through the writing of the persuasive essay during the last day of intervention. Before the student began to write, the teacher reminded him to skip lines, indent each paragraph, include transitions, and write the essay one paragraph at a time. As the student wrote the essay, the teacher monitored his performance and provided feedback, prompting the student to refer to the graphic organizer and make corrections when needed.

Post-intervention. Post-training sessions were conducted across two days. On the first day of each session, the student was given a blank graphic organizer and told to write a persuasive essay on one of the two questions listed on the board. The student was given 40 min to plan his essay using the graphic organizer. On the second day, the student was given 40 min to write his persuasive essay using the completed graphic organizer. Data on student writing were collected in a manner identical to that described in the baseline condition.

Results

Correct writing sequences. The results for CWS for each student are depicted in Figure 1, and Table 3 shows mean CWS scores across conditions. During baseline, Tom’s CWS showed a decreasing trend, ranging from 80 to 148 with a mean of 104. There was an immediate increasing trend following the graphic organizer training, then a slight decrease and second increasing trend. CWS during post-intervention ranged from 87 to 167 with a mean of 121. During baseline, Greg’s CWS was low and fairly stable, ranging from 63 to 125 with a mean of 89. There was an immediate change in level with an increasing trend during the first three post-intervention sessions, followed by a slight decrease then increase in CWS. During post-intervention, Greg’s CWS ranged from 100 to 206 with a mean of 150. Oliver’s CWS ranged from 130 to 212 with a mean 157 with a decreasing trend during baseline. Following graphic organizer training, Oliver’s CWS immediately increased and then decreased, yet maintained higher CWS on average than during baseline. During post-intervention, CWS ranged from 195 to 276 with a mean of 225.

Effects of Graphic Organizer Training on TWW

Figure 2 shows the results for TWW for each student, and Table 3 displays means across conditions for each student. During baseline, Tom’s TWW was stable, ranging from 117 to 141 with a mean of 121. There was an increasing trend across the first three post-intervention sessions, followed by some variability. Tom’s TWW ranged from 111 to 221 with a mean of 139 during post-intervention. During
Figure 1. Correct word sequences (CWS) across students.
baseline, Greg’s TWW was variable, ranging from 71 to 165 with a mean of 111. There was an immediate change in level during the first three post-intervention sessions, followed by a decrease. Post-intervention TWW ranged from 125 to 218 with a mean of 179. During baseline, Oliver’s TWW had a slow but steady decreasing trend. TWW ranged from 124 to 266 with a mean of 159 during baseline. Immediately following intervention, there was an increase in level with some variability. Oliver’s TWW post-intervention ranged from 183 to 247 with a mean of 216.

Rubric Score

Figure 3 shows results for rubric scores across conditions, and Table 3 shows means across conditions. Tom’s rubric scores were fairly low and stable during baseline, ranging from 8 to 11 with a mean of 9.75. There was an immediate increase in level followed by a steady, increasing trend during post-intervention. Tom’s rubric scores ranged from 15 to 22 with a mean of 18 during post-intervention. During baseline, Greg’s rubric scores were low and stable, ranging from 6 to 10 with a mean of 8.42. There was an immediate increase in level that remained fairly stable during post-intervention. Greg’s post-intervention rubric scores ranged from 20 to 23 with a mean of 21.6. During baseline, Oliver’s rubric scores were consistently low, ranging from 8 to 14 with a mean of 11.55. Oliver’s rubric scores immediately increased following intervention, and remained improved. Across post-intervention sessions, Oliver’s rubric scores ranged from 23 to 24 with a mean of 23.67.

Social Validity Questionnaires

Participant responses on social validity questionnaires were fairly consistent across questions. Two students strongly agreed or agreed, and one student was neutral or in disagreement with most items (e.g., confidence in ability to persuade through writing, transition effectively, provide counter-arguments, and write conclusions, and in the graphic organizer’s ease of use, utility in improving their writing skills, and probability of continued use). Additionally, two students reported that learning to use the graphic organizer made the writing process more enjoyable and that they planned to use it for other types of writing.

Parent responses on social validity questionnaires were generally positive, one parent strongly agreed and two parents agreed that the introduction caught their attention and stated the main idea. Two parents also strongly agreed that the essay presented the argument clearly and provided a counter-argument while one parent disagreed. One parent strongly agreed while two parents agreed that there are clear main ideas with supporting details. All parents agreed that the essay included interesting sentences, strong statements, and varied sentence structure while two parents strongly agreed and one parent agreed that the essay included thoughtful transitions in each paragraph and that the paper flowed well.

Discussion

The study supports the research on graphic organizer training for children with ASD (e.g., Knight et al., 2013; Zakas et al., 2013) and extends those findings to middle school stu-
Figure 2. Total words written (TWW) across students.
Figure 3. Rubric scores across students.
Results of this study demonstrated evidence of a functional relationship of graphic organizer training on improved persuasive writing. After graphic organizer training, all three participants showed immediate improvements on all three writing measures (e.g., CWS, TWW, rubric score). The clearest demonstration of improvement was evidenced by the differences in rubric scores between baseline and post-intervention. All three participants showed substantial increases on their rubric scores on the first post-training session and continued this level of improvement throughout the duration of the study. Improvements on individual categories of the rubric varied across participants. However, all participants showed significant improvement in the introduction and conclusion categories of the rubric. The least amount of improvement for all three students was the sentences category of the rubric. This is not a surprising outcome considering that there was no instruction on sentence structure or variation.

For CWS and TWW, the data patterns were similar for all three participants. In general, there was an immediate increase in CWS and TWW during the first few post-intervention sessions, followed by variable responding and overlapping data (with baseline) throughout the remaining post-intervention sessions. Overall, mean CWS and TWW scores were higher during post intervention than in baseline; however evidence of a functional relationship is weaker for these measures when compared to the rubric scores. Considering that the rubric scores remained high even when TWW was lower on those corresponding sessions may indicate that the students learned to write higher quality essays without necessarily having to increase the number of words they wrote.

Since the number of CWS is directly related to the total number of words written, it is not surprising that these two variables showed similar patterns. With regard to CWS, which is mostly a measure of writing mechanics (e.g., spelling, punctuation), it is interesting that the participants showed some improvement despite the fact that this intervention did not include instruction in writing mechanics. Since all three students had difficulties with spelling, their CWS scores may have shown greater improvement if there was an additional component of the intervention to address spelling.

Although all three students showed improvement in their persuasive writing, their opinions about the intervention and their own writing improvements were mixed. Their parents, however, all indicated “strongly agree” or “agree” on almost all of the quality indicators of writing when examining their child’s post-intervention essay. The social validity assessment for parents would have been strengthened by providing the parents with two essays, one from the baseline condition and one from the post intervention condition, and then asking them to provide an opinion on the extent to which their child’s writing improved. This would provide additional useful information regarding the social validity of the intervention.

Limitations and Future Research

Despite successful outcomes of the current study, there are several limitations that should be addressed in future research. First, due to time constraints, the writing sessions were conducted across two days. It would have been preferable for the students to complete their graphic organizers and then write their essays on the same day; however, adequate time for both aspects (i.e., planning and writing) could not be allotted in one day. When possible, the sessions were conducted across two consecutive days, but there were instances when this was not possible (e.g., weekends, student absences). Future research should examine to what extent a delay between planning and writing influences the intervention’s effectiveness, or whether the sessions could be shortened to yield successful results more efficiently.

Another limitation of the present study was the use of a multiple baseline experimental design. Continued exposure to baseline conditions is not desirable in many educational settings, and it may have fatigued the students. Also, it required implementation of the intervention with each student individually, which may not be practical for teachers in classrooms with more students. It is unclear whether the intervention would be equally effective if implemented with a whole class, or
whether the individualized direct instruction was an essential feature of the intervention. Future research should examine whether the intervention is suitable for class-wide implementation and employ an alternative experimental design.

It should also be noted that the graphic organizer intervention was a treatment package that included explicit instruction on a variety of skills (e.g., using transitions, making arguments with counterarguments and supporting details, using graphic organizers). The effects of individual components are unknown as these variables were not studied in isolation. It is unclear whether all elements are necessary in order for the intervention to be effective, and it is possible that a more parsimonious approach would suffice. Future researchers should conduct component analyses to determine the essential features of the treatment package.

Additionally, IOA on the CWS and rubric measures was lower than on TWW. This discrepancy may have resulted from handwriting idiosyncrasies (e.g., inappropriate capitalization, irregular spacing between words, general illegibility). Teachers implementing this procedure in the future may have students complete writing assignments using computer software to eliminate disagreement in interpretation of the writing. Regarding lower levels of agreement on the rubric scores, it is possible that the raters’ amount of experience in grading student writing influenced their scoring. Specifically, the first observer had teaching experience and was familiar with the students’ writing; in contrast, the second observer had never taught or graded the writing of elementary students. Although the second observer was thoroughly trained in the scoring procedures, it is possible that the differences in their prior experience contributed to the differences in scoring decisions. Future researchers are encouraged to operationalize rubric criteria and provide comprehensive training and ample practice in order to minimize threats to reliability.

Lastly, limitations concerning generalization and maintenance should be discussed and ultimately addressed in future research. For example, although this study supports previous graphic organizer research, the extent to which the findings can be generalized to other populations or environments as well as other types of writing is limited. More specifically, the students were only using graphic organizers to produce persuasive essays, and there was no measure of generalization for different types of writing. Future research should attempt to assess generalization of the writing package to different kinds of written expression such as narrative or expository. In addition, the effects of this intervention with different populations and different age groups should be examined. Furthermore, end-of-year time constraints precluded the collection of maintenance data. It is unclear whether the students would have continued using the graphic organizers, or whether their improved CWS, TWW, and rubric scores would have maintained. Future researchers should examine the durability of intervention effects.

**Implications for Practitioners**

This study demonstrated the efficacy of using a graphic organizer training package to teach persuasive writing skills. Teachers should use the graphic organizer as a tool for students whose written compositions typically lack focus and for those students who have difficulty initiating the writing process. The graphic organizer prompts the writer to adhere to a structure emphasizing main ideas and to begin the writing process with a brainstorming and planning stage. These functions can be particularly helpful for writers with ASD, because they commonly struggle with writing coherently and getting started (Goldstein et al., 2011).

Practitioners should keep in mind that graphic organizers are tools to supplement instruction, but they are not a substitute for instruction. When teaching students to write persuasive essays, teachers should demonstrate completing the graphic organizer and model how to use it to write an essay. This demonstration should be followed by guided practice during which the teacher and students work together to complete the graphic organizer and compose an essay. This stage of instruction allows the teacher to provide immediate affirmative and corrective feedback as the students take an active role in the planning and writing process. After guided prac-
tice, students should engage in independent practice with the teacher actively monitoring performance—using measures such as CWS, TWW, and rubrics—and providing individualized, specific feedback. In order to support generalization of planning skills to situations in which a graphic organizer is not available, teachers should consider using a fading procedure with the tool. Teachers can set mastery criteria for rubric scores and, once achieved, they can begin to fade elements of the graphic organizer until the students are planning their essays on blank sheets of paper. Further, a variety of graphic organizers are available for all writing genres and all grade levels, and teachers are encouraged to utilize these to facilitate generalization of planning skills.

References


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Family involvement is one of the most critical and essential elements to improve the outcomes of person with disabilities. The Individuals with Disabilities Education Act (IDEA) requires that families be involved in the Individualized Family Service Plans (IFSP) and Individualized Education Plans (IEP). The importance of family-centered services in the wellbeing and development of children who are at-risk for or diagnosed with disabilities has been well articulated and documented in the literature across age groups and disabilities (Bailey et al., 1998; Dempsey & Keen, 2008; Wehman, 1998). Research indicates that family involvement may decrease stress, improve family functioning and coping mechanisms, and enhance overall quality of life (Baily et al.)

Though diverse in nature, families are comprised of parents, siblings, grandparents, and extended family members. In a family unit, each of the family members plays an important role in care, training, emotional and/or financial support, and education of a person with a disability. After the parents or caregivers, siblings are the most significant members of families in terms of long-term care, social, emotional, and financial support of their brother or sister with a disability. In general, siblings are a very important part of normal child development as they share experiences, are available to express feelings, and support and offer friendship experiences (Verte, Roeyers, & Buysse, 2003). Thus, the involvement of typical siblings in the upbringing of an individual with a disability could have long term positive consequences and help to reduce the burden on agencies that care for persons with disabilities, particularly as they age. The impact of a child with a disability on family, particularly children with developmental disabilities and autism, has been a widely researched topic. However, literature on the positive impact of typical children on the wellbeing of individuals with autism is emerging and requires a thorough analysis.

Extant literature on siblings of persons with autism indicates three strands. The first part shows the impact on the family having a child with disability such as burden, stress, status of caregivers, financial burden, and cohesiveness (Hastings, 2003). Numerous studies have been conducted on the family stress, sibling relationships, and coping. For example, parents of children with autism, particularly mothers reported higher stress than parents of typically developing children or children with other disabilities such as Down syndrome (e.g., Dumas, Wolf, Fisman, & Culligan, 1991; Sanders & Morgan, 1997). Also, the presence of a child with autism can impact adjustment among family members (Sanders & Morgan) and can be worse when a child with severe autism has behavioral issues such as self-injury or aggression (Davis & Carter, 2008).

The second strand is the impact of siblings’ well-being because of the presence of a child or adult with autism in the family. Some studies found that typical siblings of children with autism have lower social communication and language compared to the control group sib-
lings with no brother or sister with autism (e.g., Toth, Dawson, Meltzoff, Greenson, & Fein, 2007; Verte et al., 2003) and may exhibit mental health issues such as depression (Gold, 1993). In contrast, researchers in other studies found positive impacts on typical children who had a sibling with autism (Macks & Reeve, 2007; Pilowsky, Yirmiya, Doppelt, Gross-Tsur, & Shalev, 2004; Verte et al., 2003). However, research in this area is mixed and far from conclusive.

The third strand, the focus of this review, is the intervention studies that involved typical siblings to enhance various skills in their brother or sister diagnosed with autism. Literature further indicates that, when trained, typical siblings of children with autism may facilitate social, communication, and other necessary functional skills.

Several reviews have been published in which the researchers examined studies on siblings of children with autism (Ferraioli, Hansford, & Harris, 2012; Meadan, Stoner, & Angell, 2010; Tsao, Davenport, & Schmiege, 2012). Meadan et al. (2010) conducted a comprehensive review of literature involving siblings of children with autism, identified 12 studies, and concluded that there were mixed results on outcomes for and adjustment of typically developing individuals. However, no separate analysis of intervention studies was conducted in this review. Likewise, Tsao et al. (2012) provided a broad review of studies on sibling relationships, only reviewed four single-subject intervention studies, and provided an overview of fostering sibling relationships within family systems and strategies to help siblings of children with autism; no systematic analysis of studies conducted. Similarly, in another review, Ferraioli and colleagues (2012) described the benefits of including siblings in the treatment of autism and provided two research vignettes on assessment and treatment plans. However, the authors only described five single-subject intervention studies. Overall, the previous reviewers have not thoroughly examined sibling intervention studies. Therefore, it is necessary to analyze intervention research to guide practice and make recommendation for future research. Researchers have indicated that typical siblings must be involved in improving the social skills of children with autism because a majority of the studies on social skills included peer groups as compared to typical siblings (Bass & Mullick, 2007). Thus, the purpose of present review is to summarize and synthesize sibling intervention studies that were conducted with students with autism, to evaluate methodological issues of the reviewed studies, and to provide new directions for research and practice.

**Method**

An electronic search of EBSCO databases that included a range of social, psychology, education, medical, and rehabilitation datasets was conducted. The search terms included autism, ASD, siblings, interventions, family, brothers, and sisters. Initial search of autism and siblings and intervention resulted in 140 abstracts (until year 2012). Also, additional terms with combination of autism and intervention and brother resulted in 50 abstracts; autism and intervention and sister with 47 abstracts, and Asperger and intervention and siblings with 8 abstracts, Asperger and intervention and brother/sister (four abstracts). Each abstract was then read, and 45 abstracts were retrieved for a detailed review and inclusion in the final pool. Studies that met the following criteria were included: (a) participants included typical siblings and at least one or more participants with autism; (b) intervention studies; (c) studies employed single-subject experimental designs; (d) articles were published in peer-reviewed journals; and (e) articles were available in English. Careful reading of abstracts resulted in retrieving 14 intervention studies. Each article’s content was then read by a special education doctoral student, either for inclusion or exclusion of the study and found 100% agreement regarding the inclusion criteria. Ancestral search through published studies was conducted to scrutinize for additional studies; one study was located through this method (Colletti & Harris, 1977). Of studies that included students with autism and other disabilities, only participants with autism were included in this analysis (e.g., Colletti & Harris, 1977). Studies that used children with autism only in maintenance or gener-
## TABLE 1

Summary of Intervention Studies

<table>
<thead>
<tr>
<th>Authors</th>
<th>Participants/Age</th>
<th>Target Behaviors</th>
<th>Intervention</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baker (2000)</td>
<td>5y 8m (Aut)</td>
<td>Social play interactions (engagement, nonengagement, joint attention, engagement in thematic ritualistic activities)</td>
<td>Play with siblings included ritualistic theme activities of child with autism; prompting play; no reinforcement for play; fading of adult prompts</td>
<td>All three children showed increases in social play interactions, joint attention, positive affect, during intervention, maintenance and follow-up; all three children demonstrated generalization with other peers and settings; thematic ritualistic behaviors decreased.</td>
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<td>7y 7m (Sib)</td>
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<td></td>
<td>5y 5m (Aut)</td>
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<td>8y 7m (Sib)</td>
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<td>6y 10m (Aut)</td>
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<td></td>
<td>8y 7m (Sib)</td>
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<tr>
<td>Celiberti &amp; Harris (1993)</td>
<td>4y 11m (Aut)</td>
<td>Play and play-related speech</td>
<td>Training siblings to use behavioral strategies: eliciting appropriate play related comments, praising appropriate responses, and prompting the child with autism for no response or incorrect response</td>
<td>All three siblings showed mastery in using the strategies – eliciting responses, feedback and praising. In addition, children with autism responded during training and follow-up sessions and 2 of 3 children generalized with a novel toy.</td>
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<td>7y 9m (Sib)</td>
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<td>4y 3m (Aut)</td>
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<td>10y 5m (Sib)</td>
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<td></td>
<td>4y 10m (Aut)</td>
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<td></td>
<td>8y 2m (Sib)</td>
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<tr>
<td>Clark et al. (1989)</td>
<td>11y 5m (Aut)</td>
<td>Social interactions (praise, commands, questions, signs during play)</td>
<td>Siblings were trained in a group using the following strategies: discussion, problem solving, role playing, self-monitoring, peer monitoring, and group contingency management. After training the children played with their sibling with autism.</td>
<td>For all three students’ attending and signing behaviors increased and controlling behaviors decreased; mixed results for follow-up sessions.</td>
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<tr>
<td></td>
<td>9y 3m (sib)</td>
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<td></td>
<td>6y 8m (Aut)</td>
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<td>4y 10m (Aut)</td>
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<td></td>
<td>8y 4m (Sib)</td>
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<tr>
<td>Colletti &amp; Harris (1977)</td>
<td>9y (Aut)</td>
<td>String beads and reinforcement</td>
<td>Sibling was cued to prompt her sister with autism to string beads and provide reinforcement.</td>
<td>Frequency of reinforcement and bead stringing increased in intervention phases. Excessive behaviors of a participant decreased. Compliments increased in both participants, but also decreased in one participant at the end of the intervention.</td>
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<td>10v (Sib)</td>
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<tr>
<td>Dodd et al. (2008)</td>
<td>9y 10m (PDD-NOS)</td>
<td>Social skills (decrease excessive directions and increase compliments during play)</td>
<td>Used social stories during play sessions with siblings (giving few directions and listening to others ideas for complements)</td>
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</tr>
<tr>
<td>Authors</td>
<td>Participants/Age</td>
<td>Target Behaviors</td>
<td>Intervention</td>
<td>Results</td>
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<tr>
<td>Ferraioli &amp; Harris</td>
<td>4y 3m (Aut)</td>
<td>Joint attention</td>
<td>Sibling-mediated intervention (instruction, modeling, role play, feedback),</td>
<td>Gains in responses in all 4 participants; gains in imitations in 3</td>
</tr>
<tr>
<td>(2011)</td>
<td>8y 4m (Sib)</td>
<td>(responses, eye</td>
<td>Pivotal Repose Training, and Discrete Trial Teaching</td>
<td>participants; rate of imitation increased; no gains in requests.</td>
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<tr>
<td></td>
<td>3y 7m (Aut)</td>
<td>contact, follow</td>
<td></td>
<td>Participants generalized the responses to natural settings.</td>
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<tr>
<td></td>
<td>6y (Sib)</td>
<td>point, following</td>
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<tr>
<td></td>
<td>3y 5m (Aut)</td>
<td>gaze, coordinated</td>
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<td></td>
<td>8y 2m (Sib)</td>
<td>gaze shift)</td>
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<td></td>
<td>5y 4m (Aut)</td>
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<td></td>
<td>6y 10m (Sib)</td>
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<tr>
<td>Jones &amp; Schwartz</td>
<td>3y 9m (Aut)</td>
<td>Novel language</td>
<td>Siblings, peers, and adults served as models and were trained using direct</td>
<td>All three participants responded well to all models but child models</td>
</tr>
<tr>
<td>(2004)</td>
<td>5y (Sib)</td>
<td>skills (actions,</td>
<td>instruction to improve novel language skills.</td>
<td>were as effective as adult models. In one participant, siblings were</td>
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<td></td>
<td>4y (Peer)</td>
<td>professions;</td>
<td></td>
<td>more effective than peer or adult model with two stimuli. No</td>
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<td></td>
<td>Adult teacher</td>
<td>opposites)</td>
<td></td>
<td>consistent pattern emerged across three participants.</td>
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<td></td>
<td>3y 11m (Aut)</td>
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<td>5y (Sib)</td>
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<td>4y (Peer)</td>
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<td>Adult teacher</td>
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<td>5y 2m (Aut)</td>
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<td>3y 6m (Sib)</td>
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<td></td>
<td>4y (peer)</td>
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<td></td>
<td>Adult teacher</td>
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<tr>
<td>Oppenheim-Leaf et al.</td>
<td>4y (Aut)</td>
<td>Amount and quality</td>
<td>Typical peers were trained using a teaching interaction procedure (instructions,</td>
<td>All typical children mastered and maintained the skills and</td>
</tr>
<tr>
<td>(2012)</td>
<td>5y (Sib)</td>
<td>of social play</td>
<td>modeling, role play, prompts, reinforcement)</td>
<td>generalized with their peer sibling with autism. In addition, children</td>
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<td></td>
<td>7y (Aut)</td>
<td>interactions –</td>
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<td>with autism showed improvements in social skills.</td>
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<td></td>
<td>4y (Sib)</td>
<td>joining play</td>
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<td></td>
<td>4y (Aut)</td>
<td>activity, sharing</td>
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<tr>
<td></td>
<td>5y (Sib)</td>
<td>toys, and</td>
<td></td>
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<tr>
<td></td>
<td>1 Adult model</td>
<td>engaging</td>
<td></td>
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<tr>
<td>Rayner (2011a)</td>
<td>15 yrs (Aut)</td>
<td>Imitation skills</td>
<td>Sibling and an adult served as models in the videos for three target</td>
<td>No change in participant imitation across tasks; neither sibling nor</td>
</tr>
<tr>
<td></td>
<td>12 yrs (Sib)</td>
<td>(matching coins,</td>
<td>behaviors; video models were presented to the participant</td>
<td>adult videos resulted in improving participant performance.</td>
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<tr>
<td></td>
<td>1 Adult model</td>
<td>responding to</td>
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<td></td>
<td>questions in a</td>
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<td></td>
<td></td>
<td>group, preparing</td>
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<td></td>
<td></td>
<td>a snack)</td>
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<tr>
<td>Authors</td>
<td>Participants/Age</td>
<td>Target Behaviors</td>
<td>Intervention</td>
<td>Results</td>
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<tr>
<td>Rayner (2011b)</td>
<td>3 participants with autism (9 years); only 1 participant's sibling without autism participated (9 years); for the two other participants peers participated</td>
<td>Tie a shoelace knot</td>
<td>Video included adult and sibling models for one participant in which shoelace knot was taught using video prompting and backward chaining.</td>
<td>Performance varied across models and no independence of skills was achieved in the participants.</td>
</tr>
<tr>
<td>Reagon et al. (2006)</td>
<td>4 yrs (Aut)</td>
<td>Pretend play scenarios (scripted statements and spontaneous words)</td>
<td>Video modeling; siblings participated in 4 play scenarios in the video model; participant and sibling watched video models and were directed to play.</td>
<td>Increased responses across all scenarios maintained and generalized in home setting.</td>
</tr>
<tr>
<td>Schreibman et al. (1983)</td>
<td>8 yrs (Aut) 13 yrs (Sib)</td>
<td>Correct use of behavior change procedure in siblings; correct responding of children with autism in time telling, simple discrimination tasks, and/or speech concepts</td>
<td>Videotaped training with siblings using reinforcement, shaping, chaining, and feedback. Carers worked with their sibling with autism, and training in new task.</td>
<td>Siblings used the behavioral training techniques with their sibling with autism and children with autism learned the techniques. Generalization of skills learned was observed in new settings.</td>
</tr>
<tr>
<td>Strain &amp; Danko (1995)</td>
<td>4 y (PDD)</td>
<td>Social initiations, responses, number of adult prompts</td>
<td>Home-based social skill intervention through video modeling (sibling participant with adults); role play with sibling and praise. Caregivers successfully used the social skills training to improve social skills in participants with autism and siblings. Generalization of skills learned was observed in new settings.</td>
<td></td>
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<tr>
<td>Taylor et al. (1999)</td>
<td>6 yrs (Aut)</td>
<td>Play-related scripted comments</td>
<td>Video modeling intervention facilitated scripted play, but elicited no unscripted comments in the participant.</td>
<td>Increased comments in the participant with autism.</td>
</tr>
<tr>
<td>Siblings and Autism (1985)</td>
<td>8 yrs (Sib)</td>
<td>Play-related scripted comments</td>
<td>Video modeling intervention facilitated scripted play, but elicited no unscripted comments in the participant.</td>
<td>Increased comments in the participant with autism.</td>
</tr>
</tbody>
</table>
alization phases were not included (Belchic & Harris, 1994).

Data Extraction

Studies were analyzed on several demographic, methodological, and outcome variables. Specific variables included number of participants (children with autism and their sibling), age range, diagnosis, trainers, target behavior, intervention, and results. In addition, the methodological variables included for determining the quality of studies were: study design, interobserver agreement, procedural integrity, social validity, maintenance, and generalization (see Table 1).

Results

Participants

A total of 38 children with ASD participated in 15 studies. Of those, two children were diagnosed with pervasive developmental disorders—not otherwise specified (PDD-NOS) and one with pervasive developmental disorder. The average age of participants with ASD was 6 years with an age range of 3 to 15 years. Also, 36 typical siblings of children with autism participated in the studies; in one study two peers had participated (Rayner, 2011b). The average age of siblings was 7 years with an age range of 3 to 13 years. In another study, in addition to children with autism and their siblings, three typical peers participated along with adult models (Jones & Schwartz, 2004). It appears that a majority of intervention studies were conducted with elementary age students.

Settings

Studies were conducted in different settings: a) Nine studies at home settings (Celiberti & Harris, 1993; Colletti & Harris, 1977; Dodd, Hupp, Jewell, & Krohn, 2008; Ferraioli & Harris, 2011; Oppenheimer-Leaf, Leaf, Dozier, Sheldon, & Sherman, 2012; Schreibman, O’Neill, & Koegel, 1983; Strain & Danko, 1995; Taylor, Levin, & Jasper, 1999; Tsao & Odom, 2006); b) two in elementary schools (Jones & Schwartz, 2004; Rayner, 2011b); c) one in a school setting for children with multiple disabilities (Rayner, 2011a); d) one in a university-
based settings (Clark, Cunningham, & Cunningham, 1989); e) one in a university setting and at home (Baker, 2000); and f) one in university preschool and at home (Reagon, Higbee, & Endicott, 2006). Overall, a majority of studies were conducted in home settings, which is apparent that family environments are ideal places to conduct such interventions.

**Target Behaviors**

Researchers targeted several skills, and a majority of the studies fall under the category of social-communication skills: social skills (Clark et al., 1989; Dodd et al., 2008; Strain & Danko, 1995; Tsao & Odom, 2006); play and related social skills – initiations, comments, interactions (Belchic & Harris, 1994; Celiberti & Harris, 1993; Oppenheim-Leaf et al., 2012; Taylor et al., 1999); compliments (Dodd et al., 2008); joint attention (Ferraioli & Harris, 2011); play interactions (Baker, 2000); imitation skills - matching coins, responding to questions in a group, preparing a snack (Rayner, 2011a); and self-help skills – tie a shoelace knot (Rayner, 2011b). Investigators in three studies targeted different skill areas: novel language skills (Jones & Schwartz, 2004); time telling, simple discrimination tasks, and/or speech concepts (Schreibman et al., 1983); and stringing beads (Colletti & Harris, 1977). Also, investigators in three of 15 studies targeted the reduction of excessive or problem behaviors - excessive directions during a social story (Dodd et al., 2008), ritualistic behaviors (Baker, 2000), and decreasing commands during play (Clark et al., 1989).

**Interventions**

*Training siblings of children with autism to implement interventions.* Investigators in seven studies trained typical siblings to intervene with their sister or brother with autism. Target behaviors included social skills in five of seven studies, stringing beads in one study, and communication skills in another study. In one of the first reported studies, Colletti and Harris (1977) trained a 10-year-old sibling to prompt her 9-year old sister with autism to string beads and provide reinforcement (food), and results showed that the intervention was effective and maintained at follow-up sessions.

In the area of social skills, Clark et al. (1989) investigated the impact of group sibling training strategies (e.g., discussion, problem solving, role play, self-monitoring, peer monitoring, group contingency management) on children with autism. Data were collected on siblings’ attending social behaviors, using manual signs, and decreasing commands during interactions, and results show that all three siblings increased their attending behaviors and manual signs, and decreased their commands with their siblings with autism. Although investigators reported data on attending behaviors of children with autism, no data was provided limiting the conclusions on the impact of the training program.

In another study, Celiberti and Harris (1993) examined the impact of teaching three sets of behavioral skills to typical siblings (7-10 years) while playing with their brother or sister with autism (4 years). The study included three sibling pairs in which siblings were trained to elicit play and play-related verbal communication, social praise, and provide prompts to the child with autism. All three siblings learned to implement the behavioral skills and demonstrated maintenance and generalization with a novel toy. Also, children with autism acquired skills during intervention sessions and maintained at follow-up probes.

Likewise, Tsao and Odom (2006) investigated the impact of sibling-mediated social intervention with four children with autism (3 to 6 years) and four typical siblings (4 to 11 years). The authors trained the siblings in typical behavioral strategies such as establishing eye contact, suggesting play activities, offering or asking for help, initiating interactions, responding, asking questions, and providing feedback. Parents and the experimenter provided instructional prompts to siblings as needed. Results indicated that all three siblings increased their social interaction towards their peers with autism and vice versa. Also, typical children maintained and generalized their social behaviors, but children with autism did not generalize their social behaviors towards their siblings in other settings.

Ferraioli and Harris (2011) trained four typically developing children (6-8 years) to imple-
ment joint attention strategies (i.e., responses, eye contact, follow point, following gaze, coordinated gaze shift) with their sibling with autism (3-7 years) in a home setting. Results indicated that gains in responses were observed in four children with autism and gains in initiations (requesting and joint attention) and imitations were observed in three children with autism, but no improvements were seen in requesting behaviors. Furthermore, the learned behaviors maintained during follow-ups and generalized to natural play settings.

Recently, Oppenheim-Leaf et al. (2012) conducted a study in which the siblings of children with autism were trained using a teaching interaction procedure (e.g., clear instructions, modeling, role play). Following the training procedures, typical siblings were instructed to play with their brother or sister with autism during free-play probe sessions in naturalistic environments. Results showed that typical siblings reached their mastery, and social interactions improved in children with autism.

To improve communication skills of three elementary children with autism, Jones and Schwartz (2004) examined the impact of three models (peers, siblings, and adults) on novel language skills during play sessions using direct instruction. Results indicated that all three participants responded to modeling across stimulus sets, but no preferred model emerged across participants, and child models were equal or as effective as adult models. For one participant, sibling model appeared to be more effective than the adult model. Maintenance data indicated that two of three participants correctly labeled the item at least 66% of the time; no maintenance data collected for the third participant.

Siblings in a video modeling interventions or social stories. Although researchers in five studies included typical siblings as video models or a part of social story intervention, siblings were not actively trained to intervene with their sister/brother with autism. For example, Talyor et al. (1999) investigated the impact of video modeling on participants with autism in two experiments. In experiment 1, a 6 year-old child with autism viewed video tapes of his sibling playing with an adult in which the typical sibling was trained to use scripted comments during play. Results indicated that the participant with autism emitted scripted comments after viewing the video models; however, no unscripted comments were observed. In Experiment 2, a 9-year-old child with autism watched his 6-year-old sibling’s video model which included unscripted play comments with an adult. The participant with autism showed an increase in unscripted play comments during the intervention. Reagon et al. (2006) replicated the Taylor’s (1999) study with a 4-year-old child with autism and a 6 year-old sibling to improve play skills. The investigator used video modeled responses of sibling play behaviors and then presented the video models to the participant and sibling during play. Results indicated that the participant increased play skills (scripted and unscripted comments), maintained over time, and generalized to home setting. The researchers, however, used an AB design and no functional relationship could be established in the study.

In a similar study, Rayner (2011a) studied the impact of sibling video models versus adult video models to teach imitation skills in a 15-year-old participant with autism. Intervention included both video models of siblings and adults in three tasks: matching coins, responding to questions in a group, preparing a snack. Results show that the participant did not show improvement in imitation across the tasks, and neither sibling nor adult video model resulted in increased performance. The author speculated that the complexity of skills taught and severity of autism might have resulted in lower performance. Also, in another study, Rayner (2011b) investigated the impact twin brother versus adult video model to teach tying a shoelace knot to a 9-year-old child with autism using video prompting and backward chaining. Results indicate that the participant showed minimal improvement; neither sibling nor adult model show greater effectiveness. This study has methodological problems because the results could not be compared with the other two participants who were typical peers and adults.

Dodd et al. (2008) conducted a study with two children with PDD-NOS and their siblings to improve social skills and decrease excessive directions during social stories, which included pictures of the participants and their
siblings with narratives. After reading the social story to the target student, the children were observed in play sessions. Results indicated that one participant showed improvement in providing compliments and a decrease in excessive directions. The other participant exhibited initial improvement in compliments but failed to continue; the design issues limit conclusions in this study as well.

Training caregivers to implement intervention with children with autism and their siblings. In two studies, investigators trained parents/caregivers to implement intervention strategies with their children with autism and their typical siblings. For example, Schreibman et al. (1983) conducted a study with three sibling pairs (5 years through 11 years). The target behaviors to improve were: a) numeracy in pair one; b) expressive and receptive language in pair two (pronoun and preposition discrimination, receptive and expressive labeling); and c) number and language (before or after, identification of money, spelling, letters) with pair three. Training of typical siblings included video demonstration and discussion of behavioral strategies such as reinforcement, shaping, chaining, and discrete-trial instruction, and ignoring inappropriate behaviors. Results reveal that siblings were successful and proficient in implementing the behavioral techniques, and children with autism correctly responded to the tasks. In addition, generalization data showed the skills were transferred to a new room. Similarly, Strain and Danko (1995) trained parents/caregivers to facilitate social interactions in three children with autism and their typical peers (3 to 5 years) using a validated classroom social skills package. The training included social skills video demonstration, review of social skills, practice with children (children with autism and their siblings), and reinforcement in home settings. Results indicated all caregivers successfully implemented social skills intervention, which improved social interactions between children with autism and their siblings.

Training children with autism to improve interactions with their typical siblings. In one of the 15 studies, Baker (2000) trained children with autism (5-6 years) to interact with their typical siblings (7-8 years) by including thematic ritualistic activities (incorporating perseverative activities), prompting play by adults, and fading adult prompting during typical games. Data were collected on sibling play interactions, joint attention, affect, and thematic ritualistic behaviors. Results indicated social interactions and joint attention between children with autism and their siblings increased, and children with autism showed positive affect and decrease in thematic ritualistic behaviors. Maintenance data indicated that intervention impact was observed at follow-ups, and generalization probes showed the impact to other games and home setting.

Maintenance and Generalization

Nine of 15 studies assessed maintenance of learned skills. Researchers in six studies attempted to assess generalization of learned skills from: clinical setting to a room resembling home settings in a new building (Schreibman et al., 1983); home (Reagon et al., 2006); new settings (home and school), games, and peers’ homes (Baker, 2000); novel toys and other games (Baker, 2000); novel toys (Celiberti & Harris, 1993); also from trainers to their brother or sister with autism (Oppenheim-Leaf et al., 2012), and from contrived to natural play settings (Ferraioli & Harris, 2011).

Social Validity

Social validity of sibling interventions was assessed in nine of 15 studies; parents (Dodd et al., 2008; Oppenheim-Leaf et al., 2012; Schreibman et al., 1983; Strain & Danko, 1995); of siblings and parents (Baker, 2000; Clark et al., 1989; Ferraioli & Harris, 2011; Reagon et al., 2006); and of undergraduate students (Celiberti & Harris, 1993). For example, Schreibman et al. (1983) reported social validity on parents about siblings of children with autism before and after treatment sessions, and parents indicated that siblings’ comments were neutral and/or few negative comments before treatments, and more positive comments were observed after the treatment. Also, Strain and Danko (1995) assessed social validity with parents and reported that the treatment package was easy to learn and implement at home settings, and they enjoyed taking part in the intervention. Similarly,
Dodd et al. (2008) indicated that mothers expressed satisfaction with social story use with their children (child with autism and her/his sibling) and planned to use the intervention in the future to increase social skills. Finally, Oppenheim-Leaf et al. (2012) assessed social validity of sibling intervention program. Two of three parents in this study indicated they were highly satisfied with the intervention and have seen quality and quantity of social play improved.

In the Clark et al. (1989) study, parents reported positive interactions between siblings from pretest to posttest measures and conflicts between children with autism and their siblings decreased. Two siblings reported a decrease in severity of problem behaviors but no change in acceptability from pretest to posttest. In another study (Baker, 2000), parental ratings indicated that interactions between children with autism and their siblings increased in novel settings from settings where trained, and siblings made more positive comments about their brother/sister with autism after the intervention. Similarly, Fierrioli and Harris (2011) assessed social validity with siblings of children with autism and their parents on the impact of sibling-mediated intervention, and siblings indicated a ‘moderate satisfaction’ with the intervention, and parents indicated high levels of satisfaction with the treatment. Finally, Celiberti and Harris (1993) assessed social validity using naïve observers (undergraduate students) to view video tapes of sibling interactions, and results indicated that participants rated more positive interactions during intervention sessions compared to baseline sessions.

Methodological Components

Several methodological issues appear in the reviewed studies. For example, many of the studies, particularly where typical siblings involved in interventions as video models or a part of social stories, suffer from design issues; the authors either used AB designs or results indicated a lack of functional relationship between dependent and independent variables. Although interobserver agreement was collected in all of the studies, only 5 of the 15 studies reported procedural integrity data, a major concern in this review because it is unsure if the intervention protocols were followed as designed (see Table 2).

Discussion

The purpose of this review was to analyze intervention studies that involved children with autism and their typical siblings. This is the first review that specifically analyzes siblings intervention studies in the area of autism by providing the current status of the research as well as new directions for future researchers and practitioners. Results across studies show that typical siblings, when provided training and feedback, may facilitate social and communication behaviors in children diagnosed with autism, which is consistent with the previous reviews (Bass & Mulick, 2007; Ferraioli et al., 2012). However, due to variability across studies, behaviors targeted, methods used, interventions implemented, it is too early to conclude with certainty that siblings indeed can facilitate various skills in children with autism.

Another issue that is apparent in this review is that researchers in several studies included siblings of children with autism as passive models (e.g., video model, a picture of sibling with narrative in a social story), instead of active trainers in interventions (e.g., providing prompts, feedback, error correction), to enhance the targeted skills. Thus, based on the present review, we do not yet know whether siblings are intervention facilitators, particularly as non-participants in the intervention processes. Future research is necessary about the extent of sibling involvement and its impact on children with autism.

The majority of the reviewed studies included elementary or school age children with and without autism (averages age 6 to 8 years), and only one of the studies involved an adult. More research is warranted with typical young adolescents or adults and their siblings with autism. This is an important area of concern because the impact of adult siblings is rather absent or nonexistent in the literature. Besides, most of the reviewed studies targeted social-communication or play skills. Results across these studies show improvement across participants. However, impact of siblings on other skills (e.g., academic, behavior, self-
The encouraging and positive aspect of this review is that a majority of studies were conducted in natural environments, except for two (Baker, 2000; Belchic & Harris, 1994). Although these two studies were not conducted in home environments, generalization probes were conducted in homes, which implies that all of the studies, one way or the other, included natural environments. Such a trend is an optimistic factor in this line of research and should be continued because family environments are the best places to evaluate the short- and long-term impact of sibling interventions.

Many of the reviewed studies lack rigorous experimental designs and failed to collect data on procedural integrity (66%). Future researchers should include robust experimental designs and follow principles of single-case studies (Horner et al., 2005; Kratochwill et al., 2010) to improve the quality of studies and evidence-base in this area.

Some limitations of this review should be noted and results should be interpreted with caution. First, group design studies were not included in this review. Second, no doctoral dissertations or other published report were included, indicating a publication bias. Finally, this review is a descriptive review with high potential for subjective bias; meta-analytic or quantitative reviews are preferred over descriptive reviews (Schlosser, Wendt, & Sigafos, 2007).

**Implications for Practice**

Some implications from this review should be noted. Siblings may be one of the potential and powerful peer interventionists at home and in other community settings. The present review indicates that typical siblings of children with autism, when trained using behavioral strategies such as modeling of target behaviors, providing prompts for appropriate demonstration of behaviors, fading, reinforcing, and making error corrections, can facili-
tate social-communication skills in children with autism. Also, professionals should consider training parents in facilitating using the above strategies, which may be helpful in improving behaviors in children with autism. In addition, typical siblings may also learn to use such strategies in natural settings (e.g., home, playground, community) and enhance social-communication behaviors. The impact of siblings as passive role models on their brother or sister with autism is tenuous, given the methodological issues of the reviewed studies. Although such a conclusion, based on the limited number of studies available is premature, professionals need to make decisions on using such interventions models on case-by-case basis and evaluate potential outcomes of these interventions. Using siblings as intervention models throughout the life span may have a significant impact on long-term relationships, reduce burden on society, and improve family wellbeing, functioning, and long-term support and care for individuals with autism.

References


Schlosser, R. W., Wendt, O., & Sigaoos, J. (2007). Not all systematic reviews are created equal: Considerations for appraisal. *Evidence-Based Communication Assessment & Intervention, 1*, 138–150. doi: 10.1080/17489530701560831


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Animal Assisted Interventions for Children with Autism Spectrum Disorder: A Systematic Review

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Abstract: Animal assisted intervention (AAI), which has been defined as the use of an animal to provide therapeutic benefit based on a positive relationship between the client and the animal, is a therapy option for children with autism spectrum disorder (ASD); therefore, it is beneficial to review studies that evaluated its effectiveness. A systematic search identified 20 studies that were assessed in terms of (a) participant characteristics, (b) independent variables, (c) dependent variables, (d) study outcomes, and (e) certainty of evidence. Although AAI studies reported either positive or mixed results, multiple methodological flaws were identified across the literature, which is cause for concern when determining intervention efficacy. Because of these contradictory findings and research design limitations, additional inquiry is needed. As such, caregivers and practitioners should exercise caution in selecting AAI as part of an intervention package for children with ASD.

The diagnosis of autism spectrum disorder (ASD) has steadily increased in recent years, with estimates indicating that one in every 88 children is on the spectrum (Centers for Disease Control and Prevention [CDC], 2014). ASD is characterized by deficits in social communication and restricted, repetitive behaviors (American Psychiatric Association, 2013). Most experts agree that with early behavioral intervention, children can make exceptional gains in functioning (CDC, 2014). However, the etiology of ASD remains unknown.

Perhaps influenced by this, there are a multitude of intervention choices available for children with ASD. In a survey conducted by Green and colleagues (2006), over 100 different interventions for ASD were identified. Unfortunately, not all available interventions have demonstrated empirical evidence of effectiveness, but continue to be used (Davis et al., 2013; Green et al., 2006; Helfin & Simpson, 1998; Mulloy et al., 2010). Families of children with autism often pursue these interventions in the hope of ameliorating particular aspects associated with ASD (Bowker, D’Angelo, Hicks, & Wells, 2011). Unfortunately, the implementation of interventions lacking empirical support often result in families of children with autism wasting precious time, money, and resources when those could have been allocated toward interventions fitting the evidence-based practice guidelines outlined in the National Standards Report by the National Autism Center (2009).

Animal assisted intervention (AAI) is an alternative intervention that has developed into a diverse field with practitioners in occupational, speech, behavioral, and cognitive therapies, treating individuals with a range of medical issues and developmental disabilities (e.g., Sams, Fortney, & Willenbring 2006; Silva et al., 2011; Solomon, 2010). AAI is an umbrella term that includes animal assisted therapy (AAT) and animal-assisted activities (AAA). AAT is an intervention in which the animal is an essential part of reaching a specified goal. On the other hand, AAA refers to activities in which animals are involved for potential benefit, but specific goals are not identified and the activities do not have to be conducted by trained personnel. Given the broad scope of the terms, the practice and implementation of AAI is not standardized.
and difficult to evaluate (Palley, O’Rourke, & Niemi, 2010).

The human-animal interaction theory suggests that the relationship between humans and animals results in positive physical and psychological benefits. Specifically, this theory postulates that humans view animals as sources of non-judgmental social interaction (Esposito et al., 2011; Kruger & Serpell, 2010). There may be other mechanisms at work, such as the animal serving as a mediator or translational object for social needs (Kruger & Serpell, 2010). Many physiological benefits, such as reductions in blood pressure and heart rate, have been established in cases where individuals are in the presence of an animal (Bass, Duchowny, & Llabre, 2009; Viau et al., 2010). Even so, AAI as a field lacks a unified, empirically supported theoretical framework from which practices are derived (Kruger & Serpell, 2010).

Families of children with ASD may select AAI as an intervention so that their child can be in close proximity to and interact with trained, therapeutic animals, yet evidence supporting the efficacy of these programs is limited (Breitenbach, Stumpf, Fersen, & Ebert, 2009). AAI have become increasingly popular for individuals with developmental disabilities, giving rise to programs with dogs, horses, dolphins, and more, both nationally and internationally (Bass et al., 2009; Breitenbach et al., 2009; Burrows, Adams, & Millman, 2008; Dingman, 2008; Martin & Farnum, 2002; Memishevik & Hodzhikj, 2010; Pawlik-Popiełarska, 2010; Prothmann, Ettrick, & Prothmann, 2009). These programs focus on a variety of goals and are utilized throughout varying disciplines (Maurer, Delfour, Wolff, & Adrien, 2010). As an intervention gains popularity, it is imperative that evidence supporting its therapeutic benefits, or lack thereof, be identified so that families and practitioners can make informed decisions regarding intervention selection.

A systematic literature review on the effects of AAI on symptoms associated with ASD is warranted. The purpose of the review is to describe the characteristics of interventions involving animals as well as evaluate the results on symptoms associated with ASD. To date, one review exists (O’Haire, 2013); however, the current review differs from the previous literature synthesis by specifically selecting and reviewing the studies that measured changes associated with ASD symptoms (i.e., social communication and stereotyped or challenging behavior). The previous review included additional components unrelated to core ASD symptoms (e.g. stress, well-being) as well as discussing the reviewed studies as evidence for AAI as a psychosocial intervention for ASD. With AAI being promoted as an ASD intervention, it is imperative that the effectiveness to improve symptoms specific to ASD is known. The information summarized in this review should assist caregivers and practitioners in making informed decisions regarding the use of AAI as an ASD intervention.

**Method**

This review consisted of a systematic search and analysis of studies that utilized animals in the treatment of symptoms associated with ASD. The results of the analysis are summarized in the following categories: (a) participant characteristics, (b) dependent variables, (c) independent variables, (d) study outcomes, and (e) certainty of evidence. Due to the paucity of research available on AAI, the intent of this review was to include all available studies. As a result, the quality and type of research designs varied.

**Inclusion and Exclusion Criteria**

To be included in this review, studies must have been published in English in peer-reviewed journals, but no restrictions on publication date were set. Additionally, the study had to evaluate the effects of animal interaction with at least one child, under the age of 18, with ASD. As diagnostic criteria have changed recently (American Psychiatric Association, 2013) any participants with diagnoses of autism, Asperger’s Disorder, or Pervasive Developmental Disorder, Not Otherwise Specified were included. The study design had to include measurement of at least one dependent variable related to a core symptom of ASD, that is, social communication skills or repetitive and stereotyped patterns of behavior and/or challenging behavior. Among the studies in which some participants, but not all, met this criterion, only those in which the
results for the participants meeting the criterion were extracted for review.

Because very few guidelines exist regarding the procedures that define AAI, a broad inclusion criterion was employed. Specifically, any study incorporating a non-human mammal as the independent variable (i.e., intervention), or component of the independent variable, was included. As a result, broad uses of animals are represented across these studies. However, studies were excluded if the inclusion of the animal was strictly considered pet ownership with no specifically defined activities taking place with the animals in order to maintain the focus of this review specifically on AAI. This criterion resulted in excluding studies such as that conducted by Grandgeorge and colleagues (2012) who evaluated the effects of the presence or arrival of a family pet on social behaviors of children with autism. Research addressing the use of service dogs was considered distinct from pet ownership as service dogs were highly trained to provide assistance to children with ASD and therefore studies were included for analysis.

Other studies were also excluded from this review if the purpose of the research was to eliminate the abuse of animals or to reduce animal phobias. These criteria resulted in excluding a study by Bergstrom, Tarbox, and Gutshall (2011) that used applied behavior analysis techniques to decrease the mistreatment of a family pet. Additionally, a study by Chok, Demanche, Kennedy, and Studer (2010) who utilized a behavior analytic approach to decrease a severe dog phobia was excluded as well.

Search Procedures

A systematic search was conducted in the following databases: PsycINFO, Psychology and Behavioral Sciences Collection, PsychARTICLES, Educational Resources Information Clearing House (ERIC), Education Research Complete and MEDLINE. On all databases, the following free-text terms were inserted into the keyword fields in pairs utilizing Boolean operators and truncation: “animal assisted,” “animal,” “dolphin,” “canine,” “dog,” “equine,” “horse,” “pet,” “kynotherapy” and “hippotherapy” paired with “disability,” “autism,” “Asperger,” “mental retardation,” and “intellectual disability” (e.g., “animal assisted” paired with “disability” and “canine” paired with “autism”). All possible combinations of the listed terms were applied; specifically 50 search term pairs were utilized. Although participants were PDD-NOS were included in this study, “pervasive developmental disorder-not otherwise specified” was not utilized as a search term in lieu of the use of the broader term “disability”.

The abstracts of the resulting articles were reviewed to identify studies for inclusion. A total of 329 studies were identified via the electronic database search; 20 of these met inclusion criteria. An ancestry search was then completed on all studies in order to identify additional articles, but no additional articles that met inclusion criteria were identified. Finally, hand searches covering January 2012 – December 2013 were conducted within all of the journals that had published the studies already selected for inclusion, but no additional articles that met inclusion criteria were identified.

Inter-rater agreement. To assess the reliability of our application in using the inclusion criteria, the first and second authors independently conducted the searches and then applied the inclusion and the exclusion criteria to studies identified by the search procedures. Agreement was 98.7% and the disputed studies were reviewed to reach a consensus.

Data Extraction

Each potential study was assessed against the inclusion criteria and data extracted. Participant characteristics were coded according to total number of study participants, gender, age, and diagnosis. Dependent variables were coded based on the core symptom of ASD addressed (i.e., social communication or restricted, repetitive behaviors) and how these variables were measured. Independent variables were coded according to the animal used, duration of intervention, activities taking place, person responsible for implementing AAI, any additional intervention components, and treatment fidelity.

Study outcomes were coded as (a) positive, (b) negative, or (c) mixed, based on criteria outlined by previous literature (Davis et al., 2013; Lang et al., 2012; Mulloy et al., 2010).
Accordingly, the studies were coded as having positive results if all participants made improvements on all dependent variables or if statistically significant improvements were found for all dependent variables in a group design (using the alpha levels stated in the reviewed study). Studies were coded as having negative results if none of the dependent variables improved for any participant or if a group design failed to find statistically significant improvement. Studies were coded as having mixed results if some participants improved and others did not or if improvement was found in some dependent variables, but not in others. Mixed results for group design studies applied if some improvements among dependent variables were statistically significant, but others failed to reach statistical significance (using alpha levels stated in the reviewed study).

Certainty of evidence was rated as “insufficient,” “preponderant,” or “conclusive” based upon definitions utilized in other works (e.g., Davis et al., 2013; Lang et al., 2012; Mulloy et al., 2010). The studies were classified at the insufficient level of certainty if they did not utilize a true experimental design (e.g., case studies, AB designs, and group designs without a control group) and/or did not meet the criteria of the next level of certainty. In order to be classified at the preponderance level of certainty, a study had to (a) demonstrate experimental control in a single case research design or use an experimental group design, (b) provide adequate inter-observer agreement (IOA), when applicable (i.e., 20% or more of sessions with mean agreement 80% or higher), (c) operationally define dependent variables, and (d) provide enough detail to enable replication. The studies classified at the preponderance level could contain limitations regarding alternative explanations for results (e.g., concurrent intervention or multi-component interventions). The final level of certainty (i.e., conclusive) was reserved for the studies that met the first four requirements of preponderance of evidence, and also included an additional attempt to control for confounding variables (e.g., double-blind, placebo controlled) and reported treatment fidelity.

Inter-rater agreement. To assess reliability of data extraction, one article was jointly summarized by the first four authors. An additional nine studies (45%) were then independently summarized by two authors to assess agreement. This process yielded 171 items in which there could be agreement or disagreement (i.e., nine studies with 19 items per study). Agreement for the summarized items was 93% and all disagreements were resolved by discussion until consensus was reached.

Results

A total of 20 studies met the criteria for inclusion in this review. Table 1 summarizes these studies in terms of participant characteristics, dependent variables, independent variables, study outcomes, and certainty of evidence.

Participants

A total of 330 participants received some form of AAI across the 20 studies. The sample size per study ranged from one to 64 participants. The ages ranged from 3 to 16 years old. Of the 330 participants, 242 participants were male (73%) and 62 were female (19%). The gender was not reported for 26 (8%) participants. Among the participants, 130 (39%) were diagnosed with autism, 31 (9%) with Asperger syndrome, and 32 (10%) with PDD-NOS. An additional 137 participants (42%) were reported as having ASD. In addition to ASD diagnoses, 15 participants (5%) were reported to have an additional diagnosis. This most frequently included an intellectual disability.

Dependent Variables

Although a variety of dependent variables were reported in the studies, the purpose of this review was to summarize the effects of AAI on ASD symptoms. In 16 studies (80%) included in the review the effects on social skills (e.g., sharing, eye contact, interactive play, interactions with others) were reported. In 13 studies (65%) effects on repetitive and stereotyped patterns of behavior and/or challenging behavior (e.g., stereotypy, tantrums) were reported. Another 10 studies (50%) reported on the effects of AAI on communication skills (e.g., spontaneity of speech, grammatical aspects of speech, etc.). One final study (Kern et al., 2011) did not report individual dependent
<table>
<thead>
<tr>
<th>Citation</th>
<th>Participants</th>
<th>Animal</th>
<th>Dependent Variables</th>
<th>Measurement</th>
<th>Study Outcomes</th>
<th>Certainty of Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bass et al. (2009)</td>
<td>29 male, 5 female 5 - 10 years</td>
<td>Horse</td>
<td>Social Skills</td>
<td>SRS</td>
<td>Mixed</td>
<td>Preponderant: Raters were not blind to treatment purposes; several participants simultaneously received treatments such as speech-language therapy, occupational therapy, and physical therapy.</td>
</tr>
<tr>
<td>Burrows et al. (2008)</td>
<td>10 male, 3 female 4.5 - 14 years</td>
<td>Dog</td>
<td>Social Skills</td>
<td>Parent interview</td>
<td>Positive</td>
<td>Insufficient: Data consists solely of anecdotal reports from parents and does not provide enough detail to replicate service dog experience.</td>
</tr>
<tr>
<td>Funahashi et al. (2013)</td>
<td>1 male 10 years</td>
<td>Dog</td>
<td>Communication</td>
<td>Direct observation</td>
<td>Positive</td>
<td>Insufficient: No experimental control regarding improvements in communication, IOA was not reported; insufficient detail to replicate activities with dog.</td>
</tr>
<tr>
<td>Gabriels et al. (2012)</td>
<td>36 male, 6 female 6 - 16 years</td>
<td>Horse</td>
<td>Social Skills</td>
<td>VABS, ABC</td>
<td>Mixed</td>
<td>Preponderant: Raters were not blind to treatment purposes; insufficient detail to replicate therapeutic horseback riding activities; although the procedures before and after were well described (e.g., put on helmet, mount horse, etc.), specific horseback riding activities were not thoroughly detailed.</td>
</tr>
<tr>
<td>Hohn et al. (2013)</td>
<td>3 male 6 - 8 years</td>
<td>Horse</td>
<td>Social Skills</td>
<td>SRS, ABC, CARS, SP-CQ</td>
<td>Mixed</td>
<td>Insufficient: Non-experimental ABA design, research design compared different frequencies of therapeutic horseback riding (once per week versus 3 - 5 times per week) rather than comparing therapeutic horseback riding to no riding, did not report treatment fidelity, raters were not blind to purpose of study; parent raters instructed to complete standardized measures with a &quot;look-back&quot; period of 1-month.</td>
</tr>
<tr>
<td>Kem et al. (2011)</td>
<td>18 male, 6 female 3 - 12 years</td>
<td>Horse</td>
<td>Overall autism rating on CARS</td>
<td>Social Skills: Direct observation of social contacts</td>
<td>Positive</td>
<td>Insufficient: No control group, children received multiple treatments during the course of the experiment, treatments outside of study (e.g., medication, speech therapy) were altered during the course of the experiment, insufficient detail to replicate.</td>
</tr>
<tr>
<td>Kriskova et al. (2010)</td>
<td>5 male, 1 female 6 - 15 years</td>
<td>Guinea Pig</td>
<td>Social Skills</td>
<td>Direct observation of social contacts</td>
<td>Mixed</td>
<td>Insufficient: Non-experimental AB design used; dependent variables were not operationally defined; IOA was not reported; participants simultaneously received specialized instruction including TEACCH model and structured teaching.</td>
</tr>
<tr>
<td>Citation</td>
<td>Participants</td>
<td>Animal</td>
<td>Dependent Variables</td>
<td>Measurement</td>
<td>Study Outcomes</td>
<td>Certainty of Evidence</td>
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<td>----------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Martin &amp; Farnum (2002)</td>
<td>8 male, 2 female</td>
<td>Dog</td>
<td>Social Skills</td>
<td>Direct observation</td>
<td>Mixed</td>
<td>Insufficient: Although authors refer to a research protocol that was followed, the protocol was not described, which inhibits replication; lack of experimental design, although authors refer to design as within-participants, repeated measures design, data was not displayed graphically for visual analysis; insufficient IOA.</td>
</tr>
<tr>
<td>Memishevskij &amp; Hodzhikj  (2010)</td>
<td>2 male, 2 female</td>
<td>Horse</td>
<td>Social Skills</td>
<td>ATEC</td>
<td>Mixed</td>
<td>Insufficient: Case study with no experimental design; DV measured by anecdotal report; participants simultaneously received special education, speech-language therapy, and psychomotor rehabilitation during study.</td>
</tr>
<tr>
<td>Obrusnikova et al. (2012)</td>
<td>1 male, 3 not reported</td>
<td>Dog</td>
<td>Social Skills</td>
<td>Anecdotal report</td>
<td>Mixed</td>
<td>Insufficient: Case study with no experimental design; DV measured by anecdotal reports in which parents must recall behavior from the past; insufficient detail to replicate the activities implemented with the dog present during a sports program; no operational definitions of DV.</td>
</tr>
<tr>
<td>O’Haire et al. (2013)</td>
<td>50 male, 14 female</td>
<td>Guinea pig</td>
<td>Social Skills</td>
<td>PDDBI, SSRS</td>
<td>Positive</td>
<td>Insufficient: Pre- and postassessment with no control group; respondent not blind to treatment and purpose; insufficient detail to enable replication.</td>
</tr>
<tr>
<td>Pawlik-Popielarska et al. (2010)</td>
<td>1 participant</td>
<td>Dog</td>
<td>Communication</td>
<td>Anecdotal report</td>
<td>Mixed</td>
<td>Insufficient: Case study with no experimental design; DV was measured by anecdotal reports in therapists’ journals; no operational definitions of DV; insufficient detail to replicate; participant simultaneously received special education during course of the study.</td>
</tr>
<tr>
<td>Prothman et al. (2009)</td>
<td>11 male, 3 female</td>
<td>Dog</td>
<td>Social Skills</td>
<td>Direct observation</td>
<td>Mixed</td>
<td>Insufficient: Inadequate detail provided to replicate activities that occurred with dogs; insufficient IOA reported.</td>
</tr>
<tr>
<td>Rederfer &amp; Goodman (1989)</td>
<td>9 male, 5 female</td>
<td>Dog</td>
<td>Social Skills</td>
<td>Direct observation</td>
<td>Positive</td>
<td>Insufficient: Although authors refer to design as single subject (modified time lag design), data was not displayed graphically for visual analysis and it appears that an AB with follow-up was in fact implemented; insufficient detail to replicate as data refers to three phases of treatment, but only the first two were described in the procedures.</td>
</tr>
<tr>
<td>Citation</td>
<td>Participants</td>
<td>Animal</td>
<td>Dependent Variables</td>
<td>Measurement</td>
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<tr>
<td>Salgueiro et al. (2012)</td>
<td>8 male, 2 female 3 – 13 years</td>
<td>Dolphin</td>
<td>Social Skills Communication Behavior</td>
<td>ATEC, CARS</td>
<td>Mixed</td>
<td>Insufficient: Pre- and post-assessment with no control group; insufficient detail to enable replication.</td>
</tr>
<tr>
<td>Sams et al. (2006)</td>
<td>22 participants 7 – 13 years</td>
<td>Dog, Rabbit, Llama</td>
<td>Social Skills Communication</td>
<td>Researcher-created observation forms</td>
<td>Positive</td>
<td>Insufficient: Raters not blind to the purpose of the study; IOA appears insufficient as authors reported 13 sessions independently rated, but did not report total number of sessions; however, reported 22 participants received an average of 2 sessions per week for 15 weeks (660 sessions).</td>
</tr>
<tr>
<td>Silva et al. (2011)</td>
<td>1 male 12 years</td>
<td>Dog</td>
<td>Social Skills Behavior</td>
<td>Direct observation</td>
<td>Mixed</td>
<td>Insufficient: Case study using statistical analysis with one participant; although authors report use of a structured protocol, insufficient detail was given to replicate as the protocol was never defined; raters not blind to purpose of treatment.</td>
</tr>
<tr>
<td>Solomon (2010)</td>
<td>1 male, 1 female 6 – 18 years</td>
<td>Dog</td>
<td>Social Skills Behavior</td>
<td>Anecdotal reports</td>
<td>Positive</td>
<td>Insufficient: Case study with no experimental design, DV measured using anecdotal reports; insufficient detail to replicate activities with dog.</td>
</tr>
<tr>
<td>Viau et al. (2010)</td>
<td>37 male, 5 female 3 – 14 years</td>
<td>Dog</td>
<td>Behavior</td>
<td>Researcher-created questionnaire</td>
<td>Positive</td>
<td>Insufficient: DV measured using researcher-created tool collecting anecdotal parent report; insufficient detail to replicate activities with dog; no control group.</td>
</tr>
<tr>
<td>Ward et al. (2013)</td>
<td>15 male, 6 female Mean = 8.1 years</td>
<td>Horse</td>
<td>Social Skills Communication Behavior</td>
<td>GARS</td>
<td>Mixed</td>
<td>Insufficient: Pre- and post-assessment with no control group; participant simultaneously received other services during the study (e.g., speech therapy, occupational therapy, physical therapy); respondents not blind to purpose of study.</td>
</tr>
</tbody>
</table>

*Abbreviations:* ASD, autism spectrum disorder; SRS, Social Responsiveness Scale; VABS, Vineland Adaptive Behavior Scales; ABC, Aberrant Behavior Checklist; CARS, Childhood Autism Rating Scales; SP-OQ, Sensory Profile-Caregiver Questionnaire; CARS, Childhood Autism Rating Scale; IOA, interobserver agreement; TEACCH, Treatment and Education of Autistic and related Communication Handicapped Children; PDD-NOS, Pervasive Developmental Disorder-Not Otherwise Specified; ATEC, Autism Treatment Evaluation Checklist; DV, dependent variable; PDDBI, Pervasive Developmental Disorder Behavior Inventory; SSRS, Social Skills Rating System; GARS, Gilliam Autism Rating Scales.
variables, but instead reported changes in the Childhood Autism Rating Scale (Schopler, Reichler, & Renner, 1988) score, which incorporates all three variables.

An assortment of measurement techniques were employed across studies. In eight studies (40%) standardized questionnaires, checklists, and rating scales were used to measure dependent variable changes. Various measures were used including: Social Responsiveness Scale (Constantino, 2002), Vineland Adaptive Behavior Scales (Sparrow, Cicchetti, & Balla, 2005; e.g. Gabriels et al., 2012), Aberrant Behavior Checklist (Aman, Singh, Stewart, & Field, 1985; e.g. Gabriels et al., 2012), Autism Treatment Evaluation Checklist (Rimland & Edelson, 2000; e.g., Bass et al., 2009; Gabriels et al., 2012), Gilliam Autism Rating Scale (Gilliam, 2006; e.g., Ward, Whalon, Rusnak, Wendell, & Pschall, 2013), Childhood Autism Rating Scale (Schopler et al., 1988; e.g., Holm et al., 2013), Sensory Profile-Caregiver Questionnaire (Dunn, 1999; e.g., Holm et al., 2013), Social Skills Rating System (Gresham & Elliot, 1990; e.g., O’Haire, 2013), and Pervasive Developmental Disorder Behavior Inventory (Cohen, Schmidt-Lackner, Romanycz, & Sudhalter, 2003; e.g., O’Haire, 2013).

Six studies (30%) employed direct observation and another four studies (20%) reported anecdotal data. Two studies (10%) utilized researcher-created questionnaires or measures (e.g., Sams et al., 2006) and one study utilized a parent interview (Burrows et al., 2008).

Animal Assisted Intervention

AAI is a broad term encompassing a variety of practices involving animals. The results of this review confirmed the variety among practices of those that incorporate animals for therapeutic benefit for children with ASD.

Animal selection. The studies included in this review incorporate a wide variety of animals. In 11 studies (55%) a dog was included as a component of the independent variable. The second most common animal was a horse (i.e., hippotherapy), implemented in six studies (30%), and followed by a guinea pig, implemented in two studies (10%). Other animals were incorporated in one study each, including a rabbit, llama, and dolphin.

Intervention dimensions. Generally, AAI sessions occurred relatively frequently. In 11 studies (55%) AAI was implemented on a weekly basis, whereas in three studies (15%) AAI was implemented two to five times per week. In another three studies (15%) AAI occurred daily. No interventions occurred on a monthly basis, but three studies did not specifically report frequency of AAI sessions.

The duration of AAI varied across studies as well. In 12 studies (60%) AAI was implemented for one to six months and in another three studies (15%) participants engaged in AAI for less than one month. Only two studies (10%) implemented AAI for seven months to one year, and one study (5%) implemented for over a year. The remaining two studies (10%) did not report total duration of implementation.

AAI varied widely in terms of activities taking place with the animals. Six studies (30%) taught the child a specific skill with the animal, such as mounting and riding a horse. An additional four studies (20%) had preplanned games or activities with the animal, such as feeding the animal, petting the animal, and playing fetch. Four other studies (20%) simply examined the influence of the presence of the animal with no specific interaction activities planned. Three studies (15%) included an animal as a service animal, but the studies varied in regards to the degree of detail regarding what services a service dog was providing. For example, Burrows et al. (2008) explicitly stated that the purpose of the dog was to keep the child safe and respond to his or her emotional and physical needs, but little detail about this protection and responding actually occurred. The remaining three studies (15%) did not describe the specific activities the animal participated in with the child, but rather made general statements.

Though essential to the understanding of AAI as an intervention modality, other aspects of treatment intensity as defined by Codding and Lane (2014) could not be determined from the studies included in this review.

Implementer. Similar to the type of animal incorporated into the independent variable, an array of individuals served to implement the intervention, even within studies. In 11 studies (55%) the implementer was identified as an animal trainer or therapist. The exact terminology varied, but this category contained any indi-
individual described to have training in managing the animal and/or utilizing the animal for therapeutic purposes. Various terms used by the researchers included professional animal trainer (Solomon, 2010), dog-guide (Pawlak-Popielarska, 2010), individuals with a certificate in equine-assisted psychotherapy (Memishevikj & Hodzhikj, 2010), riding instructor (Kern et al., 2011) and Professional Association of Therapeutic Horsemanship International certified instructor (Gabriels et al., 2012). In three studies (15%) the implementers included a parent whereas an occupational therapist implemented in two studies (10%), and a psychologist in two studies (10%). Additionally, each of the following implementers was incorporated in one study each: speech language pathologist, teacher, and experimenter. Finally, two studies (15%) simply measured the effects of animal presence without specific implementation guided by a human implementer.

Additional intervention components. The broad inclusion criteria resulted in the review of any research that incorporated a non-human mammal as the independent variable or component of the independent variable; therefore, studies were included that incorporated an animal into an existing intervention model. Of the 20 studies, two (10%) incorporated an animal into a distinct intervention program other than AAI. Sams and colleagues (2006) incorporated several different animals into an occupational therapy program. Similarly, Obrusnikova, Bibik, Cavalier, and Manley (2012) included dogs into an existing sports program for children with and without disabilities.

Additionally, in six studies (30%) participants received multiple interventions as part of the study and/or outside of the study during the duration of the experiment. These included special education, psychiatric services, speech therapy, occupational therapy, physical therapy, and medication.

Treatment fidelity. No studies included in the review explicitly reported the measuring of treatment fidelity.

Study Outcomes

Eight of the 20 studies (40%) found positive results (e.g., Solomon, 2010; Viau et al., 2010). The remaining 12 studies (60%) found mixed results (e.g., Bass et al., 2009; Martin & Farnum, 2002). No studies found strictly negative results.

Certainty of Evidence

The majority of the studies (90%) were classified as insufficient, the lowest level of certainty. The remaining studies (10%) were classified as preponderant. No study was classified as conclusive.

Discussion

This review identified and evaluated 20 studies that examined the effects of AAI on ASD symptomatology. Conflicting conclusions were noted with the majority finding mixed results and the remaining finding positive results. When studies report conflicting results on a similar intervention, it is necessary to take into consideration the methodological rigor of the studies (Chambless & Hollon, 1998). For example, all of the studies reporting positive results were classified as having an insufficient certainty of evidence. However, it should also be noted that studies meeting criteria for having a negative effect would not likely be published and therefore any studies implicating the participants did not improve, or worsened in the presentation of ASD symptoms, therefore cannot be used to compare those studies rated as having positive or mixed results.

Among many of the studies, threats to internal validity compromised the methodological rigor of the study. Threats to internal validity found across the reviewed studies included, but were not limited to, (a) lack of experimental design, (b) use of anecdotal observations, (c) use of researcher-constructed measurement systems, (d) additional interventions serving as confounding variables, (e) lack of detail describing the independent variable, and (f) lack of treatment fidelity reports.

The first threat to internal validity was a lack of experimental design. For example, Pawlik-Popielarska (2010) and Solomon (2010) reported only anecdotal data from case studies with no experimental design. Similarly, Burrows and colleagues (2008) reported parent interview data, but limited inferences about cause-and-effect relation-
ships can be established using this type of research methodology.

Secondly, several studies utilized anecdotal observation. For example, Obrusnikova and colleagues (2012) conducted a case study in which the measurement of changes among participants was informal interviews with parents and instructors after the completion of the program. It is difficult to confirm if such anecdotal reports are accurate, valid, and reliable, particularly with requesting information from parents and instructors only after the completion of the program, and presumably when they are not blind to the purpose of the program.

Similar concerns exist among the studies that utilized researcher-constructed measurements. For example, Sams and colleagues (2006) identified that rating forms were designed specifically for their study and Viau and colleagues (2010) described an 11-item questionnaire designed for their study. Researcher-constructed measurements may not be reliable and valid measures, and in these particular studies, data to support the reliability and validity of the measures were not reported.

Additional measurement procedures may have also biased results, including lack of blind raters and reliance on respondent memory. For example, Bass and colleagues (2009) utilized parents to respond to standardized rating scales, but parents were neither blind to the purpose of the study nor to the fact that their child was participating in therapeutic horseback riding. Holm and colleagues (2013) also used parent respondents who were not blind to the purpose of the study. Parents were asked to respond to standardized measures on three different occasions, once at the end of each phase of the study. Each time they were asked to respond with a look-back at the past 30 days, the duration of their child’s exposure to the previous phase. This reliance on memory increases the likelihood of inaccurate reports; for example, parents may report changes that occurred before the one month window.

An additional concern across several studies was the potential confound of multiple interventions. For example, Sams and colleagues (2006) incorporated animals into occupational therapy activities. As a result, it is impossible to determine if any changes in the dependent variable are a result from occupational therapy, interaction with the animal, or a combination of the two. Similarly, across the course of the study conducted by Kern and colleagues (2011), seven of the 24 participants experienced either a change in medication or therapy (e.g., speech therapy, occupational therapy); therefore, it is impossible to know if experienced changes are a result of medication or therapy changes as opposed to the horseback riding program.

Many studies failed to provide detail sufficient enough to enable replication. Many studies identified in this review provided little to no detail of the exact activities in which the participants engaged with the animals. For example, Martin and Farnum (2002) identified that the participants took part in 15 min sessions three times per week while the therapist followed a research protocol; however, the protocol did not include any more description than the inclusion of sample questions asked to the child. In fact, the responses to the participants’ appropriate and inappropriate behaviors were not described, as well as the specific activities, if any, to prompt interaction with the dog. Generally speaking, it appears there is very little detail about what constitutes AAI across disciplines and applications. As a result, the activities represented across the studies included in this review ranged from a simple exposure to animals to more detailed and sophisticated activities supporting animal interaction.

Finally, no studies reported a measure of treatment fidelity. In order to ensure that the AAI procedures are implemented with consistency over the course of the study, it is critical that authors report a measure of treatment fidelity. This would be particularly true in case studies and single-subject designs in which the independent variable (i.e., intervention) would be implemented multiple times over time (Gresham, Gansel, & Kurtz, 1993). However, no studies included in this review; therefore, it is impossible to determine the accuracy with which any of the AAI were implemented.

In addition to insufficient procedural details, the construct validity supporting AAI seems to be lacking. Many authors reported physical, social, psychological, and cognitive
benefits of animal interaction (e.g., Bass et al., 2009; Gabriels et al., 2012). Other authors reported slightly more detailed theorized benefits of animal interaction. For example, Martin and Farnum (2002) share theories that animals can serve as translational objects, which allow individuals with ASD to develop social bonds with the animal that then generalize to humans (George, 1988; Katcher, 2000; Winnicott, 1986), presumably implying that developing social bonds with animals is either easier or less aversive for individuals with ASD, though it is not explicitly stated. In other words, although some proposed theories of the benefit of AAI are shared by authors in varying degrees of detail, the exact processes in which these benefits are realized remain unclear among studies included in this review.

Aside from the lack of research support or construct validity, other factors should be considered before implementing AAIs. Safety of both the human and the animal could be at risk; in fact, both should be considered vulnerable groups. Williams (2008) made reference to such concerns in regard to dolphin therapy, reminding potential consumers that dolphins are strong, often unpredictable animals, which has led to significant injury to swimmers, such as bites and broken bones. Similar concerns should be shared for all animals, particularly larger animals such as horses and large dogs. However, human safety is not the only concern. Zamir (2006) points out that the animals may also suffer injury from rough handling or aggressive behavior of clients. Considering the high prevalence of stereotyped behavior that may inadvertently lead to injury to the animal (e.g., hand flapping) and aggression among children with ASD (e.g., Hartley, Sikora, & McCoy, 2008; Lord & Pickles, 1996; O’Reilly et al., 2010), this is a valid concern. Moreover, Preziosi (1997) points out that not all animals may want to serve as a therapist and argues that animals should never be forced to work.

The results of this systematic review conclude that the evidence to support AAI as a therapeutic intervention for children with ASD is weak. The mixed findings across studies, the methodological weaknesses in many studies, the insufficient explanation of procedures, the lack of clear construct validity, and the potential risk of harm to the child and animal should be factored into decisions regarding the implementation of AAI for children with ASD. However, there are limitations to this research, not the least of which is the unclear definition of AAI. Some studies may have been inadvertently excluded given the lack of a clear definition for what constitutes AAI. Additionally, studies with negative findings were not available for reasons related to publication, which could have impacted the findings of this review. Future research should address the methodological issues outlined in an effort to better understand the utility and efficacy of AAI. Caregivers and practitioners are cautioned in selecting AAI as it is unclear the impact this may have in treating impairments in social communication and restricted, repetitive behaviors in children with ASD.

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*Viau, R., Arsenault-Lapierre, G., Fecteau, S., Cham-


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Comparison of Three Video Perspectives When Using Video Prompting by Students with Moderate Intellectual Disability

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Abstract: The purpose of this study was to compare the effects of three video perspectives: point-of-view, scene view, and a combination of point-of-view and scene view on task completion by three young adults with moderate intellectual disability. The comparison was made, using an Adapted Alternating Treatments Design, across three sets of fundamentally different gift wrapping tasks as each of three students used step-by-step video prompting. Overall, results of the study showed minimal differences in performance across the three students regardless of the video perspective while a combination of point-of-view and scene view camera angle resulted in fewer errors by two of the three students.

Research strongly suggests that video technology is an effective means for enhancing academic, communication, employment, daily living, social, leisure, and transitioning skills for persons with intellectual disability and/or autism (Ayres & Langone, 2005; Banda, Dogoe, & Matuszny, 2011; Bellini & Akullian, 2007; Delano, 2007; Mason, Ganz, Parker, Burke, & Camargo, 2012; McCoy & Hermansen, 2007; Mechling, 2005; Rayner, Denholm, & Sigafosos, 2009; Shukla-Mehta, Miller, & Callahan, 2010). What appears to be missing in the literature is a clear delineation of what components of the actual videos lead to higher quality, more effective videos. As the use of video instruction increases in the field of special education it is important that guidelines be developed for those interested in creating their own videos for instruction. Production of quality videos, superior to those lacking key components, has implications for the level of effectiveness of the programs (Mechling, Ayres, Foster, & Bryant, in press; Rosenberg, Schwartz, & Davis, 2010). To this end, researchers recommend that further work be done to evaluate the features of custom-made programs that are most important in order to better inform decisions regarding their development (Ayres & Langone, 2007; Ramdoss et al., 2012).

Minimal work has been done to date to differentiate between video features that are critical for presenting information to the viewer. Most of the comparative work and analysis of video technology has focused on characteristics of the model – who is in the video - and whether there is a difference when a user views him or herself (video self-modeling) or another adult or peer in the video (Gihak & Schrader, 2008; Jones & Schwartz, 2004; Mason, Ganz et al., 2013; Sherer et al., 2001). Other studies, although limited in number, have compared the timing of the presentation of the video when using video modeling (Cannella-Malone et al., 2006; 2011; Mechling, Ayres, Bryant, & Foster, 2014; Sancho, Sidener, Reeve, & Sidener, 2010; Taber-Doughty, Patton, & Brennan, 2008). The difference in timing occurs through use of video modeling (video presented prior to the task); video prompting (video presented step by step as each step of a task is completed); simultaneous video modeling (video presented as the task is simultaneously being completed); and continuous video modeling.

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Four studies were identified that compared actual features of video when creating recordings (Mechling & Collins, 2012; Smith, Ayres, Mechling, & Smith, 2013; Mechling, Bryant, Ayres, & Spencer, 2015; Mechling et al., in press). Two studies examined whether voice over directions (verbal cueing) were important when creating the videos (Mechling & Collins; Smith et al.), a third compared two means for presenting passage of time on video when items were cooking, soaking, or dissolving (Mechling, Bryant et al.), and the fourth compared the ability of students with a diagnosis of autism spectrum disorder and moderate intellectual disability to generalize performance of skills when using materials identical and different from those presented through video models (Mechling et al.).

Additional studies, although not comparative in nature, have examined point-of-view modeling when preparing videos in which the video is made from the perspective of the model in the video rather than showing the actual model (Mason, Davis, Boles, & Goodwyn, 2013; Shukla-Mehta et al., 2010). In contrast to recording an entire scene or person completing the task, when creating point-of-view videos, the camera is placed at or above the model’s shoulder level when recording the step and showing only the model’s hands (Mason et al., 2012). These videos can also be made so that the viewer has the perspective of performing the task such as walking down a grocery aisle (Mechling, 2004) or sidewalk (Mechling & Seid, 2011), or riding a bus (Mechling & O’Brien, 2010) without seeing any part of the person in the video or use of a model (Schreibman, Whalen, & Stahmer, 2000; Shipley-Benamou, Lutzker, & Taubman, 2002). Recording the task, showing only the model’s hands or as if the viewer is performing the task, has been referred to as first-person perspective (Ayres & Langone, 2007) as well as point-of-view modeling (Mason, Davis et al., 2013; McCoy & Hermensen, 2007) and subjective point of view (McCoy & Hermensen). In contrast, recording the entire scene or model is referred to as scene view video modeling (Moore et al., 2013) or third-person perspective (Ayres & Langone, 2007) and the user acts as a spectator watching someone else.

Of interest to the current study is the perspective of the video when presenting multi-step adaptive living skills such as personal care, daily living, recreational, and vocational skills while using video prompting for the timing of video presentation. Point-of-view modeling and video prompting have been used to teach cleaning sunglasses, putting on a wrist watch, and zipping a jacket (Norman, Collins, & Schuster, 2001); cooking (Bereznak, Ayres, Mechling, & Alexander, 2012; Graves, Collins, Schuster, & Kleiner, 2005; Sigafoos et al., 2005); washing dishes (Cannella-Malone et al., 2011; Sigafoos et al., 2007); doing laundry (Bereznak et al.; Cannella-Malone et al.; Horn et al., 2008); putting away groceries and table setting (Cannella-Malone et al., 2006), taking and printing digital photographs (Edrisinha, O’Reilly, Choi, Sigafoos, & Lancioni, 2011), and pedestrian skills (Mechling & Seid, 2011).

Scene view modeling and video prompting have been used to teach sweeping and washing tables (Cannella-Malone, Wheaton, Wu, Tullis, & Park, 2012); vacuuming and washing tables (Cannella-Malone, Brooks, & Tullis, 2013); setting a table (Goodson, Sigafoos, O’Reilly, Cannella, & Lancioni, 2007); job skills at an animal kennel (Van Laarhoven, Johnson, Van Laarhoven-Myers, Grider, & Grider, 2009); and cooking (Payne, Cannella-Malone, Tullis, & Sabielny, 2012).

Further, some studies have included both point-of-view and scene view perspectives (wide and zoom angle) when creating different steps within video prompting programs. These video programs, combining perspectives, have been used to teach cooking skills (Johnson, Blood, Freeman, & Simmons, 2013; Mechling, Ayres, Foster, & Bryant, 2013; Mechling, Gast, & Fields, 2008; Mechling, Foster, & Ayres, 2013; Mechling, Gast, & Seid, 2009; 2010; Mechling & Stephens, 2009; Van Laarhoven, Kraus, Karpman, Nizzi, & Valentino, 2010; Van Laarhoven & Van Laarhoven-Myers, 2006); cleaning (Mechling, Foster et al.; Van Laarhoven & Van Laarhoven-Myers), folding towels (Mechling, Foster et al.; Van Laarhoven et al.; Van Laarhoven & Van Laarhoven-Myers), and painting, listening to music, and using a

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camera to take photos (Chan, Lambdin, Van Laarhoven, & Johnson, 2013). In comparison to using only one type of perspective per video step, Mechling and Seid (2011) describe a combination of point-of-view and scene view perspective (zoomed in from a wide to a narrow focus) when creating video prompts for individual steps of the task analysis.

Of the number of studies evaluating different perspectives when creating the videos, only one study compared the effects of point-of-view and scene view perspectives to prompt multi-step task completion (Ayres & Langone, 2007). Results of the study, when working with four students with autism, showed no clear superiority of one type of video model over the other. The purpose of the current study was to advance the research being conducted on the feature components that should be included when creating video models and specifically to compare different camera angles (point-of-view, scene view, and combination of views) when creating video prompting programs for students with moderate intellectual disability. While seeing the entire model in the video may provide information to the learner when skills require entire physical movements of the body, zoom shots of the model’s hands may help with minimizing distractions (Horn et al., 2008; Mason, Davis et al., 2013) and allow the learner to more closely examine the features of the task. The research objective of the current study was to compare the ability of students with moderate intellectual disability to complete fine motor tasks when presented with video models created using a point-of-view perspective (zoomed in on the materials); (b) scene view perspective (zoomed out from the materials); and (c) a combination of point-of-view and scene view perspectives (zooming in on the materials from far to near) during creation of each video step of the task analysis.

Method

Participants

Participants in the study were three young adult females, each with a diagnosis of a moderate intellectual disability. The three students attended a transition program through the local school system. Teresa and Lacy had attended the program for two years while it was Qianna’s first year in the program which was located on a university campus and had a strong community-based emphasis. The three females were recommended by the school teaching staff as participants in the study which included wrapping and decorating gifts. Each possessed the fine motor skills to manipulate scotch tape, ribbon, and other small manipulatives used in the study. Each had prior experience using computer-based instruction, but Teresa was the only student who had previously used a touch screen.

Teresa was 20 years and 9 months old at the completion of the study and had a diagnosis of moderate intellectual disability and hemi-plegia cerebral palsy (full scale IQ score 45 on the Wechsler Intelligence Scale for Children – Fourth Edition: WISC-IV: Wechsler, 2003). She was independently employed at a hair salon where she helped with cleaning tasks and various errands required by the hair stylists. She was independent in all of her personal care needs, carried her own identification card, and traveled to familiar locations independently. She was described as being a leader among her female friends although she needed reminders not to dominate or “boss” other students. She was able to cook simple dishes such as toast, eggs, and microwave dishes. She was learning to prepare stove top meals such as pasta primavera. It was reported that on weekends and school vacations she used public transportation with a friend and she was learning new routes. Teresa read community information with assistance, but read store flyers and simple grocery lists independently. She had difficulty reading orally and using decoding skills although she could decode simple consonant-vowel-consonant words. She wrote basic demographical information and was learning to write her first and last name in cursive. She enjoyed going to parties, interacting with peers, and shopping.

Qianna was 19 years and 11 months old at the completion of the study and had a diagnosis of moderate intellectual disability (full scale IQ score 52 on the Stanford-Binet Intelligence Scale – Fifth Edition: Thorndike, Hagan, & Sattler, 1986; composite score 55 on
the Adaptive Behavior Assessment System – Second Edition: Harrison & Oakland, 2000). She spoke in complete sentences, but was sometimes difficult to understand due to her articulation. She was polite and worked well with others, but when upset she used profanity and told lies about other students’ and adults’ behaviors. She needed assistance with brushing her hair and reminders to adjust her clothing and complete grooming skills. She used a washer, dryer, microwave, and toaster independently and was learning to prepare oven and stove top recipes. She read on a third grade reading level and enjoyed reading out loud. She was working on orally answering comprehension questions as well as composing her responses in writing. She could write sentences using subjects, verbs, capitalization, and punctuation. Her needs included composing paragraphs with sentences that linked thoughts and topics. She used a calculator and could complete simple addition, subtraction, and multiplication problems. She counted simple coin combinations and her needs included paying with correct change or rounding up to larger coins. She enjoyed watching videos, participating in sports and board games, and hanging out with friends.

Lacy was 20 years and 11 months old at the completion of the study and had a diagnosis of moderate intellectual disability and ADHD (full scale IQ score 54 on the Wechsler Intelligence Scale for Children – Fourth Edition: WISC-IV; Wechsler, 2003; composite score 72 on the Adaptive Behavior Assessment System – Second Edition: Harrison & Oakland, 2000). Her behavior was positive and she was easily excited about new tasks and helping others. She required reminders to use a quiet voice and was working on interacting with peers, adults, and family members with appropriate greetings, speaking in an adult voice, and using effective means to deal with conflict. She was independent in caring for her personal needs, but needed reminders to complete some personal hygiene such as washing, combing, and brushing her hair. She prepared simple meals with familiar appliances and completed household chores. She was learning to prepare a full-course meal and incorporating healthy foods. She followed pedestrian safety skills and rode the campus shuttle independently. She was working on using city bus routes and transfers. She read restaurant menus, safety signs, grocery store signs, bus schedules, and simple recipes. She answered comprehension questions (who and what), but was working on referring back to the text for more complex questions such as where and when. She wrote grocery lists and basic demographic information. She counted coin combinations to pay for purchases, but frequently became nervous and handed money to the cashier without counting it. She enjoyed volunteering at a local activity center, playing basketball, working with children, and socializing with peers.

Setting and Arrangement

All sessions took place in a university classroom in the building where the students’ classroom was based. Two 6 ft. tables were pushed together lengthwise to hold the materials used for gift wrapping and the tablet PC used for delivering the video prompts. The tablet PC was positioned at the far right end of the tables with all of the materials positioned, in random order, to the left of the tablet PC. The student stood in front of the tables and to the left of the tablet PC when completing the gift wrapping tasks. Students could position themselves closer to the materials or pick up and move materials closer to the tablet PC and center of the table when wrapping the gifts. The instructor sat to the right of the tablet PC in order to provide assistance in advancing the PowerPoint slides if the program malfunctioned. When present, the reliability data collector sat behind the student and to the left of the table.

Materials and Equipment

Gift wrapping skills were used as the target tasks for the study (Stonecipher, Schuster, Collins, & Grisham-Brown, 1999) and required fine motor skills such as manipulating scotch tape, pulling the adhesive back off of ribbons, writing one’s name, and inserting cards into envelopes. The three targeted gift wrapping tasks were: boxing and decorating gifts, wrapping and decorating gifts, and bagging and decorating gifts. Tasks required 6–8 clusters of steps (Table 1). Steps were clus-
tered on the video clips to assist with the flow of task completion when using the start and stop method required of video prompting. The paper used to wrap the box was pre-cut and multiple examples were used for the bows across the gift box and wrapping the box task. Three different gift cards were used across the three gift wrapping tasks and students were required to sign their names on the specific card shown in the video.

Each step of the task analysis for each of the three gift wrapping tasks was filmed using a Sony HDR-CX160 Handycam. Each video clip included voiceover instructions, recorded by the camera operator, describing completion of the task step (i. e., “Put the sticky notes and pens in the bag”). For each step, three different video recordings were made: a) point-of-view (zoomed in on the materials and hands of the model); (b) scene view (zoomed out at a wide angle showing the materials, setting, and body of the model); and (c) combination of point-of-view and scene view (starting at a wide angle, showing the materials, setting, and body of the model, followed by using the zooming feature of the camera and finishing the video with the camera zoomed in on the materials and hands of the model). All videos, regardless of angle, were created with the camera positioned behind and above the shoulder level of the model.

All video prompts were converted and downloaded, one video per PowerPoint slide. Slides were then saved into nine different files, each file representing a different video perspectives for each of the three gift wrapping tasks. During the comparison phase of the study the video prompts were played on an ASUS Eee Slate EP121 tablet with Windows 7. The tablet had a 12.1 in. touch screen and was positioned vertically on the table using a folding stand. Students navigated between slides by touching an arrow (bottom right of each screen) with a stylus or finger which advanced the program to the next slide where the sub-

<table>
<thead>
<tr>
<th>Steps for Gift Wrapping Tasks</th>
<th>Boxing and Decorating</th>
<th>Wrapping and Decorating</th>
<th>Bagging and Decorating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Open box</td>
<td>1. Unroll paper, put gift in middle of paper</td>
<td>1. Open bag</td>
<td></td>
</tr>
<tr>
<td>2. Hold tissue in left hand, hold tissue in rt hand, open tissue, put in box, push tissue down</td>
<td>2. Remove 4 pieces of tape and put tape on edge of table</td>
<td>2. Put one handful of shreds in the bag</td>
<td></td>
</tr>
<tr>
<td>4. Fold left edge of tissue over gift, fold right edge of tissue over gift</td>
<td>4. Tuck and fold over left paper corner, tuck and fold over right paper corner, put on tape</td>
<td>4. Write name on yellow card, put card in envelope, put envelope in bag</td>
<td></td>
</tr>
<tr>
<td>5. Write name on green card, put card in envelope, put envelope in box</td>
<td>5. Turn box, tuck and fold over left paper corner, tuck and fold over right paper corner, put on tape</td>
<td>5. Put one handful of shreds in bag on top of gift</td>
<td></td>
</tr>
<tr>
<td>6. Close box, put side tabs in box, put red front tab in box</td>
<td>6. Turn box over</td>
<td>6. Squeeze birthday cake decoration clip, close bag handles, put clip on handles</td>
<td></td>
</tr>
<tr>
<td>7. Peel tab from ribbon, place ribbon on middle of box</td>
<td>7. Write name on small card, put card in envelope, put envelope on middle of box, put tape on envelope</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Peel tab from bow, place bow on box beside envelope</td>
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</table>
sequent task step video was programmed to play automatically.

Experimental Design

An adapted alternating treatments design (AATD) replicated across three participants was used (Wolery, Gast, & Hammond, 2010) to evaluate the relationship between the independent variables (three camera angle perspectives) and the dependent variable (percentage of task steps completed independently). Using the AATD, three similar but functionally independent behaviors (three gift wrapping tasks) each received a different independent variable (video perspective) during the comparison condition. Effort was made to select three tasks that were of the same difficulty level in terms of the number of steps and fine motor requirements, yet fundamentally different and independent of each other. The three camera angle formats for presenting the video prompts were counterbalanced across the three gift wrapping tasks and three students to control for possible effects of task difficulty (Table 2). The order of presentation of the gift wrapping tasks was also counterbalanced across sessions to control for possible sequence effects.

The AATD included an initial baseline, comparison, return to baseline, and final treatment condition. The purpose of the baseline condition was to evaluate performance on each of the gift wrapping tasks across each student prior to introduction of the video prompting procedures. The comparison condition served to evaluate the three video perspectives and continued for a minimum of six sessions and until data across the three interventions were stable or met criterion levels of 100% correct performance for one session (Wolery et al., 2010). Baseline procedures were re-introduced to measure performance across the three gift wrapping tasks without video prompting followed by the final treatment condition in which all three video perspectives were applied to all gift wrapping tasks. This condition was included to evaluate performance on each task when differing video perspectives were applied in addition to those used during the comparison condition.

Response Definitions and Data Collection

The dependent variable in the study was the correct completion of the three gift wrapping tasks which was defined as the percentage of steps of each task analysis completed independently. To be scored as a correct response during baseline, the student had to initiate a step within 3 s of the task direction or completion of the previous step, and complete the step within 1 min after initiation. The same criteria were used during the comparison and final treatment conditions except that the initiation and response times were measured following the completion of the video prompt. Some steps were clustered together on separate video clips and all steps were required to be completed correctly in order for the “cluster” to be considered correct. Incorrect responses were defined across all conditions as: (a) failure to initiate a step within 3 s; (b) failure to complete a step within 1 min; (c) topographical error; and (d) sequence error (step performed correctly but not in the sequence defined by the task analysis). Errors were ignored and no corrections were made by the instructor for errors during any of the conditions except to remind the student to watch the video if needed.

Procedure

Initial baseline and return to baseline procedure. Students engaged in baseline probes for three consecutive sessions or until data stabilized with no improvement across the three gift wrapping tasks. During these sessions, students were individually taken to the university classroom, directed to the tables containing the task materials, and provided with the task direction, “wrap the gifts.” Students were provided with the opportunity to wrap all three gifts during each session and to do so in any order. Correct steps were intermittently ver-

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Video Perspectives Across Gift Wrapping Tasks</th>
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<tbody>
<tr>
<td></td>
<td>Teresa</td>
</tr>
<tr>
<td>Gift Box</td>
<td>CVM</td>
</tr>
<tr>
<td>Gift Wrap</td>
<td>VM</td>
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<tr>
<td>Gift Bag</td>
<td>VP</td>
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bally reinforced as well as efforts for attempting the tasks. Students were also verbally reinforced at the end of the session for their participation.

Comparison procedure. Students received video prompting instruction on an individual basis three mornings per week. Sessions were conducted identically to baseline sessions (all materials present on the tables) with the addition of the tablet PC being positioned at the end of the table and programmed to play the target video prompting program. Only one gift wrapping task was completed per session. The instructor provided the task direction, “watch the video and wrap the gift.” During the first session, the student watched the first video clip, the video paused, and the instructor gave the verbal prompt, “do what he did on the video.” For all subsequent sessions the instructor provided only the initial task direction to watch the video and wrap the gifts without the need for further direction. The instructor responded to correct and incorrect responses identically to baseline procedures and students were verbally reinforced at the end of each session for their participation.

Final treatment procedure. Sessions during the final treatment procedure were conducted identically to those used during the comparison condition with only one task being completed per session. During this condition each gift wrapping task was completed one time using each of the three different video perspectives (9 total sessions). Application of the treatment and tasks were alternated across sessions so that no treatments or tasks were completed consecutively across sessions.

Social Validity

Informal interviews were conducted with students who were provided with an opportunity to answer questions that revolved around whether they enjoyed using the video prompts and whether the video prompts helped them with wrapping the gifts. Students were also questioned regarding their use of the newly acquired gift wrapping skills.

Inter-Observer Agreement and Procedural Reliability

Reliability data on the number of task steps performed correctly were collected by the second and third authors across 93.3% of all conditions (baseline: 83.3%, comparison: 100%, final treatment 100%). With the exception of one session for each task during the first baseline condition, two data collectors were present across all sessions with each participant.

Interobserver agreement on the steps performed correctly was calculated on a session-by-session basis for each student by dividing the number of agreements on each step by the number of agreements plus disagreements and multiplying by 100 (Ayres & Gast, 2010). Resulting mean inter-observer agreement ranged from 85.7–100% with a mean agreement of 98.6% across all conditions and students. Mean inter-observer agreement was 99% during the baseline condition (Teresa: 99%, Qianna: 100%, Lacy: 98.1%), 97.6% during the comparison condition (Teresa 98.4%, Qianna: 95.2%, Lacy: 99.2%), and 100% during the final treatment condition.

Procedural reliability data were collected simultaneously with inter-observer agreement on the following instructor behaviors: (a) materials positioned correctly on the table; (b) providing the correct video prompting perspective per session; (c) advancement of the slides in response to students touching the screen; and (d) providing no instructor prompts for step completion. Procedural fidelity was calculated by dividing the number of observed behaviors of the instructor by the number of planned behaviors and multiplying by 100 (Billingsley, White, & Munson, 1980). Results indicated 99.5% adherence to the procedures. The majority of the errors were related to the computer program failing to advance to the correct slide, video captions not playing immediately when the slide advanced, and the computer program skipping a slide if the student held her finger on the screen too long.

Results

Results of this study showed minimal differences in performance across the three stu-
Students regardless of the video perspective used (point-of-view, scene view, combination of point-of-view and scene view) with overlapping data across the three interventions and students. Each student reached criteria, 100% for one session, within six sessions when using all three video perspective interventions (Figure 1). Teresa reached criteria with both the point-of-view and combination video perspectives on the first session of intervention and with the scene view video perspective on the second session. Although she demonstrated criteria levels with all three procedures on her fifth session, the predetermined procedure was set to continue intervention with each procedure for a minimum of six sessions.
Qianna reached criteria with scene view and combination video perspectives on Session 5 and with the point-of-view procedure on her sixth session. Lacy reached criteria with the combination procedure on Session 2 and maintained her level of performance across the remaining sessions. She reached criteria with the point-of-view procedure on session four and with the scene view procedure on Session 6.

When the video prompts were removed, students’ performances varied with some indications of difficulty when performing the gift wrapping tasks. Teresa completed each task at 100% correct for one session, but when wrapping the gift her performance dropped to 62.5% correct on her second session. Lacy also completed each of the three tasks at 100% correct, making no errors for wrapping the gift and making errors for only one session when using the gift bag task. Her performance, when using the gift box, dropped to 71.4% correct. Qianna demonstrated more variability across the three tasks when the video prompts were removed, however she did complete the gift box and gift bag tasks with 100% accuracy for at least one session. She had difficulty wrapping the gift when using the wrapping paper and completed only 37.5% of the steps correctly across two sessions.

While each student showed some decreases in performance when video prompting was removed, all three students performed at criteria levels during the final treatment condition using each of the video perspectives across all three gift wrapping tasks.

### Efficiency Data

Data were collected on the percent of errors to complete each task under the three video perspectives during the comparison and final treatment conditions (Table 3). Overall, sessions whereby a combination camera angle was used (zooming in on the materials from far to near), resulted in fewer errors. Qianna had the most difficulty using video prompting during the comparison condition, but she committed the least amount of errors when using the combination perspective (2.1%). Likewise, Lacy committed the least amount of errors when using the combination perspective (2.8%). Teresa committed the least amount of errors among the three students and performed best, in terms of errors, when using the point-of-view perspective. In the final treatment condition, in which the three different video perspectives were used with all three gift wrapping tasks, Teresa and Lacy made no errors while Qianna only committed one error when using the scene view and combination perspectives.

### Social Validity

All students stated that they enjoyed using video prompting and that it helped them wrap the gifts. Teresa said that it helped her to “know what to do.” At the beginning of the study the students reported that they did not help wrap gifts at home and at the end of the study each reported that she felt her gift wrapping skills had improved. Lacy reported that she was going to help her mother wrap Christ-
mas gifts this year and at the end of the study, Teresa reported that she had helped her mother wrap a gift.

**Discussion**

Similar to the results in the Ayres and Langone (2007) study when comparing point-of-view and scene view video modeling, results of the current study did not provide a clear indication of superiority of one video perspective over the other. Students reached criteria levels with all of the video interventions as indicated in the figure. Measures of efficiency in Table 3 show that task completion when using the combination (far to near) video perspective was more efficient for two of the three students (fewer errors).

Efficiency measures indicate a small difference in favor of zooming from a wide angle (full view of the model) to a zoom shot of the model’s hands. This may indicate that when completing fine motor tasks, such as those used in the study, participants may find it helpful to first see the entire scene of the task followed by a close-up perspective of the intricate steps of the task. However, it should be recognized that the tasks used were all fine motor in nature and further studies will be needed with tasks requiring other behaviors such as those using gross motor and communication skills, both discrete and multi-step in nature. In a recent study comparing gross and fine motor task performance by students with moderate intellectual disability and autism, Mechling and Swindle (2013) used scene view (entire body of an adult) when video recording gross motor skills and zoomed in on the hands and upper body of the model (point-of-view) when video recording fine motor tasks. From their procedures, it still remains unclear whether one camera perspective is more effective with gross motor tasks since only one angle (scene view) was used. Likewise, Mechling, Ayres, Purrazzella, and Purrazzella (2012) used both point-of-view and scene view perspectives when comparing fine and gross motor task completion by adults with moderate intellectual disabilities, but both perspectives were used with each type of task.

One limitation of the current study may have been in the selection and equating of the gift wrapping tasks. Effort was made to select three gift wrapping tasks that were functionally independent and analysis of the three gift wrapping tasks in Table 2 shows that each student made errors across the different types of gifts. However, Teresa and Lacy made minimal errors when using the gift bag which may indicate that this task, with fewer steps, may have been simpler to perform. In particular, Qianna’s data may have influenced the overall efficiency data as she committed 35.4% of her errors when the camera perspective was zoomed in on the materials for the wrapping gift task. It is possible that the camera angle was not the reason for her level of performance, but instead her difficulty with using the wrapping paper may have affected her performance. This notion is supported by the data when the video prompts were removed and her task performance was lower when using the wrapping paper.

While the results of this study add to previous research supporting use of video prompting, regardless of the video perspective, more work remains to be done to tease out the individual video variables that are critical when developing instructional videos. Features such as the person in the video, video perspective, use of audio, as well as material and equipment types used in the video, are some of the identified variables which have been researched and which warrant further evaluation. It appears that the field is still not in a position to make clear recommendations on the critical characteristics that make a superior video. Once these critical characteristics are identified, then creators of instructional videos can use them in isolation or combine the most salient features into each video program in an effort to create the most effective and efficient means of video instruction. Although these features may vary according to the task and level of disability of the user, it is likely that critical video features will be consistent across many of these variables and one crucial way to determine this is through comparative studies such as the one conducted in the current study.

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Using an Animated Cartoon Hero in Video Instruction to Improve Bathroom-Related Skills of a Student with Autism Spectrum Disorder

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Abstract: The present study investigated the effectiveness of video hero modeling (VHM) for building four bathroom-related behaviors of an elementary-aged student with autism spectrum disorder. In the VHM intervention, the participant watched a video immediately before going to the bathroom he typically used. In the video, an animated face of a cartoon hero with which the participant was preoccupied and an adult who pretended he was the hero appeared in the bathroom. While the adult (whose head was not shown in the film) engaged in the target behavior, the animated cartoon hero explained that the adult was hero and showed how the student had to behave. A multiple baseline across behaviors demonstrated that VHM interventions contributed to improving the four target behaviors. However, for one target behavior, the video hero praising (VHP) intervention seemed necessary to evoke a correct response in a stable manner.

Self-care skills (e.g., using the bathroom, changing clothes, brushing teeth) are important for independent functioning because they are used every day and relatively frequently (Farlow & Snell, 2000). Therefore, those skills are generally prioritized as targets to teach and typically included in the individualized education program (IEP) for lower functioning students with autism spectrum disorders (ASD).

To teach those skills, instructional technologies developed in connection with applied behavior analysis (ABA) are often used, such as response and stimulus prompting, prompt fading, chaining, shaping, token economy, and self-management, all recognized as evidence-based practices (Alberto & Troutman, 2013).

Not all students with ASD are responsive to these traditional skill-building strategies, however. Occasionally, the steps necessary to engage in self-care skills are seen as aversive by students with ASD (Geiger, Carr, & LeBlanc, 2010), who, therefore, may try to escape or avoid and seek more enjoyable stimuli. In addition, when teachers provide prompting (e.g., verbal, model, or physical), students may exhibit aggressive or self-injurious behaviors in order to escape from or avoid the nonpreferred activity and access a preferred activity as soon as possible (Geiger et al., 2010). To promote learning, therefore, it is important to develop a strategy that makes the target activities enjoyable and valuable to the student (McLaughlin & Carr, 2005). One of the strategies that have the potential to make engaging in self-care skills enjoyable and valuable to students with ASD is video hero modeling (VHM) (Ohtake, 2015; Ohtake, Takeuchi, & Watanabe, 2014).

VHM involves showing a video in which a character with which the student is preoccupied engages in the student’s target behavior immediately before the student has to exhibit the behavior. The term “being preoccupied” here means that the student interacts with a given character very intensely and for a significant portion of the time in a
variety of forms, including, but not limited to, talking about the character, playing with a representation of the character, collecting related memorabilia, or pretending he is the character (Gagnon, 2001).

Preoccupation with a hero or special interest is a hallmark of students with ASD (Gagnon, 2001; Winter-Messiers, 2007). By watching a VHM, the student may be motivated to engage in the target behavior because doing so results in following the hero’s wish or being like the hero, which is generally enjoyable or valuable to the student (Ohtake et al., 2014). In this sense, VHM is motivating by enhancing the value of the consequence contingent on engaging in the target behavior and, at the same time, reducing the value of the consequence contingent on escaping from or avoiding the activity or rejecting teacher prompting (Laraway, Snycerski, Michael, & Poling, 2003).

To date, a limited number of studies have examined the effectiveness of VHM in improving the self-care skills of students with ASD. Among the existing research, Ohtake et al. (2014) applied VHM to an elementary-aged student with ASD whose target behavior was keeping his buttocks covered in his pants during urination. The VHM intervention was introduced after a video self-modeling intervention was found not to evoke the target behavior. In the VHM intervention, the student watched a video in which an animated tyrannosaurus (i.e., his hero) appeared next to him with its buttocks covered in its pants during urination. Results showed that the student exhibited the target behavior in a stable manner after the VHM was introduced. In addition, his performance was maintained for more than 2 months. Furthermore, when the student engaged in the correct response, he told his teacher, “I am tyranno.” This comment was interpreted to show that he had a visual image of the hero in mind when he engaged in the task and that being like the hero was valuable to him.

Despite these promising results, however, the study demonstrated a behavior change contingent on introducing VHM only once. Therefore, the functional relationship between VHM and behavior change was not demonstrated in a conclusive or convincing manner. Considering the weakness of the study, Ohtake (2015) followed up with another study in which VHM was applied sequentially in a time-lagging manner to three target behaviors of an elementary-aged student with ASD. The target behaviors consisted of drying hands, folding clothes, and reading lunch menus out loud in an appropriately articulated manner.

In the VHM intervention, the participant watched VHMs, in which the Masked Rider Wizard® (his hero) exhibited a correct response accompanied by matching descriptions expressed by the hero immediately before the student had to engage in the target behavior. Results indicated that unequivocal improvement of each target behavior was observed only when VHM was introduced and the student met the criterion of all the target behaviors within a short period of time. Similar to the findings of Ohtake et al. (2014), when the participant engaged in the third target behavior (i.e., reading menus aloud), he made a comment (“I will do like Wizard”) to his teacher, implying that being like the hero was valuable to him. Considering the potential of this intervention, further research is needed to determine the extent to which the VHM strategy is applicable to students with ASD.

In the process of developing the VHM, Ohtake (2015) and Ohtake et al. (2014) wore single colored gloves and sleeves and manipulated a realistic-looking representation (figure) of the student’s hero engaging in the target behavior in front of the same colored wall. After filming the scene, the authors used video-editing software to make the color transparent and overlapped it with a scene of the natural setting where the student was required to exhibit the target behavior.

The drawback to this process is that not all heroes or special interests are readily available as realistic-looking figures. For example, the hero may be a cartoon character from a TV program for which no realistic-looking representation is commercially available. To extend the applicability of the VHM strategy, alternative methods are needed, as explored in the present study. Specifically, this study investigated the effectiveness of VHM in improving
bathroom-related behaviors of an elementary-aged student with ASD.

Method

Participant

The participant was Shinnosuke, a 12-year-old male student with ASD enrolled in the elementary school division of a special school for students with intellectual disabilities. The student’s IQ scores were not available, but his developmental age was 4 years and 5 months in cognitive/language domains and 4 years and 1 month in the adaptive/social domains, according to the Kyoto Scale of Psychological Development (KSPD; Ikusawa, Matsushita, & Nakase, 2002) – a measure commonly used in Japan to provide estimates of the developmental age of children with disabilities. Shinnosuke used a complete sentence to convey past, current, and future events to a communication partner.

To control his impulsiveness and aggressiveness, Risperidon and Concerta® had been administered starting one year before the start of the study. When Shinnosuke was forced by his teacher to do something he did not want to do, he often shouted out, hit, and kicked the teacher. At age 10, he received video self-modeling interventions to improve his listening behavior and object counting. Although he watched the videos with more than 90% of the time, the target behaviors did not improve.

Before starting the study, informed consent was obtained from Shinnosuke’s mother. The authors informed Shinnosuke’s main teachers of the purpose, methods, expected results of the study, and any possible negative effects of the VHM strategies on participants’ emotions. One of the teachers, in turn, explained the same information to Shinnosuke’s mother. In addition, hero modeling videos were shown to her.

Participant’s Hero

Shinnosuke’s two main teachers (one male and one female) identified as his hero Mr. Takumi Fujiwara (hereafter referred to as Mr. Fujiwara), the main character of a popular Japanese TV cartoon program, “Initial D.” To determine the degree of Shinnosuke’s preoccupation with his hero, the authors developed the Attitudes Toward the Hero Questionnaire (hereafter referred to as AHQ) on the basis of the literature related to special interests (Gagnon, 2001; Uechi, 2011). As shown in Table 1, the AHQ consisted of 15 items divided into five subcategories, “Talking about the hero” (5 items), “Imitating the hero” (4 items), “Accessing to the hero” (4 items), “Playing with the hero” (3 items), and “Duration of the student’s interest in the hero” (1 item).

The male main teacher was asked to rate all items, with the exception of the “Duration of the student’s interest in the hero,” using a Likert-type scale ranging from 0 (“not at all”) to 3 (“very much”). For “Duration of the student’s interest in the hero,” the teacher was asked to choose “yes” if the student’s interest had lasted for 6 months or more and “no” if less than 6 months. The average score was 2.71 (range 2 to 3), meaning that almost all the items were scored as “very much.” Additionally, the teacher noted that the level of Shinnosuke’s preoccupation had lasted for at least 6 months.

Target Behaviors

Four bathroom-related behaviors were selected as targets to teach: Drying Hands, Arranging Shoes, Covering Buttocks, and Tucking Shirt. “Drying Hands” was defined as using a handkerchief to dry the top and underside of the hands for 5 seconds after washing hands. “Arranging Shoes” was defined as taking off indoor shoes and placing them on shoe-shaped marks in a parallel manner before putting on bathroom slippers. “Covering Buttocks” was defined as pulling down only the front part of the pants, leaving the buttocks covered during urination. “Tucking Shirt” was defined as putting the lower part of the undershirt into the pants after urination so that no part of the undershirt is visible. All the behaviors took place and were required in the bathrooms in Japanese schools.

Shinnosuke had not acquired the four bathroom-related behaviors, which were recognized as important by his main teachers during an hour-long meeting. Although the behaviors occurred sequentially within a bathroom event, starting with Arranging Shoes, and followed by Covering Buttocks, Tucking Shirt, and Drying Hands, the teaching order was not consistent with the actual time se-
sequence. The relative importance of the behaviors and the ease with which Shinnosuke was acquiring them were considered in deciding the teaching order.

Prior to the present study, the male main teacher taught the four target behaviors using verbal, gestural, model, as well as physical and picture prompts. However, these strategies had not been effective. The teacher found it difficult to provide the prompts because Shinnosuke rejected them by ignoring or running away or sometimes shouting, hitting, or kicking the teacher as he tried to present the prompts. According to a functional assessment interview (O’Neill et al., 1997), Shinnosuke’s rejection behaviors were thought to be maintained by him escaping from aversive activities and accessing preferred play.

**Setting**

A bathroom closest to Shinnosuke’s home-room was utilized for observation of the target behaviors. All 18 students in the elementary division used the bathroom, typically, one or two students at the same time as Shinnosuke. At the entrance, six pairs of shoe-shaped marks were placed on the floor to help the students understand where they were supposed to put on their indoor shoes. Six pairs of bathroom slippers were placed in six colored squares in the same area. The bathroom included three urinals, three toilet bowls, and one sink.

**Data Collection**

The second author videotaped all the target behaviors twice a week for seven months, with the exceptions of Day 32 and 33 when a video camera was not available. The data on his performance were collected via hand-written notes. The teacher stood 3 m away from the participant while videotaping. Although Shinnosuke occasionally looked at the camera or talked to her, his behaviors did not seem to be

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**TABLE 1**

**Items in the Attitudes Toward the Hero Questionnaire**

<table>
<thead>
<tr>
<th>Attitudes Toward The Hero</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Talking about the hero</td>
<td>- The student talks about the hero.</td>
</tr>
<tr>
<td>- Once beginning to talk about the hero, the student persists in the same topic.</td>
<td></td>
</tr>
<tr>
<td>- The student initiates the conversation by picking up the topic related to the hero.</td>
<td></td>
</tr>
<tr>
<td>Imitating the hero</td>
<td>- The student pretends he or she is the hero.</td>
</tr>
<tr>
<td>- Once beginning to pretend to be the hero, the student continues to do so.</td>
<td></td>
</tr>
<tr>
<td>- The student shows off pretending he or she is the hero to obtain the attention of others.</td>
<td></td>
</tr>
<tr>
<td>- The student is delighted when the teacher uses the hero’s name to call him or her.</td>
<td></td>
</tr>
<tr>
<td>Accessing to the hero</td>
<td>- The student collects goods related to the hero (e.g., toy, stationery).</td>
</tr>
<tr>
<td>- The student wants to keep his or her belonging related to the hero with him or her.</td>
<td></td>
</tr>
<tr>
<td>- When the teacher shows an item related to the hero with the student, he or she excitedly reacts to the item.</td>
<td></td>
</tr>
<tr>
<td>- The student shows off an item related to the hero to obtain the attention of others.</td>
<td></td>
</tr>
<tr>
<td>Playing with the hero</td>
<td>- The student plays with toys related to the hero.</td>
</tr>
<tr>
<td>- Once a toy related to the hero is given to the student, he or she continues to play with it.</td>
<td></td>
</tr>
<tr>
<td>- The student plays with toys related to the hero with others.</td>
<td></td>
</tr>
<tr>
<td>Duration of the student’s interest to the hero</td>
<td>- The student is interested in the hero for at least 6 months.</td>
</tr>
</tbody>
</table>

*Note.* The male main teacher was asked to pick up the hero preferred the most by the student. For each item, the teacher circled the number that he thought best represented the level of the participant’s attitudes toward the hero.
influenced by him being observed. He typically used the bathroom before lunch (around 11:45 a.m.) and before dismissal circle time (around 2:30 p.m.). The bathroom time before lunch was targeted for observation. The second author assigned one of the four ordinal scores (level 0 to 3) to each behavior in the bathroom to quantify Shinnosuke’s performance. The definition of each score for each of the four target behaviors is listed in Table 2.

**Materials**

*Hero modeling video.* In the hero modeling video, Mr. Fujiwara (a cartoon character) served as a model, who engaged in each of the four target behaviors.

It was extremely time consuming to look for scenes in which Mr. Fujiwara engaged in Drying Hands, Arranging Shoes, Covering Buttocks, and Tucking Shirt in the available TV stories. Additionally, no realistic-looking figure of Mr. Fujiwara was commercially available. Therefore, we had to come up with procedures that were different from those used by Ohtake (2015) and Ohtake et al. (2014) to develop the hero modeling videos in their studies. The following are the general procedures used to develop the video clips in the present study.

**Step 1.** Using a video camera (Canon iVIS HF M43®), the second author videotaped the first author engaging in each of the target behaviors in the bathroom that Shinnosuke typically used at school. The video included only the part of the first author’s body, below the neck. The video clip was downloaded to a personal computer (Panasonic CF-S10®) and saved in MTF format (hereafter referred to as Video Clip 1).

**Step 2.** Again using the video camera, the first author filmed a scene of a story from “Initial D” where Mr. Fujiwara talked to somebody, with his face zoomed up. The video clip was downloaded to the personal computer and saved in MTF format. Specifically, it was downloaded to the layer of the composition window of the Adobe® After Effect®, and using the rod brush function of the software, the animated face of Mr. Fujiwara was cut off from the video clip. The 5 s video clip, where only Mr. Fujiwara’s animated face was filmed, was saved in AVI format (hereafter referred to as Video Clip 2).

**Step 3.** Video Clip 1 was downloaded to the second layer of the composition window of the Adobe® After Effect®. In the meantime, Video

<table>
<thead>
<tr>
<th>Target Behavior</th>
<th>Level</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drying Hands</td>
<td>3</td>
<td>Dry top and under sides of his hands for 5 seconds</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Dry a part of his hands for 5 seconds</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Dry a part of his hands for less than 5 seconds</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>Did not dry any part of his hands</td>
</tr>
<tr>
<td>Arranging Shoes</td>
<td>3</td>
<td>Place his own shoes on the shoe-shaped marks in a parallel manner</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Place his own shoes on the shoe-shaped marks in a non-parallel manner or place his own shoes out of the shoe-shaped marks in a parallel manner</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Place his own shoes out of the shoe-shaped marks in a non-parallel manner</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>Enter the bathroom without changing his shoes</td>
</tr>
<tr>
<td>Covering Buttocks</td>
<td>3</td>
<td>Cover the buttocks in the pants</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Cover the buttocks in the underpants but pulling the pants under the buttocks</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Cover the buttocks in the underpants but pulling the pants under the knees</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>Expose the buttocks</td>
</tr>
<tr>
<td>Tucking Shirt</td>
<td>3</td>
<td>Tuck the shirt in the pants</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Tuck more than half part of the shirt in the pants</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Tuck less than half part of the shirt in the pants</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>Did not show any tucking behaviors at all</td>
</tr>
</tbody>
</table>
Clip 2 was downloaded several times to the parts of the first layer of the same window, where the lines read by the pseudo-voice of Mr. Fujiwara were to be inserted (see Table 3). The composite video clip, which looked as if Mr. Fujiwara appeared in the bathroom and his “replicated” body (i.e., the first author) engaged in the target behavior, was saved in AVI format (hereafter referred to as Video Clip 3).

**Step 4.** The voice of Mr. Fujiwara was developed by Toshiba ToSpeak®, a free voice-synthesizing software that allows users to make a selected voice read typed sentences. Using the software, the first author typed the lines (see Table 3) of Mr. Fujiwara, chose a voice most similar to the hero’s voice, and made the voice read the lines. The voice descriptions were recorded by Audacity (a free voice-editing software) and saved in WAV format (hereafter referred to as Voice Clip 1).

**Step 5.** Video Clip 3 was downloaded to the first layer of the composition window of Corel® Video Studio®, another video-editing software, with Voice Clip 1 downloaded to the voice layer of the same window. Using the zooming function, the first author zoomed up the area where Shinnosuke’s attention was needed (e.g., buttocks covered by pants). In addition, using the painting function, the author placed a red circle around the area. The edited video clip was saved in AVI format in a compact disc. Duration of the completed hero modeling videos was around 1 min.

*Hero praising video.* In this video, the hero appeared in the bathroom, watched Shinnosuke engage in the target behavior, and praised performance. The following are the general procedures used to develop this series of videos.

**Step 1.** The correct behavior exhibited by Shinnosuke was filmed during the VHM phase. The video clip was then downloaded to the personal computer and saved in MTS format (hereafter referred to as Video Clip 4).

**Step 2.** Video Clip 4 was downloaded to the second layer of the composition window of the Adobe® After Effect®. Video Clip 2 (i.e., Mr. Fujiwara’s animated face) was downloaded several times to the first layer of the same window at the places where the lines read by Mr. Fujiwara were to be inserted. The combined video clip, which looked as if Mr. Fujiwara appeared in the bathroom where Shinnosuke was engaging in the target behavior at the same time, was saved in AVI format (hereafter referred to as Video Clip 5).

**Step 3.** As described above when discussing the VHM, the authors activated Toshiba ToSpeak® to make Mr. Fujiwara’s pseudo-voice read the predetermined lines (see Table 4). The voice descriptions were recorded by Audacity and saved in WAV format (Voice Clip 2).

**Step 4.** Video Clip 5 was downloaded to the first layer of the composition window of Corel Video Studio® with Voice Clip 2 downloaded to the voice layer of the same window. As for

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**Table 3**

<table>
<thead>
<tr>
<th>Time Line</th>
<th>Lines Narrated by Mr. Fujiwara</th>
</tr>
</thead>
<tbody>
<tr>
<td>0:00-0:07</td>
<td>Shinnosuke, let’s watch Mr. Fujiwara put his shoes on the shoe marks neatly.</td>
</tr>
<tr>
<td>0:07-0:10</td>
<td>First, watch Mr. Fujiwara.</td>
</tr>
<tr>
<td>0:10-0:20</td>
<td>Mr. Fujiwara put his shoes exactly on the shoe marks. This is the way of Mr. Fujiwara.</td>
</tr>
<tr>
<td>0:20-0:26</td>
<td>Let’s watch Mr. Fujiwara put his shoes on the shoe marks neatly once more.</td>
</tr>
<tr>
<td>0:30-0:35</td>
<td>Mr. Fujiwara put his shoes exactly on the shoe marks. This is the way of Mr. Fujiwara.</td>
</tr>
<tr>
<td>0:35-0:43</td>
<td>Now, it is your turn, Shinnosuke. Put your shoes on the marks as Mr. Fujiwara did.</td>
</tr>
<tr>
<td>0:43-0:45</td>
<td>Mr. Fujiwara will watch you doing well.</td>
</tr>
</tbody>
</table>

**Table 4**

<table>
<thead>
<tr>
<th>Time Line</th>
<th>Lines Narrated by Mr. Fujiwara</th>
</tr>
</thead>
<tbody>
<tr>
<td>0:00-0:05</td>
<td>Shinnosuke, let’s watch Shinnosuke cover the buttocks in the pants during urination.</td>
</tr>
<tr>
<td>0:05-0:12</td>
<td>Great, Shinnosuke! You cover the buttocks in the pants. You are Mr. Fujiwara!</td>
</tr>
</tbody>
</table>
the VHM, a red circle was placed on the area where Shinnosuke needed to pay attention using the painting function. The edited video clip was saved in AVI format on the same compact disc as the VHM. Duration of the completed hero praising videos was 10–15 s.

Research Design

A multiple baseline design across behaviors was utilized to demonstrate a functional relationship between VHM and behavior change. The four target behaviors, which were considered independent (unlikely covariate) from each other in terms of behavior change but occurring sequentially within a short period of time, were selected (i.e., Arranging Shoes → Covering Buttocks → Drying Hands → Tucking Shirt) (Cooper, Heron, & Heward, 2007). If the only baseline to which the VHM intervention was introduced changed immediately after the intervention was introduced, it was considered unlikely that confounding factors that otherwise might threaten internal validity were involved in improving the target behavior (Cooper et al., 2007).

Procedure

Baseline. During baseline, the male main teacher was asked to behave as he usually did. Typically, the teacher did not provide any response prompts to Shinnosuke. No video interventions were conducted in this condition.

Video hero modeling (VHM). For five days a week, the male main teacher set up a DVD player (AVOX® DVD Video, ADP-701AB) on Shinnosuke’s desk, asked him to come the desk, and started the hero modeling video 5 min before Shinnosuke typically went to the bathroom in the morning. While watching the video, if the teacher felt it was appropriate, he commented on the filmed behavior (e.g., “Mr. Fujiwara wiped the palms very well.”). The hero modeling video was not presented during bathroom time in the afternoon.

In the bathroom, the male teacher provided a reminder of the video (e.g., “Be like Mr. Fujiwara?”) and verbal praise (e.g., “You are like Mr. Fujiwara”) as deemed appropriate. Otherwise, the condition was identical to baseline.

Baseline 2. For Drying Hands, the second baseline was introduced following the VHM phase to determine if Shinnosuke’s performance was maintained even when VHM was withdrawn. For Covering Buttocks, the second baseline was also introduced even though Shinnosuke’s performance did not reach to the highest level (Level 3). This withdrawal was implemented because on Day 21, considering Shinnosuke’s clumsiness with regard to using his fingers and hands, the male teacher felt that covering the buttocks in the underpants (i.e., level 2) but not in the pants (i.e., Level 3) would be sufficient.

Between Day 21 and 22, there was an 18-day winter break. Additionally, VHM was not implemented on Day 22 because the male main teacher was sick and the female main teacher was too busy to take over his role. Despite the long non-treatment period, Shinnosuke independently covered the buttocks in the underpants (i.e., Level 2) on Day 22. Furthermore, the male teacher witnessed him cover the buttocks in the underpants independently for two consecutive school days between Day 22 and Day 23, on which formal observation by the second author was not scheduled. Based on these observations, the male teacher wanted to redefine covering the buttocks in the underpants (not in the pants) as an interim target behavior, and the level of Shinnosuke’s performance was thought to be maintained without VHM. Consequently, VHM was intentionally terminated starting on Day 23.

Video hero praising (VHP). For Drying Hands, Arranging Shoes, and Covering Buttocks, VHP interventions was also implemented, in which a hero praising video was presented in the same manner as in VHM. For Drying Hands, the VHP phase followed the second baseline. This decision was made on the basis of a request from the teacher indicating that Shinnosuke would be pleased and more motivated if he watched a video in which Mr. Fujiwara praised Shinnosuke engaging in the target behavior. For Arranging Shoes, the VHP phase immediately followed the VHM phase because VHM did not evoke Level 3 performance in a stable manner. Finally, for Covering Buttocks, the VHP phase followed the second baseline phase. As described below in the Results section, Shinnosuke independently covered the buttocks in the pants (i.e.,...
Level 3) on Day 28 and 29 without direct instructions. According to the male teacher, between Day 27 and Day 28, the back of the pants was unexpectedly caught in the top of the buttocks when Shinnosuke attempted to pull his pants down. To stabilize the “beyond expectation” level of performance, VHP was introduced from Day 30.

Maintenance. For Drying Hands and Arranging Shoes, the maintenance phase was introduced following the VHP phase. This phase was identical to the baseline phase.

Inter-Rater Reliability
A trained graduate research assistant served as the second rater for the target behaviors. Watching 30% of the videos filmed by the second author (the first rater) across phases and behaviors, she independently assigned a score (0 to 3) to each target behavior. When both raters assigned the same score to the same target behavior, an agreement was noted. Conversely, when both raters assigned different scores to the same behavior, a disagreement was noted. Finally, a reliability score was computed by dividing the total number of agreements by the total number of agreements and disagreements and multiplying by 100. Specifically, the reliability scores for Drying Hands, Arranging Shoes, Covering Buttocks, and Tucking Shirt were 90%, 90%, 100%, 89%, respectively.

Treatment Fidelity

Video presentation. The second author checked at least once a week to see if the male teacher presented the correct video at the designated time (i.e., 5 minutes before going to the bathroom). It was determined that the teacher presented the video correctly at all times.

Attention to the video. The second author videotaped Shinnosuke watching videos at least once during VHM and VHP across four target behaviors, with the exception of the VHP phase for Arranging Shoes and the VHM phase for Covering Buttocks due to schedule conflicts. She utilized a 5-s momentary time sampling procedure to measure the extent to which Shinnosuke attended to the video. A + was recorded when his gaze direction was toward the video and a – was recorded when his gaze direction was toward something other than video. The mean percentage of Shinnosuke attending to the VH with 96.3% (range, 80.0% to 100%) and 96.3% (range, 88.9% to 100%) to the VHP.

Teacher interaction in the bathroom and during video watching. The male teacher was allowed to behave as he usually did in interacting with Shinnosuke in the bathroom and while watching the video. This “informal” approach was employed because it was not acceptable to the culture of the teachers in the elementary division to strictly control teacher behavior according to an experimental protocol.

To determine the extent to which the male teacher interacted with Shinnosuke in the bathroom, the occurrence of response prompts, verbal reminders, and verbal praise was recorded for each target behavior for every observation day, with the exception of Day 32 and 33 when a video camera was not available. For example, if response prompts and verbal reminders were observed once or several times but verbal praise was not observed at all for an event of Drying Hands, a + was recorded in each space for response prompts and verbal reminders and a – was recorded in the space for verbal praises in Drying Hands column on the data sheet. "Response prompt" was defined as a teacher behavior occurring during or after Shinnosuke engaging with a task, with the intention of evoking the target behavior. Response prompt included verbal, gestural, model, and physical prompts. “Verbal reminder” was defined as a verbal teacher behavior occurring within 1 minute before Shinnosuke engaging with a task and referring to the hero (e.g., “Be like Mr. Fujiwara”). Finally, “verbal praise” was defined as positive verbal feedback presented within 1 min after Shinnosuke engaging with a task (e.g., “Great, You are like Mr. Fujiwara”). The first author analyzed the data using the videos filmed by the second author.

Figure 1 shows when and for which behavior each type of teacher interaction was provided across session dates. In general, response prompts (P) were not provided across behaviors, with the exception of Drying Hands. Verbal reminders (R) were provided
during the first three days in the VHM phase for Arranging Shoes, sporadically across phases for Drying Hands, rarely for Covering Buttocks, and not used at all for Tucking Shirt. Finally, verbal praise (C) was sporadically used for Drying Hands and Covering Buttocks, rarely for Arranging Shoes, and not used at all for Tucking Shirt.

Similarly, the second author measured the extent to which the male teacher interacted with Shinnosuke while he watched videos. Watching the same videos as in the attention analysis, she employed a 5-s partial interval recording procedure in which a + was recorded for the interval when a comment was observed and a – was recorded when no comment was observed. A comment was defined as a teacher's verbal behavior, with or without gestures, describing the content of the video (e.g., “Look, Mr. Fujiwara is drying palms”). During the VHM presentation, the male teacher made comments, on average, 12.1% of the time (range, 0% to 50%). During the VHP presentation, he made comments, on average, 7.4% of the time (range, 0% to 22.2%).

Social Validation Interview

Two weeks after completing the data collection, the authors interviewed for 20 min the male teacher who implemented the video presentation to obtain his thoughts and feelings about the VHM and VHP interventions. Specifically, the teacher was asked to respond to an open-ended question, “What are your thoughts and feelings about the video hero interventions?”

Results

Figure 1 shows Shinnosuke’s performance across the four target behaviors, further discussed below.

Drying Hands

Shinnosuke typically dried a part of his hands for less than 5 s (i.e., Level 1). Immediately after introducing the VHM intervention, he dried all parts of his hands for at least 5 s (i.e., Level 3) on 4 out of 5 days. At the same time, the remaining three baselines (i.e., Arranging Shoes, Covering Buttocks, Tucking Shirt) were stable at low levels, indicating that it was unlikely that any factors other than VHM contributed to the improvement of Drying Hands. According to the male teacher, Shinnosuke exhibited a correct response during every afternoon bathroom time when he did not watch the video immediately before going to the bathroom. When the VHM intervention was withdrawn from Drying Hands and the new VHM intervention was introduced to Arranging Shoes (the second target behavior), his performance on Drying Hands dropped to Level 2 but improved to Level 3 the next day.

During VHP, Shinnosuke stayed at the highest level of performance, with the exception of Day 20 when the VHM intervention was initiated for Covering Buttocks (the third target behavior). After VHP was withdrawn, he continued to exhibit correct responses for more than 2 months, with the exception of Days 25, 30, and 31. It should be noted that Day 30 was the first day of introducing the VHM intervention to Tucking Shirt (the fourth target behavior).

Arranging Shoes

Shinnosuke typically placed his shoes away from the shoe marks in a nonparallel way (i.e., Level 1). When VHM interventions were implemented, his performance improved to Level 2 or 3; that is, he put his shoes on the shoe marks in either a nonparallel or a parallel way. In contrast, the remaining two baselines (i.e., Covering Buttocks, Tucking Shirt) were stable at Level 0. This means that it was unlikely that any factors other than VHM were involved in the behavior change of Arranging Shoes.

When VHP interventions were initiated, Shinnosuke exhibited Level 3 performance for 2 consecutive days. Even after the VHP interventions were withdrawn, Shinnosuke continued to exhibit the highest level of performance, with the exception of Day 31, for more than two months. He also exhibited Level 3 performance in the afternoon, according to the male teacher.

Covering Buttocks

Shinnosuke always pulled his pants down to his ankles during baseline. On the first day of
the VHM phase, he voluntarily asked the male main teacher to help him cover his buttocks before urination. The teacher provided Shinnosuke with model and physical prompts to help him engage in the target behavior (i.e., Level 0). On the second day of the intervention phase, Shinnosuke independently covered his buttocks in the \textit{under}pants but pulled his pants down to his knees (i.e., Level 2). According to the male teacher, Shinnosuke showed the same level of performance during every afternoon bathroom time as in the morning. During the second baseline phase, he kept his performance at Level 2. When the behavior change of Covering Buttocks was confirmed, the remaining baseline (i.e., Tucking Shirt) was stable at the lowest level, indicating that it was unlikely that any factors other than VHM contribute to the behavior change. On Days 28 and 29, Shinnosuke independently covered the buttocks in the pants without any direct instructions. During the VHP phase, Shinnosuke’s performance was stable at Level 3. At the same time, according

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**Figure 1.** Taro’s performance levels on four target behaviors across different phases. There was an 18-day winter break between Day 21 and 22. Thirteen data points were missing in the baseline for Tucking Shirt because there were no opportunities to tuck (e.g., student wore no shirt that needed to be tucked). Other missing data in Drying Hands, Covering Buttocks, and Tucking Shirt were due to the other students blocking the observer’s view or due to observation of other students. BL = baseline, VHM = video hero modeling, VHP = video hero praising, P = prompt, R = verbal reminder, C = verbal praise.
to the male teacher, Shinnosuke covered his buttocks in the pants every afternoon bathroom time.

**Tucking Shirt**

Shinnosuke never attempted to tuck his shirt into his pants during baseline. Once the VHM intervention was introduced, he tucked in both the front and the back of his shirt without any prompts. According to the male teacher, Shinnosuke exhibited a correct response in the afternoon when he did not watch the hero modeling video immediately before going to the bathroom.

**Social Validation Interview**

During the interview, the male teacher emphasized that the VHM and VHP interventions changed the nature of engaging in the targeted bathroom-related activities for Shinnosuke from aversive to valuable stimuli. The teacher felt that Shinnosuke changed his performance because he wanted to be like the hero and attributed his wish to be the hero to the innovative idea of using the animated face and pseudo-voice of Mr. Fujiwara overlapped on a video in which an adult (without face) pretended he was Mr. Fujiwara and modeled the target behavior in the familiar bathroom. In addition, the teacher pointed out that the red circle and the zoomed-up function used to provide visual clarity in the videos promoted Shinnosuke to pay attention to the salient behavior that he had to imitate.

**Discussion**

The present study investigated the effects of VHM on the bathroom-related behaviors of an elementary-aged student with ASD. A multiple baseline across behaviors demonstrated that VHM contributed to improving the four targeted behaviors. This finding is consistent with those of previous VHM studies (Ohtake, 2015; Ohtake et al., 2014), indicating that VHM is effective in improving self-care skills of elementary-aged students with ASD. In addition, this finding extended the results of these studies by showing that compositing the animated face of a cartoon character into an adult modeling video (without face) with descriptions narrated by a pseudo-voice of the hero offers an alternative to developing a VHM when a realistic-looking representation of the hero in the form of a figure or doll is not available.

With respect to Arranging Shoes, Shinnosuke’s performance was improved to the highest level when VHM was replaced by VHP. In the VHM study conducted by Ohtake (2015), VHP interventions were used after the participant reliably exhibited the target behavior under the VHM condition. In this regard, VHP was used in the previous study as over-training. In contrast, the present study introduced VHP when correct responses for Arranging Shoes were not exhibited in a consistent manner. Given that a perfect score was observed consistently only after VHP was initiated, VHP may be used as alternative to VHM when VHM is not successful in evoking a correct response in a constant manner.

While watching the video, Shinnosuke directed his gaze toward the video in almost 100% of the instances observed. In addition, he occasionally shared his attention between the video and his teacher with smile. Furthermore, Shinnosuke told his mother what he had watched in VHM and VHP when she picked him up after school, suggesting that he positively and willingly participated in the VHM and VHP interventions.

Before the VHM intervention was initiated, Shinnosuke rejected the male teacher’s prompts in the bathroom and exhibited challenging behaviors, especially when the prompting was not quickly terminated. According to the interview with the teachers, Shinnosuke’s main goal was to shorten bathroom time as much as possible because he looked forward to free play afterwards. Thus, he viewed the teacher’s prompt to elicit a correct response as highly aversive because prompting delayed access to the preferred activity.

Interestingly, on Day 20, Shinnosuke asked his teacher to help him cover his buttocks in the pants, implying that the aversiveness of the teacher’s prompts was canceled out by the VHM interventions, which in turn increased Shinnosuke’s willingness to behave like his hero. As described in the Results section, the male teacher strongly agreed with this inter-
pretation of the change in Shinnosuke’s behavior.

Further, anecdotal data indicate that after the initiation of the VHM for Drying Hands, on five observation days, before leaving the bathroom, Shinnosuke rearranged bathroom slippers, other than the ones he had used, that were not properly lined up. This behavior, which was neither targeted nor included in the VHM, may be viewed as a case of response generalization; that is, “unprogrammed changes in similar behaviors when a target behavior is modified” (Alberto & Troutman, 2013, p. 406).

It may be hypothesized that the response generalization occurred because watching VHM made Shinnosuke believe that Mr. Fujiwara was always watching his behaviors in the bathroom and that he would be happy if Shinnosuke replicated good behavior. However, it is unknown why the remaining three target behaviors were not evoked after the VHM was introduced to the baseline of Drying Hands.

When the VHM intervention was introduced to the baseline of Arranging Shoes, Covering Buttocks, and Tucking Shirt, Shinnosuke’s performance of Drying Hands dropped to a lower level. However, the drop was recovered soon, the next observation day or the day after. It is unknown why only Drying Hands was influenced by adding a new skill. One explanation involves the degree of effort needed for each target behavior. For example, Drying Hands might require more effort than Arranging Shoes or Covering Buttocks. Also, a behavior requiring a great deal of effort to be executed might be more vulnerable to deterioration than one needing less effort when a new task is added as a target to be learned.

Anecdotal data indicate that Shinnosuke not only exhibited the target behaviors but also imitated the body postures and movement of the model in the VHM. Additionally, he talked to the male teacher or the other teachers about the content of the video while engaging in the corresponding task. For example, on Day 8, he said, “Mr. A (teacher’s name), I saw Mr. Fujiwara on the video,” and on Day 15, “Mr. Fujiwara said, ‘I am happy to see you doing well.’ ” This information could be viewed as evidence that Shinnosuke had a visual image of the hero engaging in the target behavior while performing the same task and that being like the hero was valuable to him (Ohtake et al., 2014).

Several limitations to this study should be noted. First, the male teacher provided verbal reminders (e.g., “Be like Mr. Fujiwara”) the first day of the VHM intervention for Drying Hands, Arranging Shoes, and Covering Buttocks. In addition, on some occasions, the male teacher commented on the VHM. The verbal reminders and teacher comments may partly be responsible for changing the target behaviors. Second, observations were conducted in the specific bathroom (i.e., the one closest to Shinnosuke’s classroom) at a specific time (i.e., around 11:45 a.m.). Although the male main teacher informed the authors of Shinnosuke’s performance in the afternoon, actual observation at those times was not conducted following a rigorous procedure. Third, because Shinnosuke graduated from the elementary division, maintenance data were not collected for Covering Buttocks and Tucking Shirt.

Finally, this study included only one participant who had high scores across domains in the AHQ. Thus, it is unknown whether a student who has a profile different from Shinnosuke’s would be similarly responsive to the VHM intervention. Intuitively, students whose scores on “Imitating the hero” are high would be viewed as more likely to be responsive to the VHM intervention because they are thought to be highly motivated to be like the hero. In fact, the participant in Ohtake (2015), who was responsive to the VHM intervention, made believe he was the Masked Rider Wizard® (his hero). Although the AHQ was not applied to that participant, he would most likely have obtained a high score on that subcategory. Future research is needed to investigate the relationship between students’ profiles on the AHQ and the effectiveness of the VHM intervention after the AHQ has been demonstrated to be psychometrically validated.

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Using Science Inquiry Methods to Promote Self-Determination and Problem-Solving Skills for Students with Moderate Intellectual Disability

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Abstract: This study investigated the use of guided science inquiry methods with self-monitoring checklists to support problem-solving for students and increased autonomy during science instruction for students with moderate intellectual disability. Three students with moderate intellectual disability were supported in not only accessing the general curriculum science standards, but also building self-determination skills when applying inquiry problem-solving skills to functional daily applications. A multiple probe across students design was used to establish a functional relationship between the percent of inquiry problem-solving steps performed independently and the use of self-monitoring checklists during traditional and functional-based science activities. Results indicated that following intervention students increased their autonomy in completing inquiry problem-solving activities linked to science content. In addition, students were able to successfully generalize these skills when presented with novel problem-solving tasks related to daily living situations.

A growing debate exists among academics in special education as to what should be taught to students with an intellectual disability enrolled in a functional curriculum (Ayers, Lowery, Douglas, & Sievers, 2011; Courtade, Spooner, Browder, & Jimenez, 2012). The Individuals with Disabilities Education Act (IDEA, 2004) emphasized an individualized curriculum leading to meaningful post-school outcomes and focused on daily living skills (Brown et al., 1979). Yet, No Child Left Behind (NCLB, 2001) placed a larger focus on academic content and assessments (Ayers et al., 2011) leading to a divide among educators in providing access to academic content for students enrolled in a functional curriculum (Miller, Krockover, & Doughty, 2013). Students who participate in a functional curriculum, typically those with an intellectual disability remain part of the accountability measures of NCLB (Ayers et al., 2011; Browder, Jimenez, & Trela, 2012; Courtade et al., 2012; NCLB, 2001). While their curriculum is not limited to grade-level standards, it must be linked to educational standards (Ayers et al., 2011; Browder et al., 2012). Yet many educators lack effective interventions to teach academic content in meaningful and functional ways (Miller, 2012; Miller et al., 2013).

Instructional methods for teaching science content to individuals with intellectual disability are an area in which little research exists. Yet one instructional method, scientific inquiry, is important for developing critical life skills. The ability to acquire and apply inquiry methods to problem solving holds potential for students with moderate intellectual disability in both academic and functional contexts (Miller, 2012). Students with an intellectual disability can acquire academic content (vocabulary and content knowledge); however, research has yet to provide evidence supporting the acquisition of content area academic skills (i.e., problem-solving, argumentation, and communication) for these students. Evidence-based practices such as explicit instruction, peer-mediation, time delay, and task analysis were successful in teaching students with intellectual disability content in academic areas such as language arts (Browder, Wake-
man, Spooner, Ahlgrim-Delzell, & Algozzine, 2006), mathematics (Browder et al., 2012), and science (Courtade, Spooner, & Browder, 2007). However, as studies focused on these content areas, the area of science interventions remains sparse, with limited studies relating to content standards and science as inquiry (Jimenez, Browder, Spooner, & DiBiase, 2012).

Studies examining science content included direct or systematic instruction, measured acquisition in science content (Spooner, Knight, Browder, Jimenez, & Warren, 2011) and science inquiry (Miller et al., 2013; Miller, 2012). These content areas and skills are supported by the Next Generation Science Standards (Achieve Inc., 2013) that focus on performance expectations and require students to demonstrate concepts across ideas. Students are expected to use logic and world experiences to recognize similarities among the core ideas in science and engineering (Achieve Inc., 2013). Emerging research demonstrates the potential of inquiry methods for students with a moderate intellectual disability as they investigate their world (Miller et al., 2013; Miller, 2012). For example, Miller et al. (2013) used guided inquiry methods and electronic notebooks on tablet devices to work with students with moderate intellectual disability to teach science lessons related to color blending and mealworms. Students were able to independently engage in the 5E inquiry process model (Bybee et al., 2006) and communicate their learning through both traditional and e-notebooking methods. The skills needed to generate questions about the world, solve problems, and support and communicate ideas are considered self-determination skills and valuable for students with an intellectual disability (Wehmeyer, Palmer, Agran, Mithaug, & Martin, 2000).

The purpose of this study was to examine the effectiveness of a self-monitoring checklist when used by students with a moderate intellectual disability enrolled in a functional curriculum to increase their autonomy when completing inquiry problem-solving activities linked to science content. The effectiveness of the self-monitoring checklist was also examined to determine student’s ability to independently generalize problem solving when applied to daily living situations.

**Method**

**Participants**

Participants included three secondary students diagnosed with a moderate intellectual disability and enrolled in a functional curriculum. Three students were recruited from a suburban Midwestern high school and were between the ages of 14 and 19. Each met the following participation criteria: a) had primary diagnosis of a moderate intellectual disability, b) consent from parent or guardian was provided, c) obtained assent from student, d) a lack of sensory disabilities, e) an ability to follow a 3-step directive, and f) the ability to communicate verbally (see Table 1).

**TABLE 1**

<table>
<thead>
<tr>
<th>Student</th>
<th>Age</th>
<th>Ethnicity</th>
<th>Primary Disability</th>
<th>Secondary Disability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steve</td>
<td>15</td>
<td>Caucasian</td>
<td>Moderate Intellectual Disability</td>
<td>Speech Language Impairment, Other Health Impairment</td>
</tr>
<tr>
<td>Kourtney</td>
<td>14</td>
<td>Hispanic</td>
<td>Moderate Intellectual Disability</td>
<td>Speech Language Impairment</td>
</tr>
<tr>
<td>Becca</td>
<td>19</td>
<td>Caucasian</td>
<td>Down Syndrome</td>
<td>Moderate Intellectual Disability, Speech Language Impairment, Other Health Impairment</td>
</tr>
</tbody>
</table>

*Kourtney* was a Hispanic-Caucasian, 14 year-old female in the tenth grade. Her primary diagnosis was a moderate intellectual disability with a secondary disability of speech and language impairment. She received special education services in a self-contained classroom where she followed a functional curriculum consisting of using functional sight words, ba-
sic prompting levels, and a token economy. She struggled to self-monitor and express her emotions when she felt uncomfortable in social situations and frequently smiled and giggled as a coping mechanism. She would often fall to the floor weeping and would throw things when she experienced unwanted demands. She struggled to stay focused during unstructured classroom time and was easily distracted by others. Kourtney’s previously used visual aids to prompt responses to questions and was successful using a picture journal when in the community and grocery shopping.

Becca was a Caucasian, 19 year-old female in the eleventh grade. Her primary diagnosis was Down syndrome with a moderate intellectual disability and secondary diagnoses of speech language impairment and congenital heart disease. She received instruction in a self-contained resource setting for mathematics and English Language Arts (ELA). During ELA, she was able to work on a modified curriculum focused vocabulary development and writing with picture supports. Her teacher reported that Becca could be extremely emotional and struggled to express her emotions to others in appropriate ways. She was able to phonetically write short sentences and sound out words as well as read functional sight words.

Steve was a Caucasian 15 year-old male in the tenth grade. His primary diagnosis was a moderate intellectual disability with a secondary diagnosis of speech language impairment and other health impairment. Steve was able to read sight words and write simple sentences phonetically. He could add single digits and subtract with the use of manipulatives. Current IEP goals for Steve included reading fast food words, self-monitoring performance, time management, and increasing time-on task. He participated in large group speech sessions that focused on functional tasks such as weather, stranger danger, and dressing. According to his teacher he contributed to discussions but was easily distracted and struggled to stay on topic.

Setting
The study took place in student’s regular school setting in a small private classroom located down the hall from the students regular self-contained classroom, which was used daily for small group instruction. This room was used mathematics and ELA instruction. The room contained a large conference-style white board that opened to reveal two smaller white boards inside each door. On the opposite wall were windows facing the street. The room’s center contained a long rectangular table surrounded by six chairs. The far end of the room housed a counter that held teaching materials. On the opposing wall was a computer and additional instructional materials.

Dependent and Independent Variables
The dependent variable in this study was student’s percent of independence when completing inquiry problem-solving steps and the percent of guided science inquiry steps completed without the inclusion of the self-monitoring checklist steps. The independent variables include both guided science inquiry and self-monitoring checklists. A task analysis for inquiry investigations was modified from the established 5E model and included: engagement, exploration, explanation, elaboration, and evaluation (Bybee et al., 2006). The modified task analysis steps were placed on self-monitoring checklists on a self-operated iPad device.

Materials
Apple iPad® mini. This device was used to display a self-monitoring checklist and was 7.9” × 7.2m in size, weighing .68lbs, and containing a multi-touch 1080p high definition screen display. It held a battery life of up to 10 hours and a dual-core processor A5 chip that held 32GB of memory for $429 (Apple Inc., 2013).

A Self-Monitoring Checklist Application on Choiceworks by Bee Visual LLC (2013) was used to store self-monitoring prompts for the inquiry problem-solving tasks during intervention. Choiceworks is a daily routine board maker and contains prompting tools to assist users through daily tasks. Checklists, schedule boards, activity timers, and a communication board can be developed using this system. The software was purchased on iTunes for $4.99 and allows users to create and share tasks and schedules across devices, print boards, and to
monitor progress. Audio and picture captions may be added to task lists. Once a checklist is developed, icons are placed down the left hand column. The user may listen to the audio prompt prior to beginning the task sequence. Once a step is completed, the user can use a finger to slide the icon across the iPad screen to an empty box on the right. If done correctly, a large green check appears over the icon and the user hears “all done” (see Figure 1).

Design

A multiple probe across students design was used to establish a functional relationship between the percent of inquiry problem-solving steps performed independently and the use of self-monitoring checklists. The multiple probe design was selected to expose students to fewer sessions in baseline and reduce the possibility of carryover effects due to prolonged guided science inquiry instruction during baseline (Gast & Ledford, 2010). To strengthen the design, a generalization and maintenance phase was conducted (Kennedy, 2005). All students began baseline simultaneously. Baseline probes were staggered to introduce intervention at different points in time to establish a multiple baseline, with the last two points successive prior to intervention. Intervention was introduced once the previous student reached a stable pattern in intervention for three or more sessions, reached criterion of 80%, or completed four sessions in intervention. Stability was considered when 80% of the data fell on or within a 20% range (Gast & Spriggs, 2010).

Data Collection

Event recording was used to record the percent of task analysis steps each student performed independently during science problem-solving activities and daily functional problem-solving activities. By considering the percent of independence across students and conditions, the efficacy of self-monitoring checklists and the validity of guided inquiry problem-solving methods could be demonstrated. Since the questions and tasks required critical thinking, a five-second-wait time before prompting was selected to allow students time to think about the question and respond. For the inquiry tasks analysis, initiation of a step was recorded as independent. Guidance by the facilitator, implemented after initiation to further incorrect inquiry steps, was recorded as dependent.

Procedure

Baseline. During baseline, students were provided five-guided inquiry lessons connected to the national science standards (NRC, 1996) that included a specific integrated functional skill based on the each student's IEP (e.g., cleaning up the dishes afterwards). Lesson materials were presented to students along with the science topic. Students were then able to explore the materials (i.e., touch and smell items, ask questions) they would need to complete the task. During this phase, students were asked to perform the functional skill such as measuring materials and cleaning the workspace. During the lesson, the steps of inquiry problem solving the student independently performed were recorded. A system of least prompts was used following a five-second-wait time before providing any prompt to initiate one of the 5E steps (i.e., a verbal prompt “What questions?”). Inquiry task-analysis steps were: a) ask a question, b) make and state observations, c) create a plan for a solution, d) test solution, and e) explain results.

To avoid leading questions that link to subsequent task analysis steps and prevent unintentional prompting of the next inquiry step, guided discussions of content were only conducted in step 5. For example, in natural guided inquiry conversation the facilitator would likely follow a student observation asking, “Why do you think that is?” which prompts step 5, Explain. Therefore, the facilitator would not engage in building content discussions until after they demonstrated independence in step or a need for a prompt in step 5. Baseline data were reported as the number of task analysis steps initiated independently by the student.

Training. Following baseline, a training phase was conducted to teach students the five steps of problem solving through inquiry, the iPad® picture symbols used, as well as how to use the iPad®. Three training sessions over a
two-week period for 20 minutes each were conducted on how to use the iPad® including instruction on operating the hardware. Operating instruction such as turning the device on and off, making swiping motions to move icons in the application, control the volume, and exit the application and return to the main screen were included. During training,
students practiced how to turn the iPad® on and off, swipe across the screen to access different screens, use the volume, as well as navigate the checklist application. A task analysis was used during the training phases for student’s use of the inquiry checklist application. Students were required to reach 100% independence in operating the checklist two out of three times. The five steps of inquiry (Observe, Question, Plan, Experiment, Explain; Bybee et al., 2006) and their meanings were introduced in mini lessons. Students were shown images of the inquiry step icons and words (one per page) and the concept of being a scientist and completing the steps to solve problems. Students were then shown the icon pages, the words were read aloud, and each student read it back while pointing to the corresponding icon. After reviewing each icon, their meanings and examples, students were presented with a short story problem (e.g., Sarah came home from school and noticed her dog Buddy wasn’t in his usual location in the backyard). The student discussed the problem and possible solutions. Students then viewed the self-monitoring checklist on the iPads® and guided through its use with the story problem. The student the completed a second short story problem with prompts to “use your checklist list to solve the problem.”

Intervention. A least four guided inquiry science lessons were taught during intervention. Four sessions were selected as a minimum to show any pattern or changes from baseline to intervention and provide students time to acquire inquiry methods. Students were provided with iPads® to self-monitor and track their progress in the inquiry problem-solving steps. Intervention lasted one week. The facilitator placed lesson-related materials on the table that the student was free to explore. The facilitator then introduced the topic and guiding question to the student and prompted him or her to use the checklist as each explored the materials needed to gain further explanation of the concept. Using a system of least prompts, the facilitator prompted the students to use the checklist as they problem-solved and implemented guided inquiry methods. Each student was asked to perform the functional skill integrated into the given lesson. Inquiry steps initiated independently by the student were recorded. The inquiry problem-solving task analysis was taught and assessed using the system of least prompts. The task-analysis for inquiry skills were constant across students, a) asking a question, b) making and stating observations, c) creating a plan for a solution, d) testing their solution, and e) explaining their results.

Generalization. Students used the iPad® self-monitoring checklist intervention to support inquiry problem solving in novel situations related to functional daily situations (e.g., cleaning a stain, plugging a hole in a cup). The inquiry problem-solving situations/lessons took place in their school site. Students were presented with materials and a question or scenario related to a functional daily situation and used the self-monitoring checklist to follow the inquiry problem-solving task analysis steps to problem solve. If students didn’t initiate use of the self-monitoring checklist, they were prompted and it was documented as a dependent step in the task analysis. Initiations of inquiry steps were counted as independent.

Maintenance. Two weeks following the generalization phase, the facilitator conducted two maintenance sessions to determine if students maintained what they problem solved using the self-monitoring checklists. One maintenance probe occurred during the intervention condition where students engaged in inquiry problem-solving skills during a science-focused lesson linked to content standards (slime recipes). A second maintenance probe occurred during the generalization condition where students engaged in inquiry problem solving of a daily functional task (reducing the weight of a container). Both maintenance conditions took place in the student’s regular school setting in a separate classroom from their self-contained class.

Interobserver Agreement and Treatment Fidelity

Interobserver agreement (IOA) data were collected for each student during 40% of baseline, 41.66% of intervention, 41.66% of generalization, and 50% of maintenance sessions to determine the accuracy of the data collection procedures. IOA was calculated by dividing the number of agreements by the number of agreements plus disagree-
ments and multiplying by 100. Baseline IOA resulted in 94% agreement for Steve, for 92% for Kourtney, and 94% for Becca. Intervention IOA for Steve resulted in a mean of 89.5%, for Kourtney 94%, and for Becca 89.5%, with generalization phase IOA resulting in 92% for Steve, 92.25% for Kourtney, and 96% for Becca. Maintenance phase, IOA was 94% for Steve, 98% for Kourtney, and 98% for Becca.

Treatment fidelity measures were recorded across conditions and participants. A second trained observer used specific checklists to determine the accuracy of procedural steps that were implemented. During intervention, fidelity measures were conducted for 25% of Steve and Kourtney’s intervention phases, and 50% of Becca’s intervention phase resulting in 100% for Steve and Kourtney and 93.75% for Becca (range 87.5%–100%). During generalization and maintenance sessions, treatment fidelity was conducted for 25% and 50% of sessions respectively resulting in 100% accuracy across both phases.

Results

Figures 2 and 3 illustrate the percentages of independent inquiry problem-solving task analysis steps performed were analyzed through visual analysis.

Steve. During baseline, the mean inquiry task analysis steps initiated independently was 49.53%. A generalization probe was conducted indicating 88.88% independence. During intervention, the mean level of independence was 83.33%. The mean level of independent inquiry task analysis steps during the generalization phase was 93.75%. The split-middle method was used to analyze data trends. Results indicated increased independence across conditions (see Figure 3). The percent of all non-overlap of all pairs of data (PND) between baseline and intervention was 93.73%, PND between baseline and generalization was 93.73%, and between baseline and maintenance 90%.

Steve engaged in 12 independent questions, 23 independent observations, 20 independent plans, 33 independent experiments, and 23 independent explanations across all conditions. He made 5 independent questions in both baseline and intervention phases and two during generalization. He made 7 independent observations in baseline, four during intervention and 12 during generalization. His independent planning showed an upward trend across phases, increasing from three in baseline to eight in intervention and nine during generalization. The frequency of experiments showed a negative trend with 16 independent in baseline, 9 during intervention, and 8 in generalization. Steve’s independent explanations of tasks were 5 in baseline, 5 during intervention, and 13 during generalization.

Kourtney. During baseline, the mean inquiry task analysis steps she initiated independently was 23.25%. During intervention the level of independent inquiry resulted in a mean of 58.54%. Kourtney’s mean level of independent inquiry task analysis steps during generalization was 77.92%. The split-middle method was used to analyze the trend in data. Results indicated increased independence across conditions. NAP was conducted between baseline and all following phases. Between baseline and intervention, PND resulted in 91.67% baseline and generalization 100%, and baseline to maintenance phase, 100%. The specific steps in the task analysis were analyzed by frequency within and across conditions. Overall, Kourtney engaged in 8 independent questions, 24 independent observations, 14 independent plans, 18 independent experiments, and 9 independent explanations across all conditions. Her independent planning was consistent across phases with five in baseline, five in intervention, and four in generalization. Her data illustrated a negative trend in independent experimenting, with ten independent experiments in baseline, three during intervention, and five in generalization. Kourtney’s independent explanations of tasks were zero in baseline, three in intervention and six during generalization.

Becca. During baseline, the mean inquiry task analysis steps initiated independently was 32.44%. During intervention, the mean level of independence was 95.83%. Her mean level of independent inquiry task analysis steps during generalization was 96.88%. The split-middle method was used to analyze the trend in data. Results indicated increased independence across conditions. PND was conducted resulting in 100% across baseline and all ex-
experimental phases (intervention, generalization, and maintenance).

Overall, Becca engaged in seven independent questions, 15 independent observations, 17 independent plans, 11 independent experiments, and 10 independent explanations across all conditions. She made no independent questions in baseline, four independent questions during intervention and two during generalization. She made three independent observations during baseline, and six in both during intervention and generalization condi-
tions. She demonstrated independent planning five times in both baseline and intervention phases, and seven in generalization. She demonstrated independent experiments twice in baseline, five times during intervention, and four during generalization. Becca demonstrated one independent explanation in baseline, four in intervention, and five during generalization.
Social Validity

To determine the usefulness and social value of the intervention, students completed a questionnaire following completion of the study to obtain his or her feedback. Results indicated that students enjoyed the science activities and would like to continue doing them in their classroom. They indicated they learned from doing the lessons and two students indicated the self-monitoring checklist via the iPad helped them learn. All stated they enjoyed doing the lessons but indicated that they would prefer not to use the checklist. Steve and Kourtney indicated they would not want to use the checklist around peers. However, all indicated it would help them learn in other classes.

Discussion

Over the past decade, students with a moderate intellectual disability demonstrated their ability to acquire and perform traditional academic content after intense and repetitive direct instruction (Knight, Smith, Spooner, & Browder, 2012). However, this instruction and its outcome measures lacked functional outcomes. Instruction containing more performance outcomes and functional applications such as problem-solving and communication skills hold both cross-curricular and cross-environmental value and therefore, more meaningful instructional outcomes for students. Inference methods, believed to be best practice for science instruction and promote problem-solving, critical thinking, and the skills of self-determination for students in general education (Hammerman, 2006; NRC, 1996), are now sought as a methods for linking to academic instruction for students with a moderate intellectual disability (Agran, Cavin, Wehmeyer, & Palmer, 2006; Spooner et al., 2011). The purpose of this study was to investigate the effectiveness and generalization of guided inquiry methods when supported by self-monitoring checklists for students with moderate intellectual disability. To investigate the relationship between a) the level in which students problem-solve autonomously with self-directed prompting systems and b) their ability to generalize inquiry problem-solving with self-directed prompting systems, data validity across four conditions and three students was assessed for treatment effect. The results illustrate that all students increased their level of autonomy when completing inquiry problem-solving activities linked to science content and generalized those skills to daily living situations. More research is needed to confirm the casual relationship between the checklist and the positive trend in autonomy demonstrated in participants stated in the hypotheses.

When provided a self-monitoring checklist, students increased their level of autonomy when completing inquiry problem-solving activities linked to science content. Similar to the findings by Miller and Taber-Doughty (in press), the use of guided inquiry investigations when paired with a self-monitoring checklist resulted in increases in independence when problem-solving for both science content related tasks and functional tasks. Results indicated that when provided a self-monitoring checklist, students with a moderate intellectual disability not only generalized inquiry problem-solving steps to daily problem-solving situations, but also continued to show increases in their level of independence from intervention to generalization. All three students continued to trend upward with higher means in generalization compared to intervention and baseline.

Interventions using task analysis checklists and picture prompt systems for students with a moderate intellectual disability allow students to follow concrete steps in a sequence (Browder & Minarovic, 2000). The difference between traditional self-monitoring studies and the present study was that the tasks consisted of abstract problem-solving steps that were neither tangible nor concrete. Although the steps occurred each time, they were dynamic in that the student could engage in several observations and plans unlike traditional uses of checklists prompting systems where students follow a recipe or follow a list of sequential vocational tasks (Mechling & Ayers, 2012; Taber-Doughty, Miller, Shurr, & Wiles, 2013). The icons remained constant with the steps to problem-solving tasks across sessions. However, the actual performance task was much more complex, requiring critical thinking skills, novel activities each session, and new application of the problem-solving
task-analysis. In this study, students never applied the intervention to the same activity more than once, but rather applied the self-monitoring inquiry problem-solving intervention to an entirely new scenario/activity in every session with the only constant being the problem to solve.

Students generated driving questions or were provided with the question at the start of each activity. The inquiry task analysis step of Observation indicated that students made more frequent independent observations during the activity. If a student repeated his or her experiment and planning to obtain the desired outcome, then he or she had more opportunities to make observations, increasing the opportunity to make independent observations. Likewise, when students were successful in their initial inquiry Plan, they would implement that plan with their Experiment, complete the inquiry task analysis and would have demonstrated one instance of an independent Planning and have less opportunity for generate more observations. Students who were successful at creating effective inquiry plans and executing them with proficiency had fewer frequencies in independent planning. For example, Steve had a high level of independent planning and experimenting, because he would come up with an initial idea that was not successful, but was independent in observing that the initial plan didn’t work, re-planned and re-ran experiments, increasing his frequencies. Similar to Steve, Kourtney required revision of plans and experiments and prompting from facilitators to generate the new plan, resulting in increased opportunities for new experiments and observations and fewer independent plans.

To reduce the load on the working memory, the self-monitoring checklist was designed to cue initial inquiry schema as well as the steps in the inquiry task analysis when students needed assistance. As students developed the problem-solving schema and navigated through inquiry steps, they relied less on the checklist and used it as a self-reflective/self-reporting tool to evaluate their task completion or to prompt themselves to complete the next step. Other times, students would complete the entire activity then refer to the checklist and verbalize the steps they completed. Futures studies should investigate the benefits of checklists in self-reflection of sequence process skills and activities.

Limitations

This study was not without limitations. Although student independence increased across conditions, baseline data for both Becca and Kourtney were variable. Eighty percent of their baseline scores did not fall within 20% of the mean. However, the baseline probes did not show positive or negative trends indicating a pattern in the data. Predictions of continued baseline data could be made but with less accuracy than a stable baseline.

A second limitation is the lack of generalizability of the study’s findings. Results indicated high internal validity for experimental control. To be established as an evidence-based practice and the generalizability of this single-case study, replication is required across five studies by other researchers and with twenty or more participants (Horner et al., 2005). Three students participated in this study demonstrating increases in autonomy in problem solving in both science standards-related activities and functional problem-solving activities. The students in this study also represented a homogenous population of secondary students in a very successful secondary school in a small Midwest town. Future replications should consider including more diverse locations and populations such as elementary age students, young preschool children, or adults in post-school settings who are economically, ethnically, and culturally diverse.

A third limitation is engaging students in applied research. When conducting research in classrooms, many variables often occur that affect student’s behavior and performance (Alberto & Troutman, 2006). Examples of variables encountered during this study included medication changes, schedule changes, reported hormone changes, and illness. For example, special activities would be conducted often in the afternoon during session causing Steve anxiety about missing them. Becca engaged in an emotional response that included crying and yelling at paraprofessionals prior to sessions following overeating and having her food removed.
Conclusions and Recommendations

The present study extended findings from Miller and Taber-Doughty (in press), Jimenez, Browder, and Courtade (2010), and Jimenez, Browder, Spooner, & DiBiase (2012), investigating the impact of science inquiry investigation and self-monitoring interventions for students with moderate intellectual disability. Unlike the previous studies (e.g., Jimenez et al.) this investigation incorporated generalization phases making the connections to functional application of science inquiry problem-solving skills, and expanding on generalization. The findings indicate that students with a moderate intellectual disability can use self-monitoring checklist to acquire, apply, and generalize inquiry problem-solving skills. Replication studies are needed to verify these findings and confirm the role of the checklist compared with guided inquiry methods or using guided inquiry methods without a self-monitoring checklist. It is plausible that students learned the inquiry problem-solving skills over time via the use of guided-inquiry teaching methods and used the checklist as a way to check their work after the fact.

Future studies should examine the role that guided inquiry methods play in building self-determination skills. Empirical evidence is lacking from the literature that demonstrate interventions increasing self-determination and meaningful outcomes stemming from self-determination interventions (Algozzine, Browder, Karvonen, Test, & Wood, 2001). Futures studies should also continue to look at the use of self-monitoring interventions such as a self-monitoring checklist paired with guided inquiry for inclusion in grade-level science activities and projects. The integration of science inquiry methods can bring added benefits for this population who are involved in inclusive settings. This study was conducted in small Midwest high school; therefore, to strengthen these findings and generalizability, studies involving larger numbers and more diverse participants should be conducted (Horner et al., 2005). Researchers should also consider studies observing the teachers as facilitators, both special and general education (Courtade et al., 2012).

Research suggests that inquiry methods help students acquire critical thinking skills, self-determination, and the ability to problem-solve (NGA, 2010; NRC, 1996). Science inquiry methods are linked to self-determination models for students with more moderate and severe intellectual disability (Agran et al., 2006; Spooner et al., 2011). Self-monitoring devices that scaffold inquiry problem-solving steps may hold potential for students with a moderate intellectual disability (Jimenez et al., 2010; Miller & Taber-Doughty in press). Therefore, future research should examine the benefits that self-monitoring inquiry methods hold for students post high school, the interventions to support these skills across settings, and support for increased levels of independence when performing these skills.

References


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Education and Training in Autism and Developmental Disabilities

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*Education and Training in Autism and Developmental Disabilities* focuses on the education and welfare of persons with autism and developmental disabilities. *ETADD* invites research and expository manuscripts and critical review of the literature. Major emphasis is on identification and assessment, educational programming, characteristics, training of instructional personnel, habilitation, prevention, community understanding and provisions, and legislation.

Each manuscript is evaluated anonymously by three reviewers. Criteria for acceptance include the following: relevance, reader interest, quality, applicability, contribution to the field, and economy and smoothness of expression. The review process requires two to four months.

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