Autism spectrum disorder (ASD) represents a continuum of pervasive developmental disorders characterized by varying degrees of impairments in social and cognitive functioning (Johnson & Myers, 2007). Atypical social communication and restricted repetitive behaviors are two key characteristics of ASD. More specifically, high-functioning autism (HFA) is associated with more advanced skill sets, and often average or above average IQ levels. Children with HFA display fewer deficits in verbal communication than children with more severe forms of ASD. However, they consistently demonstrate impairments in social interaction, and engage in repetitive behaviors and routines. Additional symptoms include obsessions with particular items or subjects, lack of eye contact, and difficulty maintaining prolonged attention or on-task behavior (American Psychiatric Association, 2013).

Currently, a significant concern facing clinicians, researchers, and educators is the lack of well-defined and effective treatment options for increasing positive sustained attention in children with HFA. Although off-task behavior has been noted in many children with HFA, it is difficult to accurately identify and individualize proper interventions for each child. However, it is clear that children with HFA can benefit from strategies used to increase attention including time-on-task behavior (Mesibov, Shea, & Adams, 2001).

**Attention**

Sustained attention involves the capacity to maintain prolonged focus on a stimulus (i.e., a task, object, person, or event; Patten & Watson, 2011). Researchers studying attention have noted that children with ASDs exhibit patterns of overfocused or selective attention (e.g., intense preoccupation with an object or toy). Specifically, overarousal likely causes individuals to be selective in their attention, similarly displaying above-average memory in areas relevant to their interests.
of self-chosen or obsessive interest (Liss, Sauliner, Fein, & Kinsbourne, 2006; Patten & Watson, 2011).

Although sustained attention in ASD has been frequently observed in situations of hyperfocus (similar to overfocus), it is not accurate to say that children with ASD have well-developed attention skills. In other words, hyperfocus may instead indicate an inability to shift attention. Furthermore, activities that are not related to a child’s chosen interest are often interrupted by off-task responses including repetitive behaviors (e.g., hand flapping, rocking, spinning), humming, making faces, and engaging in scripted conversations (Bertoglio & Hendren, 2009).

To explicate the nature of attention deficits in children with ASD, reasons why children with HFA struggle to maintain focus must be further explored. According to education mandates, children with disabilities are placed in the least restrictive environment (Individuals with Disabilities Education Act, 2004). This may be important because children with HFA are often mainstreamed into a typical classroom setting where they are expected to stay on task for prolonged periods of time. Studies have indicated that children with ASD struggle to maintain focus in the academic setting when prompted to complete a task. This is likely the result of poor attention span, perhaps further rooted in lack of motivation and feelings of learned helplessness (Koegel & Mentis, 1985; Palmen & Didden, 2012). Although previous studies have primarily explored attention in the classroom context, exposure to academic stimuli is also prevalent in the home environment.

Some researchers believe that children with ASD may engage in disruptive, avoidant, and escape behaviors in response to overly demanding or boring academic activities, and thus exhibit off-task behaviors (Geiger, Carr, & LeBlanc, 2010; McComas, Hoch, Paone, & El-Roy, 2000). Consequently, researchers should take into account motivational factors when examining engagement in on-task versus off-task behaviors in children with ASD (Kang et al., 2013). Further, Koegel, Singh, and Koegel (2010) conducted a study using child-preferred reinforcers to increase motivation in children with ASD during academic tasks. Results of their study indicated that the use of individually tailored reinforcers decreased the amount of time for a child to begin a given task. Improvements were seen in maladaptive and distraction behaviors in addition to overall academic achievement.

### Interventions Targeting Attention

Several forms of intervention exist to promote attention-oriented behaviors in children with ASD. Previous research has suggested that intensive and cross-setting programs are most beneficial because behavior should be modified consistently across all settings (Koegel et al., 2010; Matson et al., 2012). Applied behavior analysis (ABA) involves the modification and analysis of behavior to produce socially significant behavior change (Cooper, Heron, & Heward, 2007). One form of ABA, known as early intensive behavioral intervention, provides children with one-on-one attention, allowing for intensive focus on target areas (Bertoglio & Hendren, 2009). Specifically, researchers have discussed the use of early intensive behavioral intervention to treat stereotyped behaviors, which are often manifested during time off task or used to disengage from unwanted stimuli (Matson et al., 2012).

Researchers have also explored the use of stimulus prompting, or self-management strategies to improve time on task and overall task engagement in children with ASD (Coyle & Cole, 2004; Massey & Wheeler, 2000). One study utilized picture activity schedules to prompt children with autism to engage in on-task behaviors (Bryan & Gast, 2000). The visual stimuli communicated clear instructions and helped children transition from one task to another. Results of the study indicated that children exhibited more on-task and independent behavior with the use of picture activity schedules (Bryan & Gast, 2000).

A similar study by Mechling, Gast, and Seid (2009) used personal digital assistants to prompt task completion. The device used auditory, video, and picture prompts to help individuals with autism complete cooking tasks and follow recipes. Students completed recipes more accurately and independently with the prompts, suggesting that personal devices can effectively promote time on task (Mechling & Savidge, 2011). Additional research has validated the use of self-operated prompts to decrease time off task across activities and environments (Taber, Seltzer, Heflin, & Alberto, 1999). Although less support has been offered, additional interventions have included self-monitoring, touch therapy, and behavioral skills training (Field et al., 1997; Holifield, Goodman, Hazelkorn, & Heflin, 2010; Palmen & Didden, 2012).

Our study expanded previous literature on interventions designed to increase time-on-task
behavior in children with ASD. Previous strategies (e.g., stimulus prompting and self-management) have benefitted children with ASD through increasing time-on-task behavior in educational environments. Such strategies are thus important to consider when assessing on-task behavior in children with ASD in novel environments (e.g., in the child’s home). Few studies have specifically addressed time on task in the home environment, where the child may not have access to more complex interventions as outlined above. Positive reinforcement can be easily implemented by parents and caregivers in the home setting and may serve as an effective technique to promote time-on-task behavior.

Reinforcement

Efforts to increase time-on-task behavior have incorporated techniques from ABA. As seen in previous studies, reinforcement has been shown to increase desirable behaviors in children with ASD. However, identifying effective reinforcement is challenging because children with ASD do not respond to stimuli in the same way as their typically developing peers (Mechling, Gast, & Cronin, 2006). This challenge is further compounded by the fact that children with ASD have restricted interests. Few studies have explored time on task and attention within the home setting where there is generally less access to support from trained professionals. Moreover, engagement in school-based tasks must be maintained between the classroom and home environment where time-on-task behaviors have not been comprehensively studied. Two specific types of reinforcement include material and social reinforcement (Ormrod, 2012). However, there is limited research suggesting which type of reinforcement is most effective.

The purpose of our study was to compare the relative effectiveness of material versus social reinforcement on in-home time-on-task behavior in an individual with HFA. Further aims were to increase overall understanding of reinforcement in cases of children with HFA and to therefore utilize the most effective reinforcement strategy for increasing time on task during in-home academic assignments. Based on prior research and distinguished behavioral deficits in children with HFA, the current study assessed which type of reinforcement, material or social, was most effective in increasing time-on-task behavior for the target child. We hypothesized that the child would engage in a higher percentage of overall time-on-task behavior (across the duration of the 4-week study) with the use of material reinforcement than with the use of social reinforcement.

Method

Participant and Setting

The sample consisted of one child, a 10-year-old European American boy with HFA; the participant was eligible for special education services as set forth in an individualized education program. The participant was selected using convenience sampling because the primary investigator had been previously working with the child in the home setting in the role of in-home behavioral therapist. The participant exhibited severe deficits in attending to tasks, which interfered with learning and academic productivity as observed by the researcher. After receiving approval from the institutional review board, parents provided informed consent for their child to participate. The participant also provided written assent and was given the opportunity to withdraw from the study at any time. No external rewards or monetary funding were provided for participation, and the family could withdraw from the study at any time with no detriment to their child’s treatment plan. It is not uncommon for professionals working in home-based ABA programs to conduct research with children for whom they provide behavioral interventions.

The participant in our study had been previously working on academic tasks with the primary investigator for 6 months, and was therefore well adapted to a routine. The child did not consistently engage in time-on-task behavior in the home environment. Moreover, the child rarely completed educational activities without significant guidance, prompting, and redirection from the researcher. This study was designed to compare the relative effectiveness of material versus social reinforcement on time-on-task behavior, with the ultimate goal to increase time-on-task behavior through using effective reinforcers. As stated in the informed consent document, the study would cease if it caused harm to the child, or if treatment goals were not met.

The participant was educated through the public school system and received further assistance in the home environment. Family members reported that the participant displayed off-task behavior during academic tasks, low motivation to complete independent coursework, and task refusal. These
behaviors also contributed to poor performance and test scores in the classroom. Likewise, time off task was accompanied by stereotyped behaviors such as hand flapping, quoting videos, and talking about obsessive interests. In-home assistance focused on tasks and objectives assigned by the participant’s teachers and resource instructors.

**Measures**

**Material reinforcement.** Material reinforcement is any physical object presented contingent upon a response (Ormrod, 2012). The material reinforcement used in the present study included miniature Reese’s Peanut Butter Cups®, Airheads®, chocolate chip cookies, Smarties®, and bubbles.

**Social reinforcement.** Social reinforcement is a gesture or sign used to communicate positive regard, presented contingent upon a response (Ormrod, 2012). The social reinforcement used in the present study included words of encouragement, pats on the back and shoulder, high-fives, smiles, and nods of approval.

**On-task behavior.** On-task behavior was defined as engaging in the task presented, using materials appropriately (e.g., pencil and paper), and following the researcher’s instructions. On-task behavior included instances when the participant was engaged in targeted homework tasks as provided by the participant’s teachers and resource instructors (e.g., math and science worksheets).

**Off-task behavior.** Off-task behavior was defined as disengagement from the task presented, failure to engage in the task presented, and using materials inappropriately (e.g., throwing the pencil). Off-task behavior also included instances of self-stimulation (e.g., hand flapping) and inappropriate behaviors (quoting videos, singing, playing with toys, and failure to follow the researcher’s instructions).

**Procedure**

The participant was asked to engage in school-based tasks including basic math and science worksheets in the home environment for approximately 30 min per research session. Each task was of relatively equal difficulty and length. Academic tasks were administered with the use of material or social reinforcement, which were given upon task completion. The participant was given material or social reinforcement for a period of 4 weeks, 3 days per week. Material reinforcement was used during Weeks 1 and 3. Social reinforcement was used during Weeks 2 and 4. The researcher offered reinforcement based on informal observations of the participant’s enjoyment preferences. Material and social reinforcement alternated each week for the duration of the 4-week data collection period. The study measured the duration in seconds of on- and off-task behavior during each task completed in order to compare differences in time on task with the use of material or social reinforcement. The researcher noted the participant’s reaction to each type of reinforcement offered; examples included task refusal and specific comments about the reinforcement offered. Distraction behaviors were also noted during each task.

**Results**

Results of the study indicated that overall, material reinforcement produced a higher percentage of time-on-task behavior than social reinforcement for the duration of the 4-week study (see Figure 1). Specifically, the child was on task for 77.1% of total time with the use of material reinforcement, and off task for 22.9% of total time with the use of material reinforcement. Similarly, the child was on task for 50.8% of total time with the use of social reinforcement, and off task for 49.2% of total time with the use of social reinforcement.

To compare material and social reinforcement over time, time-on-task behavior and time-off-task behavior were calculated as percentages of total task time for each week (see Figure 2). Note that these conditions are not completely independent of one another. Therefore, the interpretation of these results should consider the influence of the previous week’s reinforcement strategy (see

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**FIGURE 1**

Total On-Task Versus Off-Task Behaviors With the Use of Material or Social Reinforcement in the Home environment

<table>
<thead>
<tr>
<th>Percentage of Time-On-Task and Time-Off-Task</th>
<th>Material</th>
<th>Social</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of Total Task Time</td>
<td>77.1%</td>
<td>50.8%</td>
</tr>
<tr>
<td>On-Task</td>
<td>90%</td>
<td>70%</td>
</tr>
<tr>
<td>Off-Task</td>
<td>10%</td>
<td>30%</td>
</tr>
</tbody>
</table>

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discussion section below for greater detail). During Week 1, the participant was on-task for 64.6% of the total sessions with the use of material reinforcement and off-task for 35.4% of the total sessions with the use of material reinforcement. During Week 3, the participant was on-task for 86.4% of the total sessions with the use of material reinforcement and off-task for 13.6% of the total sessions with the use of material reinforcement (see Figure 3). In contrast, during Week 2, the participant was on-task for 71.2% of the total sessions with the use of social reinforcement, and off-task for 28.8% of the total sessions with the use of social reinforcement. Finally, during Week 4, the participant engaged in time-on-task behavior for 32.8% of the total sessions with the use of social reinforcement, and engaged in time-off-task behavior for 67.2% of the total sessions with the use of social reinforcement (see Figure 4).

Discussion

In our case study of one child with HFA, we compared the relative effectiveness of material versus social reinforcement on in-home time-on-task behavior in an individual with HFA. In line with previous literature, our study supported the use of strategies to increase attention (Coyle & Cole, 2004; Massey & Wheeler, 2000). Consistent with our hypotheses, data suggested that the participant engaged in a higher percentage of time-on-task behavior with the use of material reinforcement than with the use of social reinforcement. However, variation in type of academic task (e.g., science vs. math) might have also influenced the participant's time-on-task behavior. With the use of material reinforcement, the child engaged in more time-on-task behavior as the study progressed. In other words, the participant engaged in more time-on-task behavior during Week 3 than during Week 1. In contrast, the participant engaged in less time-on-task behavior over time with the use of social reinforcement. Specifically, he engaged in more time-on-task behavior during Week 2 than during Week 4. These results are not surprising because the participant might have grown accustomed to the use of social reinforcement, making it less appealing and reinforcing during Week 4 (e.g., the novelty effect).

It is important to note that, although these types of reinforcement were used during different weeks, they are not completely independent. For example, it is possible that the return to material reinforcement in Week 3 (after its loss during Week 2 social reinforcement) amplified its impact on behavior. In contrast to our hypotheses, the use...
of social reinforcement during Week 4 produced more off-task behavior than on-task behavior. This result is puzzling because it does not follow the same pattern as seen during Weeks 1 to 3. However, the return to social reinforcement during Week 4 after a second week of material reinforcement may be responsible for this inconsistent finding. It is difficult to assess the longitudinal impact of reinforcers without first demonstrating experimental control. However, our study expanded previous literature by comparing material and social reinforcement in the home environment, and provided important considerations for future researchers and clinicians providing in-home services to children with HFA.

To further tease apart the influence of material and social reinforcement on time-on-task behavior in children with HFA, it is clear that alternative study designs should be explored. For example, material and social reinforcement could be treated as two separate experiments (rather than being implemented during alternating weeks) with baseline conditions for comparison. A preference assessment should also be conducted to identify highly preferred tangible items (Kang et al., 2013). The preference assessment should then be followed by a reinforcer assessment to verify that the chosen items were effective in reinforcing the child’s behavior (Carr, Nicolson, & Higbee, 2000).

Several limitations apply to the results of our study. First, there was no baseline phase, which made it difficult to compare the participant’s behavior with and without the use of reinforcement. Because the data were collected in a natural setting, there was also less control over confounding variables. For example, not all school tasks were equivalent during each data collection period. Unexpected factors such as illness, appointments, and days off from school changed the nature of the child’s routine and might have also affected his behavior. The total available task time during the social reinforcing weeks was greater than the total available task time during the material reinforcing weeks. Although the study attempted to control for length and difficulty of task, future research should explore on-task-behavior during only one type of task or compare the effectiveness of reinforcement across different types of tasks.

As with all case study designs, the results of our study may not be generalizable to the wider population. More specifically, because autism is a spectrum disorder, the present study may not be generalizable to other children with an ASD diagnosis.

Although positive reinforcement has been effective in increasing time-on-task behavior, children with ASD may respond differently to behavioral interventions due to the heterogeneity of the disorder. Therefore, additional studies should be conducted with larger and more diverse samples. Additionally, there was no interobserver agreement (IOA). To reduce the potential for experimenter bias, replication and extension of the current study should include an independent observer, with calculations of IOA (Carr et al. 2000).

Material and social reinforcement can serve as an effective tool to increase motivation, attention, and time-on-task behavior in children with HFA. However, not every child is motivated by the same stimuli (Kang et al., 2013). These stimuli should be adapted to the individual child and must be consistent and contingent on the target behavior. In our study, material reinforcement was effective for the child. However, social reinforcement was not a sustainable effective reinforcement technique. It may also be helpful for families to receive guidance from professionals (e.g., a Board Certified Behavior Analyst®, developmental specialist, or in-home provider) so that reinforcement procedures can be successfully implemented across settings.

Consistent with educational records, the participant continued to engage in some off-task behaviors even with the use of reinforcement. For example, the participant was administered the Developmental Neuropsychological Assessment (NEPSY-II) by a clinical psychologist following the completion of the case study. Results of the NEPSY-II revealed significant deficits in tasks measuring attention. Specifically, the participant’s ability to remain focused during long tasks was well below average. Similar to behaviors observed in the home setting, the participant often stopped responding when a task became uninteresting or difficult.

The participant’s on-task behavior was inconsistently reinforced in the home environment (outside of in-home therapy sessions as observed by the primary investigator). It was therefore difficult to assess the strength of certain reinforcement, although they were items the child enjoyed. The effectiveness of a reinforcement depends on its immediacy and consistency. Family members must also be consistent in applying reinforcement to positive behavior.

Results of the material reinforcement sessions have implications for clinicians and parents raising children with ASD. Namely, the use of material reinforcement may be an effective long-term
strategy for promoting time-on-task behavior in children with ASD. Additional studies are needed to replicate and extend these results. Specifically, future studies should use longitudinal designs to assess relations between material reinforcement and time-on-task behavior in large samples of children with HFA. Material reinforcement should also be explored in combination with previous interventions targeting attention such as self-monitoring and picture activity schedules (Bryan & Gast, 2000; Mechling & Savidge, 2011). Again, the results of our study should be taken in context and should not be used in practice without further research, corroborating evidence, and clinical guidance.

In sum, the findings of our study supported the use of reinforcement for promoting time-on-task behavior in a child with HFA. Reinforcement procedures are an effective method for increasing sustained attention (Koegel et al., 2010), which may also result in improved task-completion and classroom performance. As children with HFA progress in task engagement, improvements may also be seen in overall skill development.

References

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