Journal of Behavioral Education (2019) 28:456–478
https://doi.org/10.1007/s10864-018-09317-2

ORIGINAL PAPER

Effects of a Self-Management with Peer Training Intervention on Academic Engagement for High School Students with Autism Spectrum Disorder

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Published online: 2 January 2019

Abstract

Self-management interventions have been shown to improve behavioral, social, and academic outcomes across age-groups and settings; yet, a dearth of research exists on the impact of self-management interventions on academic engagement of high school students with autism spectrum disorder (ASD). The present study uses an ABAB withdrawal design to examine the effects of a self-management with peer trainer (SM + PT) intervention on the academic engagement of two high school students with ASD. The peer trainer in this study also had ASD. Additionally, the study examines the extent to which the peer trainer with ASD implemented a peer training session with fidelity and the social validity of the SM + PT intervention. Based on the *What Works Clearinghouse Procedures and Standards Handbook* guidelines (Institute of Education Sciences 2017), this study found moderate evidence for a causal relationship of the SM + PT intervention and academic engagement for both students. Data suggest that the peer trainer implemented the peer training component with fidelity. Social validity results suggest that the intervention was feasible, acceptable, and effective. Limitations include the presence of naturally occurring variations in the teacher-assigned tasks, school-imposed time constraints, and data outliers in both students' second baseline phases. Future research is needed to investigate the extent to which SM + PT interventions can be effectively implemented and generalized to more inclusive high school settings.

Keywords Autism · Self-management · Classroom interventions · High school · Engagement

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Introduction

Student engagement during academic tasks is positively associated with academic achievement among school-age children with autism spectrum disorder (ASD; Koegel et al. 2003, 2010), though students with ASD often display low levels of academic engagement (Dunlap 1999). Fortunately, students with ASD who display low levels of engagement can benefit from self-management interventions (Carr et al. 2014; de Bruin et al. 2013). Previous research shows that self-management interventions improve behavioral, social, and academic outcomes across age-groups (3–20 years old) and settings (Carr et al. 2014). Teaching students to self-manage often requires multiple steps and may be initially more time consuming than antecedent and consequence-based strategies (e.g., Carr et al. 2014; Cooper et al. 2007; Southall and Gast 2011). Yet, there are many benefits to teaching students to self-manage. Self-management skills are beneficial for long-term success, promote generalization (e.g., locations, domains) and maintenance of skills, increase independence, and can be applied in multiple school settings (e.g., classroom, lunchroom; Carr et al. 2014; Cooper et al. 2007).

Cooper et al. (2007) broadly defined *self-management* as "the personal application of behavior change tactics that produces a desired change in behavior" (p. 578), adding that self-management may involve multiple behavioral principles and multiple instructional components. Carr et al. (2014), in fact, found that 93% ($n = 27$) of self-management interventions used multiple components. Within these multicomponent interventions, many aspects can vary—both within and across age-groups and outcomes of interest (Carr et al. 2014; Cooper et al. 2007; de Bruin et al. 2013). Findings from Carr et al. also suggested that self-management interventions were more effective for students ages 6–20, as compared to the preschool ages of 2–5. Of note, studies conducted with preschool-age students targeted social skills, whereas studies conducted with older students targeted academic and life skills.

To develop self-management interventions, researchers have used some or all of the following components: self-monitoring, self-recording, self-evaluation, and self-reinforcement. Self-monitoring tasks require the individual to determine whether a target behavior occurred. Self-recording tasks require the individual to record the occurrence or nonoccurrence of the behavior. Self-evaluation tasks call for the individual to determine whether the goal was met. Finally, self-reinforcement tasks require the individual to give a contingent self-reward for the demonstration of a target behavior (Southall and Gast 2011). The ultimate goal of self-management interventions is for students to implement the strategies independently (Dunlap et al. 1991).

Self-Management Interventions and Academic Behaviors

Results from self-management studies meeting the What Works Clearinghouse (WWC) quality indicator guidelines (Kratochwill et al. 2010) suggest that self-management interventions improve a range of academic behaviors (e.g., engagement,

work completion for students older than 5; Carr et al. 2014). The studies targeting academic behaviors for students who are 6–12 years of age found improvements in academic engagement, productivity, and accuracy. All of these studies used self-management, self-recording, and either visual or verbal prompts or both visual and verbal prompts (Carr et al. 2014).

Despite broad agreement among researchers on the efficacy of self-management interventions in improving academic engagement outcomes, the research is unclear on how to advise practitioners to implement these practices in their classrooms (Briesch et al. 2018). Findings from meta-analyses on self-management strategies done by Briesch et al. and de Bruin et al. (2013) suggested that a range of self-management intervention strategies are effective (e.g., external prompts, additional reinforcement), but even among similar self-management packages (e.g., self-monitor on-task behavior with reinforcement for accurate responses), variation in effect sizes has been considerable. This finding led Briesch and colleagues to provide two recommendations. First, despite wide agreement that self-management interventions can be effective, practitioners are advised to identify studies that align with their students' characteristics and settings of interest. Second, due to the effect size variations among similar self-management packages, more research is needed to better understand the extent to which variations in the independent (e.g., self-management with reinforcement as compared to without reinforcement) and dependent variables, settings, and populations affect student outcomes.

In particular, research is limited on self-management intervention for students with ASD in middle and high school settings. Carr et al. (2014) identified only two self-management interventions targeting academic behaviors for this age group (Cihak et al. 2010; Delano 2007). Cihak et al. and Delano both used self-monitoring, self-recording, and picture prompts. Delano also implemented visual and verbal prompts. Findings from Cihak et al. suggest improvements in task engagement for middle school students, and findings from Delano suggest increases in academic production for high school students. More recently, Clemons et al. (2016) found an increase in academic engagement following the implementation of a self-management intervention with a handheld technological device for three high school students with ASD. Cihak et al., Delano, and Clemons et al. all met the WWC quality indicator guidelines (Kratochwill et al. 2010). Of these three studies, only Clemons et al. and Delano implemented a self-management intervention for students in high school.

Overall, self-management interventions have been shown to be effective for adolescents, though variations in effect sizes are present based on individual study parameters. Therefore, for practitioners to identify the appropriate self-management intervention package for their students, more research is needed to address the range of settings and students they may encounter (Briesch et al. 2018; Carr et al. 2014; de Bruin et al. 2013).

Peer-Mediated Interventions

Peer-mediated interventions can use a student's peers to tutor (Parker and Kamps 2011), monitor (Morrison et al. 2001), provide positive reinforcement (Loftin et al. 2008), and support social (Chan et al. 2009; Kamps et al. 1999) and academic tasks (Chan et al. 2009). Peer-mediated interventions have been found to be effective for both the peer acting as the tutor and the tutee (Cochran et al. 1993; Silverman et al. 2017; Watts et al. 2018). Peer mediation can be used as a stand-alone intervention or as an intervention component within a self-management intervention.

In a meta-analysis on the effect of peer tutoring on academic outcomes for students in grades 1–12, Bowman-Perrott et al. (2013) found moderate-to-large effect sizes, although these findings did not include students with ASD. In a review of peer-mediated interventions for students with ASD, Chan et al. (2009) found that 91% of the interventions led to positive outcomes, with improvement in both social and academic outcomes (e.g., math outcomes). However, Chan et al. did not identify a study using peer mediation to improve academic engagement. Carr et al. (2014) found that self-management interventions with embedded peer mediation improved social skill outcomes for students ages 3–13, although, similar to Chan et al., their review did not identify studies targeting academic engagement.

In their meta-analysis, Chan et al. (2009) also investigated how studies trained the tutors to work with the tutees. Chan et al. identified 28 studies providing verbal explanations to the tutor, 25 studies including a form of role-playing or acting out of specific behaviors, and 13 studies asking the tutor guiding questions (e.g., "How would you model on-task behavior to the students?"). Chan et al. also identified the methods by which the tutor interacted with the tutee. Twelve studies taught the tutors to prompt tutees to engage in specific appropriate behaviors and 12 studies had tutors provide behavior-contingent rewards (e.g., praise) for appropriate tutee behaviors. Of note, Chan et al. stated that studies with peer mediation could benefit from more robust measures of fidelity. Along with Chan et al., Briesch et al. (2018) and Carr et al. (2014) noted the benefits of using peer mediation but also stated the need for more research in an increased range of academic levels and classroom settings.

Reinforcement

Several meta-analyses have noted the efficacy of incorporating a reinforcement component (e.g., the delivery of tangibles such as a token economy, intangibles such as adult praise) to increase the likelihood of a behavior occurring within self-management interventions (Briesch et al. 2018; Carr et al. 2014; de Bruin et al. 2013). Carr et al. identified 13 self-management intervention studies with self-delivered reinforcement components and five studies with adult-delivered reinforcement components. More specifically, Carr et al. found that token economies embedded within

self-management interventions improved student on-task behaviors. Carr et al. did not identify a self-management intervention with a reinforcement component targeting academic behaviors for middle and high school students with ASD. Briesch et al. identified six studies with a self-management and reinforcement component and noted that when the purpose of the intervention was to improve on-task behaviors ($n = 3$), there was large variation in the effect sizes, as compared to studies with the aim to decrease disruptive behaviors ($n = 3$). Researchers have noted both the promise of using reinforcement in self-management interventions and the need for further investigation into self-management interventions that use reinforcement (Briesch et al. 2018; Carr et al. 2014).

Study Purpose

Self-management interventions have been shown to have long-term success, promote generalization (e.g., locations, domains), increase independence, and improve outcomes when combined with other evidence-based practices such as a peer mediation (e.g., Loftin et al. 2008; Parker and Kamps 2011). However, researchers have noted a dearth of inquiry into the effects of self-management interventions on academic engagement for adolescents with ASD (Carr et al. 2014; de Bruin et al. 2013). This lack of research is problematic because, as noted by Briesch et al. (2018), variations in self-management interventions (e.g., self-management package, setting, age of students) are associated with differences in effect sizes. Consequently, research does not show that outcomes are generalizable to novel settings or students. Therefore, practitioners may benefit from further research that is representative of the diverse student populations that they serve.

To add to the research base on self-management interventions for high school students and to provide research for practitioners to use, this study implemented a self-management with peer trainer (SM + PT) intervention for two high school students with ASD. Additionally, this study included a peer trainer with ASD (described later in this paper) for several reasons. First, the peer trainer with ASD was readily available for the training day, without disruption to his schedule. Second, previous peer mediation research has found benefits to both the tutors with a disability and tutees with a disability (Cochran et al. 1993; Kamps et al. 1999; Silverman et al. 2017; Watts et al. 2018). Finally, using a peer trainer enabled students (i.e., trainer with ASD and trainees with ASD) additional time to interact with peers.

Based on research-based components of self-management interventions, such as self-monitoring, self-recording, peer mediation, and reinforcement, we developed and conducted an SM + PT intervention for two high school students with ASD. We conducted this study to answer three research questions. First, what are the effects of an SM + PT intervention on the academic engagement of two high school students with ASD? Second, what are the special education teacher and student perceptions of this intervention? Third, to what extent would the peer trainer with ASD be able to implement the first day of a 2-day self-management intervention training with fidelity?

We hypothesized that the SM + PT intervention would improve academic engagement for the two students with ASD. We also hypothesized that the special education teacher and students would find the intervention feasible and useful. Finally, we hypothesized that the peer trainer with ASD would be able to successfully implement the training session. Findings from this study will add to the limited research on self-management interventions for high school students with ASD. Furthermore, this study will investigate the feasibility of using a student with ASD as a peer trainer to implement a single training session, which has the potential to benefit the students with ASD receiving the intervention and the peer trainer with ASD.

Method

Participants

Students were selected to participate in the study if they met the following criteria: (a) met the school district criteria for ASD (i.e., deficits in verbal and nonverbal communication and social interactions that negatively affected educational performance), (b) accessed the general education academic content for at least one period during the school day, (c) participated in a study skills period, (d) were selected by school staff members as needing behavioral supports, (e) agreed to participate in the study, and (f) were granted consent to participate by their parents. Pseudonyms will be used for all students in this study.

The first student, Andrew, was an 18-year-old Caucasian male in the 12th grade. Results from the Wechsler Intelligence Scale for Children—4th ed. (Wechsler 2003), completed that same academic year, indicated that Andrew had a full-scale IQ standard score of 99. Observations and teacher interviews indicated that Andrew had difficulty independently managing his materials, planning, organizing, monitoring his performance, beginning tasks, using classroom time productively, performing fine-motor skills required for writing, and using social skills. A school-district-administered functional behavior assessment (FBA) indicated that the function of Andrew's off-task behaviors (e.g., not beginning tasks when directed) during academic class time was escape and avoidance from academic tasks and access to attention. Based on Andrew's FBA, his individualized education program included goals related to increasing on-task behavior (i.e., academic engagement), completing classwork, and using a checklist to complete unfinished work.

The second student, Derek, was a 17-year-old Caucasian male in the 11th grade. The Wechsler Intelligence Scale for Children—4th ed. (Wechsler 2003), completed 2 years previously, indicated that Derek had a full-scale IQ standard score of 105. According to observation and interview data, Derek had difficulty initiating and completing tasks on time, organizing his assignments, using fine-motor skills in writing, maintaining attention, and using social skills. A school-district-administered FBA indicated that the function of Derek's off-task behaviors (e.g., not beginning tasks when directed) were escape and avoidance from academic tasks. Similar to Andrew, and based on Derek's FBA, his individualized education program

included goals related to increasing on-task behavior (i.e., academic engagement), completing classwork, and using a checklist to complete unfinished work.

Setting

This study was conducted in a rural public high school outside a major metropolitan area in the southwestern USA. The high school had more than 2300 students, and 65% of these students were classified as economically disadvantaged. The students' ethnicities were 9% African-American, 49%, Caucasian, 41% Hispanic, and 1% other.

Sessions took place during a 50-min "study skills" class period in a special education setting. The study skills class was the first period of the day and included five students, one paraprofessional, and one female Caucasian special education teacher with a master's degree and 5 years of teaching experience. This class provided students with additional time and support to complete assignments from their general education classes.

Experimental Design

An ABAB single-case research design was used to evaluate the effects of this SM + PT intervention on academic engagement. The ABAB design consisted of baseline and self-management intervention phases. Results were interpreted using visual analysis to identify a causal relationship based on the WWC *Procedures and Standards Handbook* (Institute of Education Sciences [IES] 2017). Using these guidelines, we evaluated three within-phase and three between-adjacent-phase variables to determine the presence and direction of a causal relationship. The within-phase parameters included the level (i.e., mean score), the trend or slope, and the range or standard deviation of the data from the trend line. Between-adjacent-phase variables included immediacy of effect (i.e., how quickly a change in the pattern of the dependent variable occurred following a change in the independent variable), the degree of overlap (i.e., the proportion of overlap of data points between phases; lower percentage indicates greater effect), and consistency of data in similar phases (i.e., first and second self-management phases, first and second baseline phases). We assessed each case individually according to these guidelines. We characterized study findings as no evidence (study did not find three evidences of effect), moderate evidence (study found three evidences of effect and at least one demonstration of noneffect), or strong evidence (study found three evidences of effect and no noneffect) of a causal relationship.

Procedures

Baseline

The baseline phase was conducted during a study skills period and consisted of students walking into the classroom, sitting at their desk, and completing assigned

work from other classes. Typical classwork included completing multiple-choice worksheets, completing fill-in-the-blank worksheets, writing responses to open-ended questions, reading from an assigned book, and working on class projects.

Peer Trainer

The peer trainer was Sam, a 16-year-old Caucasian male with ASD in the 10th grade who participated in the special education teacher's study skills period during a different instructional block from the participants. The special education teacher recommended Sam to support a training session before the self-management intervention. The special education teacher stated that Sam could complete the task and that the task would provide Sam an opportunity to improve his communication and social skills.

Sam's individualized education program stated that he had average to above-average cognitive abilities and deficits in conversational language and social skills. Observation and interview data revealed that Sam had difficulty initiating and completing tasks on time, organizing his assignments, maintaining attention, and using social skills. Sam also engaged in inappropriate and aggressive interactions with peers.

Training the Peer Trainer

One day before the self-management intervention began, the special education teacher and lead author trained Sam, the peer trainer, in a 50-min session. The training session was divided into three parts and was based on several practices defined by Chan et al. (2009; e.g., verbal explanations, role-play).

During the first part of the training (approximately 20 min), the special education teacher and lead author taught Sam the components of the self-management intervention (described later) and operationally defined and demonstrated both appropriate behaviors (e.g., sitting in a chair, reading assigned materials) and inappropriate behaviors (e.g., talking to peers, staring at the ceiling). During this section of the training, the special education teacher and lead author explained that when students arrive, they are to sit down, identify the items that needed to be completed for the day, write their name, date, and tasks on their to-do list (see Fig. 1), and ask

Name: Andrew		**Date:** 5/26
	X When Completed	**Items to Complete**
1.	X	Complete math worksheet.
2.	X	Read chapter 17 and answer questions at the end of the chapter.
3.		
4.		
5.		

Fig. 1 Student to-do list example

Name: Andrew					
Goal	**Monday 5/26**	**Tuesday 5/27**	**Wednesday 5/28**	**Thursday 5/29**	**Friday 5/30**
1. I came in and sat down.	2	~~2~~ 1	2	2	2
2. I quickly began working on my checklist.	1	~~2~~ 1	2	2	2
3. I tried my best.	2	2	1	1	2
Adult agrees? Yes = 2; No = 0	2	0	2	2	2
Total points	7	4	7	7	8
Student prize (6 points)? Circle one	Yes No	Yes No	Yes No	Yes No	Yes No

Fig. 2 Completed student self-management form example

for special education teacher support when needed. Behaviors, as listed on the self-management form (see Fig. 2), were described and modeled (e.g., "I came in and sat down.").

Next, Sam was given example assignments and asked to complete a to-do list by writing his name, date, and example assignments (see Fig. 1). Once Sam completed the to-do list, the special education teachers modeled behaviors and Sam completed the self-management form based on the modeled behaviors (see Fig. 2). The evaluation of the special education teacher-modeled behaviors was discussed, and Sam completed the remaining sections of the self-management form.

During the second part of the training (approximately 10 min), the special education teacher and lead author used the to-do list and self-management form (see Figs. 1, 2) to describe to Sam the five required student training components. The first component was to discuss and model appropriate behaviors as described on the self-management form. The second and third components were to explain the use of the to-do list (see Fig. 1) and self-management form (see Fig. 2), respectively. The last two components had the peer trainer provide a practice scenario to students, to allow them to complete the to-do list and self-management forms. During the final two components, the peer trainer was to provide feedback and rewards for appropriate behaviors, as designated by the intervention. Finally, the special education teacher, lead author, and Sam discussed research-based instructional practices to increase student engagement. Specifically, the importance of using explicit language, prompting, and delivering behavior-contingent praise was emphasized (Chan et al. 2009; Simonsen et al. 2008).

During the third and final part of the training, Sam led a 20-min abbreviated training session for the special education teacher and lead author, as previously described. In addition to the training, the night before the presentation, Sam voluntarily prepared notes for the presentation and practiced at home. The morning of the student training, Sam arrived 30 min before school. During this time, Sam continued to practice his student training, ask questions, and prepare his materials.

Student Training

Two 50-min training sessions were conducted before the self-management intervention phase and after the initial baseline phase. Andrew and Derek received the training concurrently. Sam, the peer trainer, led the first day of training with the special education teacher's support. Observation data were collected on Sam's ability to complete the first day of training as previously described. Treatment (or training) integrity (TI; Lane et al. 2004) information is provided later in this paper.

On day 2 of the training, the lead author, special education teacher, and paraprofessional led a 15-min review of the expectations for the entire self-management intervention. After the review, students worked on a short assignment in which they filled out the to-do list, completed a 10-min scaffolded activity (i.e., task difficulty reduced, task length reduced), completed the self-management form, and received preferred activity time. Before the intervention, students were required to meet a minimum of 90% accuracy in completing a self-management form (e.g., completed form, accurate self-evaluation). This requirement was met on each student's first attempt. Due to the amount of peer- and adult-led activities during the two days of training, academic engagement was not recorded.

SM + PT Intervention

The intervention was based on self-management techniques described by Koegel and Koegel (1995). These techniques consisted of (a) operationally defining all target behaviors; (b) identifying reinforcers to be earned for meeting a specified goal; (c) designing a self-management system (completed by the lead author and classroom special education teacher prior to the training; see Figs. 1 and 2); (d) teaching the participants to use the self-management system, allowing them to self-monitor, self-record, and self-evaluate (Southall and Gast 2011); and (e) teaching the participants to be independent in the use of the self-management system.

Target behaviors were operationally defined in two phases. First, students noted what assignments were to be accomplished during the study skills period by completing their to-do list (see Fig. 1). The to-do list acted as a visual prompt to remind students of the work completion expectations. Students put an *X* next to items when completed. The special education teacher or paraprofessional in the classroom supported students in identifying the assignments to be completed during the study skills period based on required work from other courses and a reasonable workload for the time allotted. Over the course of the intervention, Andrew averaged 1.33 (SD = 0.71, range = 1–3) items on his to-do list per day, and Derek averaged 1.43 (SD = 0.53, range = 1–2) items per day. Examples of student work included completing physics tests and answering reading comprehension questions from an assigned novel. To provide a naturalistic environment for the SM + PT intervention, we did not control for number or difficulty of tasks on the to-do list.

To further operationally define target behaviors, after completing the daily to-do list, students reviewed their goals, or appropriate behaviors, with a special education teacher or paraprofessional. These goals were (a) "I came in and sat down,"

(b) "I began working on my checklist and completed all my work," and (c) "I tried my best." Students were reminded daily of their goals, providing additional teaching of the self-management intervention expectations. After the 100% accurate completion (verified by the special education teacher or paraprofessional) of the tasks on the to-do list, the students identified a preferred task to be earned (e.g., talking to teacher, playing a game on a cell phone). Once earned, students could do their preferred task for the remainder of that class period only. By providing access to a desired activity for task completion, the maintaining consequence of the intervention addressed Andrew and Derek's escape- and avoidance-maintained challenging behaviors.

Throughout the study skills period, the special education teacher and paraprofessionals were available to answer questions and support the students' work, just as during the baseline phases. When all items on the to-do list were completed or the study skills period concluded, Andrew and Derek used the self-management form to evaluate themselves on their goals. The self-evaluation was based on a three-point scale of 0: did not meet the goal, 1: almost met the goal, or 2: met the goal.

Finally, to build further independence in their self-evaluations, the special education teacher or a paraprofessional evaluated the accuracy of the participant's responses on the self-management form. If the participant was accurate (i.e., agreement between the participant and special education teacher scores), two additional points were awarded. This procedure acted as reinforcement for accurate self-evaluation. If special education teacher disagreed with the student's evaluation, the special education teacher's score was recorded and the student's score was considered invalid.

Class Money, the classroom's token economy, was awarded when students earned six points in a single study skills class period. Class Money could be exchanged for items in the class store that day or stored for later use. The Class Money was available during baseline conditions, although there were no set procedures on how or when students earned Class Money. During the baseline session observations, no Class Money was discussed or earned by students. Based on school-administered FBAs, neither Andrew nor Derek had access to tangible-maintained challenging behaviors, and therefore the Class Money was not a function-based reinforcement system. Because Andrew and Derek stated before the intervention that they enjoyed earning Class Money, we used it to increase buy-in and to avoid the risk of viewing the intervention as resulting in a loss of a class privilege.

Data Collection and Interobserver Agreement

All observations were video-recorded prior to coding. Each session began when the first-period bell rang (unless the student had indicated that he would like to begin work earlier) and the student was seated for 30 consecutive seconds. If students filled out the to-do list or the special education teacher or paraprofessional reviewed the goals within the 30-min observation period, the presence or absence of academic engagement was recorded during these activities. Coding sessions ended after 30 min of class observations. Sessions of less than 30 min were excluded from

the analysis. A total of ten sessions ended prior to 30 min due to family (e.g., parent pickup) or school (e.g., school testing) reasons. No sessions ended prior to 30 min due to students completing their work and their self-monitoring form being reviewed by a special education teacher or paraprofessional. Due to sessions ending early, five data points were excluded for Andrew, all from the first baseline. Five data points were also excluded for Derek, with one data point from the first self-management condition, one session during the second baseline condition, and three sessions from the second self-management session.

Coding for interobserver agreement (IOA) used observation data from the video-recorded sessions. Prior to this study, the lead author trained one graduate student to reliably record academic engagement using a 10-s whole-interval recording system. Interval-by-interval comparisons were used to calculate IOA. This calculation summed the number of intervals with agreements, divided the resulting sum by the total number of intervals (i.e., agreements plus disagreements), and converted the result to a percentage. IOA was conducted on an average of 48% (SD = 8%, range: 33–60%) of the sessions per phase. Across both students, IOA averaged 93% (SD = 5%, range: 83–98%). For Andrew's sessions, IOA averaged 92% (SD = 5%, range: 83–98%). For Derek's sessions, IOA averaged 94% (SD = 5%, range: 83–98%). See Table 1 for IOA by student and phase.

Dependent Variable

Academic engagement was defined as (a) having eyes oriented toward an assignment or the teacher during instruction, directions, or on-topic comments or questions; (b) working on an assigned task; (c) using the materials appropriately (e.g., writing on paper with a pencil, entering numbers into a calculator, reading a book, opening a binder); (d) appropriately asking the teacher for assistance; and (e) interacting with teachers or peers about academic topics relevant to completing assignments. Academic engagement behaviors did not include (a) asking about or engaging with off-topic subject matter; (b) organizing materials; (c) turning pages in a book, except when required by the task; and (d) being out of seat.

Table 1 Study results by student and phase

Student	Phase	AE% *M* (SD)	Overlap %[a]	IOA % *M* (SD)	TI % *M* (SD)
Andrew	Baseline 1	22 (9)		94 (4)	0 (0)
	Intervention 1	51 (16)	25	91 (11)	100 (0)
	Baseline 2	44 (26)	100	94 (6)	0 (0)
	Intervention 2	74 (4)	100	95 (5)	81 (38)
Derek	Baseline 1	28 (24)		93 (9)	0 (0)
	Intervention 1	79 (10)	0	93 (0)	100 (0)
	Baseline 2	51 (28)	25	96 (1)	0 (0)
	Intervention 2	88 (13)	0	94 (0)	100 (0)

AE academic engagement, *IOA* interobserver agreement, *TI* treatment integrity

[a]Percentage of overlapping data contrasting the identified to the previous phase

Treatment Integrity

Direct observation methods of treatment integrity (TI; Lane et al. 2004) were used to evaluate all intervention sessions. Based on the direct observation methods, the lead author created a "treatment integrity protocol" with four operational definitions of the intervention components. The treatment integrity protocol identified the absence or presence of the students completing the to-do list, students self-evaluating, the special education teacher or paraprofessional reviewing the goals, and a point value being assigned to the student followed by a delivery of a reinforcer, if applicable. Next, the lead author trained a graduate student to code sessions by identifying and documenting the presence of each treatment component on the protocol with a 1 or the absence of each component with a 0. Both the lead author and the graduate student coded all sessions. IOA on TI was 100% in all cases.

To calculate TI, the number of intervention components implemented was divided by the total possible number of intervention components and multiplied by 100%. TI across all intervention sessions averaged 95% (SD = 19%, range: 25–100%) for both Andrew and Derek. Across all intervention sessions, Andrew's sessions averaged 91% (SD = 27%, range: 25–100%) and Derek's sessions was 100% in all cases. On Andrew's last session, the paraprofessional did not distribute the self-management form, making this the only session with TI not equaling 100%. During all baseline sessions, the treatment was not present; therefore, TI averaged 0% in all cases. See Table 1 for TI by student and phase.

TI was also collected for the student-led first day of training. Sam completed all five required training session components. Therefore, TI was at 100% for this single session.

Social Validity

Following the study, the special education teacher and students completed an adapted version of a social validity questionnaire (Chafouleas et al. 2009). The questionnaire was adapted to reflect the appropriate population and intervention of the study. The teacher survey contained 22 questions with a six-point Likert-type scale. Scores ranged from 1 representing *strongly disagree* to 6 representing *strongly agree*. The questions encompassed three topics: (1) training, coaching, and support; (2) feasibility and acceptability; and (3) usefulness and effectiveness. The student questionnaire had five questions with three possible responses: *yes*, *not sure*, and *no*. Questions targeted student perception of the effectiveness of the intervention to improve schoolwork skills, perception of generalizability to home, and general attitudes toward the intervention and its implementation. The five questions were (1) "I think working on this skill helped me in school," (2) "I think working on this skill helped me at home," (3) "I liked working on this skill," (4) "The way that the teachers worked with me helped me to improve my skills," and (5) "I would like to learn more skills to help me become more independent."

Results

For Andrew, Table 1 shows the mean percentage and standard deviations of intervals of academic engagement per phase and Fig. 3 displays the percentage of intervals of academic engagement per session. During the initial baseline phase, Andrew displayed relatively low and stable percentages of academic engagement ($M = 22\%$, SD = 9%, range: 13–35%). During the self-management intervention phase, academic engagement increased with a stable positive trend ($M = 51\%$, SD = 16%, range: 31–68%). During this phase, on Andrew's three self-management form goals, he earned 100%, 83%, 67%, and 83% of the points possible, sequentially across the four sessions. After an initial decrease in academic engagement, upon introduction of the second baseline phase, academic engagement had a decreasing trend with high overlap between phases ($M = 44\%$, SD = 26%, range: 13–78%). It is unclear why the first data point on the second baseline phase demonstrated such an abrupt decrease in academic engagement. When the intervention phase was reintroduced, academic engagement immediately increased to 77%, maintained a stable flat trend with low levels of variability, and the highest average level of any phase ($M = 73\%$, SD = 4%, range: 68–77%). During this phase, on Andrew's three self-management form goals, he earned 50%, 83%, 67%, and 83% of the points possible, sequentially across the four sessions. The first session of this phase was the only day Andrew did not make his point goal. From baseline to the first self-management phase, the percentage of overlapping data was 25%. From the second baseline phase to the first self-management phase and the second self-management phase to the second baseline phase, the percentages of overlapping data were 100%. This high overlap was due to the data in the second baseline phase beginning with a high level of academic engagement (78%) prior to a steady declining trend.

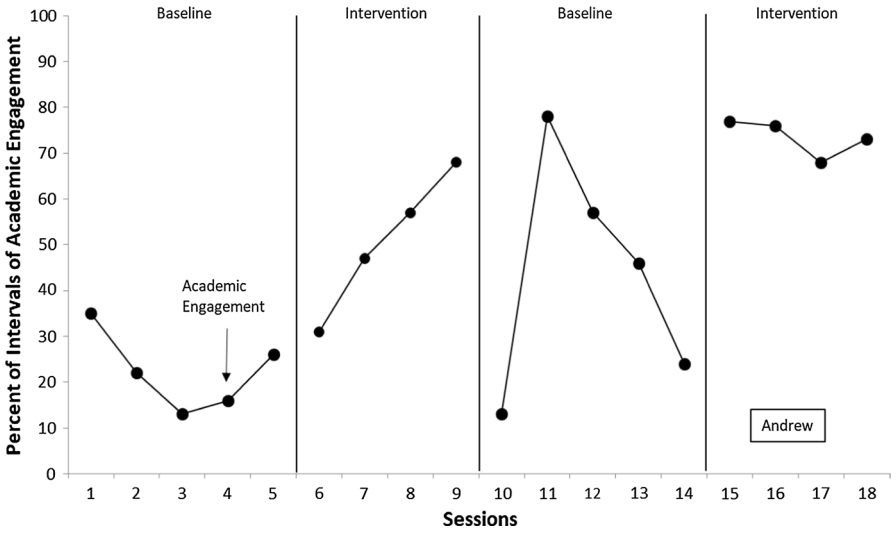

Fig. 3 Percentage of intervals of academic engagement for Andrew

Based on the WWC *Procedures and Standards Handbook* for evaluating single-case design outcomes (IES 2017), data for Andrew provided evidence of three demonstrations of effect with level, trend, and variability. For Andrew, there were also clear demonstrations of noneffect in the baseline phases, in that there was a lack of clearly defined pattern of responding (i.e., slight upward trend in the last two data points of the first baseline phase, outlier first data point in the second baseline phase). Additionally, the clearest demonstrations of effect are demonstrated from the first intervention phase to the second baseline line phase (based on trend line) and both baseline phases compared to the second intervention phase (based on level and trend). Based on the WWC guidelines, the data for Andrew demonstrates moderate evidence of a causal relationship.

For Derek, Table 1 shows the mean percentage and standard deviations of intervals of academic engagement per phase and Fig. 4 displays the percentage of intervals of academic engagement per session. During the initial baseline phase, Derek displayed relatively low levels of academic engagement with high variability ($M = 28\%$, SD = 24%, range: 2–63%). During the initial intervention phase, an immediate increase in academic engagement level was observed ($M = 79\%$, SD = 10%, range: 68–94%) with a slightly increasing trend and relatively less variability than the initial baseline phase. During this phase, on Derek's three self-management form goals, he earned 100%, 100%, 100%, 100% and 83% of the points possible, sequentially across the five sessions. When the intervention was withdrawn, academic engagement immediately decreased to 59% for two sessions, increased to 76%, then decreased to 10%. As compared to the first intervention phase, the second baseline phase also had a lower level of academic engagement, increased variability, and a decreasing trend ($M = 51\%$, SD = 28%, range: 10–76%). After four sessions in the

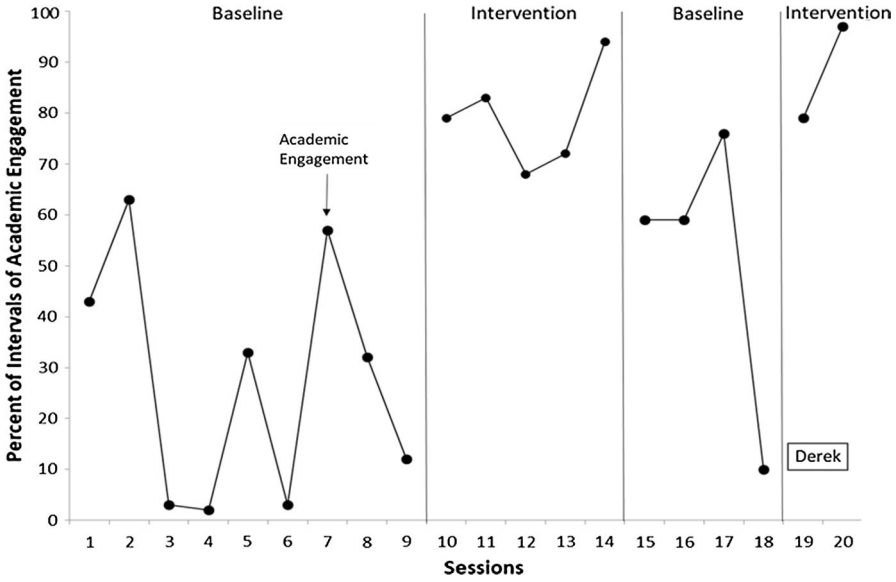

Fig. 4 Percentage of intervals of academic engagement for Derek

second baseline phase, the self-management intervention was reintroduced. During the second self-management phase, academic engagement immediately increased to 79% and then 97%. During this phase, on Derek's three self-management form goals, he earned 100% and 100% of the points possible, sequentially across the two sessions. As compared to the second baseline phase, the second self-management phase included a higher level ($M = 88\%$; SD = 13%, range: 79–97%), although variability and trend could not be determined due to a lack of data points. From baseline to the first self-management phase, the percentage of overlapping data was 0%. From the first self-management phase to the second baseline, the percentage of overlapping data was 25%, and from the second baseline to the second self-management phase, the percentage of overlapping data was 0%.

Based on the WWC *Procedures and Standards Handbook* for evaluating single-case design outcomes (IES 2017), the data for Derek provided evidence for three demonstrations of effect with trend, variability, and immediacy of effect. There were also clear demonstrations of noneffect in the baseline phases for Derek, based on a lack of a clearly defined pattern of responding (i.e., high variability in the first baseline phase, outlier last data point in the second baseline phase). There was also not a clear demonstration that the two intervention phases had a higher level than the second baseline phase, despite a clear increase in level from the first baseline to the first and second intervention phases. Additionally, the clearest demonstrations of effect are higher levels in the intervention phases compared to the baseline phases and a decrease in variability upon entering the intervention phases. Based on the WWC guidelines, the data for Derek demonstrates moderate evidence of a causal relationship.

Social Validity

To examine social validity, the participating special education teacher and students completed an adapted version of a social validity questionnaire (Chafouleas et al. 2009). The special education teacher used a six-point Likert-type scale to respond to the questionnaire. The average special education teacher rating for training, coaching, and support was 4.75 (SD = 1.49, range: 2–6); for feasibility and acceptability was 5.57 (SD = 0.53, range: 5–6); and for usefulness and effectiveness was 5.57 (SD = 0.79, range: 4–6). When the students were asked about their perceptions of the intervention in the social validity measure, Derek noted that he liked working on the self-management skills. All other responses indicated that the students were *not sure* how they felt about the intervention.

Discussion

Previous studies suggest that self-management interventions can improve adolescent academic and behavioral outcomes (Carr et al. 2014); however, a lack of research exists on the impact of self-management interventions on academic behaviors for adolescents with ASD (Carr et al. 2014; de Bruin et al. 2013). To

address this gap in the research, we investigated the impact of a SM + PT intervention on the academic engagement of two high school students with ASD. The intervention demonstrated moderate evidence of a causal relationship for both students in increasing academic engagement, with some previously noted evidence of noneffects. Results support earlier studies suggesting that self-management strategies (e.g., Koegel et al. 1999; State and Kern 2011) and self-management strategies using a peer component (Carr et al. 2014) improve target behaviors.

The TI results suggest that the treatment components were implemented consistently, with the TI data across all treatment sessions averaging 96% (SD = 16%, range: 25–100%). The only session without a 100% TI was the final treatment session for Andrew. This low TI session occurred on the school's last day of academic instruction, which may have led to the paraprofessional being distracted. Regardless of the cause, low TI suggests a need for additional training to ensure that interventions are implemented as designed.

Teacher social validity results indicated that the intervention was feasible, acceptable, useful, and effective. Specifically, the special education teacher reported that this intervention required a manageable amount of time to implement, was not disruptive to other students, and was appropriate for her students. She *strongly agreed* that she would use this intervention in the future. The student social validity data were inconclusive and may have benefited from personal interviews to prompt additional responses and garner information that was not available on the survey.

Sam, the peer trainer with ASD, led the first day of training with 100% treatment (or training) integrity. This finding suggests that it is possible for a peer with ASD to deliver self-management intervention training. Furthermore, Sam, who previously demonstrated difficulty using social skills and engaged in inappropriate and aggressive interactions with peers, appeared motivated by his role as a peer trainer, affording him opportunities to appropriately engage with peers. Sam also showed willingness to participate in the study, highlighted by practicing for the training during his lunch period, at home, and before school. He did all of these tasks voluntarily, leading to increased practice of his communication and social skills.

In designing the SM + PT intervention, we aimed to address Andrew and Derek's escape- and avoidance-maintained challenging behaviors. First, we aimed to reinforce appropriate, on-task behaviors, as stated by the goals on the self-management form. Then, if Andrew or Derek completed their work during an SM + PT intervention phase, the maintaining consequence of escape from an academic task remained, with a preferred activity (e.g., playing a game on their phone). In other words, if Andrew or Derek chose not to complete the academic tasks, they were able to escape or avoid academic tasks and do a less preferred task (e.g., sitting and staring blankly at a book). Although Andrew and Derek could also chose to complete the academic task and then engage in escape from academic tasks, with more preferred task (e.g., playing a game on their phone), thus meeting the same function of the challenging behaviors. Finally, in designing the intervention, we operationally defined expected behaviors and included visual prompts, self-monitoring, and self-recording, all of which were shown to be effective with middle school students with ASD (Carr et al. 2014).

The SM + PT intervention was also designed to be practical. This study was implemented in a public high school setting. It was low cost, explicit, and easily modifiable based on student work demands, time constraints, or the need to change goals. We did not change any goals on the self-management form, but it is possible to change goals to align to changing learner needs.

Finally, this study did not see an association between each student's points earned and level of academic engagement. However, Derek earned more points on his self-management forms and had overall higher levels of engagement than Andrew. This finding suggests that the self-management form may need to be adjusted in future research to better facilitate academic engagement.

Limitations

The limitations of this study are consistent with difficulties associated with working in a public school setting in which interruptions occur due to planned and unplanned school activities. Additionally, teacher-generated assignments can vary in interest level, length, and complexity. The aim of this study was to test the efficacy of the SM + PT intervention for student engagement in an environment that students naturally experience. This study was held during a study skills period, and the tasks could be from any of the students' subjects. We did not attempt to control naturally occurring assignment variations such as student interest level, length, or complexity. This assignment variation was not measured and may have led to variation in the students' academic engagement levels. It may be worth exploring in future research the length, complexity, and student interest level of the assignments and how these features are associated with academic engagement.

The evaluation of the causal relationship for both Andrew and Derek should consider the second baseline phase's higher levels of academic engagement (as compared to the first baseline phase), outlier data points, and concerns about determining the functional relationship between specific components of the intervention and academic engagement. The inconsistent patterns across the first and second baseline phases for each student may suggest that a withdrawal design was not best suited to demonstrate a causal relationship for the SM + PT intervention. A greater demonstration of a causal relationship may have been achieved through a multiple-baseline design, similar to the self-management intervention study by Holifield et al. (2010). It is also possible that withdrawing the intervention did not produce immediate changes in academic engagement and that additional data points in the second baseline and self-management phases would have allowed a clearer relationship between the intervention and academic engagement to emerge.

When evaluating the functional relationship of the SM + PT treatment package, it is unclear what effect, if any, the peer training or additional reinforcements (e.g., preferred activity time) had on academic engagement in addition to or separate from the self-management intervention. This study was unable to identify the extent to which the reinforcement with the self-management improved academic engagement as compared to self-management alone or alternative reinforcement alone. Additionally, the peer training occurred before the self-management, precluding

an ability to determine a functional relationship between the peer training and academic engagement.

Additional data may have also allowed for further conclusions to be drawn from this study. Data on the generalization and maintenance of skills may have provided valuable information. Unfortunately, collecting additional data after the second intervention phase was not possible due to the school calendar. Collecting communication or social skills data on Sam may have allowed us to evaluate the impact of peer training on Sam's outcomes, particularly as previous research has found that tutors as well as tutees can benefit from peer-mediated interventions. Finally, conducting an independent ASD evaluation on Andrew, Derek, and Sam may have allowed a better understanding of the student characteristics, although from a behavioral perspective, the participants' constellation of problematic behavior topographies was similar to other studies using the term *ASD* (e.g., Cihak et al. 2010; Clemons et al. 2016).

Implications for Future Research and Practice

As noted by Briesch et al. (2018), self-management intervention research is still needed, as outcomes vary by treatment components, settings, and participants and there are no "one-size-fits-all" self-management interventions. Therefore, despite the stated limitations, findings from this study, implemented with high levels of TI, allowed for researchers to increase their understanding of self-management interventions (Tincani and Travers 2018). Findings could also allow practitioners to consider using this treatment package in a similar setting with similar students (Briesch et al. 2018).

There is also promise for future research to explore extensions and variations of this SM + PT intervention in different settings (e.g., general education), with varying assignment difficulties, and with students with differing cognitive and academic abilities. Studies may also evaluate the impact of the individual components of the intervention (e.g., peer training) and their social validity. Future studies could systematically decrease teacher involvement in instruction and implementation. This modification may identify the extent to which teacher support affects outcomes and increase student independence in the use of self-management interventions. Even though the present study did not collect social validity or social or communication skill data for the peer trainer before or after the training session, the finding that peers with ASD can provide a training with fidelity is promising for future research and may lead to a peer trainer with ASD playing a larger role (e.g., participating in daily intervention sessions) in future studies. Future replications and variations of this study may also explore increasing the internal validity of the study through greater control of session length and assignment difficulty. Finally, it is prudent to assess effective means to increase student independence by fading support and to assess maintenance and generalization across settings.

Findings from this research also provide insights for future interventions for special education teachers and practitioners who work with students with ASD. Even though this intervention was relatively short, with seven to eight intervention

sessions per student, practitioners could use a self-management intervention, such as the one in this study, as a framework to meet individual student needs. Practitioners also could measure the intervention's effectiveness in both special education and general education settings. Incorporating a peer trainer with ASD may also motivate students to practice social and communication skills, as was anecdotally witnessed in this study. Finally, it is important to have ongoing or booster training sessions for implementers to guard against reductions in treatment integrity when implementing interventions similar to the one used in this study. The drop in treatment integrity we experienced in the last session could have been avoided through such additional training.

Overall, this study addressed a gap in the research investigating the impact of self-management interventions on the engagement of high school students with ASD. Results from this study hold promise for increasing the academic engagement of students with ASD and for using peer trainers with ASD in a self-management intervention. Further research examining the effects of self-management interventions for high school students with ASD is warranted, as little research is available on how to improve academic engagement for this subgroup of students.

Funding This study was funded by the Institute of Education Sciences, U.S. Department of Education, through Grant R324C120006. The opinions expressed represent those of the authors and do not represent the views of the Institute of Education Sciences or the U.S. Department of Education.

Compliance with Ethical Standards

Conflict of interest The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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