RESEARCH ARTICLE

Improving On-Task Behavior in Middle School Students With Disabilities Using Activity Schedules

Stephanie L. Mattson¹ · Sarah E. Pinkelman¹

Published online: 30 July 2019

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Abstract

Middle school students receiving special education services for specific learning disabilities and other health impairments often struggle to remain on task and meet independent work demands. Although a variety of strategies have been documented as effective in improving on-task behavior in students with disabilities, most are not contextually appropriate for public schools. Activity schedules may provide an efficient, minimally intrusive, and low-effort intervention for middle school classrooms. In this study, a concurrent multiple-baseline design across participants with an embedded reversal was used to examine the effects of activity schedules on the on-task and on-schedule behavior of four middle school students with disabilities in a resource classroom. Results demonstrate increased on-task and on-schedule behavior for all participants in math and language arts settings, and students and teachers indicated both that they enjoyed the activity schedule and that it improved on-task behavior and work completion. Implications for practice and future research are discussed.

Keywords activity schedule · learning disabilities · middle school · other health impairment · on-task behavior

Students who receive special education services under specific learning disability (SLD) and other health impairment (OHI) classifications struggle to meet the academic expectations of middle school (Wagner, Newman, Cameto, & Levine, 2006). As students enter middle school, teachers expect them to attend to instruction, follow complex directions, and work independently. However, students with disabilities have difficulty remaining on task and completing assignments, particularly when asked to work independently (Bryan & Gast, 2000; Lloyd, Hallahan, Kosiewicz, & Kneidler, 1982). Such behavior impacts the extent

to which students with disabilities access grade-level curriculum, which is essential to academic success in school. Students with SLD and OHI classifications make up 48% of the students who qualify for services under the Individuals with Disabilities Education Improvement Act (IDEIA, 2004; Kena et al., 2016), and this large proportion of students are increasingly participating in regular education settings (McLeskey, Landers, Williamson, & Hoppey, 2012). Given the academic work demands in both resource and regular education settings, it is crucial that students remain on task and complete assigned work.

A variety of strategies have been used to improve behavioral outcomes for students with disabilities in school settings. Token economies (Kazdin, 2001) are an example of a common intervention used to improve student behavior in schools (Filcheck, McNeil, Greco, & Bernard, 2004; Matson & Boisjoli, 2009). Token economies have been used in a variety of classroom settings, and some studies have found token economies to be effective in improving the on-task behavior of students with disabilities (Carnett et al., 2014; Kazdin & Geesey, 1980). Other interventions that have been used to increase student on-task behavior are group contingencies (Maggin, Johnson, Chafouleas, Ruberto, & Berggren, 2012). Group contingencies involve teacher delivery of a preferred item or activity to a group of students contingent on the behavior of one or more students (Heering & Wilder, 2006).

Research Highlights

- Activity schedules are an effective intervention to increase on-task behavior during independent work time for middle school students with disabilities.
- Activity schedules can be implemented in middle school classrooms with minimal teacher prompting and involvement.
- The activity schedule intervention can generalize to other classroom settings with no additional training.
- Activity schedules are a socially valid intervention to increase on-task behavior for middle school students with disabilities.

✉ Sarah E. Pinkelman
sarah.pinkelman@usu.edu

¹ Department of Special Education and Rehabilitation, Utah State University, Logan, UT 84321, USA

Despite the efficacy of token economies and group contingencies in improving on-task behavior in students with disabilities, these strategies require a significant amount of teacher involvement, which may not be feasible in educational settings such as middle school classrooms with large class sizes and limited resources.

Researchers have also increased student on-task behavior using self-monitoring and activity schedule interventions, which minimize teacher involvement and facilitate student independence. Self-monitoring has been used to effectively increase on-task behavior and task completion for adolescents with learning disabilities, attention deficit hyperactivity disorder (ADHD), and behavior disorders (Axelrod, Elizabeth, Haugen, & Klein, 2009; Shimabukuro, Prater, Jenkins, & Edelen-Smith, 1999). Self-monitoring typically includes self-observation and self-recording, where students discriminate whether a target behavior has occurred and record instances of the behavior (Harris, 1986). Self-monitoring is effective, but the self-observation and data collection aspects may not be practical in middle school classrooms because of existing environmental demands. For example, middle school students with disabilities, particularly those who participate in regular education classes (such as students with SLD and OHI classifications), are expected to engage in high-level academic tasks during independent work time. As a result, it may not be reasonable to increase response effort by adding self-observation and data collection responsibilities to existing expectations.

Activity schedules, defined as a “set of pictures or words that cue a person to engage in a sequence of activities” (McClannahan & Krantz, 1999, p. 3), may be a promising alternative to interventions that require extensive teacher involvement or increased student effort. Activity schedules have been used to teach independence in many areas, including social behavior (e.g., Krantz, MacDuff, & McClannahan, 1993), daily living skills (e.g., Pierce & Schreibman, 1994; Wacker, Berg, Berrie, & Swatta, 1985), and on-task behavior (e.g., Bryan & Gast, 2000; MacDuff, Krantz, & McClannahan, 1993). Research with individuals with disabilities demonstrates that activity schedules are an effective way to increase on-task behavior in both self-contained and resource classroom settings (e.g., Bryan & Gast, 2000; Carson, Gast, & Ayres, 2008; Spriggs, Gast, & Ayres, 2007). However, the schedule-teaching and prompting procedures used in these studies may not be appropriate for adolescent students in resource and regular education classrooms. Students in these settings present a more sophisticated behavioral repertoire than participants in much of the activity schedule research, such that graduated guidance and physical prompting is not only unnecessary but also inappropriate. To address this issue, Cirelli, Sidener, Reeve, and Reeve (2016) used modeling, verbal directions, and other types of prompts (gestural, verbal, and model prompts) to

implement activity schedules with elementary-aged students at risk for ADHD in a regular education classroom. This research presented some preliminary evidence of the efficacy of using less intrusive prompting and teaching procedures to implement activity schedules for students with high-incidence disabilities.

Although previous research demonstrates that activity schedules can increase on-task behavior for students with developmental disabilities (e.g., Bryan & Gast, 2000) and students at risk for ADHD (Cirelli et al., 2016), no studies have implemented activity schedules during independent work time for middle school students with SLD and OHI classifications. Therefore, the purpose of this study was to examine the effects of activity schedules on on-task academic and on-schedule behaviors of 12- to 14-year-old students with SLD and OHI classifications during independent work time.

Method

Participants and Setting

Four seventh-grade students participated in this study. Students were selected for initial observation based on classroom teacher referral. To be eligible for participation, students had to (a) receive special education math services in a resource classroom, (b) attend school regularly (no more than 12 absences in the previous trimester), and (c) engage in on-task behavior (defined as head orientation within approximately 45° of the worksheet or other materials, including manipulating work materials as they were designed to be used) in 69% or less of 10-s intervals across three initial 15-min observations during independent work time, as measured by momentary time sampling.

Ronald was a 13-year-old, White, English-speaking male in seventh grade. Ronald received special education services for math, writing, and study skills in a resource classroom under the classification of SLD. Prior to the study, Ronald demonstrated mastery across ratio, proportion, and geometry math skills. He also performed several language arts skills proficiently, including answering figurative language questions, text structure questions, and text-dependent comprehension questions in multiple-choice, full-sentence, and paragraph formats. During the initial classroom observations, Ronald engaged in on-task behavior in 26%, 21%, and 21% of 10-s intervals.

Adam was a 13-year-old, White, English-speaking male in seventh grade. Adam received special education services for math under the classification of SLD. Aside from his math class, he spent the remainder of the school day in regular education classrooms. Prior to the study, Adam demonstrated mastery across integer operation, expression, equation, ratio, rate, proportion, and geometry math skills. He also performed

several language arts skills proficiently, including answering figurative language and text-dependent comprehension questions in multiple-choice, full-sentence, and paragraph formats and writing five-paragraph informational and argumentative essays. During the initial classroom observations, Adam engaged in on-task behavior in 48%, 44%, and 29% of 10-s intervals.

Miles was a 14-year-old, White, English-speaking male in seventh grade. Miles received special education services for math under the classification of SLD. Aside from his math class, he spent the remainder of the school day in regular education classrooms. Prior to the study, Miles demonstrated mastery across integer operation, expression, equation, ratio, rate, proportion, and geometry math skills. He also performed several language arts skills proficiently, including answering figurative language and text-dependent comprehension questions in multiple-choice, full-sentence, and paragraph formats and writing five-paragraph informational and argumentative essays. During the initial classroom observations, Miles engaged in on-task behavior in 42%, 51%, and 55% of 10-s intervals.

Anna was a 13-year-old, White, English-speaking female in seventh grade. Anna received special education services for math, reading fluency, reading comprehension, and writing under the classification of OHI (for ADHD). Prior to the study, Anna demonstrated mastery across integer operation, expression, equation, ratio, rate, and proportion math skills. She also performed several language arts skills proficiently, including answering figurative language questions, text structure questions, and text-dependent comprehension questions in multiple-choice, full-sentence, and paragraph formats. During the initial classroom observations, Anna engaged in on-task behavior in 59%, 46%, and 43% of 10-s intervals.

The study took place in a resource math classroom and two other teachers' language arts classrooms, all on a public middle school campus serving seventh- and eighth-grade students in the Intermountain West region of the United States. Sessions occurred in the participants' resource math classroom (10 m $\times$ 8 m) containing 15 student desks, a teacher's desk, and a large, rectangular table (2 m $\times$ 1 m). Generalization probes for Ronald and Anna were conducted in a resource language arts classroom (10 m $\times$ 8 m) containing 15 student desks, a teacher's desk, and two large, rectangular tables (2 m $\times$ 1 m). Generalization probes for Adam and Miles were conducted in a regular education language arts classroom (10 m $\times$ 8 m) containing 35 student desks, a teacher's desk, and a large, rectangular table (2 m $\times$ 1 m).

In the resource math classroom, the teacher provided instruction on seventh-grade regular education math concepts. A typical lesson during the resource math instructional block included review, presentation of new material, guided practice, and independent practice. During the independent practice portion of the instructional block, students completed

assigned math problems. If students completed the assigned work, they could read, draw, or sit quietly at their desks. Both the resource language arts and regular education language arts classrooms followed a similar structure. A typical lesson during the language arts instructional blocks during the time the researcher conducted this study included review, novel reading, novel discussion and guided practice, and independent practice. During the independent practice portion of the language arts instructional block, the students answered text-dependent comprehension questions based on novels they were reading in class.

Materials

Materials used in the study included academic worksheets, activity schedule binders, vibrating timers, pencils, erasers, and calculators. For all sessions, the researcher placed three academic worksheets with previously mastered skills on participants' desks. Worksheet problems were taken from a teacher-developed curriculum that was in alignment with seventh-grade regular education math and language arts state standards. Difference in response effort across worksheets was controlled for by only including questions that targeted mastered skills and by ensuring the problem types and the number of problems were consistent across all sessions and conditions. Each worksheet contained a heading that identified the unit in the curriculum and the category of the worksheet problems (i.e., "3.2—Simplifying Expressions"). In math, Adam, Miles, and Anna completed algebraic expression and equation problems and Ronald completed unit rate and proportion problems. In language arts, all participants produced one-sentence responses to text-dependent comprehension questions based on novels they were reading in class. Adam and Miles produced typed responses, and Ronald and Anna produced handwritten responses.

Participants used standard letter-size binders for activity schedules with six sheet-protector pages: three math (or language arts for generalization probes) pages and three break pages. Participants alternated between worksheet pages and break pages. Worksheet pages contained strips of paper that corresponded to the header of the math or language arts worksheets (i.e., "3.2—Simplifying Expressions"). Break pages contained index cards that read "Break—3 minutes." The purpose of including breaks was to allow participants to contact reinforcement for work completion, and offering breaks contingent on work completion was typical practice in the middle school setting.

Students used a standard timer with a vibration setting to time breaks. During activity schedule breaks, participants had access to drawing materials and books. In addition to the materials described previously, researchers provided participants with pencils, erasers, and calculators as needed to complete academic worksheet problems.

Measurement

On-task academic behavior and on-schedule behavior were the primary dependent measures. On-task academic behavior was defined as head orientation within approximately 45° of the worksheet or other materials, head and shoulders oriented toward materials, eyes open, and body positioned within 1 m of materials for a minimum of 3 s. This included manipulating any work materials such as a chart, calculator, and so on as they were designed to be used. On-task academic data were only collected while participants were completing academic worksheets (i.e., not while participants were on break).

On-schedule behavior was defined as (a) using any part of either hand to open the schedule at the beginning of the session or turn a page in the schedule following the completion of the previous page, (b) using either hand to match any part of the worksheet strip to the top heading of the corresponding worksheet on the desk, (c) completing worksheet problems (see the definition for on-task behavior), (d) using either hand to place the completed worksheet in either pocket of the folder, or (e) using any finger on either hand to click the minute button on a timer, click the start button, or take a break when on a break page. Participants were considered on break if they were sitting with their buttocks contacting the seat of the chair and with their feet on the floor, without making any vocalizations, including whispering, talking, or yelling, during a break time indicated by the activity schedule. Participants also had the option to read or draw during break time. Reading-on-break behavior was defined as head orientation within approximately 45° of reading materials, head and shoulders oriented toward reading materials, and body positioned within 1 m of reading materials, without making any vocalizations, including whispering, talking, or yelling. Drawing-on-break behavior was defined as manipulating any writing utensil to come into contact with a piece of paper, without making any vocalizations, including whispering, talking, or yelling. On-break behavior was only scored when participants were on activity schedule break pages. Researchers scored on-break behavior under the umbrella of on-schedule behavior for the purposes of graphing and data analysis.

Data collection occurred during independent practice, the last 15–20 min of the 52-min instructional block. Each experimental session was 15 min. Data collectors observed four to six sessions per week per participant using 10-s momentary time sampling to measure on-task academic and on-schedule behaviors. From these data, the percentage of intervals on task and on schedule were derived. To calculate the percentage of intervals on task, researchers divided the number of intervals on task by the number of intervals a participant was working on academic tasks (not on break) and multiplied the result by 100. To calculate the percentage of intervals on schedule, researchers divided the number intervals on schedule by the total number of intervals and multiplied the result by 100.

A second trained observer collected data on both dependent variables for a minimum of 30% of sessions in each condition across all participants. An agreement was recorded if both observers determined the participant was on task or on schedule during the same 10-s interval. Interobserver agreement (IOA) was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. Mean agreement for on-task academic behavior was 97% for Ronald (range 83%–100%), 95% for Adam (range 91%–99%), 96% for Miles (range 88%–100%), and 90% for Anna (range 87%–96%). Mean agreement for on-schedule behavior was 99% for Ronald (range 94%–100%), 98% for Adam (range 94%–100%), 98% for Miles (range 98%–100%), and 98% for Anna (range 90%–100%). Mean generalization probe agreement for on-task academic behavior was 88% for Ronald (range 81%–96%), 96% for Adam (range 90%–100%), 90% for Miles (range 87%–93%), and 85% for Anna (range 80%–92%). Mean generalization probe agreement for on-schedule behavior was 98% for Ronald (range 97%–100%), 96% for Adam (range 92%–100%), 100% for Miles, and 97% for Anna (range 91%–100%).

The second trained observer also collected treatment integrity data for a minimum of 33% of sessions for each condition across all participants. The observer used a checklist to record whether the researcher (a) had the activity schedule materials ready (i.e., activity schedule binder with timer inside underneath the participant's desk and three worksheets on the desk), (b) gave the initial direction at the beginning of the session ("It is time to do your math problems. If you complete your math problems, you can go on break."), and (c) used the appropriate prompting procedure, if needed. Treatment integrity scores were 100% across all conditions and participants.

To capture the extent to which participants were not only remaining on task but also completing mastered math and language arts problems correctly, researchers measured accuracy from permanent product academic worksheets. Accuracy was defined as the number of problems correct out of the number of problems attempted. Researchers scored a problem as correct if the participant wrote the correct solution to the math problem. A problem was scored as incorrect if the participant wrote the wrong answer, included additional numbers in the response, or if the participant's response was not legible. Language arts comprehension questions were scored as correct if the participant's response answered the comprehension question. A language arts question was marked as incorrect if the participant's response did not answer the comprehension question or if the response was not legible. Language arts comprehension questions were not graded based on conventions (i.e., spelling, punctuation, grammar). Once all problems were scored as correct or incorrect, the accuracy percentage was derived by dividing the number of problems correct by the number of problems attempted (correct and incorrect) and multiplying the result by 100. Accuracy percentages were

reported as a mean score across all sessions for each participant.

Social Validity

At the conclusion of the study, participants and language arts teachers completed a social validity questionnaire. The participant questionnaire contained seven items, and participants responded by ranking the statement on a scale from 1 to 5 (1 = *strongly disagree* to 5 = *strongly agree*). The teacher questionnaire contained five items and used the same ranking scale. Social validity was not assessed with the math teacher because one of the researchers was also the resource math teacher.

Procedures

A concurrent multiple-baseline across-participants design with an embedded reversal was used to examine the effects of activity schedules on on-task and on-schedule behaviors during independent work time. Conditions included baseline, schedule-use, no-schedule (reversal), and a final schedule-use condition with embedded generalization probes in the language arts setting across all conditions.

Baseline Each session began with three math worksheets on participants' desks and the activity schedule binder underneath the desks with class materials. Although it was unlikely that participants would use the activity schedule, it was set up with the strips that corresponded to worksheets and break pages. At the beginning of each session, the teacher gave the following directions to the class: "It is time to do your math problems. If you complete your math problems, you can go on break." No additional prompts were provided.

Schedule Training Schedule training occurred following the final baseline data point and prior to the first schedule-use data point. Adam, Miles, and Anna completed schedule training in 1 day (60 min) during the study hall class period following the last baseline data point. Ronald completed schedule training in 2 days (90 min). Schedule training was conducted in the resource math classroom during study hall so participants did not miss instruction or independent work time. To begin, the participant sat at a desk next to the researcher. The researcher explained how to use the schedule with the following directions: (a) when the teacher says, "It is time to do your math problems. If you complete your math problems, you can go on break," get your schedule from under your desk; (b) open the schedule; (c) turn a page in the schedule; (d) find the worksheet on your desk that matches the worksheet strip in the schedule; (e) complete your worksheet; (f) put the completed worksheet in your activity schedule binder; (g) turn the page in your schedule to the break page; (h) set the timer on

your desk for 3 min; (i) when the timer goes off, stop the timer; (j) turn the page in your activity schedule; and (k) repeat the process for finding the corresponding worksheet and completing it and taking a break for the remaining pages of the schedule. Next, the researcher provided an in vivo model of completing the activity schedule.

After the researcher provided directions and a model, the participant and researcher completed the schedule together and the researcher provided corrective feedback as necessary. At the end of schedule training, participants used the schedule three times independently after the researcher gave the direction from the baseline condition, "It is time to do your math problems. If you complete your math problems, you can go on break." Participants mastered schedule training when they completed three consecutive sessions with on-task and on-schedule behavior at 80% of intervals or higher.

A least-to-most prompting hierarchy (MacDuff et al., 1993) was used to correct errors during schedule training and the schedule-use condition. An error occurred if a participant turned to the wrong page in the activity schedule, engaged in behavior that matched a different page of the activity schedule, or was oriented toward the materials but did not contact the paper to answer a question within 60 s. If an error occurred, the researcher provided prompts as follows: (a) gestural prompt, (b) indirect verbal prompt, and (c) direct verbal prompt. For example, if a participant did not turn the page of the activity schedule after finishing the first academic worksheet, the researcher pointed to the page of the activity schedule. If the participant did not respond to the gestural prompt, the researcher provided an indirect verbal prompt such as, "What do you do next?" If the participant did not respond to the indirect verbal prompt, the researcher used a direct verbal prompt such as, "I need you to turn the page in your activity schedule." Each prompt was followed by the opportunity for the participant to engage in that step of the schedule independently. Physical prompts were not used in this study because it would not have been socially acceptable in the middle school setting. Participants did not require any prompts during independent schedule training sessions.

Schedule Use During the schedule-use condition, the teacher provided the same instruction as during baseline: "It is time to do your math problems. If you complete your math problems, you can go on break." The researcher used the most-to-least prompting hierarchy described previously to correct errors. Error correction was necessary twice in the schedule-use condition. Adam required one gestural prompt during Session 12 to turn the page in the schedule before starting his next math worksheet. Ronald required one gestural prompt during Session 10 to turn the page in the schedule from the first math page to the first break page before beginning his break.

No Schedule (reversal) The no-schedule condition was identical to baseline except the activity schedule was not available to participants.

Return to Schedule Use This condition was identical to the schedule-use condition. Error correction was necessary twice in the return-to-schedule-use condition. Adam required two gestural prompts (Sessions 19 and 22) to turn the page in the schedule before starting on the next math worksheet.

Generalization Probes Generalization probes occurred in a resource language arts classroom (Ronald and Anna) and a regular education language arts classroom (Adam and Miles). The activity schedule was set up in the same manner, but participants completed language arts worksheets, and each language arts teacher gave the following directions: “It is time to do your language arts work. If you complete your language arts work, you can go on break.” Data were collected in the same manner as the other conditions. Language arts teachers did not provide any additional prompts.

Results

Figure 1 displays the percentage of intervals on task and on schedule for all four participants in the resource math classroom and language arts classroom (generalization probes) across all conditions. Schedule-use data were not collected for Ronald on Sessions 6 and 7 because he was in schedule training until Session 8. Due to absences, data were not collected for Ronald on Sessions 16 and 17 or for Anna on Sessions 19 and 24. Final generalization probes were conducted 1 day prior to the last schedule-use session, because language arts teachers did not hold typical classes with independent work time on the final day of sessions (Session 29).

On-Task Academic and On-Schedule Behavior

As shown in Figure 1, all participants engaged in moderate-low levels of on-task academic behavior in baseline. Ronald’s data show a low, stable pattern of responding ranging from 0% to 10% of intervals on task. Adam engaged in moderate levels of on-task academic behavior (40%–50% of intervals on task) in the first two sessions of baseline, which decreased throughout the rest of the condition (0%–5% of intervals on-task). Miles’s data were low but slightly variable, ranging between 2% and 35% of intervals. Anna engaged in moderate, stable levels of on-task academic behavior ranging from 39% to 60% of intervals on task. During the schedule-use condition, levels of on-task academic behavior immediately increased and remained high and stable for all participants. Mean on-task academic behavior for Ronald, Adam, Miles, and Anna was 88%, 95%, 97%, and 82% of intervals, respectively. When the

Fig. 1 On-task academic and on-schedule behavior for Ronald, Adam, Miles, and Anna during baseline (BL), schedule-use (SU), and no-schedule (NS) conditions. The asterisk represents sessions with a prompt

no-schedule condition was introduced, all participants engaged in less on-task behavior than in the schedule-use condition. For Ronald and Anna, on-task behavior immediately decreased and returned to baseline levels. On-task behavior was variable for Adam and Miles, but data show an overall decrease in level and a downward trend. When the activity schedule was reintroduced, on-task academic behavior immediately returned to high, stable levels for all participants. Mean on-task academic behavior in the return-to-schedule-use condition for Ronald, Adam, Miles, and Anna was 99%, 93%, 98%, and 88% of intervals, respectively.

Because none of the participants used the activity schedule during the baseline condition, on-schedule performance was 0% of intervals for all participants. In the

schedule-use condition, all participants immediately engaged in high, stable levels of on-schedule behavior. Mean on-schedule performance for Ronald, Adam, Miles, and Anna was 93%, 96%, 98%, and 87% of intervals, respectively. Because participants did not have access to the activity schedule during the no-schedule condition, on-schedule performance was 0% of intervals for all participants. When the activity schedule was reintroduced, on-schedule performance immediately returned to high, stable levels for all participants. Mean on-schedule performance in the return-to-schedule-use condition for Ronald, Adam, Miles, and Anna was 99%, 96%, 99%, and 91% of intervals, respectively.

During baseline generalization probes, all participants engaged in moderate-low levels of on-task academic behavior. During schedule-use generalization probes, on-task academic behavior for Ronald, Adam, Miles, and Anna immediately increased to 83%, 98%, 94%, and 68% of intervals, respectively. No-schedule generalization probe on-task percentages for Ronald, Adam, Miles, and Anna decreased to 8%, 44%, 56%, and 46% of intervals, respectively. In the return-to-schedule-use condition, Ronald's on-task academic behavior increased to 81% and 95% of intervals, Adam's increased to 93% and 84% of intervals, Miles's increased to 92% of intervals, and Anna's increased to 76% of intervals.

Because none of the participants used the activity schedule during baseline generalization probes, on-schedule performance was 0% for all participants. During schedule-use generalization probes, on-schedule performance for Ronald, Adam, Miles, and Anna immediately increased to 90%, 98%, 95%, and 74% of intervals, respectively. Because participants did not have access to the activity schedule in the no-schedule condition, on-schedule performance was 0% for all participants. During final schedule-use generalization probes, Ronald's on-schedule behavior increased to 88% and 97% of intervals, Adam's increased to 95% and 88% of intervals, Miles's increased to 90% of intervals, and Anna's increased to 85% of intervals.

Schedule Training

Schedule training occurred following baseline and prior to the initial schedule-use condition. Throughout schedule training, all participants engaged in high, stable levels of on-task and on-schedule behavior. Mean schedule-training scores for on-task academic behavior for Ronald, Adam, Miles, and Anna were 89%, 97%, 99%, and 91% of intervals, respectively. Mean schedule-training scores for on-schedule behavior for Ronald, Adam, Miles, and Anna were 93%, 98%, 99%, and 94% of intervals, respectively.

Social Validity

As shown in Table 1, all participants indicated the activity schedule was easy to use ($M = 4.75$). Adam and Miles reported they liked using the activity schedule, and Ronald and Anna were neutral about using it ($M = 4$). Participants also indicated the activity schedule helped them complete math work ($M = 4.75$) and they would be willing to continue using it in math class ($M = 4.75$) and other classes ($M = 4.75$). Finally, all participants indicated they strongly disagreed that other students asked them about the activity schedule ($M = 1$).

As shown in Table 2, both language arts teachers recorded scores of 5 across all items on the teacher questionnaire. Both teachers indicated they strongly agreed the activity schedule was easy to use, helped participants stay on task, and helped participants complete more classwork. Additionally, both language arts teachers reported that participants seemed to enjoy using the activity schedule and would benefit from using it in class.

Accuracy

During baseline and no-schedule conditions, all participants completed academic worksheets with a mean of 80% or higher (Ronald $M = 87%$, Adam $M = 90%$, Miles $M = 90%$, and Anna $M = 89%$). During schedule-use conditions, all participants completed academic worksheets with a mean of 80% or higher (Ronald $M = 83%$, Adam $M = 86%$, Miles $M = 84%$, and Anna $M = 95%$). These results show that average accuracy scores across all sessions were 80% or higher, demonstrating that participants completed academic work at an appropriate level of accuracy throughout the study.

Discussion

The current study evaluated the effects of activity schedules on the on-task and on-schedule behaviors of four middle school students with SLD and OHI classifications in a resource math classroom. Results demonstrate increased on-task and on-schedule behavior across all participants in both the primary experimental setting (resource math classroom) and the generalization setting (language arts classroom). Language arts teachers and student participants indicated that the activity schedule intervention increased student on-task behavior and helped students complete independent work. This study adds to the existing body of activity schedule literature, extends findings of previous school-based activity schedule research (Bryan & Gast, 2000; Cirelli et al., 2016), and presents valuable practical implications.

This investigation extends the use of activity schedules in improving on-task behavior to a novel population (middle school students with SLD and OHI classifications), as much

Table 1 Participant social validity questionnaire results for Ronald, Adam, Anna, and Miles

Question	Ronald	Adam	Miles	Anna	Mean
1. The activity schedule was easy for me to use.	5	5	5	4	4.75
2. I liked using the activity schedule.	3	5	5	3	4.00
3. Other students in the class asked about the activity schedule.	1	1	1	1	1.00
4. The activity schedule helped me get my math work done.	5	5	5	4	4.75
5. I would be willing to continue using the activity schedule in my math class.	5	5	5	4	4.75
6. I would be willing to use the activity schedule in my other classes.	5	5	5	4	4.75
7. The activity schedule would help me get my work done in other classes.	5	5	5	3	4.50

Note. 1 = *strongly disagree*; 2 = *disagree*; 3 = *neutral*; 4 = *agree*; 5 = *strongly agree*.

of the existing research on activity schedules includes participants with developmental disabilities (e.g., Bryan & Gast, 2000; MacDuff et al., 1993). Given that this study targeted middle school students in a resource classroom, researchers used modified schedule-teaching, prompting, and data collection procedures. These modified procedures extend the work of Cirelli et al. (2016), who implemented activity schedules with students at risk for ADHD in a regular education classroom. Schedule teaching in the current study differed from typical activity schedule research in that verbal directions and modeling were used to teach schedule-following in brief training sessions. Minimally intrusive prompts (i.e., gestural and verbal prompts) were used instead of the graduated guidance and physical prompting that is common in much of the activity schedule research. Data collection for schedule-following in the current study included momentary time sampling rather than percentage of independent schedule-following steps, which is commonplace in previous activity schedule research, given that participants met criterion for schedule-following in one to two brief training sessions. Researchers determined that an estimate of schedule-following as measured by momentary time sampling was sufficient to capture schedule-following for these participants. With these modifications, participants demonstrated immediate and sustained high levels of on-task behavior, suggesting that activity schedules can be efficiently implemented and effectively used in public middle school settings.

The results of the current study suggest activity schedules are a minimally intrusive intervention. Participants in the current study demonstrated increased on-task behavior with only four teacher prompts across all schedule-use sessions, suggesting that activity schedules can facilitate student independence and minimize the need for intensive teacher involvement. This is particularly meaningful for students with SLD and OHI classifications in middle school, given that middle school teachers are unable to provide the continuous support often needed to ensure that these students remain on task and complete academic work. Providing fewer prompts could also facilitate student independence, which is crucial in middle school given the expectations to work independently and complete assignments in a timely manner. Further, providing students with SLD and OHI classifications with strategies that allow them to work independently could present more opportunities for them to participate in less restrictive classroom settings.

Results from the no-schedule condition extend the findings of Bryan and Gast (2000), who demonstrated that elementary students with autism spectrum disorder engaged in lower levels of on-task behavior in conditions when the schedule was not available. The current study demonstrated a similar effect with students with SLD and OHI classifications. Although data from the no-schedule condition varied slightly across participants, on-task behavior was more stable and predictable in the schedule-use conditions. It is important for practitioners to note these findings as they consider fading activity schedules. All participants

Table 2 Language arts (LA) teacher social validity questionnaire results for Ronald, Adam, Anna, and Miles

Question	Resource LA		Regular Education LA		Mean
	Ronald	Anna	Miles	Adam	
1. The activity schedule intervention was easy for the student to use.	5	5	5	5	5
2. The activity schedule helped the student using it stay on task.	5	5	5	5	5
3. The activity schedule helped the student complete more classwork.	5	5	5	5	5
4. The student seemed to enjoy using the activity schedule.	5	5	5	5	5
5. The student would benefit from using an activity schedule in this class.	5	5	5	5	5

Note. 1 = *strongly disagree*; 2 = *disagree*; 3 = *neutral*; 4 = *agree*; 5 = *strongly agree*.

engaged in lower, less stable levels of on-task behavior in the no-schedule condition, which illustrates the need to investigate procedures to systematically fade activity schedules while maintaining high levels of responding.

In addition to engaging in high levels of on-task and on-schedule behavior in a resource math classroom, participants in the current study engaged in high levels of on-task and on-schedule behaviors with language arts tasks during schedule-use generalization probes. This extends findings of previous researchers (e.g., Bryan & Gast, 2000; MacDuff et al., 1993) who demonstrated generalization to novel tasks with little or no extra training. These results suggest that middle school students with SLD and OHI classifications could use activity schedules during independent work time in multiple classrooms with little or no context-specific training. Interventions that can be utilized across classrooms could prove to be valuable in secondary education because students transition to different classrooms throughout the day.

Finally, participants and language arts teachers responded positively to items on the social validity questionnaires. Assessing the extent to which an intervention and procedures are socially acceptable to adolescents in public school is particularly important, as they are likely to be concerned about how they appear to their teachers and peers. Participants indicated through questionnaire responses that they would be willing to continue using the activity schedule in math and other classes, which suggests the activity schedules were a socially valid intervention for this population.

Although results indicate the intervention was effective, several limitations should be noted. First, only four students participated in this study, and they all received special education services in a resource math classroom. Future research should consider replication of this study in other academic settings, particularly classrooms with demanding independent work requirements, such as science, history, or computer classes. Future research could also replicate these procedures with other populations, such as students who receive special education services in a coteaching setting or students without disabilities who engage in low levels of on-task behavior. Second, the current study did not fade the break component of the activity schedule or the activity schedule binder. However, Adam required two gestural prompts in the second schedule-training condition to turn the page in the activity schedule before beginning his math worksheet. This could have been an indication that he was ready for schedule fading, as he may have been mastering the work/break routine and relying less on the schedule as a stimulus prompt. Future research should consider fading the break time within the schedule (e.g., from 3-min breaks to 1-min breaks) and fading the activity schedule binder to a single sheet of paper, a page in a student planner, or a list kept on a cell phone or electronic device. Third, participant worksheets were checked to ensure students accurately completed math and language arts problems (average accuracy percentages were 80% or higher across all participants

and conditions), but researchers did not systematically address accuracy with the activity schedule intervention. Future studies should evaluate the effects of an activity schedule intervention on accuracy measures or other indicators of academic success such as number of assignments completed or performance on assessments related to independent work tasks. Finally, the activity schedule was a multicomponent intervention including initial verbal directions from the teacher, prompts on activity schedule pages, and both negative and positive reinforcement contingencies (break pages and access to preferred materials during break times). Because of this, researchers cannot determine which component, or combination of components, caused the change in the dependent variables. Future research should consider component analyses to analyze the individual effects of components of the intervention.

Despite these limitations, participants learned schedule-following in brief training sessions, demonstrated increased on-task behavior with minimal teacher support, and generalized the use of the activity schedule to both resource and regular education language arts classrooms. Additionally, both participants and language arts teachers rated the intervention as socially valid. Taken together, these findings indicate the implementation of activity schedules during independent work time may lead to improved academic outcomes for middle school students with disabilities.

Acknowledgements This study was conducted as part of the first author's master's thesis at Utah State University. Special thanks go to Tyra P. Sellers and Kaitlin Bundock for their help in the preparation of this manuscript.

Funding No funding was received for this study.

Compliance with Ethical Standards

Conflict of Interest All authors declare that there are no conflicts of interest.

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 Helsinki declaration 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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