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Getting SMART About Social Skills Interventions for Students With ASD in Inclusive Classrooms

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Abstract

Children with autism demonstrate considerable heterogeneity in their social skills and, therefore, their school intervention needs. No single intervention is expected to address the needs of all children with autism. In addition, not all evidence-based school interventions can be provided to all children with autism at all times. Thus, there is a need to understand how best to combine, sequence, and individualize social skills interventions to meet the heterogeneous needs of these children. *Adaptive interventions* (AIs) are prespecified sequences of decision rules used to guide schools in how best to combine, sequence, and individualize social skills interventions. However, there are currently no empirically derived AIs shown to improve social skills in schoolchildren with autism; moreover, there is a dearth of literature on the acceptability and feasibility of schoolwide, multilevel AIs that combine both environmental-level and individual-level interventions. The purpose of this study is to understand the acceptability and feasibility of four AIs in a SMART (sequential multiple-assignment randomized trial) implemented by educators and parents. The AIs include environmental (Remaking Recess, classroom supports) and individual interventions (parent assisted, peer mediated). Thirty-three elementary-age students with autism (male = 76%, Hispanic = 73%) were educated in 21 classrooms across seven schools by 25 teachers and 24 teaching assistants. Treatment expectations, acceptability, feasibility, and implementation data were collected over 18 weeks. Results indicated respondents were agreeable to treatment changes, but perceived feasibility was average and implementation was moderate. A number of lessons learned and proposed changes for scaling up are discussed.

Children with autism spectrum disorder (ASD) are the fastest-growing segment of the school population. Among children with disabilities, the overall percentage of students with ASD rose from 0.4% to 1.1% between 2004–2005 and 2014–2015. In the Los Angeles Unified School District alone, there are currently 15,000 children with ASD, and more than half of these children are educated in general education classrooms. Although the majority of children with ASD are academically able, they have significant impairment in social communication skills, one of the core deficits of the disorder. Social communication impairments affect their social understanding as well as their ability to execute social skills appropriate to the situation. As a result, children with ASD often experience isolation, peer rejection, and a lack of friends at school (Kasari et al., 2011; Locke et al., 2013). These difficulties tend to worsen with age (Rotheram-Fuller et al., 2010) and can lead to poor academic outcomes (Steedly et al., 2008).

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No Single Effective Intervention for All Children With ASD

Although challenges in social communication are central to a diagnosis of ASD, children's strengths and needs vary substantially, and therefore, it is unlikely that a single intervention will be effective for all children. Interventions for social interaction can include environmental supports (e.g., visual schedules, access to typical peers on playgrounds), direct instruction by adults (e.g., social skills groups), and peer-mediated supports (e.g., peer buddy programs). These interventions vary in their implementation, cost, duration, and intensity. Although there are multiple types of interventions—and at multiple levels (e.g., school, classroom, individual) of intervention—to support children's social skills, few have been tested alone or in combination with other interventions when applied in authentic and inclusive school contexts. What is needed is an evidence-based approach to intervention that simultaneously (a) provides interventions that have been shown to accelerate the development of social and academic engagement and (b) adapts such interventions to the changing needs of the child (e.g., if there are indications of slow response).

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Adaptive Interventions (AIs)

AIs provide empirical guidelines for sequential intervention decision making by providing decision rules that recommend when, how, and for whom interventions should be applied (Nahum-Shani & Almirall, 2019). These decision rules lead to individualized intervention sequences. AIs are intended to guide what happens in usual practice, where, for example, changes are made based on student response. (AIs can also guide changes made based on the response of schools, classrooms within schools, or school professionals within classrooms.) An advantage of AIs is that the decision rules that lead to individualized sequences are protocolized (well operationalized and prespecified), which ensures that changes (increases, decreases, or different interventions determined a priori) are systematically applied to ensure replicability of evidence-based practices, strategies, or modules. Another advantage is that AIs are ideally suited to conditions that are characterized by heterogeneity in intervention response, a common issue for children with disabilities generally. AIs capitalize on heterogeneity in child characteristics and response to treatment in order to improve outcomes for the greatest number of children with ASD.

AIs for Improving Social-Emotional Outcomes in ASD

School leadership, teachers, and therapists expect that not all children will respond equally well to a specific intervention but often have no guidelines on when to change or augment an intervention approach (Kasari et al., 2018; Kasari & Smith, 2013) or on what intervention to provide next when a change or augmentation is indicated. That is, there are currently no empirically derived guidelines to help guide treatment decision making for children with ASD in real-world contexts. As a result, school policy makers and teachers may implicitly or explicitly encourage the sequencing, augmentation, or change of interventions in a trial-and-error fashion or in ways that do not necessarily lead to the most improved child outcomes.

The ultimate aim of this project is to determine how best to design a three-phase AI consisting of four evidence-based interventions (Remaking Recess [RR], classroom supports [CS], and parent-assisted and peer-mediated social skills interventions) to be delivered in an authentic school setting for improving social outcomes of children with ASD. These four interventions were selected because (a) they have been previously tested and found to yield positive effects on child outcomes and (b) they represent a range of interventions that may be needed to improve child outcomes given the variability among school children with ASD. Two of the interventions (RR and CS) are considered environmental (that is, they involve whole-school-level or classroom-level interventions and focus on making

environmental changes) and two (parent-assisted and peer-mediated interventions) are considered as individual-level interventions (i.e., the child receives direct instruction to improve social outcomes). See the online supplemental information for details on interventions.

Designs to Help Researchers Construct an Effective AI

Despite the fact that multiple types of social skills interventions have been tested, we lack needed evidence to support a specific combination or sequence of the application of these environmental and individual-level interventions as well as how to tailor such sequences to the specific needs of classrooms or the children with ASD within classrooms. That is, there is no evidence to support how best to construct an AI to improve the social skill outcomes of children with ASD within schools. For example, in the context of a schoolwide environmental intervention, such as RR, how does one decide whether to augment RR with a classroom support intervention? Or how does one decide which individual-level intervention to start with—peer mediated or parent assisted? Or how does one decide whether to augment individual-level intervention with both parent-assisted and peer-mediated interventions for children who do not respond well to the initial choice of individual-level monotreatment? One way to refine the proposed sequence of interventions and decision rules that make up an AI is using a sequential multiple-assignment randomized trial (SMART; Murphy, 2005; Nahum-Shani et al., 2012;). In a SMART, participants may be randomized multiple times (at specific decision points) over the course of the trial. The results of the SMART are then used to propose an AI.

The Current Study

The goal of the current study was to conduct a feasibility SMART to prepare for a larger, full-scale trial. Consistent with these goals, in this study we do not focus on the relative effectiveness between the four AIs or the relative effectiveness of the intervention components that make up the four AIs (Kraemer et al., 2006). Rather, the goal was to use this initial data to refine the four AIs and the study design, a method applied in prior studies (e.g., Chronis-Tuscano et al., 2016; Gunlicks-Stoessel et al., 2016). We needed to first evaluate whether school staff would find the AIs and study procedures feasible and acceptable (Almirall et al., 2012; Lancaster et al., 2004). *Feasibility* refers to the school staff's ability to successfully execute the SMART study procedures (e.g., recruitment, randomization) and implement the interventions that compose the AIs (Almirall et al., 2012). *Acceptability* refers to the staff's willingness to engage in an intervention and parent as well as staff satisfaction with the intervention (Almirall et al., 2012).

The current study, a feasibility SMART, was implemented over a single school year, with the first 4 months dedicated to school recruitment and the following 5 months to intervention. Specifically, in the current study, we address the following feasibility and acceptability questions in the context of four AIs (described later):

1. Before the start of intervention, will staff and parents be amenable to receiving one of various AIs?
2. Among students who show a sufficient response to peer-mediated or parent-assisted intervention, will staff and parents agree to staying on the same intervention?
3. Among students who show a slow, insufficient response after peer or parent interventions, will staff and parents agree to a combination approach?
4. Will staff and parents adhere to the assigned implementation protocols designed to instruct them on how to deliver the different components making up the AIs?
5. Will staff and parents report satisfaction with the AIs?

Method

Study Design

A SMART design was applied in this preliminary feasibility study (see Figure 1). The four

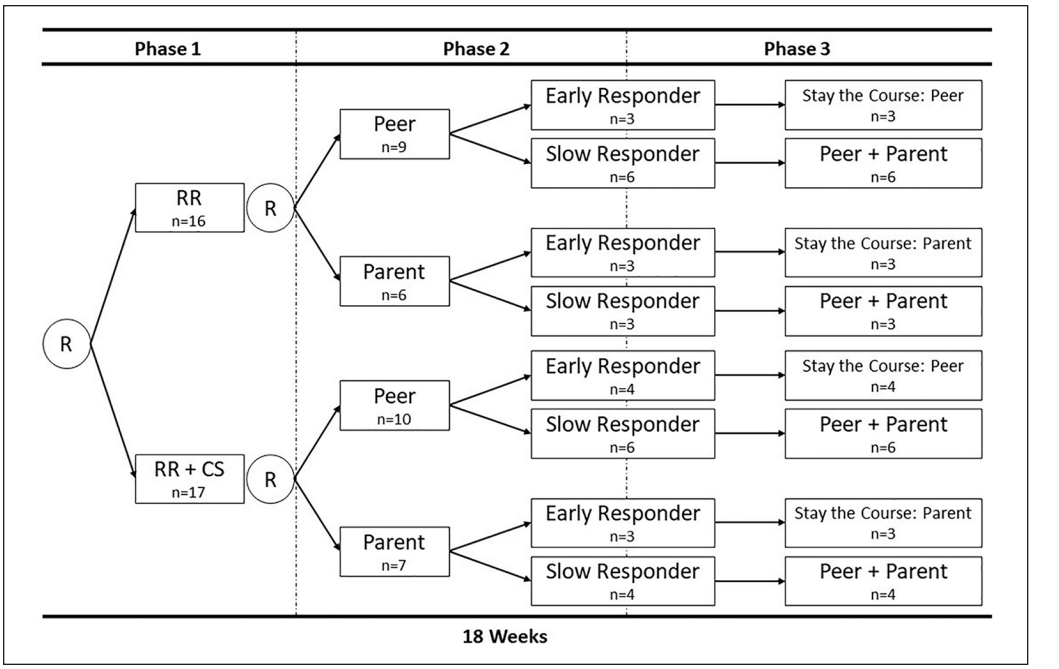

Figure 1. Study design.

AIs are detailed in Table 1. Three 6-week phases of intervention were conducted. Children were first randomized to receive either the universal environmental intervention, RR, alone or RR plus CS, another environmental intervention to help children connect in the classroom and transition to the playground.

Phase 1 explores the extent to which changing the environment may lead to positive social and behavioral outcomes. Changing the recess environment has the potential to have the largest effect on the most children while requiring the fewest resources. However, it is not clear that changes noted on the playground will transfer to the classroom unless there are specific strategies in place. The CS intervention helps teachers by providing specific schedules and tools to facilitate positive transitions between the playground and classroom and within the classroom. Both RR and CS have been tested in prior randomized controlled trials in schools for children with ASD (Iadarola et al., 2018; Shih et al., 2019), but the influence of RR and CS together has not been tested. Does the combination of classroom (CS) plus recess (RR) interventions place many more children on a positive social, behavioral, and academic trajectory? And which children within schools utilizing an RR intervention are more likely to benefit from a classroom with CS?

At the end of Phase 1, children were randomized a second time to add either the peer-mediated playground intervention or the parent-assisted home playdate intervention.

Phase 2 explores the choice of initial individual-level intervention, namely, whether to augment environmental intervention with support from peers on the playground (peer mediated) versus helping parents set up positive playdates at home (parent assisted). Both interventions have evidence from randomized controlled trials in the school or home context and, thus, provide additional options for improving social skills outcomes for children with ASD. Both peer-mediated and parent-assisted interventions require greater individualized resources with the children themselves; thus, it is important to understand the extent to which children benefit from these additional resources above and beyond less

Table 1. Adaptive Interventions.

Adaptive intervention	Phase 1	Phase 2	End of Phase 2 status	Phase 3
1	RR	Peer	Early responder	Continue peer
			Slow responder	Peer + parent
2	RR	Parent	Early responder	Continue parent
			Slow responder	Peer + parent
3	RR + CS	Peer	Early responder	Continue peer
			Slow responder	Peer + parent
4	RR + CS	Parent	Early responder	Continue parent
			Slow responder	Peer + parent

Note. RR = Remaking Recess; CS = classroom supports.

intensive environmental interventions (RR and CS). With the belief that all children could benefit from the addition of parent or peer, our aim was to determine if parent-assisted or peer-mediated interventions were more successful in boosting child social skills beyond the environmental changes made by RR with or without CS.

At the end of Phase 2, children's response to their intervention sequence was assessed by the assistants conducting the intervention using the Clinical Global Impression (CGI; Guy, 1976; see Measures). The CGI is a brief, seven-item Likert rating of the child's improvement from the start of the intervention. It is a measure of the intervention and not an outcome in this study. The CGI has been used similarly in other SMART trials (Gunlicks-Stoessel et al., 2016; Holbrook et al., 2019). Past trials indicate that after receiving both environmental and individual interventions, a number of children will be on a positive trajectory for peer engagement. However, is it not yet clear how best to support peer engagement if a child has not responded to these interventions.

In Phase 3, children responding to the interventions stayed the course with their current intervention, whereas those responding more slowly received the remaining intervention (either peer mediated or parent assisted). Phase 3 explores the combination of both peer-mediated and parent-assisted interventions to support gains in peer engagement.

Determining Sufficient and Insufficient Responder Status (End of Phase 2). CGI (Guy, 1976) for Severity (CGI-S) and Improvement (CGI-I) were completed by the research staff. These scores were used to assess children's response to intervention. In addition, the teaching assistants who were delivering the RR intervention also independently rated the CGI for their target students. Both the research staff and the teaching assistants rated the CGI in order to explore scoring reliability. Although the CGI has been rated reliably on prior projects by interventionists (e.g., Holbrook et al., 2019), the team has not previously transferred this measure to school staff.

CGI Training and Rating Procedures for Assistants. Identifying children's engagement states is a core component of the RR intervention. Teaching assistants were taught to scan the playground, notice children who were not engaged with peers, and then take action. This training formed the basis of the CGI, which applies scores (1–7) for children's engagement. A member of the research team reviewed the CGI measure individually with each assistant and assisted with practice scoring with a live observation and discussion. The teaching assistant and research team member then independently scored the target child's CGI through a live observation of the child on the playground or during lunch. The CGI was completed at study baseline (CGI-S) and at the end of Phase 2 (CGI-S and CGI-I). Research staff ratings determined the child's responder status. These ratings are not research outcome assessments; rather, these ratings are only to provide us with potential tailoring information for a fully powered SMART.

Measures

Screening Measures. Children's cognitive abilities were measured using the Differential Abilities Scale (DAS-II; Elliott, 2007). The DAS-II measures reasoning and conceptual learning. The composite score yields a general conceptual abilities (GCA) score ($M = 100$, $SD = 15$) that is highly reliable, with internal consistency scores ranging from .89 to .95 and a test-retest coefficient of .90 for the GCA. A GCA of 70 or above was required for inclusion (see Participants section).

Children entered into the study also needed to demonstrate no greater than 70% time jointly engaged with peers (Locke, Shih et al., 2016). Seventy percent time in peer engagement was selected as the cutoff because neurotypical children spend approximately this amount of time engaged during recess. Therefore, there was little need for intervention for students engaged at this level or above. Children's engagement with classmates was measured during unstructured school time (e.g., recess, lunch) using the Playground Observation of Peer Engagement (POPE; Kasari et al., 2005). The POPE is a timed-interval behavior-coding system. Engagement is scored for active involvement of the child with ASD in games or conversations with peers. Independent evaluators blind to the child's intervention condition scored the POPE in 1-min intervals (observed for 40 consecutive seconds, coded for 20 s) for at least 10 min during recess or lunchtime play. Observations were made twice within 1 week at baseline. The POPE has previously been used in measuring peer engagement in children with ASD (Frankel et al., 2010; Kasari et al., 2012) and has demonstrated high levels of reliability. Reliability across seven independent raters including research assistants and graduate students was high (Kappa = .94–.99).

Baseline Descriptive Measures. Families, school champions, classroom teachers, and teaching assistants each completed a demographic form at study baseline. Families reported on child characteristics (e.g., birthdate, ethnicity), and educators described their educational and employment history.

School champions were also asked to describe the school day of the participating children with ASD. School champions reported the grade, the percentage of day the child was in an included setting, the classes the child was included in, and whether or not the child was included for recess or lunch.

Acceptability, Adherence, and Satisfaction Measures. Educators and parents completed brief questionnaires regarding the acceptability of proposed adaptation of the intervention sequence before and after a change was made. Teachers were also asked to report their satisfaction with the classroom intervention. Completion of the intervention sequence by children and educators was tracked to measure treatment adherence.

Acceptability of treatment sequences: Parents and classroom teachers. Adapted from Gunlicks-Stoessel et al. (2016), this measure consisted of four questions related to whether the parent and classroom teacher would accept changes to the child's intervention plan. Changes included transitioning from RR or RR plus CS in Phase 1 to receipt of either peer-mediated or parent-assisted intervention in Phase 2 to staying the course or receipt of peer-mediated plus parent-assisted intervention in Phase 3. Ratings were from *very negative* (–2) to *very positive* (+2) on how they would feel about the change and from *definitely no* (–2) to *definitely yes* (+2).

If no change was made, the respondent was also asked to indicate what they would have preferred instead (e.g., add another intervention, make some other change). This measure provided information on how acceptable the procedures and measures were to staff and parents (Gunlicks-Stoessel et al., 2016).

Adherence and attrition. The participation of the children and educators in each phase of the study was recorded. Early exits and the reason for participant exit (e.g., child and family moved away from the area, educator on parental leave) were documented.

Teacher diary (adapted from caregiver diary; Kasari et al., 2010). The teacher diary is a rating scale that was completed at the end of Phase 1 by classroom teachers who received the CS intervention. Each item was scored from 1 (*not at all true*) to 5 (*very true*). Teachers reported their satisfaction and whether they found issues with (a) finding time to carry out the strategies, (b) complexity of the strategies, (c) fit with the classroom strategies, (d) effort required to use the strategies, (e) confidence with the strategies, and (f) comfort with the strategies.

Implementation Fidelity Measures. Research staff were trained to greater than 80% fidelity on the coaching and training components of both RR and CS prior to beginning the study. Implementation of the components of RR by teaching assistants, and of CS by teachers, was recorded by the research team via live observations at each major phase change.

RR components implemented by teaching assistants. Observed components of RR were rated by a member of the research team using a five-item scale to assess the following strategies: (a) scanning the environment for children who may need support, (b) supporting a child who is unengaged to enter an activity, (c) setting up a group activity, (d) applying support to facilitate the activity as needed, and (e) fostering peer communication. RR components were collected at the major time points (baseline, end of Phase 1, end of Phase 2, and end of Phase 3). Each item was rated for whether or not the strategy was applied when needed (necessary and present, necessary but absent, or not applicable—no support needed [NA]). When the strategy was applied, the quality of implementation was also scored (1 = *low quality*, 5 = *consistent and appropriate*). Implementation is presented as the number of items scored as necessary and present, divided by the total number of possible items (items scored as NA were excluded) and multiplied by 100 to provide a total percentage score for implementation.

CS components implemented by teachers. This scale included two five-item subscales focused on transitions and social engagement and were collected at the major time points. The transition subscale assessed key strategies for successful transitions, including providing a warning, clear instruction, reinforcement, appropriate level of support, and a signal to end the transition. The social engagement subscale assessed how the teacher set up the environment, provided spoken reminders, supported the start of conversations, supported the selection and start of an activity, and used a buddy system. Both implementation and quality were scored by a member of the research team for each item as necessary and present, necessary but absent, or NA. Implementation was calculated by the number of items scored as necessary and present, divided by the total number of possible items (items scored as NA were excluded) and multiplied by 100 to provide a total percentage score.

Participants

Students and staff were recruited from seven elementary schools within a public school district in a large U.S. metropolitan area. Schools ranged in student racial and ethnic diversity (39.33%–96.84%, M = 77.07% non-Caucasian) and largely served students receiving free and reduced lunch (31.60%–90.80%, M = 74.49%). Contact with the school staff was first made with school principals by phone and email. With the principal's permission, general education teachers and teaching assistants who oversaw children with ASD were invited to participate. Once the teacher provided consent, families of children with ASD were invited to participate. Institutional review procedures were obtained and followed at the university and school district levels.

Children. Included children (a) had a diagnosis of ASD confirmed by the research team using the Autism Diagnostic Observation Schedule–2nd Edition (Lord et al., 2012), (b) were included in a general education kindergarten-to-fifth-grade classroom for at least 80% of the school day, (c) had a cognitive score of 70 or greater using the DAS-II (Elliott, 2007), and (d) were spending no more than

Table 2. Baseline Child Characteristics.

Characteristic	RR only (n = 16)	RR + CS (n = 17)
Race-ethnicity, *n* (%)		
Hispanic or Latinx	11 (69%)	13 (76%)
Caucasian	1 (6%)	3 (18%)
African American	1 (6%)	0 (0%)
Asian	2 (13%)	0 (0%)
Other or mixed	1 (6%)	1 (6%)
Gender, *n* (%)		
Female	3 (19%)	4 (24%)
Male	10 (62%)	11 (64%)
Do not wish to disclose	3 (19%)	2 (12%)
Grade level, *n* (%)		
Kindergarten	9 (58%)	5 (29%)
1	1 (6%)	3 (18%)
2	1 (6%)	5 (29%)
3	1 (6%)	1 (6%)
4	2 (12%)	3 (18%)
5	2 (12%)	0 (0%)
Mainstream, *n* (%)		
0–20	5 (50%)	7 (47%)
40–60	3 (30%)	2 (13%)
80–100	2 (20%)	6 (40%)
Percentage of time in joint engagement, *M* (*SD*)	23.75 (21.64)	27.30 (23.57)

Note. RR = Remaking Recess; CS = classroom supports.

70% of a 10-min playground observation jointly engaged with peers as rated by research assistants using the POPE (Kasari et al., 2005). Thirty-three children met inclusion criteria. On average, children were 7.4 years old (SD = 1.8 years) and 63% were male. Finally, the majority of families identified their children as Hispanic (73%), with smaller percentages reporting Caucasian (12%), African American (3%), Asian (6%), or mixed race or other (6%) (see Table 2 for breakdown by group). The children were enrolled in 21 classrooms, with one child enrolled in each of 14 classrooms. Four classrooms included two children, two classrooms included three children, and one classroom included five children.

Teachers and Assistants. Twenty-five elementary school general education teachers and 24 teaching assistants who work with students with ASD consented to participate in the study. Teachers were approximately 44 years old on average (SD = 8.77 years), were predominantly female (84%), and worked within the current school for 8.96 years (SD = 7.42 years), and most (63%) did not have training specific to support students with ASD. Teachers self-reported as African American (8%), Asian (8%), Caucasian (50%), or mixed race (17%), and another 17% chose not to disclose. Thirty-eight percent of teachers reported Hispanic ethnicity. Assistants were slightly younger than teachers on average (M = 41 years, SD = 13.54 years), predominantly female (71%), and predominantly Hispanic (84%), and most (92%) had training specific to supporting students with ASD. Assistants self-reported as African American (8%), Caucasian (42%), or mixed race (33%), and 17% chose not to disclose. See Table 3 for teacher and assistant characteristics.

School Champions. Each principal was asked to nominate a school champion who would be the primary point of contact for the study team

Table 3. Staff Characteristics.

Characteristic	Teachers ($n = 25$)	Teaching assistants ($n = 24$)
Age, *M* (*SD*)	44.26 (8.77)	41.08 (13.54)
Gender, *n* (%)		
Male	3 (12%)	6 (4%)
Female	21 (84%)	17 (71%)
Do not wish to disclose	1 (4%)	1 (25%)
Race, *n* (%)		
African American	2 (8%)	2 (8%)
Asian	2 (8%)	0 (0%)
Caucasian	12 (50%)	10 (42%)
Other	4 (17%)	8 (33%)
Do not wish to disclose	4 (17%)	4 (17%)
Ethnicity, *n* (%)		
Hispanic	9 (38%)	20 (84%)
Not Hispanic	9 (38%)	2 (8%)
Do not wish to disclose	4 (24%)	2 (8%)
Years in current school, *M* (*SD*)	8.96 (7.42)	5.22 (6.27)
Autism experience, *n* (%)		
No	15 (63%)	20 (92%)
Yes	9 (37%)	4 (8%)

and support staff who were participating in the study. School champions could also elect to support implementation in their school by choosing to learn to either (a) deliver the playground engagement observation measure or (b) learn the RR intervention. School champions included assistant vice principals (AVPs; $n = 2$), school psychologists ($n = 2$), and principals ($n = 2$). One AVP served as the school champion for the two schools that were under her leadership. No school champion chose to participate in playground observations or RR intervention.

Results

Student Participation

School champions reported the percentage of the school day that students were included in general education settings. Of 32 students with data reported, most students spent 80% to 100% ($n = 14$) of the day included, and 12 students spent 0% to 20% of the day included. Five students spent 40% to 60% of the day included, and one student, 20% to 40%. Children spending the least amount of time included were in kindergarten ($n = 9$), first grade ($n = 2$), and fourth grade ($n = 1$).

For students spending less than 80% of the day included, school champions reported children were included (mainstreamed) for special activities, such as field trips or enrichment activities ($n = 13$); math ($n = 11$); language arts ($n = 6$); social studies ($n = 5$); science ($n = 2$); music ($n = 2$); and art ($n = 1$). Notably, two students participated in recess with peers from special education classes, and another three students had lunch with peers in special education only.

Acceptability of Intervention Adaptations

At study baseline, 85% of parents and 84% of educators responded to the acceptability questionnaire. Of respondents, 86% of parents and 90% of educators felt positive about changing the intervention plan if the child's social skills were not improving. Both parents and educators were also receptive to adding

Table 4. Acceptability: Parents and Educators' Perspectives (in percentages).

Parent and Educator's Perspectives	Very negative	Slightly negative	Neutral	Slightly positive	Very positive
Parents					
Acceptability at study baseline					
Possibility of changing intervention	0	7	7	23	63
Add peer mediated	0	11	43	22	63
Adding parent assisted	0	4	4	25	67
Acceptability at end of Phase 2					
Changes to intervention	0	0	50	20	30
Stay the course	0	14	43	14	29
Teachers and assistants					
Acceptability at study baseline					
Possibility of changing intervention	0	5	5	33	57
Add peer mediated	0	0	5	33	62
Add parent assisted	0	0	0	19	81
Acceptability at end of Phase 2					
Changes to intervention	0	0	16	16	68
Stay the course	6	6	50	6	32

peer interventions (85% parents and 95% educators), parent-facilitated playdates (92% parents and 100% educators), or intensifying support by receiving interventions at both home and school (92% parents and 100% educators).

At the end of Phase 2, 55% of the parents and 70% of educators completed the questionnaire. For children who showed a slower response to intervention, parents felt neutral to positive toward changing intervention approaches (50% neutral, 20% somewhat positive, and 30% positive). Similarly, 68% of teaching assistants felt positive toward making a change. No parent or teaching assistant reported negative feelings regarding changing the intervention.

Among parents of children responding quickly to the initial intervention, the majority of the parents felt neutral to positive about staying the course (43% neutral, 14% somewhat positive, and 29% positive; see Table 4). Further, among educators, a wider range of responses was documented (6% negative, 6% somewhat negative, 50% neutral, 6% somewhat positive, and 32% positive). However, 71% of the parents and 20% of educators indicated a desire to add another intervention in Phase 3 even though their child was showing a positive response to their current treatment sequence.

Adherence

Thirty-two of 33 children completed all phases of the intervention. Of the 49 adults (25 teachers and 24 assistants) who consented to participate, five adults (10%) exited early. The reasons for early exit included maternity leave ($n = 1$), desire to discontinue participation ($n = 2$), and the target student with ASD left their classroom ($n = 2$). Thus, 90% of the participants completed the study.

Satisfaction

Teachers randomized to receive the CS intervention completed a diary reporting their experience applying the CS strategies. Questions were on a 5-point scale (*not at all true* to *very true*). On average, item scores reflected 2 and 3s (average item scores range from 1.90 to 3.10), indicating teachers found it somewhat true that it was challenging to find the time to implement the strategies and that it required significant effort to carry out the strategies.

Intervention Implementation Outcomes on School Staff

RR Implementation by Teaching Assistants. On average, at Phase 1 entry, teaching assistants

were using 32% of the RR strategies. Implementation increased to 52% of strategies after receiving Phase 1 coaching. RR strategies 2 to 4 were used most frequently. Staff were asked to scan the environment to actively seek out children who may not be connected to peers (item 2; 65% implementation); to facilitate group activities by explaining the rules of the game, helping to navigate conflicts, and modeling appropriate behavior (item 4; 62% implementation); and to set up developmentally appropriate and motivating materials to start a group activity (item 3; 50% implementation). Items 1 and 5 were used less frequently. Staff were asked to help a child who was unengaged enter an activity (item 1; 47% implementation) and to foster peer communication by offering conversation topics, providing support for children to respond and initiate, and then fading their support (item 5; 23% implementation). By Phase 3 exit, small improvements in quality (range 1.92–2.72 on a 5-point scale) were noted, with 58% average implementation.

CS Implementation by Teachers. Teachers were asked to apply five strategies to help children stay connected to each other when moving from the classroom to recess or lunch. At baseline, teachers were using 40% of these transition strategies. Teachers randomized to CS began with higher implementation (M = 45.71%) than those who would not receive CS (M = 32.73%). At the end of Phase 1, on average, teachers demonstrated 47.78% use of the strategies. Teachers in both groups increased by approximately 10% by Phase 1 exit. Therefore, similar gains were made between teachers who received CS (M = 55.56%) and those who did not (M = 40.00%). By the end of Phase 2, teachers' usage of transition strategies remained stable, using 54% of the transition strategies (CS = 56%, no CS = 50%). At the end of Phase 3, average transition strategies usage was at 58% (CS = 52%, no CS = 68%).

At study baseline, teachers were using an average of 8.8% of the peer engagement strategies. Teachers assigned to CS showed higher strategy use at study baseline (M = 12.86%) compared with those who did not receive CS (M = 3.63%). After the CS intervention in Phase 1, teachers demonstrated 16.11% strategy use, with little difference when CS coaching was received (M = 16.67%) or not (M = 15.56%). By the end of Phase 2, teachers' usage of engagement strategies remained stable, using 23% of the strategies (CS = 17%, no CS = 38%). At the end of Phase 3, average engagement strategies usage was at 27% (CS = 34%, no CS = 17%). The quality of implementation was low for both groups across all time points.

CGI-S and Improvement in Peer Engagement

Children began the study with an average CGI-S score of 4 (M = 4.18, SD = 1.57), indicating moderate challenges engaging with peers. For example, a child may attempt to join a group with limited success or play near peers, but although the child is aware of peers, social initiations and responses with them are inconsistent, infrequent, or inappropriate. By the end of Phase 2, when children were measured for treatment response, severity was consistent, with an average score of 3 (M = 3.32, SD = 1.19). A score of 3 indicates mild challenges in peer engagement characterized by sporadic, brief periods of joint engagement while otherwise near and noticing peers (parallel aware). Average CGI-I scores indicated minimal or greater improvement (M = 2.81, SD = 1.25). Children with CGI-I scores of 1 or 2 were considered responders who were making consistent improvement and demonstrated a reduction of at least 1 point in their severity score. Scores of 3 indicate some change in peer engagement but that improvement may have leveled off during the intervention phase or did not warrant a reduction in the child's CGI-S score.

Early and Slow Response Rates. Out of the 32 children completing the study, at the end of Phase 2, 19 children (nine from RR and 10 from RR + CS) were slow responders (59%), and 13 children (six from RR and seven from RR + CS) were responders (41%) based on research team ratings.

Teaching Assistants' Rating of CGI. Teaching assistants rated 19 children, with 13 as

responders (CGI-I scores of 1 or 2) and 6 as slow responders. Of these same 19 children, the research team scored nine children as responders. Reliability between research staff and teaching assistants' rating was low for both CGI-S and CGI-I (Kappa < 0.2).

Discussion

Children with ASD have significant challenges in their social skills and peer engagement at school. Multiple studies have identified some of these challenges (Kasari et al., 2011; Locke, Beidas, et al., 2016; Locke, Shih et al., 2016), and many interventions have been developed and tested to help improve their social outcomes. This body of research finds that children do not respond the same to all interventions, and it is likely children need a sequence or combination of interventions to make significant and lasting improvements (Kasari & Smith, 2013). This project was designed with that goal in mind: to test a sequence of interventions that seemed plausible in low-resourced public school settings where children with ASD are included in the general education classroom. Low-cost environmental interventions were implemented and then augmented with more costly individualized interventions. Before scaling up to a fully powered SMART, we first undertook a feasibility study in which we could determine whether we had the study design right and the intervention design right. The discussion that follows is organized around lessons learned and potential changes in how and what we do next (see Table 5).

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The Social Landscape of Students With ASD

Our feasibility study provided us with information on our recruitment of a sample of children with ASD in general education classrooms. On the basis of these data, we learned that although we were successful in recruiting largely low-resourced, ethnic-minority children with ASD in underresourced urban schools, most of the students were not included in general education 80% of their day. This information was discovered only as we began the implementation of the interventions. It is unclear how widespread this phenomenon is, but in a future study, we need to seek more insider knowledge of the degree to which children are included in classrooms and recess with neurotypical classmates (the real day-to-day story). The fact that some children never had much contact with general education peers undoubtedly affects whom they have access to on the playground or in the classroom. This limited contact influences both the delivery of the intervention components as well as children's social engagement, the primary student-level outcome. For example, a CS teacher may prepare a student with ASD to transition from the classroom to recess with a peer, just to have the students separated to different areas of the playground because the student with ASD will be supervised by a special education assistant and have recess with their special education classmates. This separation of students results in the child with ASD having recess with peers they are not in class with as well as potentially not having access to peer mentors in the second phase of the study. Without access to the peer group on a regular basis, observations of peer engagement will be affected, and this information should affect our implementation strategy in a subsequent study.

Environmental Interventions: RR and CS

In Phase 1 of our study design, classrooms of children were randomized to receive RR or an RR-plus-CS intervention. RR was implemented by assistants whereas teachers implemented CS. Researchers observed the use of the intervention elements by teaching assistants trained in RR and teachers in CS. For RR, few of the strategies were in current use

Table 5. Lessons Learned and Potential Changes

Topic	Lessons learned in the current study	Proposed changes for next study	Category
Recruitment	We had difficulty recruiting school champions that would be sufficiently engaged. Most were administrators who were likely too busy to oversee both the study and intervention requirements.	The goal will be to recruit someone who is closer to the interventions, likely someone who is implementing the interventions at the school. This will result in more of a train-the-trainer model, where one person supervises the implementation of the interventions. Alternatively, if administrators would prefer to maintain oversight, it may be that they oversee the study design and another person who is implementing the interventions oversees the interventions. This will require more communication among the team members identified.	Implementation
	Large range in the amount that children are included with general education peers. Some children were not included at recess.	Track whom peers have access to at recess (e.g., included with mainstream peers, with special education peers, both)—this will affect propinquity.	Implementation
Phase 1: RR and RR + CS	RR strategies that require facilitation of group activities and social conversation are more challenging. Overall implementation was low.	Increase time and coaching on these strategies in particular; identify barriers to the use of these strategies and problem solve with assistants on ways to implement the strategies. Move didactic content to a group in-service or webinar to allow coaching to focus on implementation. This may be facilitated by establishing school partnerships in the school year prior to implementing a full-scale SMART.	Implementation
	CS intervention added little value to RR intervention. Low implementation.	School champions who model the use of environmental strategies can help foster a school culture that values and supports inclusion. Need to work with teachers on how best to implement strategies so they are easier to implement. Likely need to work with teachers during a period preimplementation or remove CS from AI components to implement.	Intervention design Study design

(continued)

Table 5. (continued)

Topic	Lessons learned in the current study	Proposed changes for next study	Category
Phase 2: Add peer-mediated or add parent-assisted intervention	Parent assisted: Found out that chosen "playdate" children were typically family members who were not at the same school where the other Phase 1 and 2 interventions were taking place.	It may be necessary to shift to thinking about this intervention as an opportunity to practice social skills that may generalize to schoolmates. Or we may want to think about adding this intervention for those responding quickly to the interventions to boost outcomes.	Study design Intervention design
	Peer mediated: Some children were not included during recess. Special education students sometimes had recess in a separate area of the playground, making access to and by the peers challenging.	It may be necessary to either observe a child's school day or develop a questionnaire for teachers to provide specific, detailed input on where the child is throughout their school day. This may help in understanding if and when peers would have access.	Implementation
		It may be that children need an intermediate social skills group in which there is direct instruction of peers with target children, rather than working only with neurotypical peers. Peer-mediated intervention might be replaced with a social skills group with more direct instruction (Shih et al., 2019).	Study design Intervention design
Identification of sufficient and insufficient responders	CGI scoring reliability was limited between the assistants and the researchers, causing us to use the researcher CGIs rather than our goal to transfer this measure to the RR teaching assistants.	Increase systematized practice and opportunity to use the CGI within the intervention training. A more in-depth training could be provided as part of an initial in-service or webinar. Additional opportunities to practice and receive feedback may support scoring reliability.	Intervention design Implementation
Phase 3: Continue or add remaining intervention	Difficult to execute all three phases in the required number of weeks.	The trial would need to begin in the beginning of the year to adequately get all three phases in; thus, recruitment and training would need to occur in the previous year. Alternatively, the last phase could be deleted and the first two phases increased in length.	Study design
Implementation fidelity	Assistants had difficulty implementing the higher-level strategies.	More time may be needed in each phase to increase implementation fidelity; it may be helpful to reserve coaching time for the higher-level strategies, and given numbers of students assistants are watching at recess, we may need to stratify the intervention responsibilities of different staff.	Implementation

Note. AI = adaptive intervention; CGI = Clinical Global Impression; CS = classroom supports; RR = Remaking Recess; SMART = sequential multiple-assignment randomized trial.

by teaching assistants at baseline (32%), but RR implementation increased to 58% after coaching. Teachers' use of CS strategies at baseline was at 5%, whereas after Phase 1, teachers were using about 40% of the strategies. What is unknown is the degree to which specific intervention elements are crucial for child change. It may be, as Locke et al. (2019) noted, that even a little change can improve child outcomes and that the goal should be to determine which elements are most needed for maximum change and how to help school staff implement these crucial elements (Kasari & Smith, 2013).

These findings regarding implementation are consistent with other data we have in the field. The addition of a school champion was one strategy the team hypothesized could boost implementation. This strategy was derived from work by Locke, Beidas, et al. (2019), who found that strategy use improved with more internal school supports (such as with a school champion) versus without. School champions in the current study were nominated by principals and included school administrators and school psychologists. Although the school champions facilitated the consent process for staff and families as well as the collection of additional paperwork, no champion chose to learn the RR intervention or how to monitor playground engagement. Because they were too distant from the interventions themselves, and sometimes distant from the study design, it was difficult for school champions to actively engage or support the staff members who were doing this work. Identified school leaders in each of the environmental interventions may aid in shifting accountability, confidence, and expertise to the school setting rather than the research team. Formalized, clearly specified leadership roles for intervention implementation are needed. This may or may not be an appropriate role for administrators acting as school champions. It is likely we need to rethink the use of school-based leadership teams and investigate other models for building intervention teams (e.g., Brookman-Frazee et al., 2020, with leadership teams).

Implementation Strategies to Support Higher-Level RR Techniques

Looking closely at the five RR strategies, teaching assistants mastered some of the simpler elements of the intervention (such as starting games) but struggled with higher-level group facilitation strategies (such as building conversations between children). The relatively low intervention implementation suggests that the teaching assistants may need more training time. To make the best use of the allotted 12 to 16 live 15-min coaching sessions, shifting didactic content (e.g., identifying and understanding children's states of engagement, challenges and strengths of children with ASD that may influence their social engagement, introduction to the strategies) to a large-group remote webinar or brief in-service at the beginning of Phase 1 may allow the staff more focused time to absorb the content and then allow the coaching sessions to target strategy implementation. Moreover, the phases of intervention may be too brief for teaching assistants to become proficient in all of the strategies, in particular, these higher-level facilitation strategies. In planning for a future trial, longer phases with fewer phase changes over the school year may be more effective.

However, a reconsideration of the strategies may also be needed to better fit the context of the school playground. In large, underresourced public elementary schools, the teaching assistants were often supervising many students and responsible for monitoring student safety above all else. These demands significantly limit the amount of individualized attention an assistant can provide to any given group of students to successfully foster peer-to-peer communication or help facilitate a game. Understanding how to reserve these strategies for targeted support may benefit assistants who are charged with whole-playground supervision.

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Parent-Assisted and Peer-Mediated Interventions

In Phase 2, we implemented parent-assisted and peer-mediated interventions. These individualized interventions were designed to boost children's engagement with peers on the playground. In the parent-assisted intervention, we discovered, however, that parents often planned playdates with family members (siblings or cousins) rather than classmates. In this situation, the parent-assisted intervention may provide indirect experiences to the target child rather than a direct experience with one of their classmates. It is possible that practicing at home with a family member could generalize to the playground at school with classmates, although we saw little evidence of this. In a future trial, more explicit connections among the component interventions, such as setting up the playdate with a classmate, may be necessary, or the parent-assisted intervention could be added as a generalization probe for the peer-mediated intervention at school rather than as a contrasting intervention.

We also found limitations of the peer-mediated intervention. The wide range in children's time included with typically developing peers during recess resulted in some children with ASD being more or less accessible to the prosocial peers who were participating in the peer-mediated intervention. In the case where peers were not readily available during recess, one intervention option may be to provide the target child with individualized support outside the playground. This support could come in the form of a small social skills group with direct instruction by the assistant or other staff member at school (Kasari et al., 2016). This approach has an evidence base for improving social outcomes in children with ASD (Shih et al., 2019). Randomizing the second phase of the intervention study to social skills group or individualized peer intervention may yield more information on whether a peer-directed or adult-directed intervention is needed. These considerations would change the interventions selected for study in the second phase.

Implementing Measurement of Student Response

An important aspect of the study was determining sufficient and insufficient responders to the first two phases. Our goal was to transfer the rating of students' improvement in social skills on a brief, 7-point scale indicating improvement (e.g., *very much improved* to *very much worse*) to the teaching assistants who were conducting the RR intervention. This measure, the CGI, is a part of the intervention itself, and thus, the ideal assessor is the one who knows the children the best and can rate their improvement. However, although this has been successfully used with therapists in rating improvement during the course of intervention (Gunlicks-Stoessel et al., 2016), it was much more difficult with assistants in this situation. First, the assistants rated only 19 of the 32 children. Several factors contributed to these missing data. Some assistants were reassigned to different recess periods, and others were not available to rate students during the assessment time frame (e.g., supervising a washroom visit; monitoring disciplinary actions, such as a time-out). The measure of response cannot include missing data. Therefore, this approach may not be the right one to assess response, or an alternative plan to determine response must be in place in the absence of the data.

Second, there was limited agreement between the assistants and the research team in the CGI ratings. For example, response rate was split, with about 40% of students responding well to the first two phases (environmental plus one individualized intervention) that were put into place and 60% of children responding slowly according to research staff. In contrast, teaching assistants rated nearly 70% of children as responders. Because teaching assistants are privy to daily interactions and a greater volume of information to base their judgment of improvement, it is important to better understand the differences in rating improvement between researchers and assistants. The CGI was designed to be rated using a baseline live observation and an end-phase live observation. However, due to

the many supervision demands placed on the assistants during recess, it is unclear how long the teaching assistants could focus specifically on the target child. Assistants may be rating the child's engagement using a portion of the observation window or perhaps from memory of recent interactions. It is also unclear how well the team conveyed the role, weight, and importance of the CGI in the intervention sequence to the assistants. It is possible the measure looks like another piece of paperwork to complete and the function of the tool within the intervention is not salient. Moving forward, spending more focused time on the role and use of the CGI as part of the RR intervention could take place during an initial school team meeting or professional development workshop. Increased practice time during training also may be needed to better understand how educators are evaluating improvement.

In summary, this feasibility SMART designed to improve social skills of children with ASD in school settings yielded important information in designing the next study and serves as a potential refinement of current school-based models of adapting intervention based on student response. Educators will recognize some similarity between AIs and the application of tiered interventions, such as multitiered systems of support (MTSS), which is sometimes considered an "umbrella framework," combining aspects of response to intervention and more specific orientations to intervention, such as positive behavior interventions and supports (August et al., 2018; Roberts et al., in press). AIs can be useful for operationalizing specific MTSS-inspired programs. For example, Roberts et al. (in press) describes a study to inform the development of a two-phase AI including self-regulation and reading intervention components.

AIs can be useful for operationalizing specific MTSS-inspired programs.

The advantage of AI and SMART designs is that the specific sequence of intervention has been specifically tested and optimized for individual students (August et al., 2018). The need is clearly present for children to have effective social skills interventions in schools, and future studies should test adaptive interventions based on various interventions to better understand what progress in peer relationships can be made for children with ASD in inclusive settings. However, there are several considerations regarding the dose, intensity, and school-based leadership of coaching that are needed to implement the interventions. Our considerations of lessons learned suggest the need for increased training of the selected interventions, longer phases of intervention, and simplifying the adaptive trial. This may result in a study with only two phases and not three. Given the heterogeneity in social skills among children with ASD, and their responses to interventions, a SMART design is likely the most rigorous approach to addressing the application of interventions to improve their ultimate social functioning.

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