Soundkins Evaluation Report

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Contents

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Executive Summary

Digital learning programs are a promising tool to support teachers in providing students with strong early literacy instruction, but more research is needed to understand their effectiveness. This report describes an experimental study that examined the impact of Soundkins, a digital early literacy program, on prekindergarten students' early literacy skills.

Design. The research team used a randomized controlled trial to examine the impact of providing prekindergarten students with the opportunity to use Soundkins on students' phonological awareness and letter-sound correspondence skills.

Sample. Nineteen prekindergarten teachers and 339 prekindergarten students from geographically and demographically diverse school districts across nine states participated in the study.

Key takeaways. The research team identified three key takeaways from this study.

1. **Soundkins shows promise as a supplement to prekindergarten teachers' core literacy instruction.** This study provides preliminary evidence that students in prekindergarten classrooms who were given access to Soundkins showed improved early literacy skills for the letters taught by Soundkins. This finding indicates Soundkins has the potential to support students in their development of foundational literacy skills that support future reading proficiency. Teachers require little training to implement Soundkins, and the activities can be integrated into existing classroom structures.
2. **Teachers' and parents'/guardians' feedback on Soundkins was generally positive, but program developers may need new strategies to facilitate greater uptake of the full range of Soundkins activities.** Teachers were generally able to incorporate the Soundkins whole-class activities into their daily literacy instruction, but the developers can consider potential modifications to the program that increase the feasibility of implementing the Soundkins activities in classroom and home contexts.
3. **Larger-scale research is needed to better understand the generalizability of Soundkins benefits for prekindergarten students.** This study provides preliminary evidence that Soundkins has the potential to provide educators in geographically and demographically diverse districts with a cost-effective solution to support young children's literacy. However, a larger study with a more representative sample is needed to understand whether Soundkins can support improved student learning at scale.

Background

Achieving reading proficiency by the end of the third grade is strongly associated with later educational attainment, subsequent earning potential, and life success (Hernandez, 2011). The National Early Literacy Panel (2008) identified six prereading skills that are the most crucial precursors to reading proficiency. Phonological awareness (PA)—the ability to recognize that words are made up of sound units—and alphabet knowledge (AK)—the knowledge of the names and sounds associated with printed letters—are both associated with clear and consistent relationships with later literacy skills.

However, time constraints and competing demands limit the capacity of prekindergarten teachers to provide students with sufficient PA and AK instruction (Veríssimo et al., 2021). To address this issue, digital learning programs offer teachers a promising opportunity to provide students with engaging, affordable, and low-burden PA and AK instruction within existing classroom structures. Despite the growing popularity of these digital tools, evidence of their effectiveness in supporting young children's early literacy skills is limited (Kim et al., 2021).

Soundkins is a digital early literacy program that provides young children with PA and AK skill instruction and practice. The program includes multiple 5-minute, video-based activities that target components of PA and AK skill development, such as a focus on initial phonemes and the ability to identify the letter sound for a focal letter. The Soundkins activities contain evidence-based features such as decontextualization to focus on target skills (Roberts et al., 2020) and age-appropriate movement (Niederer et al., 2011). The activities are designed for teachers to easily integrate into their routine literacy practices using existing classroom technologies. Soundkins also sends emails with activity links to students' parents and guardians, which provides students with additional opportunities to complete Soundkins activities at home.

About This Study

A team at SRI Education completed an independent efficacy evaluation of Soundkins to answer four primary research questions:

1. To what extent does the opportunity to use Soundkins improve students' phonological awareness skills?
2. To what extent does the opportunity to use Soundkins improve students' letter-sound correspondence[1] skills?
3. What were students', teachers', and parents'/guardians' experiences using the Soundkins activities in the classroom and at home?
4. How much does it cost for teachers to implement Soundkins in a prekindergarten classroom?

Who participated in the study?

The research team recruited prekindergarten teachers from across the United States to participate in the study (see Appendix A for details on recruitment procedures). Teachers and students from 17 schools and early childhood education (ECE) programs in 15 school districts across nine states participated in the study (Exhibit 1). The schools and districts varied in size, student demographics, and degree of urbanicity (see Exhibit B-1 in Appendix B for details). The study sample consisted of 19 prekindergarten (preK) teachers[2] and 339 students (see Exhibits B-2 and B-3 in Appendix B for sample details).

Exhibit 1. Study sample

[1] *Letter-sound correspondence* refers to the ability to identify the letter sound for a focal letter. This skill is an important component of alphabet knowledge.
[2] One additional teacher enrolled in the study but then declined to participate before study activities had begun. This teacher is not included in the teacher count.

Students

Study teachers reported that 153 of the 339 participating students were female (47%) and 176 were male (53%). Teachers also reported that 52 of the students (16%) were English language learners (ELLs).

Teachers

Among participating teachers, the median years of experience teaching prekindergarten was 9 years. Overall, the teachers' prekindergarten teaching experience ranged from 1 year to 19 years. All participating teachers had a bachelor's degree. Of the 19 total teachers, 11 (58%) had an advanced degree, such as a master's degree, and 13 (68%) had a degree focused on early childhood or literacy.

Participating teachers reported high levels of confidence regarding their capacity to support their students' literacy before beginning the study. All or almost all teachers (17 to 19) reported being "very" or "extremely confident" in using technology to facilitate lessons, using research-backed strategies and practices, identifying which letter sounds each student has demonstrated proficiency, and setting appropriate learning goals for students.

What was the study design?

The research team used a randomized controlled trial, which is a rigorous research design that examines cause-and-effect relationships between an intervention and an outcome. In this study, we examined the effect that the opportunity to use Soundkins had on students' phonological awareness and letter-sound correspondence skills. We randomly assigned participating teachers to an *intervention* condition or a *control* condition.[3] Intervention teachers were given access to the Soundkins program during the study period, while control teachers were asked to use business-as-usual literacy instruction during that time.

What did participating teachers do during the study?

Teachers in the intervention condition (10 of 19) were asked to implement Soundkins activities with their students for 10 weeks during fall 2022. Before using the program, intervention teachers attended a 30-minute virtual training with the Soundkins developer. The developer shared a schedule for completing the Soundkins activities over the 10-week implementation

[3] We randomized teachers to the intervention and control conditions after they had consented to participate in the research study. Because participating teachers consented to the study on a rolling basis during August and September 2022, we similarly randomized groups of teachers on a rolling basis.

period with the intervention teachers. The developer also sent weekly reminder emails to each teacher with information on the teacher's usage of Soundkins during the previous week, their schedule for the upcoming week, and links to relevant resources.

During the 10-week implementation period, teachers in the control condition (9 of 19) were prohibited from accessing Soundkins. However, they were provided access to Soundkins following the completion of study activities in spring 2023. Exhibit 2 provides a comparison of intervention and control teachers' activities during the implementation period.

Exhibit 2. Teacher study activities during the fall 2022 implementation period

Teacher Study Activity	Intervention Teachers	Control Teachers
Engaged in typical literacy instruction and activities with students	✓	✓
Attended a virtual Soundkins training with program developer	✓	
Provided access to whole-class and individual Soundkins activities at school	✓	
Provided access to Soundkins activities at home	✓	
Received weekly emails with Soundkins activity links and usage information	✓	

The research team examined how intervention teachers used Soundkins during the implementation period. We also gathered information on digital learning programs the control teachers (who did not have access to Soundkins) used to support their literacy instruction during that time.

Intervention teachers

While teachers assigned to the intervention condition were given the opportunity to use Soundkins activities in their classrooms, they were not required to implement the activities as part of their participation in the study. Teachers were asked to complete Soundkins activities designed for whole-class participation as well as individual activities students could complete independently or in small groups on a tablet or other device. Teachers were also asked to share access to Soundkins activities with parents or guardians of students in their classroom. After the study, the research team examined usage data generated by the Soundkins system to determine how teachers implemented Soundkins in their classroom under routine conditions.

Soundkins implementation

The research team examined the degree to which teachers in the intervention condition completed the sequence of Soundkins activities according to the developer's schedule (see Appendix C). We characterized teachers as implementing Soundkins with *high* fidelity if they completed at least 35 (80%) of the 44 Soundkins whole-class activities, *moderate* fidelity if they completed between 22 and 34 (50%–79%) of the whole-class activities, and *low* fidelity if they completed fewer than 22 (50%) of the activities. Six of the ten intervention teachers implemented Soundkins with high fidelity, three implemented with moderate fidelity, and one implemented with low fidelity.

Using the system-generated usage data, the research team also examined the extent to which participants used the Soundkins whole-class activities, individual activities, and home activities. All intervention teachers completed between 18 and 38 (41%–86%) of the 44 whole-class activities. Only 1 of the 10 intervention teachers used the individual activities. In that teacher's classroom, each student completed between 1 and 5 of the 28 available individual activities.

Teachers were also asked to share access to Soundkins with parents or guardians of children in their classroom. Parents and guardians who chose to sign up for Soundkins received weekly emails with links to Soundkins home activities that corresponded to the activities students were completing in class. In 4 of the 10 intervention teachers' classrooms, a least one student used the Soundkins activities at home. A total of 11 students used the home activities. The number of activities students completed at home ranged from 1 to 14 activities.

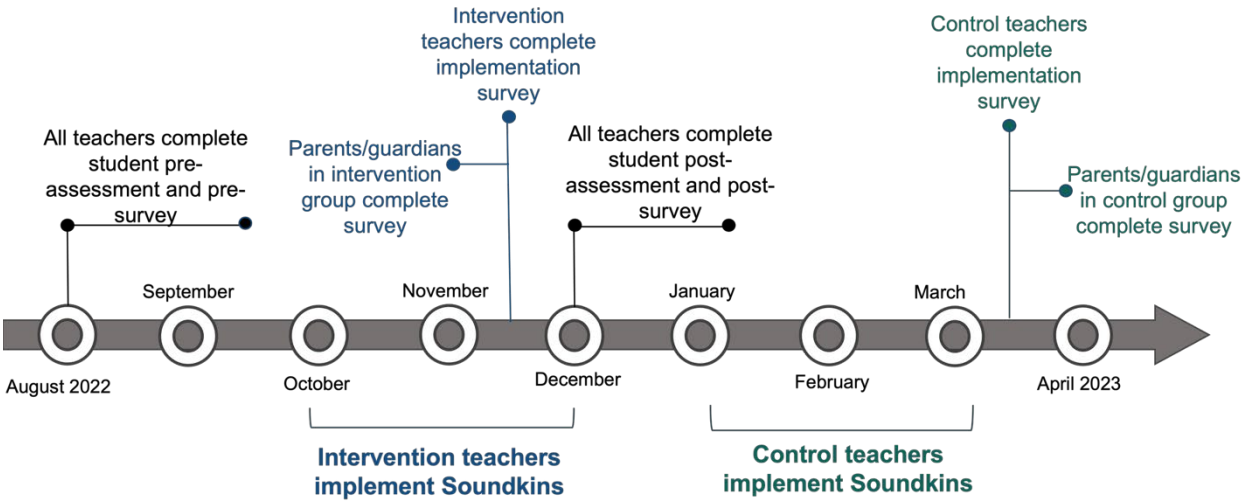
Control teachers

Teachers assigned to the control condition did not have access to Soundkins activities during the implementation period. The research team collected information about other digital literacy programs control teachers used during that time. Eight of the nine control teachers provided this information. Six of these eight teachers reported using a digital learning program, including Waterford, ABC Mouse, Lexia, Reading Eggs, and ABCya, during the implementation period. Two of the eight teachers reported not using a digital learning program during that time.

What data did the research team collect during the study?

During the study, the research team collected data using digital student assessments, surveys of participating teachers, and surveys of parents/guardians (Exhibit 3). See Appendix A for more details on the study measures and data collection procedures.

Exhibit 3. Study data collection timeline



Student assessments

The research team collected data on students' early literacy skills, specifically phonological awareness and letter-sound correspondence, using a digital assessment. Assessment items were specific to eight letters taught by Soundkins (m, s, k, b, a, t, d, and h) as well as four letters not taught during the Soundkins activities (n, i, f, g). Teachers in both the intervention and control conditions assessed their students at two timepoints. They conducted the first assessment in September to early October 2022, just before the intervention teachers began using Soundkins. Teachers conducted the second assessment in December 2022, immediately after the intervention teachers completed using Soundkins.

Teacher surveys

The research team asked intervention and control teachers to complete three surveys during the study: a pre-test survey, a post-test survey, and an implementation survey. The pre-test and post-test surveys captured information on teachers' backgrounds (e.g., their prekindergarten teaching experience and their academic credentials) and their confidence in supporting their

students' early literacy instruction. We administered the pre-test and post-test surveys to both intervention and control teachers during the same time frame as the first and second student assessments: the pre-test survey from September to early October 2022, and the post-test survey in December 2022. The implementation survey captured teachers' experiences using Soundkins in their classrooms. Intervention teachers completed the implementation survey in fall 2022, and control teachers completed the survey in spring 2023 because they were given access to the Soundkins activities after the implementation period.

Parent/guardian survey

The Soundkins developer sent a brief survey to all parents and guardians of children in participating classrooms who signed up to receive access to the home activities. The survey was sent through the Soundkins program and captured parents' and guardians' experiences completing the activities with their children at home. Parents and guardians completed the survey during the same time frame their children's teachers were completing the implementation survey: fall 2022 for parents and guardians in the intervention group, and spring 2023 for parents and guardians in the control group.

Study Findings

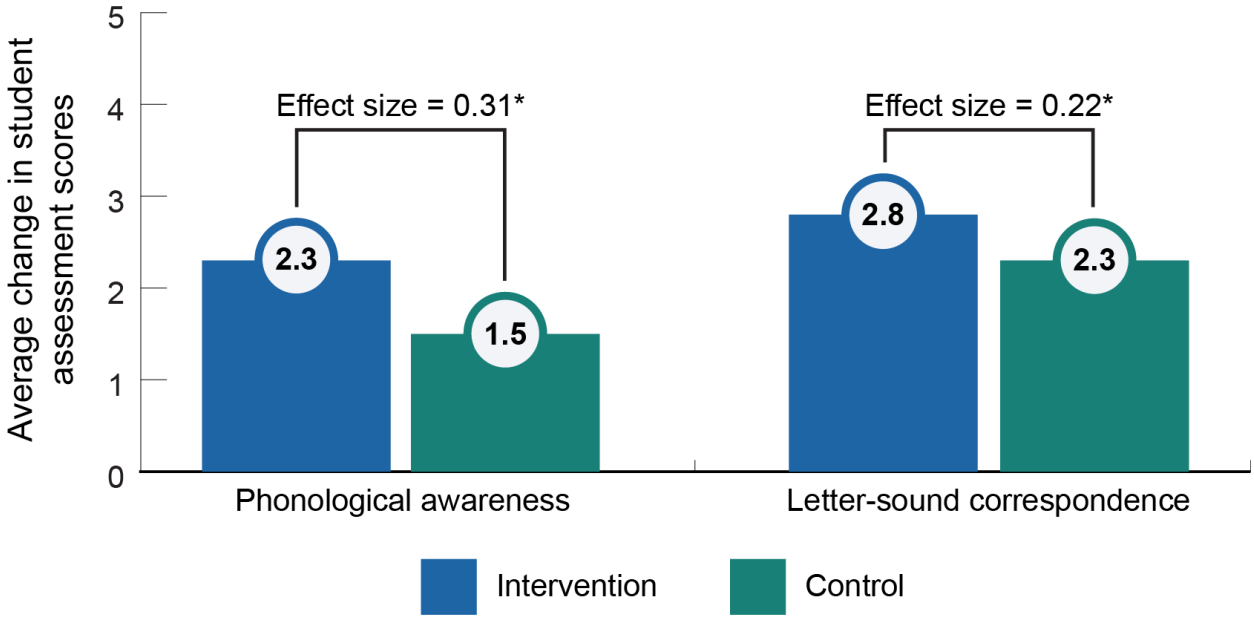
The research team examined the findings from the student assessment data to understand how the opportunity to use Soundkins impacted students' outcomes, specifically their phonological awareness (PA) and letter-sound correspondence (LSC) skills. We also examined findings from the teacher implementation survey and parent/guardian survey to learn more about teachers' and parents'/guardians' experiences with and perceptions of the Soundkins activities.

What impact did Soundkins have on students' early literacy skills?

Students in prekindergarten classrooms that were given access to Soundkins showed improved PA and LSC skills on the focal letters and sounds. The research team compared the amount of growth students showed from the first assessment in September to early October 2022 to the second assessment in December 2022. In both PA and LSC skills, students in the intervention condition, on average, showed larger gains from the first to the second assessment than students in the control condition did (Exhibit 4). The differences in gains in both PA and LSC skills between the intervention and control students were statistically significant ($p < .05$).[4] We also compared differences in students' second assessment scores while controlling for other student- and classroom-level factors. Although these analyses also pointed to stronger gains for students in the intervention group, the differences were not statistically significant. We provide additional details on the analytic approach and the sensitivity analyses in Appendix D.

[4] Statistical significance measures whether an observed effect is likely to be real or is possibly due to chance. When a study finds a statistically significant result, it means the effect is unlikely to have occurred by random chance alone.

Exhibit 4. Student gains in phonological awareness and letter-sound correspondence skills from September to December 2022, by condition



* The difference in mean gain scores between the intervention and control students reaches statistical significance ($p < .05$).

To better understand the findings specific to the impact of Soundkins on students' PA and LSC skills, the research team converted the findings to effect sizes. An effect size measures the change (in standard deviation units) in an average student's outcome that can be expected if the student is exposed to the intervention being studied. We calculated effect sizes for the analyses that examined the impact of Soundkins on students' outcomes. Across these analyses, the effect of Soundkins on students' PA skills ranged from 0.11 to 0.31, and the effect on students' LSC skills ranged from 0.22 to 0.33.

The research team used the following approaches to contextualize these effect sizes:

1. Kraft (2019) proposes that for education interventions that meet a specific per-student cost benchmark (less than $500 per student) and have the potential to scale with fidelity, the effect sizes can be interpreted as follows: less than 0.05 is *small*, 0.05 to less than 0.20 is *medium*, and 0.20 or greater is *large*. Findings from this study indicate the per-student cost of implementing Soundkins is low (see Appendix D for details on the cost analysis) and the whole-class activities have the potential to scale with fidelity**. Therefore, using Kraft's (2019) criteria, the effect sizes of Soundkins on students' PA and LSC skills can be classified as *medium* to *large*.**

2. We examined the effects of Soundkins in relation to the average prekindergarten student's natural growth in reading achievement during a school year (Lipsey et al., 2012).[5] **The students who were exposed to Soundkins demonstrated approximately 1.5 months more reading growth than if they had not been exposed to the intervention.**

Impacts on letter-sound correspondence skills for letters not taught by Soundkins

In addition to examining the impact of Soundkins on students' PA and LSC skills for letters taught by the Soundkins program (m, s, k, b, a, t, d, and h), the research team looked at students' growth in LSC skills for four letters not taught by the program (n, i, f, g). Interestingly, for letters not taught by the Soundkins program, the students in the control condition had statistically significant greater gains ($p < .05$) from the first to the second assessment than students in the intervention condition.

What were children's experiences using Soundkins?

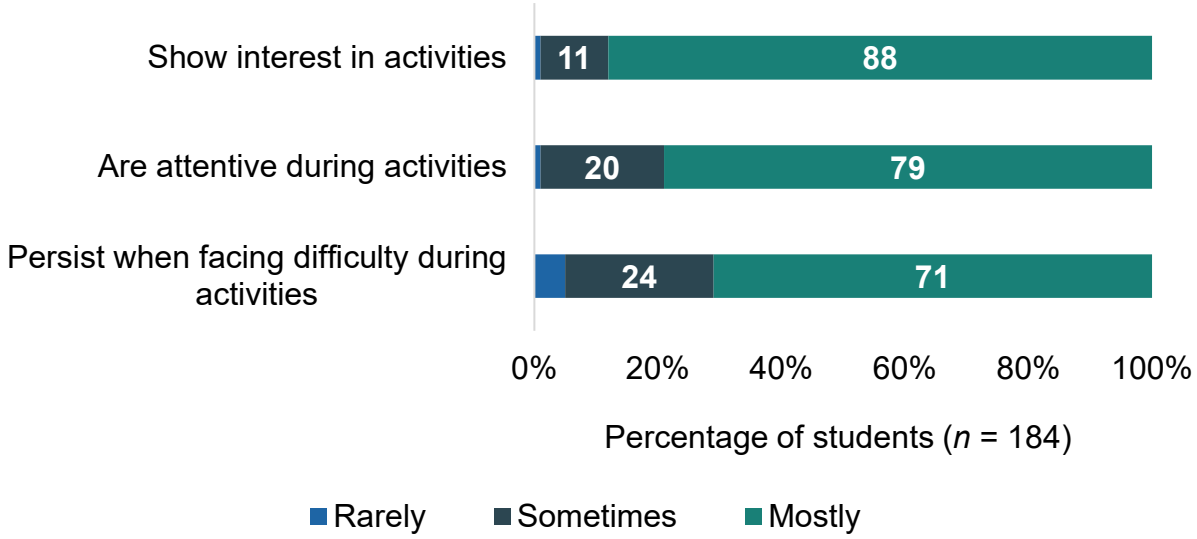
Teachers in the intervention condition reported that students maintained high levels of engagement with the Soundkins activities. At the end of the 10-week implementation period, teachers reported the majority of the 184 students in the intervention group showed interest in the activities (88%), were attentive during the activities (79%), and were persistent when they faced difficulty during the activities (71%; Exhibit 5).[6] Teachers reported that few students said the activities were too hard or did not attempt to complete them (4%). (See Exhibit B-4 in Appendix B for more details about student engagement with the Soundkins activities.) Similarly, on the teacher implementation survey (completed by teachers in both the intervention and control

> *"My students have really enjoyed Soundkins. They become excited when we are going to begin our Soundkins activities. This also helps to motivate them to complete their other activities first. They love meeting the new characters in Soundkins and then seeing them on the map."*
>
> –Prekindergarten teacher

[5] We used 1.52 standard deviation units as the estimate of natural growth in an average student's reading achievement during a year of life; we calculated this based on a sample of kindergarten and first grade students. The estimate was also specific to broad reading achievement, rather than students' PA and LSC skills specifically.
[6] During the second assessment, teachers in the treatment condition reported whether each student in their class "showed interest in the Soundkins activities, "was attentive during activities," "persisted when facing difficulty during the activities," and "said the activities were too hard or did not attempt to complete them." Teachers rated each student on the following scale: 1 = rarely, 2 = sometimes, and 3 = mostly.

conditions), 14 of 18 teachers (78%) reported that, on average, their class was "very attentive" during Soundkins activities, and 13 of 18 teachers (72%) indicated that children demonstrated "a great deal of participation." Also, 16 of 18 teachers (89%) reported their students enjoyed using Soundkins.

Exhibit 5. Students' degree of engagement with Soundkins activities



Parents and guardians reported somewhat lower engagement with the Soundkins activities at home compared to teacher-reported engagement at school. Eight of the 11 parents and guardians (73%) who completed the survey reporting their children were "moderately engaged" when using Soundkins at home. Despite lower engagement, all 11 parents and guardians reported their children enjoyed using Soundkins. In written feedback on the parent/guardian survey, one parent mentioned their child "…loves the [Soundkins] activities and often asks for them on [their] own." Another parent noted the Soundkins activities were "…often what [their child] talked about on the way home from school."

What were teachers' perceptions of Soundkins?

Teachers in both the intervention and comparison conditions generally reported positive experiences with the Soundkins program. All 18 teachers who completed the implementation survey reported Soundkins was easy for them to use and that their students were learning literacy skills from the Soundkins activities. Also, 12 of the teachers (67%) reported Soundkins was easy for their students to use and that it complemented their other literacy instruction.

> *"Soundkins fills a niche where we don't currently have a dedicated program that uses playful videos/engagement to supplement teacher instruction in phonemic awareness. It's easy to use, and the kids enjoy doing the activities."*
>
> –Prekindergarten teacher

When asked to rate their perceptions of Soundkins's impact on their students, all 18 teachers reported the program had a positive impact on their students "learning to hear sounds in spoken words" and "learning letter sounds." In addition, 17 teachers (94%) reported Soundkins had a positive impact on "accelerating literacy skills for struggling students."

When asked how Soundkins compared to other digital literacy programs they had used or were currently using with students, eight of the teachers (44%) reported Soundkins was "about the same," and nine (50%) reported that it was "better" than other programs.

What were parents' and guardians' perceptions of Soundkins?

Parents and guardians who used the Soundkins activities with their child at home also offered positive feedback on the program. Ten of the 11 parents and guardians who completed the survey (91%) reported they wanted to continue using Soundkins activities at home and that Soundkins was easy for them to use. Also, nine of the parents and guardians (82%) reported they found Soundkins to be a helpful resource for their children's early reading skills. One parent provided written feedback that their child "…seemed to be learning well from the letter-sound activities."

How much did it cost for teachers to use Soundkins?

The research team conducted additional analyses to capture the cost of using Soundkins in prekindergarten classrooms. Teachers in the study used existing technology in their classrooms to implement the Soundkins activities; therefore, we calculated the cost of implementing Soundkins based on the amount of time teachers spent implementing the different parts of the program (e.g., facilitating whole-class activities, sharing access to Soundkins with parents and guardians). Our cost analyses indicated that for the classrooms that participated in this study, the average cost to implement Soundkins per classroom was approximately $660 and the average cost per student was approximately $30. (See Appendix D for additional details on the cost analysis methodology.)

Limitations

This study used a rigorous experimental design. Nevertheless, it is important to consider several limitations when interpreting the study findings.

- **Sample size.** The research team recruited 19 prekindergarten teachers to participate in the study. While this sample size allowed us to gather preliminary evidence of the impacts of Soundkins on students' outcomes, the sample size limited the sensitivity of more rigorous analyses that require larger numbers of participants.
- **Generalizability of the study sample.** The research team used several methods to recruit prekindergarten classrooms from across the United States, but site selection was not designed to produce a nationally representative sample. Further, many participating teachers were recruited through social media posts regarding participation in a study of a digital learning program to support early literacy skills (specifically PA and LSC), and the teachers reported high levels of confidence in using technology and supporting their students' early literacy skills at the start of the study. Therefore, the teachers who participated in this study may be different from teachers who do not use social media, who are not interested in participating in a study of a digital early literacy program, or who are not as confident in supporting early literacy skills. A detailed description of our recruitment approach is in Appendix A.
- **Study measures.** To assess the impact of Soundkins on students' literacy outcomes, the research team used a measure that is typically embedded within the Soundkins program as an interim skills check for students. In collaboration with the Soundkins developer, we designed the student assessments to reflect students' PA and LSC skills in relation to the letters taught by the Soundkins program. We do not have information on the reliability and validity of the student assessments. A detailed description of the student assessments and data collection procedures is in Appendix B.

Implications of Study Findings

The research team conducted a rigorous experimental study of Soundkins, a digital early literacy program that aims to strengthen prekindergarten students' phonological awareness (PA) and letter-sound correspondence (LSC) skills. We also gathered information on teachers and parents'/guardians' experiences using Soundkins in authentic contexts. We have identified three key implications from this study:

1. **Soundkins shows promise as a supplement to prekindergarten teachers' core literacy instruction.** Findings from this study demonstrate Soundkins has the potential to support students in their development of foundational PA and LSC skills that support future reading proficiency. Although only some of the findings on the impacts of Soundkins on students' outcomes reached statistical significance, the effect sizes across all analyses demonstrate that students who were exposed to the Soundkins activities demonstrated larger gains in PA and LSC skills (for letters taught by the program) than if they had not been exposed to the intervention. In addition, Soundkins requires little teacher preparation, can be integrated into typical classroom routines, and is inexpensive to implement.
2. **Teachers' and parents'/guardians' feedback on Soundkins was generally positive, but program developers may need new strategies to facilitate greater uptake of the full range of Soundkins activities.** Educators in geographically and demographically diverse districts were generally able to incorporate the Soundkins whole-class activities into their daily literacy instruction. However, the use of Soundkins individual activities in the classroom and at home were limited. The program developers may consider additional user testing to identify some of the barriers teachers and parents or guardians encounter when using Soundkins activities in the classroom or at home and then make necessary modifications to the program to increase the feasibility of implementation in these contexts.
3. **Larger-scale research is needed to better understand the generalizability of Soundkins benefits for prekindergarten students.** Our findings provide preliminary evidence that Soundkins has the potential to provide educators in geographically and demographically diverse districts with a cost-effective solution to support young children's literacy; however, these findings should be viewed as the beginning rather than the end of the examination of Soundkins's effectiveness. This

study included volunteer teachers with high levels confidence in their ability to support students' early literacy skills. Although study teachers were drawn from across the United States, the sample is not representative of all teachers. A larger study with a more representative sample is needed to understand whether Soundkins can support improved student learning at scale. Given the small number of teachers included in this study, the differences between the intervention and control conditions did not reach conventional levels of statistical significance. A larger study would provide the statistical power to determine whether the differences observed in this study were the result of chance. Finally, additional research could more closely examine the impacts of Soundkins on letters and sounds that were not featured in the program during the study.

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Appendices

Appendix A: Recruitment and Data Collection Procedures

Recruitment

The SRI Education research team, in collaboration with the Soundkins developer (Hoogalit), used a variety of strategies to recruit the study sample. We contacted state- and district-level education personnel from Hoogalit's client list, SRI's professional connection database, and online research. We also used social media to aid with teacher recruitment. The principal investigator of the study shared the study flyer with LinkedIn professional connections. Additionally, we identified a social media content creator who was compensated to post a short video on TikTok on our behalf, describing the Soundkins study and how to contact the research team. All recruitment materials included a link to an online interest form. We followed up with all individuals who completed the interest form to share additional information about the study and to determine whether they were eligible to participate. Before enrolling interested teachers in the study, we obtained approval from school leaders as well as from school districts, if necessary.

After obtaining approval to participate in the study, teachers completed a consent form that included screening questions to confirm their eligibility. Teachers were required to meet all of the following criteria to participate in the study:

- They taught prekindergarten students who were 4 and 5 years of age.[7]
- They had access to reliable Wi-Fi in their classroom.
- They did not teach in a self-contained special education classroom.
- They were a classroom lead teacher or co-teacher (not a teacher's assistant or paraprofessional).

Teachers who enrolled in the study were asked to share information about the study with the parents or guardians of students in their classrooms. Parents and guardians were given the opportunity to contact the research team if they did not want their children's information shared

[7] Teachers of classrooms that served as a "bridge" between preschool and kindergarten (transitional kindergarten, 4-year-old prekindergarten) were eligible for participation in the study.

with us. All students whose parents or guardians did not contact us were included in data collection activities.

Data collection

The data collection activities for this study included student assessments, teacher surveys, and a parent/guardian survey. The research team conducted data collection activities between September 2022 and April 2023. Before data collection activities, all participating teachers met with us via Zoom for an orientation to the Soundkins program and study activities. Teachers received a $25 Amazon e-gift card for attending the orientation meeting.

Student assessments

The research team collected baseline and post-test data on students' early literacy skills, specifically phonological awareness (PA) and letter-sound correspondence (LSC), using a digital assessment administered at two timepoints. Teachers in both the intervention and control conditions administered the first assessment to their students in September to early October 2022 and the second assessment in December 2022. Teachers in the intervention condition administered the first assessment before they started using the Soundkins activities and the second assessment after they finished the 10-week implementation period. Teachers in the control condition administered the first assessment after they completed study onboarding activities and the second assessment approximately 10 weeks later. Six of the 19 teachers in the study had two prekindergarten sessions per day; five of these six teachers administered the assessments to students in both their morning and afternoon sessions, and the other teacher administered the assessments only to students in their morning session.

Assessment items. The assessment items were drawn from a skills-check that is typically embedded within the Soundkins program.[8] The assessment began with two practice items to introduce students to the structure of the assessment. Part 1 of the assessment contained eight questions that captured students' knowledge of initial phonemes, specifically for the eight letters that were the focus of Soundkins activities (m, s, k, b, a, t, d, and h). A student's PA score was calculated by summing the number of correct responses on the eight items. Part 2 of the assessment contained 12 items that asked students to respond with the letter sound for the letter presented on the screen. Eight of these items were specific to the letters taught in Soundkins activities, and the other four items captured information on letters not taught in Soundkins

[8] The assessment used in this study is typically administered midway through Soundkins implementation as part of the sequence of activities. For the purposes of this study, teachers did not administer the assessment as part of the Soundkins activity sequence.

activities (n, i, f, g). A student's LSC score was calculated by summing the number of correct responses on the eight items on the letters taught by Soundkins. Assessment items were consistent across both timepoints.

Assessment procedures. For both the first and second assessments, teachers assessed each student individually by playing a prerecorded video that contained the assessment items. Students responded verbally to the items, and teachers were asked to fill out a checklist capturing the students' responses. For the first assessment, teachers also provided information on each student's gender and whether the student was learning English as a second language. For the second assessment, teachers in the intervention condition also reported on each students' level of engagement when completing the Soundkins activities. After completing the first and second assessment scoring sheets, the teachers uploaded the student data to the Soundkins program. The research team provided teachers with a $50 Amazon e-gift card for each student assessment they completed to compensate them for their time. The Soundkins developer de-identified the student data and securely shared the de-identified data files with the research team.

Teacher surveys

Teachers were asked to complete three surveys during the study. They completed a 10-minute pre-test survey at the same time they facilitated the first student assessment (September to early October 2022) and a 10-minute post-test survey at the same time they facilitated the second student assessment (December 2022). Lastly, they completed an implementation survey approximately 8 weeks after they had been given access to Soundkins. Teachers in the intervention condition completed the implementation survey in fall 2022, and teachers in the control condition completed the survey in spring 2023 because they were given the opportunity to use the Soundkins activities in their classroom after the implementation period.

Survey items. The research team developed all teacher survey items in collaboration with the Soundkins developer. During the pre-test survey, teachers provided information about their backgrounds (e.g., their prekindergarten teaching experience and their academic credentials). The pre-test survey and post-test survey both contained items on teachers' confidence in supporting their students' early literacy skills. Items on the implementation survey captured teachers' experiences using the Soundkins program in their classrooms, such as when they implemented different types of Soundkins activities, the parts of the activities they liked the most, and challenges they encountered when using the activities. The implementation survey

also included items that captured the amount of time teachers spent using Soundkins in their classrooms, which informed the cost analysis.

Survey procedures. All surveys were administered via Qualtrics links. The pre-test and post-test survey links were embedded in the Soundkins program, and teachers were instructed to complete the surveys while they were facilitating the first and second student assessments. The research team sent teachers a link to the implementation survey via email and text message. We sent reminders to non-completers via email and text message for 2 weeks following survey launch. Teachers could receive up to $125 in Amazon e-gift cards for completing all three surveys.

Parent/guardian survey

The Soundkins developer sent a brief survey to all parents and guardians of children in participating classrooms who signed up to receive access to the Soundkins activities at home. Parents and guardians received the survey at approximately the same time their children's teachers received the implementation survey. Therefore, parents and guardians of children in the intervention condition completed the survey in fall 2022, and parents and guardians of children in the control condition completed the survey in spring 2023.

Survey items. The research team developed all parent/guardian survey items in collaboration with the Soundkins developer. The survey items captured details on parents' and guardians' experiences using the Soundkins activities with their children at home, including when they typically used the activities, their level of involvement when their children were completing the activities, and their perceptions of how Soundkins supported their children's early literacy.

Survey procedures. The parent/guardian survey was administered via Qualtrics. The Soundkins developer shared the opportunity to complete a survey through the Soundkins program. All parents and guardians of children in participating classrooms who had signed up to receive Soundkins activities had the opportunity to complete the survey. The developer sent a reminder to complete the survey approximately 1 week after the initial survey launch, and the research team closed the survey after approximately 3 weeks. Parents and guardians who completed the survey received a $30 Amazon e-gift card to compensate them for their time.

Usage data

The Soundkins program collected data on teachers' and parents'/guardians' usage of the Soundkins activities, such as the completion status of the activities and the time of day the

activities were completed. The Soundkins developer securely shared de-identified usage data for teachers in the intervention condition with the research team in January 2023.

Human subjects protections

All SRI researchers are trained in protecting human subjects and in maintaining participant confidentiality and data security. The research team collected only data that was needed for conducting the study. Teacher consent forms, surveys, and implementation logs were administered online via Qualtrics. Qualtrics data is protected using high-end firewalls, with systems that meet or exceed federal requirements for securing sensitive information. All other research data was transmitted and stored only via SRI's secure SharePoint site and was accessible only to members of the research team. All identifying participant information will be destroyed according to SRI's Institutional Review Board guidelines.

Appendix B: Report Tables and Figures

Exhibit B-1. Geographic distribution of study sample

State	Districts	# of Schools	# of Teachers	Locale Classification
California	CA1	2	2	Suburban – Large
	CA2	1	1	City – Large
	CA3	1	1	City – Large
	CA4	1	1	City – Large
	CA5	1	1	Rural – Fringe
Florida	FL1	1	1	Suburban – Large
Michigan	MI1	1	1	Town – Fringe
	MI2	1	1	Rural – Distant
Minnesota	MN1	1	2	City – Midsize
	MN2	1	1	Town – Distant
New York	NY1	1	1	Town – Fringe
Texas	TX1	1	1	Town – Fringe
Virginia	VA1	1	1	Rural – Distant
Washington	WA1	1	2	City – Large
Wisconsin	WI1	1	3	City – Small
Total	**15**	**16**	**20**	–

Note. One teacher withdrew from the study before data collection began. Locale classification was obtained from the National Center for Education Statistics' district locator tool (https://nces.ed.gov/ccd/districtsearch/). The research team did not include district names to protect the confidentiality of study participants.

Exhibit B-2. Student assessment completion

Student Condition	# of Possible Students	# of Students With 1st Assessment Score	# of Students With 1st and 2nd Assessment Scores
Intervention	195	185	182
Control	196	154	147
Full sample	391	339	329

Note. Teachers administered the first assessment in September to early October 2022, just before the intervention teachers began using Soundkins. Teachers administered the second assessment immediately after the intervention teachers completed using Soundkins in December 2022.

Exhibit B-3. CONSORT diagram

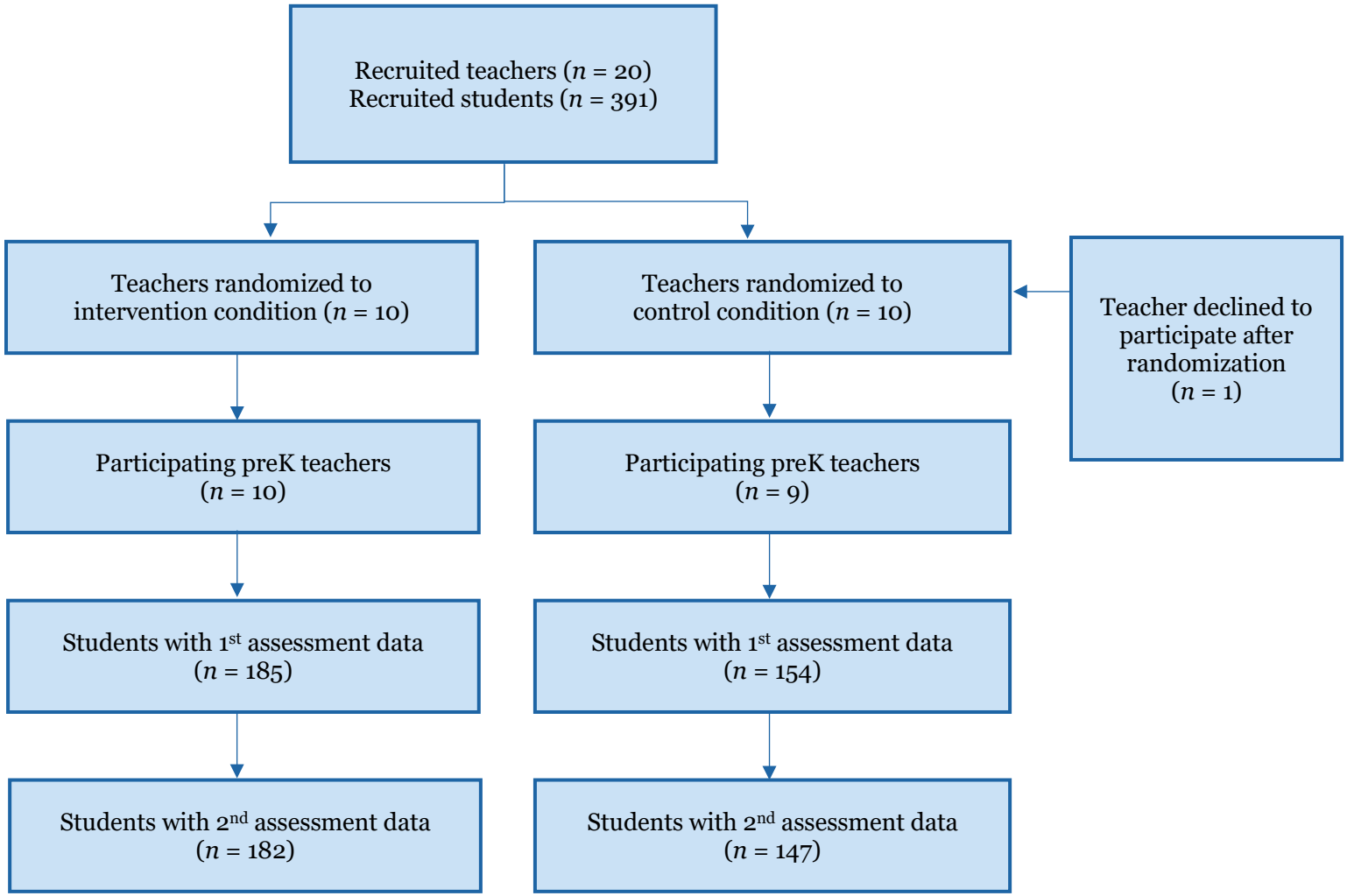

Exhibit B-4. Intervention student engagement with Soundkins activities

Engagement Item	Rarely (%)	Sometimes (%)	Mostly (%)
Is attentive during activities (n = 184)	1	20	79
Shows interest in activities (n = 184)	1	11	88
Persists when facing difficulty during activities (n = 184)	5	24	71
Says activities are too hard or does not attempt to complete the activities (n = 183)	96	4	–

Note. Intervention teachers reported on students' engagement with the Soundkins activities for each student in their classroom at the same time they administered the second student assessment in December 2022.

Appendix C: Soundkins Implementation Schedule

Activity Schedule for the Soundkins Study

(Intervention Condition)

Schedule		
Week 1 ___/___/___	**First assessment**	**Activity**
Monday–Friday	1. Assess each child individually this week. ● Instructions and materials will be sent via email. ● Training for the assessment via 30-minute live Zoom session prior to week 1. 2. Fill in the survey in the assessment tab of the app.	
Below is the schedule to play whole-group activities at the same time each day. Children can then play the activities independently at school and home.		
Week 2 ___/___/___	**Module 1: Phonemes**	**Activity**
Monday	/m/	Mike
Tuesday	/s/	Sam
Wednesday	/m/	Mike 2
Thursday	/s/	Sam 2
Friday	Review of /m/ and /s/	Sounds with Miss Gennie
Week 3 ___/___/___	**Module 1: Phonemes**	**Activity**
Monday	/k/	Kate
Tuesday	/b/	Bob
Wednesday	/k/	Kate 2
Thursday	/b/	Bob 2
Friday	Review of /k/ and /b/	Sounds with Miss Gennie
Week 4 ___/___/___	**Module 1: Phonemes**	**Activity**
Monday	/a/	Addie
Tuesday	/t/	Tilly

Schedule		
Wednesday	/a/	Addie 2
Thursday	/t/	Tilly 2
Friday	Review of /a/ and /t/	Sounds with Miss Gennie
Week 5 ___/___/___	**Module 1: Phonemes**	**Activity**
Monday	/d/	Dov
Tuesday	/h/	Hua
Wednesday	/d/	Dov 2
Thursday	/h/	Hua 2
Friday	Review of /d/ and /h/	Sounds with Miss Gennie
Week 6 ___/___/___	**Module 2: Letter sounds**	**Activity**
Monday	m	m Monkey
Tuesday	s	s Snake
Wednesday	m	m Monkey 2
Thursday	s	s Snake 2
Friday	Review of m and s	Sing with Monkey and Snake
Week 7 ___/___/___	**Module 2: Letter sounds**	**Activity**
Monday	k	k Kitty
Tuesday	b	b Bunny
Wednesday	k	k Kitty 2
Thursday	b	b Bunny 2
Friday	Review of k and b	Sing with Kitty and Bunny
Week 8 ___/___/___	**Module 2: Letter sounds**	**Activity**
Monday	a	a Ant
Tuesday	t	t Teddy

Schedule		
Wednesday	a	a Ant 2
Thursday	t	t Teddy 2
Friday	Review of a and t	Sing with Ant and Teddy
Week 9 ___/___/___	**Module 2: Letter sounds**	**Activity**
Monday	d	d Dog
Tuesday	h	h Horse
Wednesday	d	d Dog 2
Thursday	h	h Horse 2
Friday	Review of d and h	Sing with Dog and Horse
Week 10 ___/___/___	**Second assessment**	**Activity**
Monday	h (as a review activity)	h Horse
Monday–Friday	1. Assess each child individually this week. ● Instructions and materials will be sent via email. ● Training video 2. Fill in the survey in the assessment tab of the app.	

Appendix D: Analysis Details and Data Tables

This appendix details the methodology and findings from the student impact analyses and the cost analysis.

Student impact analyses and results

For the student impact analyses, the research team conducted preliminary analyses to determine the extent to which potential bias might be introduced into the study findings. These preliminary analyses included examining the amount of attrition from the study sample and measuring baseline equivalence of the student and teacher samples.

The research team subsequently examined the impacts of Soundkins on students' phonological awareness (PA) and letter-sound correspondence (LSC) skills, using *t*-tests and regression analyses. The team conducted an intent-to-treat (ITT) impact analysis to estimate the expected effect of Soundkins as implemented under routine conditions. ITT is the average effect of an intervention based on initial study condition assignment, regardless of the extent to which a participant received or completed the intervention. Therefore, for this study, an ITT analysis allowed the team to document the impact on students when their teacher had the opportunity to use Soundkins activities rather than examining the impacts on only those students whose teacher completed the Soundkins activities.

Attrition

This study had low levels of teacher and student attrition (see Exhibits B-2 and B-3 in Appendix B). One teacher (5% of the total sample of 20 teachers) withdrew from the study after randomization but before the baseline student assessment (first assessment) was administered. No additional teachers left the study. Participating teachers collected baseline student assessments from 87% of all possible students in their classrooms (95% in the intervention condition and 79% in the control condition). The research team included students with baseline data in the study sample. From baseline to post-test (second assessment), the student-level attrition rate for the whole sample was 3% (intervention condition = 2%, comparison condition = 5%, differential attrition = 3%). According to What Works Clearinghouse (WWC) standards (2020), there is low risk of bias due to attrition from the study sample.

Baseline equivalence

The research team also conducted a baseline equivalence analysis of the study sample. There were no statistically significant (p <. 05) differences between intervention and control students

on demographics or baseline scores. In no cases did intervention and control student differences exceed the WWC (2020) cutoff standard of 0.25 standard deviations (Exhibit D-1). The differences between teacher characteristics in the intervention and control conditions (years teaching prekindergarten and educational attainment) were also not statistically significant (see Exhibit D-1).

Exhibit D-1. Student characteristics, student baseline scores, and teacher characteristics

Characteristic	Full sample	Intervention	Control	Effect size (*d*)
	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	
Student characteristics				
Gender (female)	0.46 (0.50)	0.49 (0.50)	0.42 (0.50)	0.13
Teacher-reported ELL	0.16 (0.37)	0.18 (0.39)	0.13 (0.34)	0.15
Student baseline scores				
Phonological awareness	1.48 (2.42)	1.34 (2.35)	1.66 (2.49)	−0.13
Letter-sound correspondence	1.22 (2.19)	1.27 (2.31)	1.17 (2.05)	0.05
Non-Soundkins letters	0.33 (0.89)	0.41 (0.99)	0.23 (0.75)	0.19
Teacher characteristics				
Years teaching preK	8.26 (5.01)	7.20 (5.27)	9.44 (4.72)	–
Bachelor's degree	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	–
Advanced degree	0.58 (0.51)	0.50 (0.53)	0.67 (0.50)	–
ECE or literacy-focused degree	0.68 (0.48)	0.80 (0.42)	0.56 (0.53)	–

Note. N = 339 for the full student sample; n = 185 for students in the intervention condition, and n = 154 for students in the control condition. N = 19 for the full teacher sample; n = 10 for teachers in the intervention condition, and n = 9 for teachers in the control condition. ELL = English language learner; preK = prekindergarten; ECE = early childhood education. The research team did not find statistically significant differences between the intervention and control conditions on student characteristics, student baseline scores, or teacher characteristics. Student characteristics and baseline scores did not exceed the What Works Clearinghouse (2020) cutoff standard of 0.25 standard deviations.

Primary analyses

To assess the impact of Soundkins on students' PA and LSC skills, the research team conducted separate two-sample *t*-tests to compare the mean gain scores (i.e., students' baseline score subtracted from their post-test score) for PA and LSC skills with students in the intervention condition and the control condition (Exhibit D-2). We also conducted a two-sample *t*-test of the mean gain score for four assessment items that captured letter sounds not taught as part of the

Soundkins program to examine how the effects compared to letters taught by the program. We also conducted *t*-tests examining the mean PA and LSC gain scores comparing students in the intervention condition and control condition who had been reported by their teachers as being English language learners (ELLs; Exhibit D-3).

Phonological awareness. A two-sample *t*-test for students' PA skills indicated there was a statistically significant difference in the mean PA gain score between the intervention condition and the control condition in favor of the intervention condition [$t(df) = 2.81\ (321.66)$, $p < .01$]. The effect size for the PA gain score *t*-test was $d = 0.31$.

Letter-sound correspondence. A two-sample *t*-test indicated there was also a statistically significant difference in the mean LSC gain score between the intervention condition and the control condition in favor of the intervention condition [$t(df) = 2.01\ (317.22)$, $p < .05$]. The effect size for LSC gain score *t*-test was $d = .22$.

Letters not taught by Soundkins. A two-sample *t*-test indicated there was a statistically significant difference in the mean gain score for letters not taught by Soundkins between the intervention condition and the control condition, with students in the control condition having higher gain scores, on average [$t(df) = -3.01\ (281.80)$, $p < .01$].

Exhibit D-2. Comparing mean gain scores for students in the intervention and control conditions

Construct	Intervention (n = 182) Mean (*SD*)	Control (n = 147) Mean (*SD*)	*t* score	*df*	*p*-value	Effect size
Phonological awareness	2.27 (2.76)	1.45 (2.53)	2.81	321.66	< .01	0.31
Letter-sound correspondence	2.82 (2.44)	2.29 (2.35)	2.01	317.22	< .05	0.22
Non-Soundkins letters	0.62 (1.05)	1.01 (1.27)	−3.01	281.8	< .01	−0.34

Note. These findings include students who had both baseline and post-assessment scores. The research team conducted independent samples two-tailed *t*-tests. For each outcome, we calculated gain scores by subtracting students' baseline scores from their post-test scores.

English language learners. Two-sample *t*-tests indicated that for PA and LSC skills for letters taught by Soundkins, there were no statistically significant differences in the mean gain scores for students in the intervention and control conditions who had been reported by their teachers as being ELLs (see Exhibit D-3).

Exhibit D-3. Comparing mean gain scores for English language learners in the intervention and control conditions

	Intervention (n = 34)	Control (n = 18)				
Construct	**Mean (*SD*)**	**Mean (*SD*)**	***t* score**	***df***	***p*-value**	**Effect size**
Phonological awareness	1.65 (2.37)	1.83 (2.94)	−0.23	29.00	0.82	-0.07
Letter-sound correspondence	2.62 (2.77)	2.72 (2.74)	−0.13	35.14	0.90	-0.04

Note. The research team conducted independent samples two-tailed *t*-tests. For each outcome, we calculated gain scores by subtracting students' baseline scores from their post-test scores.

Sensitivity analyses

The research team conducted additional sensitivity analyses to further examine the impact of Soundkins on students' PA and LSC skills. To account for the nested structure of the data, we specified a series of two-level hierarchical linear models (HLMs; Raudenbush & Bryk, 2002), one corresponding to each outcome variable (i.e., PA and LSC) at post-test, where students (Level 1) were clustered within teachers, the unit of randomization (Level 2). Teachers were modeled as a random effect. For both PA and LSC, we fit a taxonomy of fitted models; all models included a dichotomous intervention indicator (comparison = 0, intervention = 1). To reduce residual variability, Model 2 included covariates that were significantly correlated with students' PA or LSC post-test scores ($p < .05$), and Model 3 included all possible covariates. Possible teacher-level covariates included number of years teaching prekindergarten, whether the teacher had an advanced degree, whether the teacher had a degree focused on early childhood education or literacy, the average baseline score for students in their classes, and whether the teachers' classrooms were classified as transitional kindergarten, 4-year-old kindergarten, or early 5's prekindergarten. Possible student-level covariates were students' gender, whether they were reported by their teachers as being English language learners, their baseline scores (for the corresponding outcome), and the number of days between their baseline and post-assessment.

Exhibits D-4 and D-5 provide the primary estimates of Soundkins impacts derived from the ITT taxonomy of multilevel HLM analyses, including covariates that were included in each model. The research team calculated Cohen's *d* effect sizes for the main impact by dividing the HLM coefficient for the intervention's effect by an estimate of the standard deviation of the outcome variable.

Phonological awareness. The HLM models capturing the impact of Soundkins on students' PA skills did not reach statistical significance (see Exhibit D-4). The effect size for the models ranged from 0.11 to 0.22.

Letter-sound correspondence. The HLM models capturing the impact of Soundkins on students' LSC skills also did not reach statistical significance (see Exhibit D-5). The effect size for the models ranged from 0.29 to 0.33.

Exhibit D-4. Hierarchical linear models predicting phonological awareness post-test scores

	Model 1				Model 2				Model 3			
Covariate	*b*	(*SE*)	*p*	*d*	*b*	(*SE*)	*p*	*d*	*b*	(*SE*)	*p*	*d*
Soundkins (intervention)	0.27	(0.81)	.74	0.11	0.52	(0.48)	0.28	0.22	0.51	(0.58)	0.38	0.22
Baseline score	–	–	–	–	0.72	(0.06)	< 0.001	–	0.72	(0.06)	< 0.001	–
# of days between assessments	–	–	–	–	0.03	(0.02)	0.14	–	0.03	(0.02)	0.23	–
Class average baseline score	–	–	–	–	0.36	(0.21)	0.09	–	0.36	(0.23)	0.11	–
Teacher years teaching preK	–	–	–	–	−0.08	(0.06)	0.16	–	−0.08	(0.06)	0.19	–
Teacher advanced degree	–	–	–	–	−0.08	(0.55)	0.88	–	−0.10	(0.60)	0.87	–
Classroom grade level	–	–	–	–	–	–	–	–	0.00	(0.57)	1.0	–
Student is female	–	–	–	–	–	–	–	–	0.11	(0.28)	0.70	–
Teacher reported student is an ELL	–	–	–	–	–	–	–	–	−0.18	(0.47)	0.71	–
Teacher has ECE or literacy-focused degree	–	–	–	–	–	–	–	–	0.00	(0.70)	1.0	–
Intercept	3.48	(0.59)	< 0.001	–	−0.02	(1.92)	0.99	–	0.11	(2.26)	0.96	–
R-squared	0.00	–	–	–	0.39	–	–	–	0.39	–	–	–
Conditional R-squared	0.22	–	–	–	0.44	–	–	–	0.45	–	–	–
ICC	0.22	–	–	–	0.08	–	–	–	0.10	–	–	–
N	329	–	–	–	328	–	–	–	328	–	–	–

Note. PreK = prekindergarten; ELL = English language learner; ECE = early childhood education; ICC = intraclass correlation coefficient. Analyses reflect separate hierarchical linear models with Level 1 = student and Level 2 = teacher. Teachers were modeled as a random effect. All models included a dichotomous intervention indicator (comparison = 0, intervention = 1). To reduce residual variability, Model 2 includes covariates that were significantly correlated with students' PA post-test scores, and Model 3 includes all possible covariates. Classroom grade level captures whether the teachers' classrooms were classified as transitional kindergarten, 4-year-old kindergarten, or early 5's prekindergarten.

Table D-5. Hierarchical linear models predicting letter-sound correspondence post-test scores

	Model 1				Model 2				Model 3			
Covariates	*b*	(*SE*)	*p*	*d*	*b*	(*SE*)	*p*	*d*	*b*	(*SE*)	*p*	*d*
Soundkins (intervention)	0.63	0.59	0.29	0.33	0.57	0.41	0.17	0.29	0.64	0.49	0.20	0.33
Baseline score	–	–	–	–	0.62	0.06	< 0.001	–	0.62	0.06	< 0.001	–
# of days between assessments	–	–	–	–	0.02	0.02	0.28	–	0.02	0.02	0.41	–
Class average baseline score	–	–	–	–	0.12	0.21	0.56	–	0.12	0.23	0.61	–
Teacher years teaching preK	–	–	–	–	−0.07	0.05	0.19	–	−0.07	0.05	0.18	–
Teacher advanced degree	–	–	–	–	0.25	0.48	0.60	–	0.22	0.51	0.66	–
Classroom grade level	–	–	–	–	0.78	0.42	0.06	–	0.85	0.49	0.09	–
Student is female	–	–	–	–	–	–	–	–	−0.23	0.24	0.35	–
Teacher reported student is an ELL	–	–	–	–	–	–	–	–	−0.13	0.40	0.75	–
Teacher has ECE or literacy-focused degree	–	–	–	–	–	–	–	–	−0.14	0.63	0.83	–
Intercept	3.56	0.43	< 0.001	–	1.12	1.75	0.52	–	1.58	1.99	0.43	–
R-squared	0.01	–	–	–	0.34	–	–	–	0.34	–	–	–
Conditional R-squared	0.18	–	–	–	0.39	–	–	–	0.40	–	–	–
ICC	0.16	–	–	–	0.08	–	–	–	0.09	–	–	–
N	329	–	–	–	328	–	–	–	328	–	–	–

Note. PreK = prekindergarten; ELL = English language learner; ECE = early childhood education; ICC = intraclass correlation coefficient. Analyses reflect separate hierarchical linear models with Level 1 = student and Level 2 = teacher. Teachers were modeled as a random effect. All models included a dichotomous intervention indicator (comparison = 0, intervention = 1). To reduce residual variability, Model 2 includes covariates that were significantly correlated with students' LSC post-test scores, and Model 3 includes all possible covariates. Classroom grade level captures whether the teachers' classrooms were classified as transitional kindergarten, 4-year-old kindergarten, or early 5's prekindergarten.

Cost Analysis

The research team used the ingredients method (Levin et al., 2017) to determine the average cost per student and the average cost per teacher across the 15 school districts that participated in the study. The ingredients method is a detailed process for identifying and calculating the cost of all resources needed to implement an intervention. Categories of resources can include costs for personnel hours, facilities, materials and equipment, and other inputs.

For this study, teachers used existing technology in their classrooms (e.g., Chromebooks or tablets) to implement the Soundkins program. Therefore, the only category of resources included in these analyses were personnel hours spent, which included Soundkins training, implementation, and other activities (i.e., reading weekly emails, communicating with parents and guardians, and reviewing student progress). Soundkins does not require that each student have their own device at school to access the program, but the research team expects successful implementation would require at least five devices for a classroom of students to share and a way to display the whole-class lessons to all students at one time. If a school does not have this technology available, staff should factor those costs into their budgeting for Soundkins, as the costs outlined in Exhibit D-6 below do not include any purchase of technology.

To estimate the costs and carry out the analyses, the research team created a data collection and estimation tool in Microsoft Excel. A total of 19 teachers participated in the study during the 2022–23 school year, across 15 school districts in the United States. At the end of the 10-week implementation period, which took place in fall 2022 for treatment teachers and spring 2023 for control teachers, we distributed an implementation survey to all participating teachers to gather their self-reported approximations of hours spent on each of the Soundkins activities. One teacher in the control condition elected not to implement the Soundkins activities with their students and did not provide survey data related to time spent using Soundkins; therefore, we conducted our analyses using the data from the 18 teachers who implemented the Soundkins activities and completed their implementation survey. For the districts that included more than one participating teacher (see Exhibit B-1 in Appendix B), we averaged their reported time spent on Soundkins training and activities. We also reviewed data from the U.S. Bureau of Labor Statistics to determine national average salaries and fringe benefits for the teachers implementing the intervention. We used the most recent 2021 data from the U.S. Bureau of Labor Statistics (n.d.) to provide relevant costs for other districts considering implementing Soundkins. Soundkins was implemented for a 10-week period during the school year, so all costs were calculated for a 10-week period rather than a full school year.

Exhibit D-6 includes the total implementation costs for the teachers that participated in our study during the 2022–23 school year. The 18 teachers who provided implementation data reported having a total of 401 students in their classrooms.[9] Therefore, we used the total of 401 students in our sample to calculate the per-classroom and per-student costs in Exhibit D-6.

Table D-6. Estimated cost of implementing Soundkins

Resource	Number of Participants/Units	Total Hours per Year	Cost
Study classroom average			
Total teacher labor cost	18	285.83	$11,934.53
Average cost per teacher/ classroom			**$663.03**
Average cost per student			**$29.76**

Note. To calculate these costs, the research team needed to determine the total number of hours that each teacher works during one school year. The largest number of teachers in our study sample were based in California school districts, so we used California's state elementary school requirement for all teachers in our sample, which was 1,170 hours, or 6.5 hours for 180 school days (Education Commission of the States, 2023; National Center for Education Statistics, n.d.).

[9] Teachers reported the number of students in their classroom at the time they completed the implementation survey, so the total number of students used in the cost analyses differs from the number of students with assessment data that were included in the study sample.

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