Online Literacy Instruction for Young Korean Dual Language Learners in General Education

Sunyoung Kim1 · Veronica Kang2 · Hanae Kim1 · Jing Wang1 · Emily Gregori1

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Abstract

English language development is a critical component for young children’s school readiness. In this study, we examined the effect of Read it again-Pre-K! (Justice and McGinty in Read it again!-Prek: a preschool curriculum supplement to promote language and literacy foundations, Crane Center for Early Childhood Research and Policy, Columbus, 2013), a literacy curriculum designed to prepare young children’s school readiness on the English literacy skills of Korean dual language learners in general education. Using a multiple probe design, eight 4- to 5-year-old Korean dual language learners (1 female, 7 males) received 1:1 online synchronous daily instruction over 2 months during the summer before entering their kindergarten programs. Through the intervention, all eight children demonstrated increases in the use of English vocabulary, story comprehension, and oral fluency. Post-intervention data on vocabulary and reading fluency through three standardized tests, Dynamic Indicators of Basic Early Literacy Skills, Peabody Picture Vocabulary Test, and Expressive Vocabulary Test, showed improvement over baseline for most children. Discussion and implications for future research were provided.

Keywords Literacy instruction · Read it again · Dual language learners · Online instruction · Korean · English language learners

Introduction

English language development is a critical component for young children’s school readiness (National Early Literacy Panel [NELP], 2008). Children who acquire critical literacy skills including phonological awareness, print knowledge, vocabulary identification, and narrative comprehension are able to demonstrate strong reading
and writing skills (NELP, 2008; Wasik & Hindman, 2011; Xu et al., 2014) and have better outcomes in elementary school (Niklas et al., 2016). Among many factors that may predict academic achievements for young children, literacy competency is shown to predict later achievements throughout school-aged years and adulthood (Lo et al., 2009; Niklas et al., 2016; Spira et al., 2005).

Despite the importance of obtaining critical literacy skills, not all students achieve these outcomes in Pre-K. In particular, dual language learners (DLL) who come from families whose primary language is not English may experience less than ideal literacy outcomes in early childhood (Hammer et al., 2011; NCES, 2006). The number of young DLLs in the USA continues to rise, specifically Korean Americans, who are the fifth-largest ethnic group in the US. Korean Americans are also a part of the Asian population, which is the second largest racial minority group in the USA (Hammer et al., 2011). Thus, adequate instruction is critical as DLLs are more likely to have poor school achievement and are at an increased risk of school failure and more specifically, at an increased risk of poor literacy outcomes (Castro et al., 2011; García & Markos, 2015).

Fortunately, a substantial number of research studies have examined methods for improving literacy outcomes for DLLs. The extant literature has identified several factors predictive of achieving optimal literacy outcomes, including English proficiency in early childhood (Halle et al., 2012). In fact, DLLs who reach proficiency in English before kindergarten perform at the same level as their native English-speaking peers in both literacy and mathematics (Halle et al., 2012). Developing English proficiency in early childhood may, however, become a complicated cultural and familial issue for many Korean families who wish to maintain a balance between English and their child’s native language.

Many Korean American families feel that using their child’s home language (Korean) is critical in order to maintain the child’s ethnic identity, development, and communication with family members (Dinovitzer et al., 2003; Kang, 2013; Kim, 2011; Park & Sarkar, 2007; Shin, 2005; Worthy & Rodríguez-Galindo, 2006). However, DLL children often begin to lose their native language in school when instruction is only provided in English (Song, 2016). Despite wanting their children to maintain their home language, Korean American families also want their children to be proficient in English for the children’s successful school adaptations but feel helpless in bridging the language and cultural barriers (Kim, 2011). Thus, literacy instruction that emphasizes critical literacy skills, parent involvement, and use of the child’s native language might be critical in literacy instruction for young Korean DLLs.

Read it again-Pre-K! (RIA; Justice & McGinty, 2013) is a literacy curriculum designed to promote young children’s school readiness, including literacy development. RIA involves book reading and instruction that targets four main areas in literacy including phonological awareness, print knowledge, vocabulary, and narrative (Justice & McGinty, 2013). Each lesson covers either (a) print knowledge and vocabulary or (b) phonological awareness and narrative and includes a script that utilizes various behavioral strategies such as modeling and verbal prompts. Children of ages 3–5 years who are native English speakers participated in RIA and demonstrated improvement in grammar and vocabulary as well as rhyming, alliteration,
and print awareness skills in pre–post-research design (Justice et al., 2010). Similarly, Mashburn and colleagues (2016) conducted a cluster randomized control study and found a significant increase in print and letter knowledge of 506 students in pre-kindergarten classrooms after the delivery of RIA. More recent studies showed that RIA can be implemented successfully with high fidelity by early childhood education teachers targeting the four literacy skills embedded in the curriculum (i.e., phonological awareness, print knowledge, vocabulary, narrative) in group instructions (randomized control trial; Piasta et al., 2020) and dual language format (pilot study: Duran et al., 2016). These studies suggest multiple ways for cultural/linguistic adaptations of RIA such as using visual cues, interactive book preview, and repeated book readings through the course of intervention sessions. While these studies examined teacher fidelity as the main outcome and found that teachers can implement language-adapted RIA with high fidelity, there is no research that examines the effects of linguistically adapted, 1:1 delivery of RIA on children’s literacy skills such as story comprehension, vocabulary, and oral fluency.

In addition to intervention agent and language adaptations, recent RIA research has begun to explore implementation of the program delivered via technology. Examination of technology-based RIA is not surprising given that young children interact with an array of digital technologies in daily lives. For instance, children can make substantial gains in the area of literacy and the use of digital devices such as tablets or computers (Colwell & Hutchison, 2015; Myrtil et al., 2018). For example, Flewitt and colleagues (2015) examined the effects of utilizing iPad embedded literacy activities to teach literacy skills to two groups of 3- to 5-year-old children and one group of 7- to 12-year-old children diagnosed with learning disabilities. The findings suggested that well-planned digital literacy activities can be successful in improving literacy skills of children at risk and/or with disabilities. Another study with 30 preschool teachers and 225 children found that technology-based RIA could be implemented in a classroom by teachers with high fidelity through paired sample t test and correlational analyses (Myrtil et al., 2018). More recently, research has begun to explore the implementation of literacy intervention delivered via tele-technology using a one-on-one format. This approach to instruction lends itself well to support varied levels of learning needs in early literacy skills and is appropriate for enhancing personalized virtual learning experience (Wilkes et al., 2020). However, there are no studies that examined the effects of RIA delivered in this format on the early literacy skills of the participating children.

Despite the positive findings of RIA, there is a gap in the literature of RIA for Korean dual language learners using an online one-on-one format. Considering the continued use of remote or hybrid learning in K-12 education as well as the nature of dual language instruction which involves the instructor to use two languages interchangeably in response to individual student’s response to instructor’s directions and questions, examining the effects of dual language implementation of RIA using a one-on-one, virtual format will be relevant to understand how widely used, RIA could be adapted to align with the characteristics of individual student, classroom, and school setting. Therefore, we examined the effects of RIA on eight young Korean DLLs English literacy development using a synchronous online one-to-one format. Specifically, we asked the following research question: Is there a functional
relation between 1:1 online RIA instruction and Korean Dual language learners’ English literacy skills?

Method

Participants and Implementers

Participants included eight Korean American DLL children. To recruit the children, the first author distributed a flyer to non-profit Korean American organizations in the Midwest United States. To meet the inclusion criteria for this study, children had to be between the ages of 4–5 years old and their home language had to be Korean. Having a tablet device or a computer was not a part of the inclusionary criteria; however, the recruitment led to the enrollment of families who all had access to such resources. A total of eight children (seven males and one female) consented to participate in this study. Six children were US-born Korean children and two children immigrated from Korea. None of the children were officially diagnosed with speech impairment or delay but were referred to this study for delays in communication in English by their parents. Table 1 depicts participants’ characteristics. All names are pseudonyms.

The second and third authors served as interventionists for this study. Both implementers were Korean American doctoral students in special education who were bilingual in Korean and English. The second author was a US-born, and the third author was a Korean born who immigrated to the USA when she was an elementary school student.

Settings

The study was conducted in a suburban area in the Midwest region of the USA. All research procedures were conducted online using Zoom during the spread of the COVID-19. The researchers provided an individualized URL link and a passcode to each parent so that the parent can enter the Zoom sessions managed by University

| Table 1 | Participants’ Characteristics and IOA |
|---------|-------------------------------------|
| Child   | Age | Gender | Years in US | SES         | Home language |
| Dae-Ho  | 5   | Male   | 1 year      | Middle      | Korean        |
| June    | 4   | Male   | Born        | Middle      | Korean        |
| Ho-Jun  | 5   | Male   | Born        | Middle      | Korean        |
| April   | 4   | Female | 4 years     | Middle      | Korean        |
| Carter  | 5   | Male   | Born        | Middle      | Korean        |
| Eli     | 5   | Male   | Born        | Middle      | Korean        |
| Jack    | 4   | Male   | Born        | Middle      | Korean and English |
| Tony    | 5   | Male   | Born        | Middle      | Korean        |

SES socioeconomic status
A. For each session, the parent logged into the Zoom session from their home to access the synchronous instruction. The child was positioned in front of a computer, a tablet, or a laptop with a full-screen access. The parent was instructed to log in at the scheduled time and open the Zoom window as a full screen. The interventionists logged into the Zoom sessions from an isolated and enclosed space in their home and sat in front of their screen. However, as this was a home-based intervention, we did not prevent family members’ observations. All interventions and assessments were delivered virtually and synchronously at their scheduled time and were video recorded.

**Independent Variable and Materials**

The independent variable was Read It Again! Pre-K (RIA; Justice & McGinty, 2013). RIA has a total of 60 lessons and during each 30-min session, two lessons were implemented to target vocabulary, print awareness, phonological awareness, and narratives. The RIA had a lesson plan for every lesson that included the objectives, a step-by-step description of interactive activities, verbal scripts for the implementer to read out loud, visual materials (e.g., flashcards), and the name of the picture book to read for the lesson. The 30-min session was divided into the following segments: (a) an activity targeting phonological awareness such as rhyming, (b) an activity targeting print awareness such as the direction for reading texts from left to right, (c) reading of the designated book, (d) an activity targeting story comprehension such as characters, story plot, and settings, and (e) an activity targeting five vocabularies.

For the purpose of the study, RIA was implemented after making modifications in three ways. First, all instruction was provided online using Zoom. Therefore, all materials including the books, flashcards, and blank pages to write or draw relevant instructional content were presented on PowerPoint slides using the screen sharing mode on Zoom. When the implementer had to point to a section of the book as described in the RIA lesson plan, the implementer used the Pen function on the PowerPoint slideshow to underline or circle the section. When the implementer had to show one card at a time to compare two or more cards, the Animation function on the PowerPoints slideshow was used to show one flashcard at a time on the same slide. Finally, if the RIA lesson plan required the student to point to a section of a book or select a flashcard out of multiple flashcards, the implementer used a choice question with two options (e.g., “Which one is red? Is it this one? [circling or underlining the first option] or that one? [circling or underlining the second option]”) so that the student could respond verbally (e.g., This one, That one). The second modification was the one-on-one instruction. Considering the online format of the instruction, RIA was modified to be implemented individually. If the script on the RIA lesson plan presented questions that started with “Who can tell/show me…?”, the implementer changed this to “Please tell/show me…”. The third modification was the dual language instruction. In order to provide culturally and linguistically responsive instruction, bilingual implementers used English and Korean interchangeably to deliver RIA. After a statement was presented in English, if the student...
(a) did not respond within 3–5 s, (b) showed a behavioral indication that the student did not understand (e.g., putting heads down, shrugging shoulders), or (c) explicitly stated that the student did not understand, the implementer repeated the statement in Korean.

**Dependent Variables**

Data were collected daily, weekly, and pre–post-intervention using multiple measures. All dependent variables were adopted from the definitions from Hitchcock et al. (2004) and Tam et al. (2006) and included (a) oral fluency: % words read correctly in 1 min, (b) target vocabulary: % target vocabularies identified correctly, and (c) story comprehension: % comprehension questions answered correctly. All assessments were conducted in English by the two interventionists, as the purpose of this intervention was to promote and measure English literacy skills. The first author reviewed the video recorded sessions and collected data as a primary data coder. The fourth author completed 40% of the data collection as a second data coder. Both coders were blind to students’ engagement and progress in intervention.

**Oral Fluency: % Words Read Correctly in 1 Min**

Each child was given a short paragraph that included about 35–40 words without pictures. We asked the parent and the student if they have read or seen the story before, and selected texts that were novel to the student. Considering that students were 4–5 years old, we used the stories from *A Collection of Stories for 4 & 5 Year Olds* (Parragon Books, 2015). In every assessment, a new passage was used. The assessor set a timer for 1 min and asked the student to read the passage aloud. Substitutions, omissions, or words that were not read within 5 s were considered as incorrect. If a child said “I don’t know this word” or did not say anything within 5 s, the implementer read the word, and then allowed the child to read the next words. We measured five probes during baseline and six probes during intervention weekly every Friday, after each week’s lesson. Percentage of words read correctly in 1 min was calculated by dividing the number of words read correctly in 1 min by the sum of the number of words read correctly and incorrectly and multiplying by 100.

**Target Vocabulary: % Target Vocabularies Identified Correctly**

During intervention sessions, each daily lesson from RIA included three to seven target vocabulary words from the required book read for the day. After the lesson, the interventionist said the definition of a target vocabulary out loud, presented two words on a Power Point slide, and asked while pointing to the word, “Is it *this one* or *that one*?” For the two words presented, one word was the correct answer (vocabulary), and the other word was an irrelevant word that was neither a synonym nor an antonym. For example, if the target vocabulary was “badger,” an irrelevant word, “climb” was presented. The position (i.e., left vs. right) of the correct word on the screen was selected randomly.
A response was considered correct when the child said “this one” or “that one” referring to the correct word, within 5 s after the interventionist finished saying the definition. Nine out of the 30 RIA vocabulary lesson plans did not provide three or more target vocabulary words, so we developed five target words for the lessons, taught them, and assessed the child’s acquisition. If the child responded correctly, then the interventionist said, “Yes, that’s correct” and moved onto the next question. If the child did not respond correctly, the interventionist provided a phonemic prompt, and then if necessary, a visual prompt by pointing to the correct word with the mouse cursor, so that the child identifies the correct word in the end. However, if this error correction was used, the response was marked as incorrect.

During baseline and maintenance, we similarly chose five target vocabulary words from the book read to measure the comprehension during the baseline. We did not directly teach the target vocabularies or explain the definitions of target vocabulary words during book reading. Students were given the definition and two words (one correct and one incorrect). Children were asked which word is the correct definition. Percentage of target vocabularies were calculated by dividing the number of vocabulary words identified correctly by the total number of vocabulary words and multiplying by 100.

**Story Comprehension: % Comprehension Questions Answered Correctly**

During intervention, after each lesson, each child was given five comprehension questions that were developed from the required book that was used for the day’s lesson. The examples of literal questions included “What was the name of the red dog?” “Who saved the baby letters?” and “What did the baby animals do at night?”.

We ensured equal levels of difficulty across questions by having all questions start with “what” (e.g., story plot), “where” (e.g., setting), or “who” (e.g., character). Since there were five questions in each session, at least one “what,” “where,” or “who” question was asked.

During baseline and maintenance, a novel, age-appropriate book was chosen for each baseline session and read to children. We used the required books that were used in the first edition of RIA curriculum, but not used in the current edition (e.g., “Is your Mama a Llama?”; Guarino & Kellogg, 1997). Similar to the intervention sessions, five questions were developed from the book that was read for the baseline and maintenance session. There was only one correct answer for each comprehension question and the researchers developed the answer key to collect correct/incorrect answers. Percentage of comprehension questions answered correctly was calculated by dividing the total number of questions answered correctly by the total number of comprehension questions and multiplying by 100.

**Pre–Post-intervention Measure**

To measure vocabulary skills, we used two norm-referenced standardized tests, the Peabody Picture Vocabulary Test™ Fifth Edition (PPVT™-5) and the Expressive Vocabulary Test Third Edition (EVT-3). PPVT-5 was used to measure children’s English receptive vocabulary skills and EVT-3 was used to measure children’s
English expressive vocabulary skills. These tests were conducted in English before and after the intervention. Each assessment took approximately 10–15 min each and was conducted virtually by presenting the pictures on the screen.

We also used Dynamic Indicators of Basic Early Literacy Skills, 8th edition (DIBELS 8; University of Oregon, 2018), a standardized reading assessment, to measure word reading fluency, nonsense word fluency, phoneme segmentation fluency, and letter naming fluency. Word reading fluency measured student’s ability to pronounce printed words (e.g., “of”). Nonsense word fluency measured student’s ability to pronounce letter sounds or nonsense words such as “hap.” Phoneme segmentation fluency measured student’s ability to pronounce each phoneme of a word verbally presented by the assessor (e.g., /s/, /a/, /t/). Letter naming fluency measured student’s ability to name upper and lowercase letters. The assessment was also conducted virtually before and after the intervention by the two interventionists.

**Interobserver Agreement (IOA)**

The measurement of IOA was ongoing throughout the study. A second rater viewed each baseline, intervention, and maintenance session to obtain reliability data. The rater was a graduate student in education (the fourth author) who was studying literacy education, was not Korean bilingual, and had no experience with single case research methodology. The secondary rater was trained by the first author using sample video clips. After they reached 80% of agreement in separate practice coding prior to data collection, the graduate student reviewed a minimum of 40% of video recorded sessions for each child across all study phases. IOA was reported for each child by calculating the total number of agreements by sum of agreement plus disagreements and multiplying by 100. Table 2 depicts the reliability across children and dependent behaviors.

**Table 2** Interobserver agreement

|         | Oral reading fluency (%; Range) | Reading comprehension (%; Range) | Target vocabulary (%; Range) | Total (%) |
|---------|---------------------------------|----------------------------------|-----------------------------|-----------|
| Dae-Ho  | 92.7 (85–100)                   | 98.46 (80–100)                  | 100                         | 97.05     |
| June    | 89.81 (84.2–97.7)               | 94.3 (75–100)                   | 100                         | 94.7      |
| Ho-Jun  | 96.45 (87.5–100)                | 100                             | 100                         | 98.81     |
| April   | 95.73 (86.36–100)               | 100                             | 98.67 (80–100)              | 98.13     |
| Carter  | 93.18 (86.5–100)                | 95.38 (80–100)                  | 96.67 (80–100)              | 95.07     |
| Eli     | 92.5 (83.3–100)                 | 95.38 (80–100)                  | 95.38 (80–100)              | 94.42     |
| Jack    | 92.53 (87.5–100)                | 100                             | 96.9 (80–100)               | 96.48     |
| Tony    | 93.1 (83.9–100)                 | 100                             | 100                         | 97.7      |
Treatement Fidelity

Baseline, intervention, and maintenance fidelity measures were adopted from Duran et al. (2016). Appendix shows the list of fidelity checklist items for baseline and maintenance phase as well as the intervention phase. The measurement of fidelity scores was ongoing throughout the study. Fidelity scores were calculated by dividing the number of items met by the total number of items and multiplying by 100. Fidelity data were collected for 100% of sessions and fidelity scores were 100% for each child and for each phase.

Social Validity

To measure the social importance of intervention goal, procedures, and behavior changes associated with the intervention, we interviewed each caregiver using a semi-structured interview format before and after the intervention via Zoom. The purpose of having two interviews was to have the caregivers report their expectation of intervention and children’s behavior changes after the intervention. Example interview questions included “How will the changes in your child’s skills/behaviors impact their behaviors or experiences in kindergarten?”, “Which skills would have the greatest long-term benefit for your child?”, and “How did the program address your concerns about your child’s development?” A total of 14 caregivers participated in the interviews before and after the intervention. As a part of this study, the in-depth qualitative social validity of RIA was analyzed and reported in a separate manuscript (Kang et al., in progress).

Experimental Design and Conditions

A multiple probe design across participants (Gast et al., 2014) was used. Each multiple probe design consisted of four children. The second author implemented the intervention for four children, and the third author implemented the intervention for the other four children. Experimental control was established through the staggered introduction of the intervention across the four children. With this design, one implementer could do four intra-subject replications as well as two inter-subject replications across the four children. Each phase had at least five data points and the intervention was introduced in a staggered fashion after stable levels of responding were observed for each dependent variable across consecutive days. Each child participated in 30 intervention sessions, and the duration of each session was 30–35 min. Maintenance data were collected for each child 1–4 weeks after the intervention.

Pre-intervention Assessment

The two implementers conducted PPVT-5, EVT-3, and DIBELS 8 prior to baseline sessions. All assessment materials were scanned and each page of the assessment booklet was presented on the screen via Zoom. Prior to administering the PPVT-5, the assessor and the child practiced verbally naming numbers 1–4 in order to
receptively identify the pictures on the PPVT-5 booklet. For EVT-3, the assessor presented the picture and asked the child to expressively identify the picture. For DIBELS 8, the assessor used the laser pointer function on PowerPoint slideshow to reference the word, letter, or picture, and the child was asked to provide a verbal response (Table 3).

Baseline

During baseline, implementers met each child during the designated time of the day. During baseline sessions, the implementers administered each assessment. No instruction was provided. For the daily assessment during baseline, the implementer first presented a paragraph to read to measure the number of words read correctly per min. Then, the implementer read a book, presented on the screen, and asked five comprehension questions and five questions for vocabulary identifications. The implementers did not provide prompting or reinforcement. Each assessment took approximately 5–10 min to complete.

Intervention

During intervention, the implementers met each child (1:1) during their designated time of the day for five days a week for six weeks. The entire RIA program consisted for 60 lessons. For the purposes of this study, two lessons were implemented per day. The implementer introduced phonemic awareness and print awareness lessons, read a book, and provided instruction and practice opportunities on story comprehension and vocabulary. Immediately after the lesson, the implementers administered the assessments in the same manner as baseline. Each intervention session took approximately 30–35 min to complete.
Maintenance

Three maintenance sessions were conducted after the intervention ended. Procedures for the maintenance sessions were identical to those described for baseline.

Post-intervention Assessment

The post-intervention assessment using PPVT-5, EVT-3, and DIBELS 8 occurred after the last intervention session (Table 3). All procedures were identical to the pre-intervention assessment.

Effect Size.

A web-based calculator (http://www.singlecaseresearch.org/calculators/tau-u) was used to calculate the Tau-U to compare the nonoverlapping data points between the baseline and the maintenance phases. Tau-U of 0–0.65 indicates weak effect sizes, 0.66–0.92 moderate effects, and 0.93–1 strong effect sizes (i.e., 100% nonoverlapping data points).

Results

Figure 1 presents the percentage of words read correctly in 1 min (oral fluency), the percentage of words identified correctly (target vocabulary), and the percentage of questions answered correctly (story comprehension) for Ho-Jun, April, Tony, and Jack. Figure 2 presents data on the dependent variables for Dae-Ho, June, Carter, and Eli. Table 4 presents the mean and range for the percentage of words read correctly in 1 min (oral fluency), the percentage of words identified correctly (target vocabulary), and the percentage of questions answered correctly (story comprehension) across conditions and participants as well as scores from the PPVT-5, EVT-3, and DIBELS 8 before and after the intervention.

Oral Fluency: % Words Read Correctly in 1 Min

With Interventionist 1, Ho-Jun showed moderate levels in % words read correctly in 1 min with a decelerating trend and low variability ($M=43\%$, range $37–49\%$) during baseline. During the first intervention, Ho-Jun’s oral fluency increased immediately to $74\%$ and presented high levels with an accelerating trend and low variability throughout the intervention condition ($M=88\%$, range $73–100\%$). During maintenance, Ho-Jun read $100\%$ of words correctly for all three sessions ($M=100\%$). Tau-U was $1$, $p=0.03$, 95% CI [0.1, 1]. Similarly, April showed moderate levels in oral fluency with a decelerating trend and low variability ($M=46\%$, range $39–53\%$) during baseline. When the intervention was introduced the first time, April’s oral fluency doubled to $92\%$, showing an immediacy of effect, and presented high levels with zero-celerating trend and low variability ($M=92\%$, range $81–97\%$). During maintenance, April read $100\%$ of word correctly for all three sessions ($M=100\%$). Tau-U was $1$, $p=0.05$, 95% CI [0.01, 1]. Tony showed low levels in oral fluency
with zero-celerating trend and low variability during baseline \((M=1\%\text{, range 0–5\%})\). During the first intervention session, Tony’s oral fluency increased to 51\%, showing an immediacy of effect, and presented moderate to high levels with an accelerating trend and low variability \((M=61\%\text{, range 51–67\%})\). During maintenance, Tony read 80\% and 72\% of words correctly showing high levels. Tau-U was 1, \(p=0.05\), 95\% CI [0.01, 1].

Jack showed moderate levels in oral fluency with a zero-celerating trend and moderate variability during baseline \((M=28\%\text{, range 8–40\%})\). Upon the introduction of intervention, Jack read 61\% of words correctly in the first session, showing an immediacy of effect, and presented moderate to high levels with an accelerating trend and low variability \((M=77\%\text{, range 61–87\%})\). During maintenance, Jack read 85\% of word correctly. Tau-U was 1, \(p=0.05\), 95\% CI [0.01, 1].

With Interventionist 2, Dae-Ho showed moderate levels in oral fluency with a decelerating trend and low variability \((M=39\%\text{, range 33–46\%})\) during baseline. Upon intervention, Dae-Ho read 63\% of the words correctly during the first session showing an immediate increase and continued to show high levels with an accelerating trend and low variability \((M=72\%\text{, range 63–79\%})\). During maintenance, high levels were maintained with an accelerating trend and low variability \((M=79\%\text{, range 73–84\%})\). Tau-U was 1, \(p=0.01\), 95\% CI [0.2, 1]. June showed moderate levels in oral fluency with a stable pattern \((M=35\%\text{, range 30–42\%})\) during baseline. When the intervention was introduced the first time, June’s oral fluency increased gradually with an accelerating trend and low variability \((M=62\%\text{, range 50–74\%})\). During maintenance, June showed high levels of oral fluency with an accelerating trend and low variability \((M=74\%\text{, range 70–79\%})\). Tau-U was 1, \(p=0.03\), 95\% CI [0.1, 1].

Carter showed low levels with zero-celerating trend and low variability \((M=3\%\text{, range 0–5\%})\) during baseline. As the intervention was implemented, Carter read 61\% of the words correctly during the first session, showing an immediacy of effect, and showed high levels with moderate variability and an accelerating trend \((M=85\%\text{, range 61–100\%})\). During maintenance, Carter showed high levels in oral fluency with an accelerating trend \((M=91\%\text{, range 83–100\%})\). Tau-U was 1, \(p=0.03\), 95\% CI [0.1, 1].

Eli showed low levels in oral fluency with a zero-celerating trend and low variability \((M=1\%\text{, range 0–3\%})\) during baseline. Upon intervention, Eli read 26\% of words correctly during the first session showing an immediacy of effect and showed moderate levels with an accelerating trend and low variability \((M=33\%\text{, range 26–41\%})\). Per Eli’s caregiver’s request, Eli participated in the oral fluency task for three sessions only, and maintenance data were not collected. Tau-U was 1, \(p=0.03\), 95\% CI [0.1, 1].

**Target Vocabulary: % Target Vocabularies Identified Correctly**

With Interventionist 1, Ho-Jun showed moderate to low levels in % words identified correctly with a decelerating trend and moderate variability \((M=16\%\text{, range 0–5\%})\).
Fig. 2 Interventionist 2 with four children’s data is depicted
Upon the introduction of intervention, Ho-Jun identified 100% of words correctly in the first session, showing immediacy of effect, with zero-celerating trend and low variability ($M = 99\%$, range 83–100\%). During maintenance, Ho-Jun identified 100% of words correctly across all three sessions. Tau-U was 1, $p = 0.03$, 95\% CI [0.1, 1]. Similarly, April showed moderate to low levels in % words identified correctly with a decelerating trend and moderate variability ($M = 16\%$, range 0–40\%) during baseline. With intervention, April identified 80% of words correctly in the first session, showing an immediacy of effect. April continued to show high levels with an accelerating trend and low variability during the first half of the phase and identified 100% of the words correctly during the second half of the intervention phase ($M = 99\%$, range 80–100\%). During maintenance, April identified 100% of the words for three sessions. Tau-U was 1, $p = 0.03$, 95\% CI [0.1, 1]. Tony showed moderate to low levels with a decelerating trend and low variability ($M = 8\%$, range 0–40\%) during baseline. Upon intervention, Tony identified 100% of words.
words during the first session, showing an immediacy of effect. Tony continued to present high levels with a zero-accelerating trend and moderate variability during the first half of the phase and identified 100% of words correctly during the second half of the intervention phase ($M=97\%$, range 80–100%). During maintenance, Tony identified 100% of the words correctly for two sessions. Tau-U was 1, $p=0.05$, 95% CI [0.01, 1]. Jack presented moderate to low levels with a decelerating trend and low variability ($M=20\%$, range 0–40%) during baseline. In the first intervention session, Jack identified 80% of the words correctly, showing an immediacy of effect. Jack presented high levels with an accelerating trend and moderate variability during the first half of the phase and identified 100% of the words correctly during the second half of the intervention phase ($M=98\%$, range 80–100%). During maintenance, Jack identified 80% of the words correctly in one session. Tau-U was 1, $p=0.05$, 95% CI [0.01, 1].

With Interventionist 2, Dae-Ho showed moderate to low levels with a decelerating trend and low variability ($M=12\%$, range 0–40%) during baseline. With intervention, Dae-Ho identified 60% of the words correctly in the first session, showing an immediacy of effect. Dae-Ho continued to show high levels with a zero-accelerating trend and low variability during intervention ($M=99\%$, range 80–100%). During maintenance, Dae-Ho showed high levels with zero-accelerating trend and low variability ($M=28\%$, range 20–40%) during baseline. Upon intervention, June presented high levels with an accelerating trend and low variability during the first half of the intervention phase and identified 100% of the words correctly during the second half ($M=98\%$, range 40–100%). During maintenance, June showed high levels with a zero-accelerating trend and low variability during baseline ($M=4\%$, range 0–20%). Upon intervention, Carter showed high levels in % words identified correctly with zero-accelerating trend and low variability ($M=98\%$, range 80–100%). During maintenance, Carter showed low levels with zero-accelerating trend and low variability during baseline ($M=4\%$, range 0–20%). Upon intervention, Eli showed low levels with zero-accelerating trend and low variability consistently, with an exception of the last two intervention sessions where Eli identified 80% of the words correctly ($M=97\%$, range 60–100%). During maintenance, Eli identified 80% of the words correctly. Tau-U was 1, $p=0.05$, 95% CI [0.01, 1].

**Story Comprehension: % Comprehension Questions Answered Correctly**

With Interventionist 1, Ho-Jun showed low levels with zero-accelerating trend and low variability during baseline ($M=16\%$, range 0–20%). Upon intervention, Ho-Jun answered 100% of the questions correctly in the first session, showing an
immediacy of effect. During intervention and maintenance, Ho-Jun answered 100% of the questions correctly ($M = 100%$; 100%). Tau-U was $1, p = 0.03, 95\%$ CI [0.1, 1]. April showed moderate to low levels with decelerating trend and low variability during baseline ($M = 24\%$, range 20–40%). With intervention, April answered 100% of the questions correctly during the first session, showing an immediacy of effect. Throughout intervention, April presented high levels with zero-celerating trend and low variability ($M = 99\%$, range 80–100%). During maintenance, April answered 100% of the questions correctly for three sessions. Tau-U was $1, p = 0.03, 95\%$ CI [0.1, 1]. Tony showed low levels with a decelerating trend and low variability during baseline ($M = 8\%$, range 0–20%). Upon intervention, Tony answered 100% of the questions correctly in the first session, showing an immediacy of effect. Tony answered 100% of the questions correctly throughout all intervention sessions ($M = 100\%$) as well as the two maintenance sessions ($M = 100$). Tau-U was $1, p = 0.03, 95\%$ CI [0.1, 1].

With Interventionist 2, Dae-Ho showed low levels with a decelerating trend and low variability during baseline ($M = 12\%$, range 0–20%). In the first intervention session, Dae-Ho answered 60% of the questions correctly, showing an immediacy of effect. Dae-Ho answered 100% of the questions correctly throughout intervention ($M = 99\%$, range 60–100%) and maintenance ($M = 100\%$). Tau-U was $1, p = 0.05, 95\%$ CI [0.01, 1]. June showed low levels with a zero-celerating trend and low variability during baseline ($M = 12\%$, range 0–20%). Upon intervention, June answered 80% of the questions correctly in the first session, showing an immediacy of effect. June answered 100% of the questions correctly throughout intervention ($M = 99\%$, range 80–100%). During maintenance, June showed moderate to high levels with an accelerating trend and low variability ($M = 80\%$, range 60–100%). Tau-U was $1, p = 0.03, 95\%$ CI [0.1, 1]. Carter showed low levels with a zero-celerating trend and low variability during baseline ($M = 4\%$, range 0–20%). In the first intervention session, Carter answered 60% of the questions correctly, showing an immediacy of effect. Throughout intervention, Carter showed high levels with an accelerating trend with moderate variability ($M = 96\%$, range 60–100%). Carter showed high levels with a decelerating trend and low variability during the two maintenance sessions ($M = 90\%$, range 80–100%). Tau-U was $1, p = 0.05, 95\%$ CI [0.01, 1]. Eli answered 0% of the questions correctly during baseline ($M = 0\%$). Upon intervention, Eli answered 100% of the question correctly in the first session, showing an immediacy of effect. Throughout intervention, Eli showed high levels with a zero-celerating trend and moderate variability, particularly at the beginning and end of the intervention phase ($M = 98\%$, range 80–100%). Eli answered 100% of the questions correctly during maintenance. Tau-U was $1, p = 0.03, 95\%$ CI [0.1, 1].

Across all three variables including the oral fluency, vocabulary, and story comprehension, the effect sizes were 1, showing strong effects of instruction across all
eight participants. As the effect sizes were calculated to examine the nonoverlapping data from the baseline to the maintenance phases, the data pattern showed that all eight children showed meaningful improvements in their literacy skills after completing all lessons of the Read-it Again curriculum. Thus, along with the visual analysis of the graphed data, the computation of the effect sizes showed that there is a functional relation between the dual language instruction of Read-it-again and the three literacy measures.

**Pre- and Post-intervention Measures**

Table 3 presents the pre- and post-intervention scores for PPVT-5 (receptive vocabulary), EVT-3 (expressive vocabulary), and DIBELS (letter and phonological awareness). The receptive and expressive vocabulary as well as the letter and phonological awareness showed improvement after the completion of the intervention for all eight participants with an exception of Eli whose EVT-3 score decreased slightly from 79 (8%) to 77 (6%).

**Social Validity**

Qualitative interviews pre-and post-interventions with 14 caregivers summarized that parents liked the consistent patterns of instruction procedures (i.e., delivering the four areas of literacy in order with consistent teaching manners; Kang et al., in progress). They also indicated that the intervention was helpful as this experience became a preview of children’s kindergarten program that expected to be virtual due to COVID-19 and helpful to set children’s attitude for online learning. Many caregivers also indicated that 1:1 format made the intervention manageable and provided children with opportunities to interact with the implementers. More detailed qualitative social validity data were developed and reported in a separate manuscript (Kang et al., in progress).

**Discussion**

The purpose of this study was to examine the effects of RIA delivered in an online synchronous format on English literacy for young Korean American children. The results demonstrated a functional relation between the adapted RIA program and the acquisition of oral fluency, target vocabulary, and story comprehensions. For all children, high levels of responding were maintained after intervention, indicating sustainability of the intervention effects. Overall, the findings of this study indicate that RIA can be effective in improving literacy skills when delivered via distance technology and when adapted for Korean DLLs.

The positive results from this study with Korean American children align with previous studies for online literacy instruction for DLLs (e.g., Flewitt et al., 2015). However, this study extended previous research on RIA for DLLs (Duran et al., 2016) by embedding visual cues for vocabulary and phonological awareness lessons.
as well as repeated book readings. These results add to the growing evidence that RIA can be an efficacious method for improving English literacy skills for Korean American children.

Increases in all three dependent variables were observed for all participants immediately following the introduction of RIA. The immediacy of effects observed in this study is not entirely surprising, given that recent research has shown that structured reading programs can lead to substantial and immediate increases in story comprehension (Kim et al., 2018). This finding is particularly important given that the participants all entered the study with varying levels of English vocabulary, story comprehension, and oral fluency. This might suggest that adapted RIA delivered online can be effective for learners with varying levels of English and reading support needs. Positive changes in participant responding are likely a result of the components of the RIA intervention. The scripts, guidelines, and materials included in RIA utilize behavior analytic components of systematic instruction such as verbal, phonemic, echoic, and visual prompts, model, and behavior-specific praises. For example, the lesson plan states that the teacher shows a page of the book or a flashcard/picture (i.e., visual prompt), model the target words or rhyming sounds (e.g., “Watch, my mouth does the same things at the end: hat, mat”), and provide a behavior-specific praise/feedback after the student’s response (e.g., “Yes, map and cap sound the same!”). These evidence-based strategies are associated with increases in literacy skills for children with and without disabilities (Joseph et al., 2016). Therefore, it is likely that the combination of these procedures facilitated the children’s literacy development in this study.

Although overall, RIA led to increases for all three dependent variables, improvements in reading comprehension and vocabulary recognition were greater than those observed for words read correctly in 1 min. This is likely because the children learned the target vocabulary and the answers to the comprehension questions throughout the sessions because those skills were directly linked to the story content. Oral reading fluency predicts not only reading comprehensions skills but also the overall later academic performance (Bigozzi et al., 2017; Petscher & Kim, 2011). Thus, additional supports related to reading fluency such as decoding may be critical especially for dual language learner children to support their literacy and overall academic development as these skills impact children’s reading comprehension skills (García & Cain, 2014).

Although the RIA program was implemented by members of the research team, the online synchronous format did require support from the children’s parents. Specifically, parents were required to manage session time and technology-related issues. For example, before the intervention, parents were asked to adjust the size of the computer or tablet screen so that the children would be able to see the letters and pictures that appeared on the screen. Parents were also asked to log in at their scheduled time and set up the learning environments at home. Although some children eventually learned how to log into zoom by themselves at their scheduled times, some parents stayed near their children for the entire session. Parents’ managing role during the sessions was critical, and such involvement provided an opportunity for immigrant parents, who are less familiar with the American education, with increased exposure to evidence-based literacy interventions (Kim, 2016). Although
not formally measured, exposure to such intervention may have increased parents' knowledge of or ability to implement evidence-based literacy interventions at home.

Although not formally measured, we observed and anecdotally recorded how the children’s behavior varied whether or not a parent was present during the intervention session. Additionally, we observed that some children responded differently during sessions depending on who was present (e.g., mother, father). For example, based on observation and parent report, one participant followed the direction of the implementer with shorter latency when the mother was present. Analysis of how caregiver–child interactions impacted literacy outcomes was beyond the scope of this study but should be addressed in future research. Additionally, some children required redirection from their parent or caregiver to stay on task during the instructional session. Data on child interfering behavior (e.g., elopement from instructional setting, nonengagement, etc.) were not collected during this study so it is unclear how those behaviors or amount of redirection needed impacted literacy outcomes. Future research might examine this relationship given that many young children engage in one or more forms of interfering behavior (Prior et al., 2016).

Providing academic instruction at home presented a number of unique challenges. One challenge was that students had the ability to leave the designated instructional setting to a more preferred area of the home. In this study, we observed that the instructional setting impacted student on-task behavior and interfering behaviors, such as off-task behavior. The instruction was implemented virtually, but non-virtual environment such as noise, types of furniture used (e.g., large kitchen table vs. small child worktable), or artifacts unrelated to instruction (e.g., toys or windows) seemed to influence to children’s attitude toward the RIA intervention. Another challenge with virtual instruction was the ability to maintain instructional control. In this study, parent involvement was critical to keeping children engaged in maintaining instructional control. However, even with prompting, some students engaged in off-task behavior (e.g., talking about non-lesson-related activities) that required additional prompting to redirect. Future research may consider embedding additional low-intensity supports in the RIA program to increase child engagement including. Supports such as timers (Legge et al., 2010), visual schedules (Macdonald et al., 2018), and token economies (Carnett et al., 2014) have all been shown to increase on-task behavior and could be easily incorporated into the RIA program. Incorporating supplemental supports to increase on-task behavior during RIA may decrease the need for parent involvement during intervention, making the intervention more feasible and less resource intensive.

Limitations

While this study found positive effects for the RIA program on English literacy skills for young Korean DLLs, there are some limitations that should be noted. First, for Eli, we were only able to collect three data points for oral fluency. Eli’s parents indicated that the assessment discouraged Eli’s overall learning in this program. As each session consisted of instruction, and three different assessments on vocabulary, comprehension, and oral fluency, the implementer completed the entire procedure.
identically as other students except for the oral fluency assessment at the end of the session for Eli. As a result, while delivering interventions and other assessments regularly, we did not conduct the weekly measurement on oral fluency after 3 weeks of intervention for Eli. While we intentionally implemented this study in natural environments, we could not control the settings in which each participant completed the RIA intervention. Some children chose to attend sessions in less structured settings (e.g., living room), while other children chose to participate in more structured settings with fewer distractions. Since we were not able to hold the instructional context consistent across all participants, it is unclear how differences in these settings impacted child outcomes. Additionally, although we asked parents to refrain from providing instructional prompting or reinforcement during instructional sessions, it was impossible to control these variables during the online sessions. While no instances of parent prompting or reinforcement were observed, it is possible that one or both of these events occurred and may have confounded the results of this study.

**Implications for Research and Practice**

This study investigated the impact of dual language instruction on English literacy skills of Korean American children. Overall, we found that an adapted dual language RIA intervention could lead to improvements in multiple English literacy skills. Since many Korean immigrant families aim to maintain their child’s home language (e.g., Kang, 2013; Kim, 2011) while subsequently building English literacy, teachers and early childhood practitioners may consider using a dual language approach to foster critical literacy skills. To extend the work of this study, future research may also measure students’ language development in Korean along with English before and after the intervention. Systematic measurement of the effect of proportion of using Korean and English during intervention also could produce meaningful data related to dual language education.

In this study, we found that successful implementation of the RIA program required some parent involvement. Specially, setting up the instructional technology and keeping their children on-task throughout the sessions. Therefore, practitioners who choose to use this model should focus on developing meaningful partnerships with parents and families as well as providing pre-intervention training to ensure that parents understand their role in the program. Ongoing parent support may promote generalization and maintenance of learned skills and facilitate child acquisition of critical literacy skills.

In this study, we implemented RIA sessions in a synchronous 1:1 format. Parents indicated that they found this format to be beneficial since their children could receive personalized prompts, explanations, and attention from the implementers. However, some parents indicated that having multiple children in one synchronous session might be beneficial for other developmental domains. For example, having multiple children in one instructional session may facilitate engagement with same-age peers or increases in social communication. Future research should examine the impact of instructional arrangements (e.g., 1:1, small group, or whole group) on literacy outcomes for young children who are DLLs.
Appendix

Fidelity Checklist

Baseline and Maintenance

1. The interventionist recorded the entire session.
2. The interventionist presented and read out loud the book that is (a) age appropriate and (b) not listed in the lesson plan.
3. The interventionist did not present or use the materials (e.g., flashcards) from the lesson plan.
4. The interventionist did not use a laser point or underlining function to “point” to the assigned section(s) of the book.
5. The interventionist did not use any scaffolding strategies described in the lesson plan.

Intervention

1. The interventionist recorded the entire session.
2. The interventionist presented and read out loud the book listed in the lesson plan.
3. The interventionist completed all 4 activities listed in the two lesson plans designated for the day.
4. The interventionist completed the 4 activities in the following order: phonological awareness, print knowledge, vocabulary, and narrative.
5. The interventionist presented and used the materials (e.g., flashcards) for each lesson plan.
6. The interventionist used a laser point or underlining function to “point” to the assigned section(s) of the book.
7. The interventionist addressed all four objectives for the two lessons designated for the day.
8. The interventionist used scaffolding strategies described in the lesson plan.
9. If the child did not look at the screen, the interventionist redirected the child.
10. The interventionist used both English and Korean interchangeably for dual language instruction (i.e., English first then Korean if needed).

Declarations

Conflict of interest The authors declare that there is no conflict of interest.

Informed consent A total of eight children (seven males and one female) consented to participate in this study.
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Authors and Affiliations

Sunyoung Kim1✉ · Veronica Kang2 · Hanae Kim1✉ · Jing Wang1✉ · Emily Gregori1✉

Veronica Kang
Kang.veronica@gmail.com

Hanae Kim
kimh@uic.edu

Jing Wang
jwang213@uic.edu

Emily Gregori
egregori@uic.edu

1 Department of Special Education, University of Illinois at Chicago, 1040 W Harrison St. M/C 147, Chicago, IL 60607, USA

2 Department of Counseling, Higher Education, and Special Education, University of Maryland, College Park, MD, USA