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Preventing Summer Reading Slide: Examining the Effects of Two Computer-Assisted Reading Programs

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Abstract

Students who display reading difficulties/disabilities at the end of third grade are less likely to succeed in content areas and graduate from high school than their reading-proficient peers. Literature suggests that students in rural school districts lag behind their suburban peers in terms of their reading levels and accessibility to resources. Furthermore, students from low socioeconomic status (SES) households and those who have disabilities exhibit greater learning loss during the summer break. This exploratory study examined the effects of two parent-implemented computer-based reading programs on the reading skills of 20 students at-risk for reading failure during a summer break. Parental and students' perceptions regarding the effectiveness and desirability of the programs were elicited. Results suggested that both programs facilitated gains in phonemic awareness and phonics. Furthermore, students in the *Funnix* group exhibited large gains in vocabulary and oral reading fluency, and the students in the *PLATO* group exhibited large gains in comprehension. Most of the students indicated they liked the programs and the programs helped them read. Similarly, most of the parents agreed that the programs were useful, and they were comfortable using the programs. A description of the computer programs, results, implications, and limitations of the study are discussed.

Keywords

computer-based reading programs, parent-implemented interventions, summer reading loss, rural special education

Reading literacy in the earlier grades is an essential prerequisite for later academic success (Slavin et al., 2009). Students who display reading difficulties/disabilities at the end of third grade are less likely than their reading-proficient peers to succeed in content areas and graduate from high school (Mather et al., 2001). Reading literacy involves two essential subskills: word recognition and comprehension (Scarborough, 2001). Word recognition involves mastery of sound–symbol correspondence and phonic word attack strategies. During elementary grades, students transition from learning letter–sound correspondence to recognizing words automatically and reading text fluently (Slavin et al., 2009). Difficulties with fluent word recognition adversely affect oral reading fluency and comprehension (Macaruso et al., 2006). Recent data indicate that many students in today's schools do not become skilled readers. For example, the 2017 National Assessment of Educational Progress (NAEP) results indicate that 65% of the fourth- and eighth-grade students performed below the "proficient" level in reading (National Center for Education Statistics, 2018). Furthermore, the recent Programme for International Student Assessment (PISA) 2015 conducted by the Organization for Economic Cooperation and Development indicated that 19% of the 15-year-old students (one in five U.S. students) scored below the proficiency level on the reading measure (Carr, 2016).

During the last two decades, there has been an increased understanding and focus on literacy instruction. The most influential evidence came from the report of the National Reading Panel (National Institute of Child Health and Human Development [NICHD], 2000). This report called for explicit instruction in the areas of phonemic awareness and phonics along with instruction in the areas of vocabulary, fluency, and comprehension to facilitate reading literacy. The National Reading Panel's recommendations led to an increased emphasis on explicit instruction in the areas of phonemic awareness and phonics to promote early literacy skills of all children including children with reading disabilities or at-risk for reading difficulties. Lyon (2001) estimated that through appropriate, explicit, comprehensive, and intensive early instruction that the current number of

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20-million children with reading failures in the United States can be reduced by approximately two thirds. Some researchers suggest that 25 to 173 hr of preventive instruction is essential to successfully accelerate early reading development of at-risk students (Scammaca et al., 2007; Torgensen et al., 2010).

Students in rural school districts lag behind their peers in their reading achievement levels (Graham & Teague, 2011; Provasnik et al., 2007). The average third-grade rural student's score is 8 points lower (approximately one third of a standard deviation) than the score of an average suburban student and 2 points lower than the score of an average urban student (Graham & Teague, 2011). Students who struggle in reading during the earlier years tend to make fewer gains across grades than students who do not (Sandberg-Patton & Reschly, 2013). This learning loss is compounded during the summer months. According to a recent study by Sandberg-Patton and Reschly (2013), students in lower elementary grades (second and third) demonstrated a greater summer learning loss in oral reading fluency than students in the upper elementary grades. Furthermore, the learning loss was higher for students in special education and/or students from lower socioeconomic backgrounds (Sandberg-Patton & Reschly, 2013). This loss of reading skills when compounded over multiple years creates an estimated 2- to 3-year reading deficit in students (Allington & McGill-Franzen, 2003).

Given the magnitude of the problem, yearlong instruction, both at home and at school, is essential to meet the literacy needs of students with reading difficulties/deficits. Parents are good at reading to their children or hearing their children read, but they are not skilled at teaching phonemic awareness and phonics skills in an explicit manner (Pindiprolu & Forbush, 2009; Watson & Hempenstall, 2008). As the teaching of phonemic awareness and phonics in an explicit and systematic way is fundamental to addressing the learning needs of students with reading difficulties or at-risk for reading disabilities, it is essential to identify intervention programs that can provide the necessary structure and support for parents to teach literacy skills to their children with reading difficulties. Direct Instruction (DI) programs, which are carefully sequenced and explicit, are one way to provide the needed explicit structure and support to overcome limited parental skills in teaching phonemic awareness and phonics (Watson & Hempenstall, 2008). The efficacy of DI programs is supported by research conducted over a half century (see Coughlin, 2011; Hattie, 2009; Stockard et al., 2018; Stockard & Wood, 2017). Another avenue is to support parents' utilization of technology such as computer-based reading programs (CBRPs) that have been shown effective in developing phonological skills in beginning readers (MacArthur et al., 2001; Macaruso et al., 2006).

In recent years, a few studies have examined the effectiveness of CBRPs in facilitating basic literacy skills when implemented by adults. Huffstetter et al. (2010) examined the effects of *Headsprout* program on the early literacy skills of at-risk preschool children. Based on the results, the authors concluded that *Headsprout* facilitated early literacy skills of at-risk preschool children and the teachers/teacher assistants were positive regarding *Headsprout* effectiveness. The authors called for additional studies with multiple conditions, including a literacy program condition, to evaluate the comparative effectiveness of the *Headsprout* program. Similarly, Regvoort and Leji (2007) examined the effects of a parent implemented CBRP on the phonemic awareness and letter knowledge of students identified as at-risk for reading difficulty due to a familial history of reading impairments. The researcher-created intervention focused on three types of computerized exercises: letters, segmenting and blending, and word decoding. At-risk students who received computer-based instruction made greater gains on letter knowledge than their at-risk counterparts in a control group. The trained at-risk students were able to keep up with the phonemic awareness skills of students in a comparison group comprised of students who did not have a familial history of reading impairments. At-risk students who did not receive the computer-based training exhibited a lower rate of development. A common finding between the two studies is that adult-implemented CBRPs facilitate early literacy skills of preschool and kindergarten (KG) students with reading difficulties.

Two studies examined the effectiveness of a CBRP, *PLATO Beginning Reading for the Real World*, that targets beginning reading skills in K–3 grades. Bauserman et al. (2005) examined the effectiveness of *PLATO's Beginning Reading for Real World* (Level A) on the emergent skills of KG students using a quasi-experimental design. After 8 weeks of intervention, the authors concluded that students showed measurable growth in the areas of phonological awareness, knowledge of print concepts, and listening comprehension. The authors also reported that accessing the software was difficult for KG students as PLATO's login procedures were complicated. Similarly, Carter (n.d.) conducted an action research project that examined the effectiveness of PLATO on the reading skills of eight students with learning/reading disabilities. The results indicated that PLATO was effective in increasing the reading skills of seven of the eight students with disabilities. Despite 28% of the students experiencing technical and navigational difficulties, students had positive attitudes toward the program and were motivated to learn using the PLATO program. The teachers also had positive attitudes regarding the program and wanted to continue implementing the program after the project was completed.

Watson and Hempenstall (2008) examined the effectiveness of a DI computer program, *Funnix*, on the early literacy skills of students in KG and first grade. Results of the study indicated that KG students in the intervention group

had statistically significant gains when compared with the control group students on the (a) phonemic awareness, (b) letter–sound fluency, (c) oral reading fluency, and (d) non-word decoding measures. First-grade students who received the *Funnix* intervention had significant pre–post increases on the (a) letter–sound fluency, (b) letter–name knowledge, (c) non-word decoding, and (d) oral reading fluency measures, but these gains were not significant when compared with the gains made by the students in the control group. In view of the positive findings, the authors called for future studies examining the effectiveness of *Funnix* with at-risk beginning readers.

Given the need for explicit instruction in the areas of phonemic awareness and phonics, which are essential for fluent oral reading, and to prevent the loss of reading skills during the summer break, it is essential to support parental ability to teach phonemic awareness and phonics skills to their children who are at-risk for reading disabilities. One way to address parents' ability is to utilize CBRPs. However, there is very limited literature on the effectiveness of CBRPs in facilitating the development of reading skills and motivating struggling readers (Cheung & Slavin, 2013; Escueta et al., 2017; Hansen, 2014; NICHD, 2000; Regan et al., 2014; Stetter & Hughes, 2010). Consequently, this study was undertaken as there is a significant dearth in rigorous evaluations of the effectiveness of CBRPs in ameliorating the reading deficits of students (Agodini et al., 2003; Kim et al., 2017; Rouse & Krueger, 2004). Specifically, the study evaluated the comparative effects of the CBRPs on the acquisition of basic early literacy skills of K–2 grades students with reading difficulties when implemented by parents during a summer break. Furthermore, (a) parental perceptions regarding the effectiveness, ease of implementation, and desirability of the program and (b) students' perceptions on the effectiveness and desirability of the programs were examined.

Method

Participants and Recruitment

Participants for the study consisted of students with reading difficulties in K–2 grades and their parents. The researchers met with district supervisors of schools located in East Tennessee to share the study objectives and to obtain feedback on the procedures, measures, and CRBPs used in the study. During initial discussions with the district supervisors, a pre–post randomized controlled trial (RCT) study with a control group was proposed. Based on the feedback from the district supervisors, who requested that all at-risk students be provided a reading intervention and the limited time frame for conducting a summer study, the proposed study objective was modified to evaluate the effectiveness of two CBRPs, when implemented by parents, on the reading skills of elementary students in K–2 grades with reading difficulties/disabilities. After obtaining institutional review board approval, flyers were developed and distributed with the assistance of classroom teachers working in KG, first, and second grades in two rural counties in East Tennessee. The teachers were asked to (a) identify students scoring below the 15th percentile on a local, state, or national test of reading achievement and (b) send the flyers home with students. Two informational sessions were conducted for the parents who expressed an interest in participating in the study. Among the parents who expressed an interest, 27 parents signed the consent and participated in the study. At the end of the study, each parent received a US$50 honorarium for his or her participation.

Setting

Participants in the study primarily resided in two rural school districts in East Tennessee. At the beginning of the study, project personnel contacted parents and tested their children at a place of their convenience (i.e., at the child's home, at a school, or at the University) and collected computer systems information to ensure that the basic system requirements for the CBRPs were met. Parents in both groups implemented the CBRPs at their homes on their personal home computers during the summer break; three parents in the *PLATO* group who did not have internet access at home implemented the *PLATO* program at a school computer lab.

Independent Variables

Criteria used to identify the CBRP included (a) the program-addressed instructional targets identified by the National Reading Panel Report (i.e., phonemic awareness, phonics, fluency, vocabulary, and reading comprehension); (b) curriculum targeted in the programs was appropriate for K–2 grades students; and (c) the program enabled similar lengths of time to complete a computer-based lesson/episode (i.e., 30 min). Based on the above criteria, two CBRPs, *Funnix* and *PLATO*, were selected for the study.

Funnix. *Funnix* is a CD-based DI reading program designed for home use. It consists of two levels: *Funnix Beginning Reading* and *Funnix 2*. *Funnix Beginning Reading* comes with a parent CD, an instructional guide on how to use the program, 120 lessons, and a consumable workbook for the student to complete after each lesson. *Funnix 2* contains lessons on CDs and a reading book (Pindiprolu & Forbush, 2009). *Funnix* provides for a placement test to determine the entry points into the program for students (see http://www.funnix.com/ for more details). *Funnix* has a built-in narrator that models reading skills and requires an adult to navigate the program and make appropriate choices (pause,

repeat, continue, exit, etc.) to deliver the instruction based on students' responses (Pindiprolu & Forbush, 2009). For example, an adult can repeat the instructions of the narrator or repeat the exercises if the student is making multiple errors. Instructions for parents are also provided in the *Funnix* parent training CD on correct sound pronunciations, when to repeat exercises, how to navigate through lessons and exercises in a lesson, and how to praise students for the correct responses so the parent can review them when needed (Pindiprolu & Forbush, 2009). The program provides explicit training in the areas of phonological awareness, alphabetic principle, fluency, vocabulary, and comprehension. Each lesson begins with a narrated introduction and cues the student to produce oral responses to stimuli presented on the screen, complete workbook exercises, or read from a hardback reader. *Funnix* program (both Beginning Reading and 2) with workbooks costs about 53 dollars per student (without shipping).

PLATO. *PLATO Beginning Reading for the Real World* is a web-based program that employs a variety of instructional strategies, including DI, and provides numerous practice opportunities to facilitate the acquisition and use of phonetic and comprehension skills. The reading curriculum is organized into four leveled modules progressing from K–3 grades. Each module has a thematic focus and includes four to five lessons. A student begins the module by completing a skill assessment that determines the needed skills-based lessons. The student works independently at his or her level and pace, under the supervision of an adult. Each lesson consists of informational and interactive activities that present tasks and/or asks questions. The interactive nature of the program requires a student to make frequent choices on each screen. A variety of question types (e.g., label placement, fill in the blank, selection options) and formats (e.g., matching games, cloze tasks) are used in the program, and each activity ends with an information screen, which provides information on the percent of questions correctly answered with a recommendation to proceed to the next activity or to redo the activity (score of 80% or higher). Students can go back and forth between screens and exit an activity or resume from the point where they left off. The courseware also provides a workroom that enables students to play games and use tools to practice and extend their learning (see Quinn et al., 2003 for more information). *PLATO* costs vary depending on the package (e.g., K–3 Reading or K–6 Elementary Package) and the number of student licenses purchased (e.g., US$387 each for 100 licenses, US$288 each for 500 licenses) by a school.

Dependent Measures

Dynamic Indicators of Basic Early Literacy Skills (DIBELS). DIBELS progress monitoring (PM) probes were used to measure the effectiveness of the CBRPs on the students' reading skills. DIBELS probes can be individually administered in 1-min time intervals and consist of seven subtests: Letter Naming Fluency (LNF), Initial Sound Fluency (ISF), Word Use Fluency (WUF), Phoneme Segmentation Fluency (PSF), Nonsense Word Fluency (NWF), Oral Reading Fluency (ORF), and Retell Fluency (RF; Good et al., 2001). For the purposes of this study, PM probe 19 (except for LNF) was used as the pretest and PM probe 20 was used as the posttest. For LNF measure, the K–3 grades benchmark assessment was used as the pretest and the first benchmark at the first grade was used as the posttest as progress monitoring probes are not available for this subtest. As there was no ORF PM probe for KG, the first-grade PM probes were used with KG students. The DIBELS measures are reliable and valid indicators of students' early literacy skills (see Good et al., 2004). For the LNF measure, the median criterion-related validity with the Woodcock-Johnson Psycho-Educational Battery–Revised (WJ-R) Readiness Cluster standard score is .70 in KG and the predictive validity of KG LNF with first-grade WJ-R Reading Cluster standard score is .65 (Good et al., 2004). For the ISF measure, criterion-related validity with the WJ-R is .36 and predictive validity is .36 (Good et al., 2004). For the PSF measure, the criterion-related validity with the WJ-R Readiness Cluster is .54 and predictive validity with WJ-R Total Reading Cluster is .62 (Good et al., 2004). For the NWF measure, criterion-related validity with the WJ-R Readiness Cluster is .59 and predictive validity with WJ-R Total Reading Cluster is .66 (Good et al., 2004). For the ORF measure, test–retest reliabilities range from .92 to .97 and criterion-related validity coefficients range from .52 to .91 (Good et al., 2004).

Interobserver agreement. All individual paper–pencil administrations of the DIBELS measures were recorded on an audiotape and subsequently used for calculating interobserver agreement. A graduate student in special education, trained in the administration of DIBELS assessments, performed interobserver agreement by listening to the audiotapes and independently scoring the responses on the DIBELS scoring sheets for LNF, PSF, NWF, WUF, ORF, and RF measures. Interobserver agreement was undertaken for 20% of all pretest and posttest administered.

The average interobserver agreement (IOA) and range for the pretests were as follows: 99.26% for the LNF measure (98.41%–100%), 91.07% (80%–100%) for the PSF measure, 89.58% (83.67%–100%) for the NWF measure, 97.34% (92.69%–100%) for the WUF measure, 87.55% (77.27%–98.93%) for the ORF measure, and 93.61% (80%–100%) for the RF measure. The average IOA and range for the posttest were as follows: 97.29% (95.5%–100%) for the LNF measure, 90.75% (85.29%–94.7%) for the PSF measure, 88.57% (80%–96.55%) for the NWF

measure, 90.99% (83.33%–97.67) for the WUF measure, 92.09% (82.6%–100%) for the ORF measure, and 82.43% (78.95%–88.88%) for the RF measure.

Social validity measures. Collecting social validity data on the (a) effectiveness, (b) efficiency/ease to use, and (c) desirableness is very important for the sustainability of a program in practice (Pindiprolu & Forbush, 2009). Such information, especially for parent-implemented interventions, provides both practitioners and parents a comprehensive picture of the programs and will aid in their selection of programs. Hence, researchers developed social validity questionnaires for parents and students before the study commenced. These questionnaires were reviewed by a focus group consisting of faculty and school administrators. At the completion of the study, the social validity questionnaire was administered to elicit participants' perceptions. Students were orally asked about their satisfaction with the program, their perception of specific elements (e.g., stories, graphics, activities), and their perceived effectiveness of the program in teaching them how to read. The researchers recorded the responses on the questionnaire. Parents responded to questions such as the ease of navigating the program, their perceived effectiveness of the program, whether they would recommend the program to other parents, and if they would use the program in the future.

Procedures

Assignment of the participants. After the initial consent for participation was obtained, parents completed a demographic questionnaire that asked for (a) family demographics, (b) information on summer services for their child, and (c) home computer information (i.e., operating system, availability of internet). The students were randomly assigned to one of the two CBRPs.

The initial sample consisted of 27 parent–child dyads. Out of the 27, seven did not complete all the requirements of the study (five in the *PLATO* group and two in the *Funnix* group). Out of the 20 dyads who completed the study, seven were from the *PLATO* group and 13 were from the *Funnix* group. Eight of the students were from KG (three *PLATO* and five *Funnix*) and first grade (three *PLATO* and five *Funnix*) and four were second-grade students (one *PLATO* and three *Funnix*). Seventeen of the children were from a two-parent household and three were from a single parent household. Most of the parents had some university-level education. Eight parents completed high school, two completed an associate degree, four completed a bachelor's degree, two completed a master's degree, and four indicated that they had completed some college. Six of the families indicated a presence of a familial reading disability, and six of the students were receiving some form of summer services from their school district.

Parent training. Project personnel met with each parent to train the parent on how to use the CBRP. A handout was developed for each CBRP to assist with the training. Training consisted of (a) reviewing CBRP-related materials, (b) instructions for logging into the CRBP, (c) instructions on the role of assessments, (d) modeling overall use of programs (e.g., repeating an exercise or activity, reviewing and practicing procedures for properly correcting reading errors for *Funnix*), (e) discussing child and parental roles during instructional sessions, and (f) discussing weekly progress reporting procedures. After the orientation and training, parents were asked to deliver reading instruction 5 days a week, for 8 weeks (i.e., for 20 hr). Each parent was provided with self-addressed envelopes and progress sheets and instructed to send daily log sheets to the researchers on a weekly basis.

Testing. DIBELS pretests were administered to the student in a quiet location either at the student's home, at a school, or at the university. The entire session (training and pretest) lasted approximately 90 min, with 1 hr for the overview and training of parent and approximately 30 min for the administration of DIBELS measures. After 8 weeks of intervention, the students were tested again using DIBELS. At this time, parents were asked to complete the social validity questionnaire and a form for receiving their honorarium. Furthermore, students were orally asked the questions on the social validity forms and their responses were recorded on the form by the researchers.

Results

Effectiveness of CBRPs

To evaluate the effects of the programs on the basic early reading skills of the students, three types of statistical analyses were undertaken. First, a one-way analysis of covariance (ANCOVA) was undertaken to compare the groups. The ANCOVA was conducted with the CBRP as the independent variable, posttests as the dependent variable, and pretests as the covariate. The homogeneity-of-slopes assumption to evaluate the interaction between the pretest and the independent variable in the prediction of the posttest score was undertaken. A preliminary analysis of the evaluation of the homogeneity-of-slopes assumption indicated that the relationship between the covariate (pretest) and the dependent measure (posttest) did not differ significantly as a function of the independent variable for LNF, ISF, PSF, NWF, and WUF measures. However, two of the seven tests, ORF and RF, did not meet the homogeneity-of-slopes assumption. Furthermore, all seven analyses testing population-adjusted means between the two groups are equal were not rejected. Means on the posttests, standard deviations, and estimated marginal means are provided in Table 1.

Table 1. Means, Standard Deviation, and Adjusted Means on the Posttests for the Two Groups.

Posttest	Group	*n*	*M*	*SD*	Adjusted means
LNF	*PLATO*	7	47.85	19.43	45.71
	Funnix	13	37.92	21.97	39.06
ISF	*PLATO*	7	19.05	13.67	19.06
	Funnix	13	25.33	10.55	25.32
PSF	*PLATO*	7	26.28	15.53	28.40
	Funnix	3	25.69	15.60	24.55
NWF	*PLATO*	7	31.71	25.79	32.01
	Funnix	13	34.07	32.86	33.91
WUF	*PLATO*	7	34.28	19.98	27.67
	Funnix	13	31.38	17.70	34.92
ORF	*PLATO*	7	19.85	18.70	19.52
	Funnix	13	23.92	31.02	24.10
RF	*PLATO*	7	6.85	6.38	8.50
	Funnix	14	7.00	9.16	6.11

Note. LNF = Letter Naming Fluency; ISF = Initial Sound Fluency; PSF = Phoneme Segmentation Fluency; NWF = Nonsense Word Fluency; WUF = Word Use Fluency; ORF = Oral Reading Fluency; RF = Retell Fluency.

Table 2. Means and Standard Deviations on the Pre- and Posttests for the Two Groups.

	DIBELS	Pretest		Posttest	
Group	Measure	*M*	*SD*	*M*	*SD*
PLATO	LNF	42.00	24.12	47.85	19.43
	ISF	12.55	9.47	19.05	13.67
	PSF	17.42	13.30	26.28	15.53
	NWF	27.85	31.18	31.71	25.79
	WUF	33.42	21.54	34.28	19.98
	ORF	18.00	25.76	19.85	18.70
	RF	0.00	0.00	6.85	6.38
Funnix	LNF	37.53	24.07	37.92	21.97
	ISF	12.84	11.68	25.33	10.55
	PSF	21.30	11.82	25.69	15.60
	NWF	28.46	36.25	34.07	32.86
	WUF	19.15	16.35	31.38	17.70
	ORF	17.46	28.16	23.92	31.02
	RF	4.23	10.52	7.00	9.16

Note. DIBELS = Dynamic Indicators of Basic Early Literacy Skills; LNF = Letter Naming Fluency; ISF = Initial Sound Fluency; PSF = Phoneme Segmentation Fluency; NWF = Nonsense Word Fluency; WUF = Word Use Fluency; ORF = Oral Reading Fluency; RF = Retell Fluency.

Second, paired samples *t*-tests were undertaken to explore if there were statistically significant differences between the pre- and posttest scores across the seven measures for the whole sample (i.e., both groups combined; $n = 20$). The paired samples *t*-tests indicated statistically significant differences on the ISF ($p = .00$), RF ($p = .02$), WUF ($p = .02$), ORF ($p = .02$), and PSF ($p = .03$). No statistically significant effects were found on the LNF and NWF measures. The effect sizes were *medium* for the ISF (.68), RF (.56), WUF (.55), ORF (.53), and PSF (.50) measure. The effect size was small for the NWF (.30) measure.

Third, paired samples *t*-tests were undertaken to examine pre–post gains for each group. Means and standard deviations on the pre- and posttest are provided in Table 2. The students in the *PLATO* group had statistically significant gains at the .05 significance level on the RF measure. The students in the *Funnix* group had statistically significant gains on three DIBELS measures: ISF, WUF, and ORF. As the sample sizes were small ($n = 7$ for *PLATO* and $n = 13$ for *Funnix*), standardized effects size index *d* was calculated. For the students in the *PLATO* group, the effect size was *large* for the RF measure (1.07); *medium* for the PSF (.74), LNF (.61), and ISF measures (.53); and *small* for the NWF (.27) measure. For the students in the *Funnix* group, the effect size was *large* for the WUF (.89) and ORF (.86) measures; *medium* for the ISF (.74) measure; and *small* for the PSF (.37), RF (.35), and NWF (.31) measures (Good et al., 2004; Good & Kaminski, 2002). Given that effect size is an estimate calculated from statistical inference and is less likely to be accurate when estimated from a small sample size, calculation of 95% confidence interval for the effect size is essential to understand the magnitude of the effect (Lee, 2016). Assuming normal distribution of data, 95% confidence intervals (CIs) were calculated. For the *PLATO* group, the 95% CI for the effect size ranged from .82 to 1.32 on the RF measure, .26 to 1.22 on the PSF measure, .13 to 1.09 on the LNF measure, .05 to 1.01 on the ISF measure, and −.2 to .74 on the NWF measure. For the *Funnix* group, the 95% CI for the effect size ranged from .4 to .138 on the WUF measure, .37 to 1.35 on the ORF measure, .26 to 1.22 on the ISF measure, −.1 to .84 on the PSF measure, −.12 to .82 on the RF measure, and −.16 to .78 on the NWF measure. As the 95% CI for the effect size contains "0" on the NWF measure for the *PLATO* group and on the PSF, RF, and NWF measures for *Funnix* group, these effects sizes should be considered as nonsignificant.

Parental Perceptions

The social validity questionnaire was completed by 11 parents in the *Funnix* group. Five parents indicated they used *Funnix Beginning Reading*, three indicated they had used the *Funnix 2* program, two indicated they had used both the programs, and one did not answer. Eight parents indicated they had previous experiences using a computer-based instruction software and similar number indicated they had previous experience with teaching reading. All 11 parents indicated they were comfortable using the *Funnix* program but only eight agreed that it was useful in facilitating the reading skills of their child (one was neutral and the other two disagreed). Ten parents agreed (a) the overall quality of

Table 3. Parental Perceptions of Computer-Based Reading Programs.

Questions	*Funnix* % (*n*)	*PLATO* % (*n*)
1. Did you have any previous experience with reading software before this study?	72.7 (8)	57.1 (4)
2. Did you have any previous experience helping others with reading instruction?	72.7 (8)	57.1 (4)
3. Overall quality of the program was very good.	90.9 (10)	100 (7)
4. If you were to help another child with reading, would you use this program?	90.9 (10)	100 (7)
5. Would you recommend this program to a friend helping his/her child with reading?	90.9 (10)	100 (7)
6. Would you use the program over other materials for teaching reading skills?	90.9 (10)	100 (7)
7. Program was useful in facilitating the reading skills of the student.	72.7 (8)	100 (7)
8. Program helped maintain child's attention.	72.7 (8)	100 (7)

the program was very good (one disagreed), (b) they would recommend the program to a friend, (c) they would use it to help another child, and (d) they would use the *Funnix* program over other materials for teaching reading skills (see Table 3). Regarding the ease of use of the *Funnix* program, most of the parents agreed that starting a lesson (10 parents), moving between exercises (nine parents), repeating a lesson (10 parents), and stopping the program to provide error correction were easy (10 parents). Three parents were neutral regarding their child's ability to follow the instructions of the narrator. Regarding the appropriateness of the *Funnix* program, all parents agreed that the activities for teaching sounds and reading words were appropriate and only one disagreed on the appropriateness of activities for teaching comprehension. Eight parents agreed with a statement the computer graphics/animation helped maintain their child's attention and their feedback helped their child's reading skills (two were neutral and one disagreed). Regarding workbook activities, nine parents agreed the activities were useful in practicing reading skills (one was neutral and another disagreed), and eight parents agreed the assessment activities for placing the child in the program were appropriate. Some of the positive responses to "comments and concerns" questions included the following: (a) "We loved the workbook sections!" (b) "I really thought the program helped my son with recognizing and using letters correctly. I saw major improvement from beginning to end." and (c) "This program helped my child advance to a grade level that at the end of the previous school year he was not at." The concern of one parent was that "It really has to be monitored (parents sit down with child). If you have other small kids, that makes it tough to do."

All seven parents in the *PLATO* group completed the social validity questionnaire. The results indicated that four parents had previous experience with computer-based software and a similar number had some previous experience with teaching reading. Only two of the seven parents were able to identify the levels/modules their child accessed. All parents indicated (a) *PLATO* program is a very good program, (b) they would recommend the program to a friend, (c) they would use it to help another child, and (d) they would use the program over other materials for teaching reading skills. Similarly, all the respondents felt the program helped facilitate the reading skills of their child. Regarding the ease of using the *PLATO* program, all seven indicated that logging onto the *PLATO* website and accessing a lesson/activity was easy. Four of the seven agreed their child was able to follow the narrator's instructions (three were neutral). All seven parents indicated their child was comfortable using the program and that the *PLATO* program was useful in facilitating the reading skills of their child (see Table 3). Regarding appropriateness of the curriculum, all parents indicated activities for teaching sounds of letters and words were appropriate. All seven parents agreed that the graphics/animation helped maintain their child's attention (see Table 3). Six parents agreed that activities for teaching comprehension were appropriate (one was neutral) and five parents thought the assessment placement activities were appropriate (one neutral and one disagreed). Regarding "comments and concerns," parents reported the following: (a) "There were few areas that confused me, especially choosing the moral of the story." (b) "It was sometimes hard to hear the narrator no matter how loud the volume, just sounded like it all ran together at times." and (c) "I had to assist my child most of the lessons." One parent reported concerns regarding the accessibility of the school labs during summer.

Students' Perceptions

The results from the social validity questionnaire administered with the students in the *Funnix* group indicated nine of the respondents agreed they liked the *Funnix* program (two indicated they did not like it, and two did not answer). Regarding specific components, (a) 12 students liked the visual/animations, (b) nine students liked the activities, and (c) 11 students liked the stories (some did not answer). On their overall perception of the program, 10 students indicated *Funnix* helped them learn to read (one said "no"), and five students indicated their friends would like the *Funnix*

Table 4. Students' Perceptions of Computer-Based Reading Programs.

	Funnix	*PLATO*
Questions	% (*n*)	% (*n*)
1. Did you like the CBRP?	69.2 (9)	85.7 (6)
2. Did you like the activities in the CBRP?	69.2 (9)	71.4 (5)
3. Did you like the stories in the CBRP?	84.6 (11)	85.7 (6)
4. Did the CRBP help you learn to read?	76.9 (10)	85.7 (6)
5. Do you think your friends will like the CBRP?	38.5 (5)	71.4 (5)

Note. CBRP = computer-based reading programs.

program (see Table 4). Some of the students' responses to an open-ended question on what helped them to read included (a) "*Funnix*," (b) "all the words," (c) "stories," (d) "reading," and (e) "pretty much everything."

The results from the social validity questionnaire administered with the students in the *PLATO* group indicated six of the students liked the program (one did not answer). Regarding specific components, five students liked the visual/animations and activities, and six students liked the stories (see Table 4). Regarding their overall perception of the program, (a) six students indicated *PLATO* helped them learn to read (one said "no"), (b) five indicated the program was easy to use, and (c) five students indicated their friends would like the program (one said "no"). The students' responses to an open-ended question on what helped them to read included (a) "stories," (b) "sentences," (c) "sounds," (d) "reading parts," and (e) "practicing and reading." The students' responses on what they liked about the *PLATO* program included (a) "I like everything," (b) "I like to play games on the computer," (c) "Playing the matching games," (d) "Match," (e) "tell the ___what," and (f) "when you give the answers, matching game."

Discussion

Learning to read by the end of third grade is essential for later academic success and is critical for students in rural school districts as literature indicates that they lag behind their peers in terms of their reading achievement levels (Graham & Teague, 2011; Provasnik et al., 2007). This investigation examined the effects of two CBRPs, *Funnix* and *PLATO*, on the basic early literacy skills of rural students at-risk for reading failure after 8 weeks (20 hr) of intervention. The overall ANCOVA results indicated there were no statistically significant differences between the two groups on the seven measures. Results from the overall paired samples *t*-tests suggested that the students made pre–post skill level gains in phonemic awareness, phonics, vocabulary, fluency, and comprehension. Furthermore, pre–post gains for each group indicated students in both groups exhibited gains in the areas of phonemic awareness and phonics, which are crucial early reading skills, when implemented by the parents. Furthermore, the students in the *Funnix* group had *large* gains in the areas of vocabulary and oral reading fluency. The students in the *PLATO* group had *large* gains in comprehension.

These findings support and extend the findings of Watson and Hempenstall (2008) and Bauserman et al., (2005) that the CBRPs, *Funnix* and *PLATO*, facilitate the basic early literacy skills of at-risk beginning readers. Another significant finding is the effectiveness of the programs in facilitating the development of early literacy skills during the summer break. This is critical because the literature suggests an average of a month of reading learning loss during the summer because of the absence of instruction (Cooper, 2003). As children with reading difficulties do not have necessary basic early literacy skills, instruction in phonemic awareness and phonics by parents is critical during summer months. This could potentially prevent summer learning loss and subsequent academic difficulties in the later years.

Parent Perceptions

Regarding the parent perceptions of technology, in general, most of the parents (more in the *PLATO* group) agreed regarding the usefulness of the programs, and all parents in both groups indicated they were comfortable using the programs. All parents in the *PLATO* group agreed that the program helped maintain the attention of their child, facilitated the reading skills of their child, and they would use the program to help another child or would recommend it to a friend. One explanation for the very positive opinions of the program could be that parents who liked the program completed the study and parents who did not like the programs may have dropped out of the study (seven dropped out of the study; five were from the *PLATO* group). The numbers were slightly lower for the *Funnix* group. This lower percentage could have been due to the nature of the *Funnix* program, which is more adult-directed and is not internet dependent. Regarding *Funnix*, one parent commented that it was difficult for her to work one-on-one with her having

other children. From the demographic questionnaire, only three of the parents had one child, and a majority had two children (11 parents). The remaining six parents had three children or more; this could have influenced the perceptions of parents who used the *Funnix* program. Despite the overall positive ratings of the programs, two responses were lower for two of the program components (for both programs): the clarity of narrator's instructions and the appropriateness of placement assessments. One of the parents also indicated in her response to an open-ended question that narrator's voice was unclear despite her adjusting the volume level. These two factors could have affected the overall rating of the programs and are suggested areas for examination in future studies.

Students' Perceptions

Most of the students liked the programs, thought the programs helped them read, and they liked the stories in the programs. A higher percentage of the students in the *Funnix* group indicated they liked the graphics/visuals but less than half of the students thought their friends would like the program. A greater percentage of the students in the *PLATO* group liked the program, thought the program helped them learn to read, and indicated their friends might like the program. This positive rating could be due to the program being student-directed. Given these are parent-implemented the programs during summer break, the nature of the parent–child interactions could have influenced the students' perceptions. For example, we visited 14 of the 20 parents to observe their implementation of the program, and our observations indicated that most parents had minimal praise rate when implementing the programs, but they provided many directions. Existing literature indicates that positive praise can facilitate (a) faster task completion, (b) intrinsic motivation, (c) students' preference for challenging tasks, (d) students relating their success to effort, and (e) increased on-task behaviors (Droe, 2013; Gambino, 2016; Gunderson et al., 2013; Royer et al., 2019). Parent's delivery of praise while providing summer computer-based reading intervention is a suggested area for examination in future studies.

Limitations of the Study and Future Research

There are some limitations to the study, and the results should be interpreted as tentative due to these limitations. These limitations include (a) small sample size and multiple comparisons, (b) disproportionate "n" across groups and grade levels, (c) the lack of treatment fidelity measures, (d) lack of a control group, and (e) nonrandom selection and attrition of the participants.

First, the sample size for the study was small (less than 15 students for each group); hence, the power of the statistical tests in rejecting the null hypotheses was weak. Despite conducting multiple tests, the null hypothesis was tested at the .05 significance level (two-tailed test) to increase the power of the test. Furthermore, effect sizes were undertaken to overcome the limited power of the statistical tests. The effect sizes computed did indicate that the results of this preliminary investigation are promising. However, the results should be considered as tentative as the students were not equally distributed across grades and groups and this could have resulted in some variance in the effect sizes computed for each group, and some of the students in both groups were also receiving summer services. Because all gains may not be attributed to the CBRPs, second-generation replication studies are needed to validate the findings of this study; identify program components such as parental praise rate and intervention intensity that are likely to improve student achievement; and examine the role of moderator variables such as previous experience with reading software and family demographics on the findings.

Second, even though the effect sizes indicate growth in basic early literacy skills, the lack of a control group makes it difficult to understand the relative significance of the results. A control group would have provided data in understanding the true effectiveness of the programs and the extent of summer learning loss (i.e., lack of opportunities to practice). Furthermore, a control group receiving traditional summer services would have helped examine the relative effects of the computer-based programs over summer services. Replication studies that include a control group condition are essential to validate the findings.

Third, this study did not employ a random selection of the participants and thus the results have limited generalizability to the wider population. Existing literature suggests that 33% of mothers and 36% of fathers of students attending rural schools have a high school diploma (Graham & Teague, 2011). In our study, most parents had some college education, and all of them had at least a high school diploma; hence, the results are applicable only to similar populations. Furthermore, only 20 of the 27 participants completed the study, indicating a high attrition rate. During the study, we found that some of the parents moved, some expressed technology problems (with *PLATO*), and one expressed her difficulty in accessing school labs. Because of the random assignment to a computer program, we provided the option of using the school labs for parents who did not have internet connection. This could have affected overall participation and completion. Future studies should examine the role of these moderator variables and their influence on the findings.

Implications for Practice

It is estimated that one third of all schools are in rural areas, serving 20% of all school-age student population in the United States (Fedora, 2016; Tichnor-Wagner et al., 2015). Rural students with reading struggles at the beginning of

KG end up performing lower on third-grade reading tests than their peers from urban and suburban schools of the same socioeconomic status (SES). Furthermore, they fall behind their peers during the summer break (Fedora, 2016). Rural children not only perform lower on school readiness skills than their peers in urban and suburban school districts, but they also have limited access to highly qualified teachers and resources (Arnold et al., 2005; Fedora, 2016; Vernon-Feagans et al., 2010). Furthermore, there is a very limited research conducted on the effectiveness of academic interventions for students in rural schools (Arnold et al., 2005; Stockard, 2011; Vernon-Feagans et al., 2010). One way to overcome the barriers of resources and the lack of qualified professionals and meet the needs of struggling readers is to empower parent's ability to provide explicit instruction in the areas of phonemic awareness and phonics. The *Funnix* and *PLATO* programs are two such programs that can be used to facilitate gains in basic early literacy skills of students at-risk for reading failure in rural communities during a summer break. Given the geographic isolation, lack of transportation for students to access services during summer months, and nonstandard working hours of parents in rural communities, *Funnix* and *PLATO* offer schools an alternative way to provide explicit instruction in foundational literacy skills (Arnold et al., 2005; Fedora, 2016; Vernon-Feagans et al., 2010). School personnel in rural areas could partner with families and support family's implementation of CBRPs to prevent summer slide among rural students with reading difficulties. Furthermore, given the limited access to broadband internet in rural communities (Perrins, 2019), programs like *Funnix* offer a choice of accessing quality reading instruction without the need for an internet connection. Also, given the limited income and resources of rural communities, *Funnix's* pricing and license options make it more affordable and appealing for parents and schools in their quest to support students with reading struggles.

Contributions of the Study

First, the study adds to the small pool of literature base on the effectiveness of CBRPs in promoting basic early literacy skills of at-risk beginning readers when implemented by parents during a summer break. More importantly, the gains made by the students were achieved in a relatively short period of time, suggesting that the two CRBPs can be instrumental in preventing summer slide/melt. Second, this study measured the perceptions of parents and students regarding ease of use, likeability, and effectiveness of the programs. The social validity data on the ease of use and desirableness is essential for understanding the sustainability of program implementation in practice. It provides parents and practitioners with information on the practical value of the programs and can aid in their selection and use of programs.

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