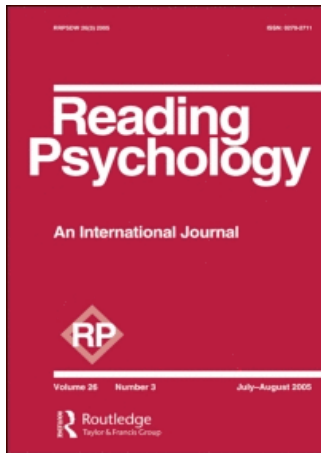


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USING AN INTERACTIVE SINGING SOFTWARE PROGRAM: A COMPARATIVE STUDY OF STRUGGLING MIDDLE SCHOOL READERS

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Software that teaches users to sing in tune and in rhythm while providing real-time pitch tracking was used in a study of struggling middle school readers. The software, Carry-a-Tune (CAT) was originally developed to improve singing; however, since it involves a repeated reading format, we used it to determine its effect on comprehension and reading achievement. Twenty-four students in grades 7 and 8 utilized the software program for 30 minutes, three times a week for 9 weeks. A matched control group of 24 students had a different reading experience during the same time period. The mean pretest instructional reading level for both groups was fourth grade. The mean instructional level scores for the treatment group improved significantly (7 months during the 9-week study). The matched control group students did not experience gains. Sustainability data from assessment 4 months after the study's conclusion indicated treatment students gained another 6 months. This placed them solidly in mid-fifth grade for instructional reading level. The control students, again, evidenced no significant gains.

It is important that schools find a way to help struggling adolescent readers become engaged in their learning so that they can experience a successful academic career (Lynch, 2002). Obviously, it is excruciatingly important that parents and educators do everything they can in order to ensure that children have all of the tools at their fingertips that will help them to succeed. Ideally, the cognitive shift from learning to read to reading to learn occurs before students leave elementary school. Some students, however, enter middle school still struggling in learning to read (Allington, 2001;

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Alvermann, 2002a; Moore, 1996; Rasinski et al., 2005). Calkins (2001) describes these students as displaying difficulty with print, meaning, and fluency.

Often, these students have long experienced these difficulties and exhibit a lack of motivation to learn as well as a belief that they will fail in their academic endeavors (Tunmer & Chapman, 2002). *Carry-A-Tune (CAT)*, a learn-to-sing software, appears to engage students in reading through its alternative format and its musical medium. It offers educators an innovative and unique source of reading intervention. The purpose of the current study was to examine the use of singing in general and this singing software as an intervention for struggling middle school readers.

Typically, struggling readers have problems meeting the school's benchmarks and expectations as they navigate their literacy learning experiences within the context of reading and writing. The implementation of benchmarks and standards ensures equal treatment of all students. Educators who try to help their students meet those standards are typically advised to utilize traditional teaching methods, which are often narrow in scope and do not consider, or allow for, diversity in students (English, 2004; Larson & Murtadha, 2002; Shields, 2004). Students who are on the lower end of the achievement spectrum in schools are often those who are the most lacking in literacy skills. According to legislative mandates, they must be brought up to the level of their grade-level peers in order to meet the appropriate benchmarks. When schools must play catch-up with their lower achieving students, opportunities for teaching and learning may be diminished (Cochran-Smith, 2004; Furman & Gruenewald, 2004).

Often, test results become the focus of school administrators, which means that opportunities for students are limited to those who can increase test scores at the lowest cost and in the shortest amount of time (McNeil, 2000). Such limitations cause concern that long-term social inequities will continue to exist in schools due to a lack of opportunities for administrators and teachers to embrace diversity and to offer new, equalizing experiences to those students who need them (Anderson, 2004; Shields, 2004).

Struggling adolescent readers need help that goes beyond the standard teacher's manual recommendations. In truth, some policy-makers are promoting equal opportunity with standards, but they are neglecting the concept of equality of results. Even though

legislators and school officials try to provide equal school facilities and materials for all students, those items only represent half of the problem. The other half of the problem, the elusive equality of results, signifies the need for officials to stage interventions to help children who are performing below the desired standards (Fowler, 2004). Test preparation classes, summer sessions, and worksheets do not appear to fulfill that need. Researchers must examine the root of the problem, why those students' performance is low, in order to successfully proclaim equality in the schools (Valencia & Buly, 2004).

Although there is some consensus in the field of literacy education regarding the general description of a struggling reader, there are several possibilities as to what the root of the problem may be for different students. The interventions used to help students overcome their literacy struggles must differ from those currently in practice—those that are not working (Alvermann, 2002b).

It is not possible to pinpoint one reason or one way to fix the literacy struggles experienced by many adolescents. Shaywitz et al. (2000) place an emphasis on the cognitive issues involved in the struggle, such as a diagnosed learning disability, whereas Moll and Gonzalez (1994) emphasize second language learning as a greater issue in the struggle. Alvermann (2002b), Kamil (2002), and Moore (1996) believe that middle school students disconnect from literacy tasks for a variety of reasons.

Motivation and Engagement

One critical issue that appears to surface in all of the literature regarding the struggle of adolescent readers is motivation and engagement (Alvermann, 2002b; Guthrie & Wigfield, 2000; Kamil, 2002). One way to address motivation and engagement for struggling readers is through literacy instruction that moves beyond the linear world of printed text and that incorporates specific strategy instruction within an integrated curriculum. In addition, this shift might reshape curriculum to meet and address the needs of all students, and as Lee (2001) found, the change might increase the struggling reader's motivation to engage in literacy tasks.

The cluster of personal goals, values, and beliefs that individuals possess and apply in a literacy situation forms their motivation (Guthrie & Wigfield, 2000). Central to most theories on motivation

is a student's sense of self-efficacy, a belief in how competently that student will perform a specific task (Bandura, 1997). Students are aware of their academic performances and often compare those to the actions of their friends and role models. If students are continually successful, then it follows that they will have a high self-efficacy as compared to that of other classmates who experience frequent failures (Schunk, 2003).

The singing software used in the current study promotes student success by focusing on singing scores rather than reading scores. This encourages students who have experienced a lack of success in reading but who now see their reading successes that have occurred with singing. Providing adolescents who experience reading difficulties with clear goals for a comprehension task and giving them feedback on progress they are making can lead to increased self-efficacy and greater use of comprehension strategies (Schunk & Rice, 1993). The singing software provides structured, interactive feedback that readily indicates to students their progress in ways that could enhance their sense of self-efficacy. In this study, middle school students who have long experienced failure in reading experienced engagement with the program. Qualitative data indicated that 98% of the students using the program expressed both enjoyment and the desire to continue using the singing software (Biggs & Homan, 2005).

Wentzel (1996) examined multiple goals of adolescents in a school setting and demonstrated how these goals relate to their school performance and behavior. If students see themselves as successful, dependable, wanting to learn new things, and getting things done, they are, in fact, more successful than their peers who do not have such positive visions of their capabilities. High-achieving students have both a higher sense of social responsibility and academic achievement goals than lower achieving students (Eccles & Wigfield, 2002). This leads to the conclusion that struggling readers who are engaged in their reading would be more motivated to read. In an extensive review of how instruction influences students' engagement, Guthrie and Wigfield (2000) concluded that the level of student engagement in reading influences student outcomes.

Alvermann (2003) suggests that the resistance shown by students may be because their inability to read their textbooks prevents them from gaining the necessary background knowledge and

specialized vocabulary needed to be successful in their courses. The same students who appear to be most at-risk for failure in the traditional academic literacy values are often more adept in media text, which motivates, engages, and connects them to real-world interactions (Alvermann, 2003). Most middle school content area instruction in reading is textbook centered, which presents a formidable task for students who struggle in their reading. Media text also has the added benefit of engaging the students to the point where they may not even realize that they are in the process of increasing their literacy skills while they are on the computer (Smith, 2000). Through the use of technological rather than traditional text format, *Carry-A-Tune* intends to provide struggling readers with an appealing form of alternative text.

The computer offers students more control in terms of support, pace, and active processing of text (Kamil, 2002). The use of technology as an alternative text links real-world experiences and interests, which provides a sound base for its use with struggling readers. The National Reading Panel (NRP; 2000) reports that there is little empirical research on the topic of the relationship of hypermedia that supports literacy learning and instruction for struggling middle school readers. However, there is promising evidence on the effectiveness of literacy instruction for this audience (Leu, 2000). When utilizing print and visual texts (e.g., hypermedia, the Internet, and interactive CD-ROMs), Leu (2000) reports that positive effects for struggling middle school readers occur.

Unfortunately, the language arts classroom is full of opportunities for students to suffer from low self-efficacy because of the intangible quality of the progress that accompanies reading and writing tasks. It is difficult for students to judge whether they are improving their reading comprehension skills, so they must rely on their teacher's input to show them if they are progressing satisfactorily. If they do not receive that feedback, their self-efficacy will remain low (Schunk, 2003). There are two types of goals that students can have: learning-oriented goals, in which they are motivated to learn, and performance-oriented goals, in which they are motivated to look good while they perform (Horner & Shwery, 2002; Scott, 1996). It is vital that students receive "goal progress feedback" when they are unable to gauge their own progress toward their goal (Schunk, 2003, p. 164).

In order to correct that problem, singing software could be utilized with the students. One benefit of the use of an alternative technological-based text such as *CAT* is that the students receive automatic feedback from the computer throughout their session. As the students sing, they can watch their pitch on the screen and can adjust their actions in order to be where they are supposed to be with their singing. The regulation that the computer provides helps show them they are on the right track. The students will try harder if they know they have the ability to meet their goal, so this is an important aspect of the program (Linnenbrink & Pintrich, 2003).

Because students today are surrounded by computers on a daily basis, many of them may be more comfortable with operating a computer than they are with reading. That comfort might provide another level of assistance when they work with the *CAT* program. Students who engage in an activity for which they have high self-efficacy might find it easier to accomplish a task in an area where they have lower self-efficacy through that medium. For example, Ross, Hogaboam-Gray, and Hannay (2001) found that students who had high self-efficacy for their ability to work with computers were able to raise their performance levels on reading tasks, an area of low self-efficacy, when they completed the reading assignments through the computer.

Fluency

Comprehension is the underlying reason for reading. If readers can read the words but not understand what they have read, there is little point in the exercise. Productive readers think as they read. They make sense of what is passing before their eyes and through their brain. Purposeful reading is the outcome of purposeful teaching of comprehension.

The National Reading Panel defined comprehension as being “specific procedures that guide students to become aware of how well they are comprehending as they attempt to read and write” (NRP, 2000, p. 24). Comprehension is only one of several reading strategies that pose a roadblock to struggling readers.

Another area of difficulty is fluency. The National Reading Panel (2000) identified fluency as one of the five critical components of reading (Pikulski & Chard, 2005). Fluency is a necessary

aspect of successful reading as it allows readers to read with speed, accuracy, and proper expression. It was included in the NRP's (2000) review of vital literacy skills because not all classroom teachers give explicit instruction in fluency despite its influence on reading achievement. The findings of the Panel revealed that there is no one agreed upon way to increase reading fluency effectively. However, during the NRP's review process, two salient areas of fluency reading studies emerged—guided oral reading and silent reading. Guided oral reading studies included such approaches as repeated, impress, paired, shared, and assisted reading.

In Chall's (1996) model of reading development, there is a suggestion that readers go through stages in their reading and that each stage emphasizes a particular aspect of the reading process. According to this theoretical model, the reader moves: (a) from early and emergent development with words, (b) through formal instruction, (c) to building fluency for words, (d) then to developing automaticity of word reading, and (e) finally, to placing emphasis on using reading to learn instead of learning to read in order to interpret and synthesize meaning.

This model suggests that the reader moves from familiarity with the sound-symbol relationship to automaticity with words, thus allowing the opportunity to direct his limited attention and cognitive capacity to comprehending the text. The number of students who struggle with fluency is not trivial. The National Assessment of Educational Progress (NAEP) oral reading study suggested that nearly half of all fourth-grade students are not sufficiently fluent to maximize their reading comprehension (Pinnell et al., 1995). Some middle school students struggle with reading fluency (LaBerge & Samuels, 1974; Rasinski et al., 2005). This struggle greatly affects their reading and causes them to focus inordinately on decoding, leaving insufficient resources to be applied to text comprehension (Kuhn & Stahl, 2003; LaBerge & Samuels, 1974; Rasinski & Hoffman, 2003). Poor decoding automaticity has an adverse impact on reading comprehension (LaBerge & Samuels, 1974; Samuels, 1979; Stanovich, 1980, 1984). Eldredge (2005), in a study of young children's growth in phonics, word recognition, and fluent oral reading, concludes by agreeing with the theoretical model that states that word recognition is necessary for fluency and that fluency is necessary for comprehension. Schwanenflugel, Hamilton, Kuhn, Wisenbaker, and Stahl

(2004) disagree. They suggest a weak relationship between reading prosody (part of fluency) and comprehension. However, as they point out, this conclusion is based on a comprehension measure that was unrelated to the passages read to measure prosody. This presents an interesting future study that could focus on the prosody inherent in singing and the strength of its relationship to comprehension.

For years, teachers thought that if students could learn to decode words accurately, they would be successful in reading printed text (Rasinski, 2004b). While it is true that accuracy in a student's ability to decode words is important for fluency, as Samuels believed in the 1970s, decoding needs to be automatic. However, this is still not sufficient. Rasinski (2004a) points out the need to connect accuracy and automaticity to reading prosody.

Reading prosody is the point where fluency connects fluent decoding directly to comprehension (Rasinski, 2004b). The prosody components of reading fluency address the use of phrasing and expression (Dowhower, 1987, 1991; Schreiber, 1980, 1987, 1991; Schreiber & Read, 1980). This occurs when readers adjust appropriate volume, tone, emphasis, phrasing, and other elements when reading aloud. By making these adjustments, they are providing evidence of comprehending text. In this sense, fluency can be seen as a multifaceted event with reading comprehension as the goal.

In this study, reading growth in comprehension was compared for struggling readers using the singing software and a matched control group that did not use the program. The researchers hypothesized that the use of software that involved both computers and singing might be motivating and engaging for the adolescent age group. Alvermann (2003), Kamil (2002), and Linnenbrink and Pintrich (2003) support both computers and alternative text as motivational for adolescents. Motivation leads to engagement, which provides a positive effect on the reading achievement of struggling middle school readers (Bandura, 1997; Guthrie & Wigfield, 2000).

Both prosody and automaticity in word recognition can be developed through guided repeated reading. Repeated reading is most authentic when the material to be practiced is eventually performed. Texts that are meant to be performed orally are ideal for repeated reading to improve decoding automaticity and prosodic reading (Rasinski, 2004a). The program used in the current study

provided opportunities for performed and repeated readings of song lyrics.

The theoretical constructs of motivation and engagement, alternative text, and reading fluency woven together provided the conceptual framework for this study.

Purpose

The design of this study allowed the researchers to study the reading growth of struggling middle school readers using a singing software program. Measures of reading growth in comprehension were utilized to determine effectiveness of the treatment. The software program *Carry-A-Tune* (Electronic Learning Products, 2004) was utilized in this study because it seemed to elicit the motivation and engagement qualities suggested by Guthrie and Wigfield (2000) and the characteristics of curricular innovation recommended by Alvermann (2002b, 2003). In addition, the National Reading Panel (2000) specifically mentions the use of music/singing as a way to improve reading fluency and comprehension.

Research Question

One major question was addressed in this study: What impact does systematic use of a singing software program used with struggling middle school readers have on their reading development as measured by instructional reading level?

Method

Participants

Students from a rural west central Florida middle school participated in the study. The schools' demographics are as follows: 1100 students in grades 6–8; 49% female and 51% male ages 11–15; 83% White students, 9% Black students, 8% Hispanic students, and 1.0% Asian students. This is a Title I school that receives funding from the state and national level to assist in the remediation of its struggling students. Forty-nine percent of the school population is currently receiving free or reduced lunch. On the Florida

Comprehensive Assessment Test (FCAT; Florida Department of Education, 2005) in reading, approximately 49% of the students taking the test scored a Level 1 or 2, which is below proficiency, according to FCAT standards (Florida Department of Education, 2005). There are 114 staff members at this school and four administrators; 28 of the 114 staff members are language arts/reading teachers.

To qualify for inclusion in the study, the students had to be in the seventh or eighth grade and had to have scored at a Level 1 or 2 in their 2004 FCAT. Students in the treatment group were taking chorus or another music elective as part of their course work during the second 9-week session of the 2004–2005 school year. This middle school utilizes an elective wheel model. This means that advisors assign students to a different elective each 9 weeks. Students do not participate in the course selection decision. Twenty-one of the treatment students were in this category of participating in a non-student-selected music elective. Three of the students in the treatment group were taking chorus and personally selected the class.

Forty-eight students participated in the study. The participants in the sample group have similar characteristics. Twenty-four students met the criteria for the treatment group: Levels 1 to 2 on FCAT, seventh or eighth grade, and taking chorus or another music elective during the 9-week period of the study. Each student was matched with one of 24 students in a control group. Two control students moved out of the school district before the study was completed. Treatment and control students were matched on the following variables: FCAT scores Levels 1 and 2, middle school grade level (seventh or eighth grade), gender, and reading/language arts teacher. Also, more than half of both the treatment and control group students received free or reduced lunch.

Instrumentation

QUALITATIVE READING INVENTORY

The Qualitative Reading Inventory (QRI), an informal reading inventory, with passages ranging from 1st- to 12th-grade levels was used to establish instructional reading level and fluency rates. The reliability, validity, and readability levels of all passages have been investigated and are reported in the QRI technical

development section of the inventory (Leslie & Caldwell, 2000). The QRI full battery takes approximately 30–40 minutes to be administered per student. Therefore, to facilitate pre- and posttest assessment of all 48 students, cloze passages were made using the graded passages from the QRI. This allowed for small group administration instead of one-on-one assessment. To correlate the scores generated by these cloze passages with the traditional use of the QRI, one third of the treatment group and one third of the control group were randomly selected to be administered the complete one-on-one inventory as well as the cloze passages. Instructional reading-level scores correlated 1.0.

The cloze scoring criteria developed by Rankin and Culhane (1969) provide a range of 40–60% correct for instructional reading level. After the Cloze QRI was administered to all treatment and control students, a percentage correct was determined. The Rankin and Culhane criteria were applied to determine whether the student was independent, instructional, or had frustration at a given grade level. Additional passages were administered as appropriate (higher if independent, lower if frustration level).

INTERACTIVE REAL-TIME SINGING SOFTWARE PROGRAM

Originally developed to improve singing for children and adults, the software program called *Carry-A-Tune* (Electronic Learning Products, 2004) has several unique features. It provides real-time pitch recognition and feedback to the user. The scoring mechanism accommodates each individual's vocal range. It contains a portfolio sign-in menu that aligns with the custom vocal range of each participant. Each student used an individual sound-proof microphone headset for listening, singing, and recording. Twenty-four songs included on the CD were analyzed for readability level. Initially, a Flesch Readability Formula (Flesch, 1940; Flesch & Kincaid, 1975) was applied to the songs. This was followed by an application of the Fry Readability Formula (Fry, 1977) to validate the initial readability level. The readability levels of the songs ranged from second- to seventh-grade reading levels. Students learned to sing songs progressing from lower to higher readability levels.

Carry-A-Tune has three levels of singing expertise—beginner, intermediate, and advanced. The 24 songs' difficulty levels also included consideration of additional stanzas, tempo, and pace,

which were added to the original songs. All students began using the software at the beginner level.

Students read the lyrics while attempting to improve their singing. In this way, repeated reading was integrated into the singing program. Two different formats of textual presentations were used during this study. The first format, linear sheet music, allowed the students to read the lyrics silently three times while listening to the background music and tempo. This repeated reading aligns with the recommended number of repetitions suggested by Samuels (1979). This was followed by a graphic textual view. This alternative text format provided a visual display of words broken into syllables without the accompanying musical staff and placed each syllable accented at the appropriate pitch within each student's personal vocal range. Along with the visual tracking of the words, a guideline was provided for accurate pitch and tone and provided a real-time track line of the children's voices while they were singing and recording a song. After singing each time, a score would be provided to the student. These scores, ranging from 0 to 100, represented accuracy of pitch and tone. The students in this study sang and recorded the songs using the visual graphic format three times and saved the recorded version of their highest score so that the researcher and student could review their singing.

By reading the lyrics silently first, opportunities for strategy use were provided each student. Each song was then sung three times (repeated readings), with students attempting to improve their singing each repetition. *CAT* provides for real-time pitch tracking (patent pending). Students could actually see what they're singing in terms of pitch. The instant feedback provides a fundamentally interactive experience that appears to promote visual tracking. The tracking line (matched to the student's singing) provides a visual image to encourage the student to improve pitch throughout the song and during additional repeated singings (readings). The score measures the discrepancy between perfect pitch and where the student is currently singing.

Procedure

Once students were selected and matched according to FCAT and other criteria, the QRI pretest was administered to all 48 control and treatment students. The researchers administered all pretest, posttest, and follow-up assessments and controlled for bias by: (a)

scoring blind, (b) co-scoring all assessments, and (c) using inter-rater reliability with the chorus teacher. Both control and treatment students were assessed three times. Pretests were administered in October at the beginning of the 9-week period. Posttesting occurred in December at the end of the 9-week treatment period. Follow-up testing to determine sustainability of results took place at the end of the 2004–2005 school year. Different passages at the same instructional levels and genre of the QRI were used on all three testing occasions.

Students used the interactive singing software program in a soundproof computer room attached to the music classroom. The 24 students in the treatment group used the singing software three times a week for 9 weeks. Each session lasted 30 minutes. Small groups of 6 to 8 students used the program at the same time. A folder for each student contained a log-in sheet for each visit. The students recorded the time, date, and songs they were working on upon arrival each day as well as their exit time and scores on departure. The students would then sing their songs progressing from lower readability level songs to songs at higher readability levels. Each student first silently read the linear text (sheet music) three times. Then they changed screens to the same song in graphic text format. Students next sang the song three times while recording all three efforts. They saved their highest scores. The students typically completed two songs in each 30-minute session.

Treatment students used the *CAT* program during their elective music period. Working with the singing program did not replace the core content or reading remediation classes for the treatment students. The control students in other elective classes had at least 30 minutes required reading time throughout the duration of the study.

Results

Table 1 presents descriptive statistics for the instructional reading levels measured by the QRI for the treatment and control groups prior to the use of the *CAT* program (pretest), 9 weeks after using the program (posttest), and 16 weeks after the posttest (follow-up). Prior to the use of *CAT*, the treatment group exhibited a slight advantage over the control group on the QRI (effect size = 0.20). Following 9 weeks of the program, the advantage of the treatment group over the control group was large (effect size =

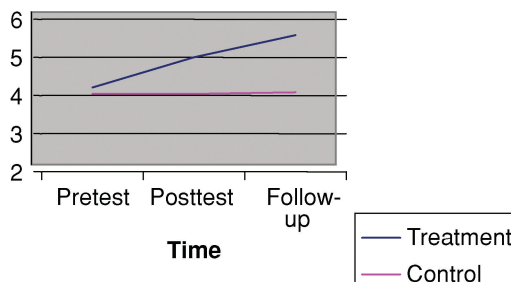
TABLE 1 Descriptive Statistics for the Qualitative Reading Inventory Across Time by Group

Group	Pretest	Posttest	Follow-up
Treatment (n = 24)			
M	4.21	5.00	5.58
SD	0.88	1.35	1.56
Skewness	-0.03	0.69	0.70
Kurtosis	-0.97	0.12	-1.04
Control (n = 22)			
M	4.05	4.05	4.09
SD	0.72	0.72	0.68
Skewness	-0.07	-0.07	-0.11
Kurtosis	-0.93	-0.93	-0.65
Effect size	0.20	0.87	1.22

Note. Effect size = $(M_{\text{Treatment}} - M_{\text{Control}}) / \text{pooled SD}$.

0.87), and at follow-up, the advantage of the treatment group was very large (effect size = 1.22).

A 2 (Group) \times 3 (Time) repeated measures ANOVA was used to examine the changes in the QRI scores. Results revealed a statistically significant Group by Time interaction, $F(2, 88) = 17.53$, $p < .001$. As can be seen in Figure 1, the treatment group exhibited a moderate increase from 4.21 at pretest to 5.00 at posttest (effect size = 0.69); scores for the treatment group continued to increase at a moderate amount and changed from 5.00 to 5.58 at follow-up (effect size = 0.40). While the effect size is considered moderate, a gain in instructional reading level of more than 7 months in just 9 weeks (and 1.37 grade-level gain in approximately 6 months from the beginning of the study to the follow-up assessment) has strong practical significance. In contrast, the control group means

**FIGURE 1** Qualitative reading inventory levels by group.

remained relatively unchanged across the three time points (4.05, 4.05, and 4.09).

Limitations

Several limitations to this study should be noted. First, the sample size was small, with only 48 students in both treatment and control groups. Second, while students were matched on important variables, random assignment to treatment or control conditions would have strengthened the study. Third, only two grade levels at one school site participated in the study. Nevertheless, we feel that the results are noteworthy and cause for further investigation.

Discussion of Findings

These findings are supportive of the use of singing, in general, and an interactive singing software program that provides real-time pitch tracking, in particular, to provide authentic repeated reading experiences for students to increase instructional reading levels for struggling middle school readers. Since the QRI can be used to measure comprehension and instructional grade level, improvement on the QRI scores reflects improvement in both of these areas of reading. The researchers believe several components of the program may have provided the impetus for student improvement in reading. The program provides for repetition, which improves fluency and continuous self-assessment, which provides confirmation and guidance (Guthrie & Wigfield, 2000; Samuels, 1979). The ability of each student to receive instant feedback through the real-time pitch tracking mechanism provides for a measure of autonomy and self-regulation. As supported in the literature (NRP, 2000, Sample, 2005), the music/singing itself was motivating and engaging for the adolescent age group.

Replication of this study with a larger population and over a longer time period is recommended. Future studies with struggling readers might examine more extensively actual fluency rates as well as specific reading achievement improvement. It is recommended that future studies utilize random assignment as well as a comparison group using repeated reading but not involving the singing software. The significant results of this study are indicative of the need for further investigation of multidimensional and multi-genre alternative texts for reading instruction.

Implications for the Classroom

The use of singing, especially combining technology and singing, could become an integral component of the reading classroom. Singing from texts in general and the use of computers and singing programs in particular can support the literacy growth of students because: (a) students appear motivated by singing, (b) students will work to be autonomous using the singing program, and (c) alternative texts provide variety and depth to the reading experience and lead to greater levels of reading achievement. The potential for singing to improve reading skills and overall reading achievement as reflected in this study are very encouraging.

In summary, the use of interactive singing software as an alternative text appears to provide autonomous support, real-world experiences, and opportunities for struggling readers to exhibit sophisticated reading techniques. To reinforce the reading strategies of fluency, vocabulary, and comprehension, instructional techniques employed by the students' use of the software program combined oral and silent reading of leveled songs, repeated readings for automaticity, and singing for reading prosody with successful comprehension as the ultimate goal.

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