

2014

A review of the effects of computer-based reading programs on middle school students

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A review of the effects of computer-based reading programs on middle school students

Abstract

With increases in the availability of technology in the classroom many educators are looking to computer-based reading programs to help close the gap in student reading achievement. The purpose of this review is to examine research on computer-based reading programs meant to improve reading achievement in middle school students in grades 6-8. Over thirty peer-reviewed journal articles and professional papers within the last 10 years were critically analyzed. The research evidence showed inconsistency about the effects of Accelerated Reader on middle school students, the mixed results of computer-based reading programs on at-risk students, and the positive results of a balanced literacy program on reading achievement. Educators should approach computer-based programs with caution due to the mixed results found in studies reviewed for this literature review. Future research is needed to fully understand the magnitude and causes for the mixed results.

A REVIEW OF THE EFFECTS OF COMPUTER-BASED READING PROGRAMS ON
MIDDLE SCHOOL STUDENTS

A Graduate Review

Submitted to the

Division of Instructional Technology

Department of Curriculum and Instruction

In Partial Fulfillment

Of the Requirements for the Degree

Master of Arts

UNIVERSITY OF NORTHERN IOWA

by

Ann Hansen

March 2014

This Review by: Ann Hansen

Titled: A Review of the Effects of Computer-based Reading Programs on Middle School Students

has been approved as meeting the research requirement for the Degree of Master of Arts.

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5/9/14

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Abstract

With increases in the availability of technology in the classroom many educators are looking to computer-based reading programs to help close the gap in student reading achievement. The purpose of this review is to examine research on computer-based reading programs meant to improve reading achievement in middle school students in grades 6-8. Over thirty peer-reviewed journal articles and professional papers within the last 10 years were critically analyzed. The research evidence showed inconsistency about the effects of Accelerated Reader on middle school students, the mixed results of computer-based reading programs on at-risk students, and the positive results of a balanced literacy program on reading achievement. Educators should approach computer-based programs with caution due to the mixed results found in studies reviewed for this literature review. Future research is needed to fully understand the magnitude and causes for the mixed results.

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Introduction

For the past two decades there has been an increase in the demand for competent reading performance. For instance, The No Child Left Behind Act (NCLB) of 2001 states:

NCLB mandates that all public school children should be proficient in reading by the end of the year 2013-2014 school year. States are required to assess students in reading and to hold schools and districts accountable for ensuring that students make adequate yearly progress toward meeting this deadline (Learning Point Associates, 2007, p. 2).

Even after more than one decade of the implementation of NCLB there is 65 percent of fourth grade students and 64 percent of eighth grade students who are not proficient as reported in the Nation's Report Card. The 2013 National Assessment of Educational Progress (NAEP) results for Mathematics and Reading report that of the 190,400 fourth grade participants eight percent are advanced, twenty-seven are proficient, thirty-three are basic, and thirty-two are below basic in reading. Of the 171,800 eighth grade participants four percent are advanced, thirty-two are proficient, forty-two are basic, and twenty-two are below basic in reading (National Center for Education Statistics, 2013). Due to the fact that the expectation by NCLB is not being met Englert, Zhao, Collings, and Romig state, there have been national and state initiatives to ensure all children meet or exceed proficiency in elementary. Schools struggle with how to teach reading at the elementary level and often turn to technology based programs (Englert et al., 2005).

With all the advances in technology, many print-based reading programs are becoming a thing of the past and computer-based programs are quickly replacing print-based programs (Gahala & Holum, 2001; Grenawalt, 2004). Computer-assisted instruction (CAI) programs refer to those that use technology to enhance reading achievement and are usually supplementary,

such as students using computer labs for additional practice. Computer-managed instruction programs such as Accelerated Reader are a related category to CAI. (Slavin, Cheung, Groff, & Lake, 2008). The basis for CAI programs is consciously planned use of computers to support student learning. To be able to prepare our students to use technology as a learning tool, teachers must integrate computer technology into the daily educational experiences of the students in a meaningful manner (Lovell & Phillips, 2009).

Technology and the Internet have changed the way we interact with information, thus changing how we read, write, listen, and communicate. Technology has contributed to an expanded definition of literacy. Students also need technology skills besides basic literacy skills to communicate, so they can investigate, access and use information, think critically, understand and evaluate data. Because of this expanded skill base, literacy has many new definitions such as information literacy, which is the ability to access and use information, analyze the content of that information, work with ideas around the information, synthesize thoughts, and communicate the results of these tasks. There are also definitions for digital literacy, new literacy, computer literacy, computer-technology literacy, critical literacy, and media literacy. Educators agree that at a minimum literacy instruction should include computer skills, while there are educators that feel that technology should have a greater emphasis in literacy instruction (Gahala & Holum, 2001). O'Hara and Pritchard cited several studies that showed that technology can enhance literacy development, impact language acquisition, increase access to information, support learning, motivate students, and enhance self-esteem, (ACT, 2004; Boster et al., 2004; CEO Forum, 2001; Mann et al., 1999; Tracey & Young, 2006; WestEd, 2002, as cited by O'Hara & Pritchard, 2010) but to what extent do these computer-based reading programs have on reading comprehension, motivation, and reading rates?

Access to technology in our schools has grown exponentially since the 1980s. It was estimated that by 2005 there were 300 pieces of software and more than 500 instructional websites available or on the market claiming to improve reading skills (Khan & Gorard, 2012). Computer technology is presumed to be the commonplace for most western schools and cites many benefits, which include individualized instruction, self-paced, instantaneous feedback and manageable recordkeeping (Lovell & Phillips, 2009).

Some educators have embraced advances in technology while others remain skeptical. Those who are skeptical understand that technology should be embraced but feel that they need more information about teaching reading in the Digital Age. Audiobooks, electronic books, online texts, electronic talking books, and programmed reading instruction all claim to support the development of reading skills (Gahala & Holum, 2001), but the focus of this review will be on programmed reading instruction or computer-based instruction. Meyer and Rose (1999) discussed the potential for new technologies to revitalize reading instruction making it more relevant to the lives of children growing up in an electronic age.

It should be noted however that Healy (1998) stated problems that may be generated by electronic texts, "Reading from a screen is slower, more fatiguing, less accurate, and more subject to information overload than standard reading (p. 152)". According to his analysis, he found that "students tested for comprehension after reading from a screen demonstrated less understanding and poorer memory than those getting the same information from a book" (1998, p. 152). The Alliance for Childhood (2000) reported by Gahala and Holum (2001) had similar warnings about the overuse of computers, among these were eyestrain, obesity, and social isolation. The Alliance also mentioned that eyestrain may create challenges for young children learning to read.

The purpose of this review is to examine research on reading programs meant to improve reading achievement in middle school students in grades 6-8. The research will then help teachers and administrators determine the appropriate program for their needs and identify research gaps for future researchers. This review will focus on the results of computer-assisted programs on at-risk students, effects of computer-based balanced literacy reading programs, and effects of Accelerated Reader through the following question:

1. What are the effects of Accelerated Reader on middle school aged students?
2. What effect does a computer-assisted program have on at-risk middle school students?
3. What are the effects of a balanced literacy program on reading achievement?

Methodology

Electronic databases were used by searching with keywords and boolean terms to locate traditional and online sources related to Accelerated Reader and its effectiveness. The primary search engine used to locate sources of information from various databases was the University of Northern Iowa's Rob Library Catalog, OneSearch! OneSearch! is the library's single index that lists items from the library's catalog UNISTAR. Another electronic database used was Google Scholar, which yielded numerous sources. The following key phrases were used to find the majority of the sources for this review: *comparison, computer-based, reading programs, effectiveness, commercial software programs, teaching reading, Accelerated Reader, comprehension, balanced-reading, balanced-literacy, at-risk, middle school, computer-assisted, READ 180, and achievement*. 52 useable sources were located, 33 from OneSearch!, four from Google Scholar, nine from ERIC, and six from a general Google search. The snowball method was also utilized to seek out additional sources that were mentioned by the authors of articles that the researcher found through the various databases. 34 peer-reviewed articles were used and a total of 44 articles and digital resources were selected for this review.

One challenge faced by the researcher was in reviewing the information presented in the sources found through the use of the electronic databases and analyzing the information for bias and opinions rather than facts. Any web resources located were checked for credibility, due to the fact that not all information published online is factual and can be misleading depending on the publishing source. Further research was conducted on authors who were questionable in their credibility pertaining to the topic. Sources that could not be validated were eliminated from the pool of available data. Not all articles could be used for their research results but still provided valuable information for other parts of this review.

Reliability was the main determination for source selection. The works cited, dates of publication, referenced sources within articles were used to analyze the articles reliability. The researcher was looking for references to experts in education and reading instruction, as well as articles published in the past 10 years. However, articles that fell outside this ten-year mark were included due to their importance to the field of technology and reading and the classical nature of the study. Articles were eliminated from the pool if they failed to mention topics related to this review or focused on research conducted at the elementary level. Articles were analyzed more closely if the number of referenced sources were low and there were indication that the information may contain bias. The abstracts, results sections, and conclusions were reviewed to help with the selection process.

The following is a specific list of criteria used in evaluating sources located for this review:

1. What are the qualifications of the author/writer of the article to be considered an expert in this area?
2. Has the information been used in other research or articles?
3. Is the information based on primary or secondary research?
4. Is the information presented in a clear and organized manner?

Analysis and Discussion

This section starts with some background information about computer-based reading programs. Then it discusses the effects of Accelerated Reader on middle school students. Furthermore, it presents the effects of computer-based reading programs for at-risk students. It ends with a brief discussion on effects of balanced literacy programs on reading achievement.

Background Information

Before presenting the research evidence about computer-based literacy programs on the effects of student learning, it is important to provide some background information about the importance of computer-based reading programs.

Srivastava and Gray (2012) state, with our growing world of technology, the way in which students interact with text has shifted from traditional text to hypertext and because of this there is the potential for it to negatively impact children with deficits in reading comprehension. This problem may be rooted in a much larger problem where adolescents with typical language development are not reading at expected levels. According to the National Assessment of Education Progress as cited by Srivastava and Gray (2012), three-quarters of eighth graders read below the proficient level. Some alarming statistics from the United Kingdom show that an estimated “seven million adults in England cannot locate the page reference for plumbers in Yellow Pages” (Khan & Gorard, 2012, p. 22), this may be an exaggeration but it has the potential to be reality if non-proficient readers do not receive appropriate instruction.

According to Good, Simmons, and Smith (1998), Snow, Burns, and Griffin (as cited by Melton, et al., 2004), and Hirsch (as cited by Khan & Gorard, 2012) one’s ability to read can play a fundamental role in one’s quality of life. It can shape a student’s habits in school, out of school, and play a part in determining their social and economic lives after school. Students who

read well early on in school are more likely to be successful in later years compared to those who do not. Lamme also stated this in her 2003 article, *A Literature Perspective on Accelerated Reader*, by saying, “Becoming literate involves developing reading habits that provide students with a better quality of life, not in school, but outside of school, habits that will last for a lifetime” (p. 37). Many schools turn to new technologies to enhance and extend current literacy practices to improve student literacy skills (Huang, 2012). In a 2006 study by Judge, Puckett, and Bell most educators agree that computer access and literacy are vital and necessary in the 21st century for young learners. Bronfenbrenner, McClelland, Wethington, Moen, and Ceci (1996) quoted in Johnson and Howard (2003) had this to say about our technological society, “In a technological society, the demands for higher literacy are constantly increasing, creating ever more grievous consequences for those who fall short and contributing to the widening economic disparities in our society” (p. 87). Therefore those who struggle with reading have bleak or uncertain futures beyond school.

Due to the fact that technology has grown so much, Valerie Grenawalt (2004) provides this example to demonstrate the benefits of technology through a reading management program; ...rather than assigning everyone the same novel, with tests and quizzes to check for understanding, teachers can assign students to earn a certain number of points during a grading period. Under this system, each student chooses his or her own book, based on reading ability and interest. Students also read at their own pace and take the computerized test when they finished their book(s) (p. 13).

According to Khan and Gorard (2012), there has been little clear evidence to show the educational benefits of various technology products. Therefore it is hard to say whether and to

what extent technology-based instruction “works”. However, there is research evidence about the effects of computer-based Accelerated Reader on middle school students.

Effects of Computer-based Accelerated Reader on Middle School Students

There are many reading programs on the market but, over the years Accelerated Reader has become very popular as a means of helping students lessen the achievement gap in reading. In this section the effects of Accelerated Reader will be explored to help teachers and administrators determine whether Accelerated Reader is an appropriate reading program for middle school students. The review focuses on achievement levels and motivation.

Many computer-based reading programs have been implemented into schools throughout the United States, one in particular; Accelerated Reader (AR) is used in more than 65,000 schools worldwide. Although AR is not the only computer-based reading program on the market it is deemed the most popular (Huang, 2012; Johnson & Howard, 2003; Luck, 2010; Nunnery, Ross, & McDonald, 2006; Pavonetti, Brimmer, & Cipielewski, 2003; Stefl-Mabry, 2005). According to the WWC Intervention Report (2010), “Accelerated Reader is a guided reading intervention used to supplement regular reading instruction in K-12 classrooms. Its aim is to improve students’ reading skills through reading practice and quizzes on the books students read” (p. 1). The AR advocates maintain that the program encourages students to read better and more books, which they feel will in turn lead to increases in overall reading achievement (Pavonetti et al., 2003). The program collects information on the books students read and the multiple-choice quizzes they take to assess their comprehension on those books. These multiple-choice questions are designed to assess literal comprehension which yields reliable and valid measures of reading practice. Students earn points for correctly answered questions, these points are determined by ATOS, a weighted formula that includes readability and the number of words

found in the book (Mallette, Henk, & Melnick, 2004; Nunnery et al., 2006; Pavonetti et al., 2003; Volland, Topping, & Evans, 1999).

Students begin their use of the program with the STAR test, which determines their reading level and reading goal. Reading levels are generally very broad, sometimes spanning an entire year and reading goals are to reflect the number of points each student is expected to earn during a grading period. The goal assigned to each student is set using a formula that estimates the number of points the student could earn reading 60 minutes per day (Johnson & Howard, 2003; Mallette et al., 2004; Nunnery et al., 2006).

Accelerated Reader is a program designed to supplement reading curriculum by assessing reading levels, suggesting materials based on that level, and testing comprehension on those materials via a computer (Slavin et al., 2008). But what does the research say about the effectiveness of the program? A positive correlation between computer-assisted programs such as AR and gains in achievement have been shown in studies conducted by Volland and colleagues (1999) and Ross and Nunnery (2005).

For instance, in the earliest study in this review about the using AR for at-risk students, Volland, Topping, and Evans (1999) wanted to investigate if a different cultural setting with at-risk students would affect the effectiveness of the AR software. They also wanted to conduct a more rigorous quasi-experimental evaluation of the AR program's effectiveness on confounding variables than previous studies and have greater evidence about the nature and direction of linkages. When comparing the pre-tests and post-tests of 6th graders with or without AR, the researchers found, that the AR group showed significant increases from pre-test to post-test over that of the 6th grade control group. This was again demonstrated in a second research project conducted by the researchers comparing the AR group with that of an alternate treatment group.

In Table 1 pre- and post-test scores for the AR group and the comparison or alternatives groups show increased achievement that indicates that AR is an effective means of increasing achievement.

Table 1

Project A and B Mean Pre- and Post-test Scores on Edinburgh and Neale Reading Tests for Experimental and Comparison Groups

	Project A					
	Edinburgh (standardized score)		Neale Accuracy (reading age, months)		Neale Comprehension (reading age, months)	
	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
Experimental Group	89.96 (11.42)	98.20 (11.49)	110.08 (25.07)	117.27 (22.33)	105.33 (16.34)	104.64 (13.49)
Comparison Group	87.42 (11.38)	90.75 (10.16)	109.83 (23.88)	109.75 (22.00)	96.42 (11.16)	84.58 (13.98)

	Project B					
	Edinburgh (standardized score)		Neale Accuracy (reading age, months)		Neale Comprehension (reading age, months)	
	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
Experimental Group	89.46 (19.06)	92.59 (15.78)	109.36 (24.20)	112.82 (20.66)	96.45 (20.72)	107.55 (26.90)
Alternative Group	93.69 (13.77)	99.96 (15.00)	106.67 (29.73)	108.83 (28.39)	103.25 (21.87)	102.67 (26.22)

Note from page 11. Standard deviation in (). Adapted from Vollands et al., (1999).

Computerized self-assessment of reading comprehension with the accelerated reader: action research. *Reading & Writing Quarterly*, 15, 197-211.

Similar findings by Ross and Nunnery (2005) also indicate a positive correlation between AR and students' reading achievement. Ross and Nunnery were looking at the effect School Renaissance has on student achievement (grades 3 through 8) in two Mississippi school districts. SR is a program that includes several individual programs that have been created over two decades by Terry and Judy Paul, founders of Renaissance Learning, Inc. Schools that are SR schools incorporate all of the following programs from Renaissance Learning: Accelerated Reader and Reading Renaissance, Accelerated Math and Math Renaissance, and Accelerated Writer and Writing Renaissance. Of these programs the one most widely used is Accelerated Reader (Ross & Nunnery, 2005). When looking at the results as a whole, Ross and Nunnery (2005) suggest that SR has a positive impact on participating schools due to the findings from Sullivan and Harper's qualitative study with the same schools. Sullivan and Harper (as cited by Ross & Nunnery, 2005) state that SR has clear teacher, administrator, and district support; and they perceive improvements in reading skills are the result of using the program. Table 2 shows the positive achievement outcomes for SR (Reading, ie Accelerated Reader) compared to the control groups (grades 3 through 8).

Table 2

2003 Mississippi Curriculum Test (MCT) Reading Scale Scores Means and Adjusted Means by Grade and Treatment Group (SR = School Renaissance)

	MCT Reading Scale					
	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade
Control Group	500.5 (530.4)	511.8 (525.4)	533.7 (536.1)	534.8 (527.4)	550.6 (534.3)	549.6 (534.5)
SR Group	500.7 (527.7)	519.3 (528.4)	538.7 (540.9)	546.6 (532.7)	567.6 (541.5)	568.3 (540.0)

Note. Adjusted Mean (). Adapted from Ross, S.M., & Nunnery, J.A. (January 2005). The effect of School Renaissance on student achievement in two Mississippi school districts. Unpublished manuscript, Center for Research in Educational Policy, University of Memphis, Memphis, Tennessee.

Not every study of AR can show a positive correlation between the program and achievement. For instance, a study conducted by Huang (2012) exploring the effectiveness of AR on middle school students' reading achievement and motivation showed there was no significant change in reading achievement (Table 3). This was confirmed by the student survey Huang conducted along with his analysis of pre- and post-tests. Seventy percent of the students surveyed reported that they felt that AR almost never or rarely increased their reading levels and scores. Huang reported that many students lost their confidence for reading when they failed tests, read less challenging books, and even cheated on book tests. A number of students also stated, "We were good readers, but test scores did not prove that" (p. 236).

Table 3

Accelerated Reader Scores Comparison of Pre- and Post-tests

Sixth – Eighth Grade AR Scores		
	Mean	Standard Deviation
Pre-test	84.26	25.07
Post-test	82.99	25.09

Note. Adapted from Huang, S. (December 2011/January 2012). A mixed method study of the effectiveness of the Accelerated Reader program on middle school students' reading achievement and motivation. *Reading Horizons*, 51(3), 229-246.

No improvements in achievement with the addition of AR were also found in a study conducted by Melton et al., (2004). The research group was looking for a significant difference between reading comprehension growth rates of fifth graders with and without a year of participating in the Accelerated Reader program. Students were divided into quartiles based on initial reading achievement scores, these quartiles included students scoring in the lower, middle, and upper quartiles for reading comprehension. Table 4 shows that the control group had a greater adjusted mean than that of the AR group with one exception in quartile 1. Melton et al., (2004) do not offer an explanation for this exception. The study examined pre- and post-test scores for the experimental and control groups and a comparison of treatments by race, however it cannot be determined if there were other factors that influenced the results.

Table 4

Ex-post facto study: 5th Grade Adjusted Mean Rank and Standard Deviation by Treatment and Quartile

Tera Nova standardized reading achievement test				
	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Experimental	249.1	242.1	265.7	240.5
Group (w/AR)	(70.9)	(88.0)	(101.6)	(83.3)
Control	227.7	307.7	327.0	322.9
Group (w/o AR)	(68.5)	(77.5)	(92.9)	(75.6)

Note. Standard deviation (). Adapted from Melton et al., (2004). A study of the effects of the Accelerated Reader program on fifth grade students' reading achievement growth. *Reading Improvement*. 41(1), 18-23.

Gains in achievement for both control and treatment groups have also been found in a study of computer-assisted instruction. Khan and Gorard (2012) conducted a study but did not disclose the name of the program the treatment group used. However, the name or publisher of the program does not change the results of the study. The publishers of the program claimed that they had an "award winning" program, that would quickly improve reading skills, and the treatment group improved their score substantially, just as they had claimed (Khan & Gorard, 2012). One must look at more than just the before and after scores of the students in the treatment group to get the whole picture and avoid false positive results. If you just look at the pre- and post-test scores in Table 5, of the treatment group, it appears that the program is significantly effective in improving reading skills. However, when you compare the treatment scores with the control scores, both groups improved but the control group had a greater increase

from pre- to post-test even though the treatment had a higher pre-test mean than the control. When looking at the results there is a noticeable difference in the standard deviation for the treatment group from pre- to post-test. This means that the treatment group's results varied more and makes it hard to know the level of effectiveness for all students. Without looking at individual students it is hard to know how the program affected different groups of students, like those that are at-risk which will be discussed later (Khan & Gorard, 2012). Not all students are going to be affected by AR in the same way (Pavonetti et al., 2003).

Table 5

Pre- and post-test mean scores for Treatment and Control Groups

Lucid Assessment System for Schools Standard scores			
	Pre-test	Post-test	Gain Score
Treatment	823	863	40
Group	(68)	(88)	
Control	817	886	70
Group	(72)	(78)	

Note. Standard Deviation (). Adapted from Khan, M. & Gorard, S. (February 2012). A randomized controlled trial of the use of a piece of commercial software for the acquisition of reading skills. *Educational Review*, 64(1), 21-35. doi:10.1080/00131911.2010.537315

AR claims to create life-long readers who will continue to read independently after they are no longer participating in AR, which Pavonetti et al., (2003) did not find to be true when they conducted their research. They found that students who were exposed to AR at elementary were not more likely to read after they stopped participating in the AR program. (2003) Table 6 shows the correlation between AR in elementary and no AR in elementary.

Table 6

School District Comparison for With and Without Elementary AR

School District	Mean z-score for Title Recognition Test		Difference
	Accelerated Reader		
	Yes	No	
Exurban (1)	.251	.275	-.024
Suburban (2)	.331	.388	-.056
Suburban (3)	.377	.340	.037

Note. Adapted from Pavonetti, L.M., Brimmer, K.M., & Ciplewski, J.F. (December 2002/January 2003). Accelerated Reader: What are the lasting effects on the reading habits of middle school students exposed to Accelerated Reader in elementary grades? *Journal of Adolescent & Adult Literacy* 46(4), 300-311.

“The motivational outcomes of literacy tasks influence how students interpret their roles in learning to read. Those interpretations can affect their desire to persist and to remain involved in literacy,” quoted by Turner & Paris (as cited by Pavonetti et al., 2003, p.309). Even though the study was done with first graders one can extend this conclusion to older students. An explanation of the importance motivation plays in the development of reading can help one understand how the two are related. Guthrie and his colleagues (1999) gave this explanation:

In our view, one of the major contributions of motivation to text comprehension is that motivation increases reading amount, which then increases text comprehension...[We] showed that different aspects of reading motivation (both intrinsic and extrinsic) predict the reading amount of children and adolescents. In addition, reading amount leads to increases in reading comprehension. (as cited in Pavonetti et al., 2003, p. 309)

There appears to be a strong correlation between motivation and comprehension level. When looking at the attitudes of students using the AR program it was discovered that students had a poor attitude toward the program. A survey conducted by Huang (2012) of sixth through eighth graders found that the amount of time required to read inhibited the students' intrinsic motivation and engagement with reading. It should be noted that the school involved in the study did not specifically set aside time for AR reading. The students indicated that they had no time to read due to afterschool activities. More than 80 percent of the students felt that the amount of reading was unmanageable, which led students to cheating, selecting books already read or having had watched the movie, and a poor attitude about the AR system. Over 70 percent of the students indicated that AR did not motivate them to read, as shown in Table 7. Students, who had little motivation to read, only read because they had to. Other students believed that their personal interest increased their comprehension because they were books that they chose to read.

Table 7

AR Survey of Effectiveness

Responses for AR Survey of Effectiveness		
Degree	Number of Students	Percentage of Students
1 (Almost never)	73	35
2 (Rarely)	75	35
3 (Often)	39	19
4 (Almost always)	24	11
Total	211 students	

Note from page 18. Adapted from Huang, S. (December 2011/January 2012). A mixed method study of the effectiveness of the Accelerated Reader program on middle school students' reading achievement and motivation. *Reading Horizons*, 51(3), 229-246.

Motivation to read as it is related to the level of success with comprehension can be seen in the story of Billy in a 2011 Knowledge Quest feature article by Stolley (2011). Billy was motivated to read by the extrinsic rewards he received as well as by the kinds of books he read. The more success he had, the more he read, the more he read the better he did on the comprehension tests and the more motivated he was to read. Although since Billy moved away from the district he attended and Stolley was unable to see the lasting effects AR would have on Billy we can see that at the time it was working to improve his attitude and achievement level.

Not every student is going to have the same experience with AR and be motivated in the same way. There are often differences in attitudes among those who use AR and gender groups. Studies conducted by Mallette et al., (2004) and Vollandts et al., (1999) found that with the use of AR there was an increase in the attitude toward reading. However, the findings from the study of Vollandts et al., (1999) showed no significance across both studies conducted indicating that there is not a strong correlation between the two. Gender differences were also similar in both studies (Mallette et al, 2004; Vollandts et al., 1999) with females having a greater attitude toward reading than males especially for academic and recreational reading (Mallette et al., 2004). According to McKenna (as cited in Mallette et al., 2004) these findings are not surprising and neither is the decline in reading attitude from fourth grade to fifth grade. Even though Vollandts et al., (1999) found a statistically significant difference in attitude for the AR group between females and males there was no gender differences in their test scores.

Effects of Computer-based Programs on At-risk Students

Since computers are more accessible in classrooms today, educators are looking to computer-assisted programs and supports to help provide readers who struggle with assistance (Stetter & Hughes, 2010). Significant difficulties in literacy occur in nearly 90 percent of students with learning disabilities, according to Vaughn, Linan-Thompson, and Hickman (as cited by Stetter & Hughes, 2010). So it would appear to be natural that after looking at the effect AR has on middle school students one is curious how these computer-assisted programs affect students who are classified as at-risk.

A shift in the reading platform from traditional text to hypertext can have a profound effect on reading comprehension, especially those with language-learning disabilities, who are known to have reading comprehension deficits (Botting, Simkin, & Conti-Ramsden, 2006; Catts, Fey, Tomblin, & Zhang, 2002; Roth, Speece, & Cooper, 2002). Such findings were supported by the findings from the two classic studies Barab, Young, & Wang, 1999; Beishuizen, Stoutijesdijk, & Zanting, 1996 that difficulties with individual reading comprehension can be associated with the cognitive overload of reading nonlinear tests such as hypertext, like those in computer-assisted programs.

When comparing students with typical language development to those with language-learning disabilities, Srivastava and Gray (2012) found that typical language development (TLD) students performed better than learning-learning disabilities (LLD) students on both paper based and computer based tests of reading comprehension. However, LLD students did perform better on the computer based test than the paper based one, but not significantly. Therefore, computer based programs may not be a main factor in success or failure of LLD students due to the lack of significance, but for some it may be beneficial.

Table 8

Computer-based and paper-based estimated marginal means & standard deviations

	Reading Comprehension Scores			
	Computer-based		Paper-based	
	M	SD	M	SD
TLD	68.08	18.35	74.28	17.40
LLD	50.74	19.21	48.56	21.59

Note. M = estimated marginal mean. SD = standard deviation. Adapted from Srivastava, P. & Gray, S. (October 2012). Computer-based and paper-based reading comprehension in adolescents with typical language development and language-learning disabilities. *Language, Speech, & Hearing Services in Schools*, 43(4), 424-437. doi:10.1044/0161-1461(2012/10-0108).

A positive correlation between AR and the achievement of students with LD was found in a study conducted by Nunnery, Ross, and McDonald (2006). They found that both the control and AR/RR group had improved their pre-test scores to post-test scores with the AR group having a greater improvement. When comparing the scores of the different grade levels it shows that there was a greater difference between pre-and post-test scores at third grade then at sixth grade. This indicates that there is a declining effect of AR as increase in grade level. One could conclude that as a student progresses up in grade the effectiveness of the AR program on increasing achievement decreases. A look at student attitudes may indicate a reason for this correlation.

Table 9

STAR Reading Scale Score Means by Grade and Treatment Status

Pre- and Post-test Reading Scale Scores									
	Third Grade		Fourth Grade		Fifth Grade		Sixth Grade		
	Control	AR/RR	Control	AR/RR	Control	AR/RR	Control	AR/RR	
Pre-test	241.8	249.4	335.6	333.8	397.4	436.5	519.8	564.9	
Post-test	315.6	383.3	385.3	405.0	435.1	484.6	592.3	652.9	

Note. AR/RR = Accelerated Reader/Reading Renaissance. Adapted from Nunnery, J.A., Ross, S.M., & McDonald, A. (2006). A Randomized experimental evaluation of the impact of Accelerated Reader/Reading Renaissance implementation on reading achievement in grades 3 to 6. *Journal of Education for Students Placed At-Risk* 11(1), 1-18.

The attitudes of good and poor readers show that good readers are more positive about their reading attitudes than poor readers in the areas of academic and recreational reading. In this same study by Mallette et al., (2004) low achieving males using AR had low self-perceptions in progress and social feedback. If low achieving males' self-perceptions are being affected by the use of AR then there is the chance that their reading achievement is also affected.

Not only can reading achievement be affected by one's attitude but also the level of AR usage. Participants in a study by Johnson and Howard (2003) looking at the effectiveness of AR and its dependence on the amount of usage showed that the AR program is effective in improving reading skills of the participants. The study also found that there was a main effect in concurrence with the level of AR usage and effectiveness. High participants, students who read the most, gained 2.24 years, average participants gained 1.52 years, and low participants gained

0.73 years; demonstrating that as the level of AR usage increases the comprehension level also increases.

Effects of Balanced Literacy Programs on Reading Achievement

The combination of skills and holistic components that are balanced is said to be excellent literacy instruction (Pressley, Roehrig, Bogner, Raphael, and Dolezal, 2002). Balanced or mixed method literacy instruction is another type of program that deserves a further look at the effects it has on reading achievement. Literacy instruction using a balanced program includes skills instruction such as phonics and comprehension strategies teaching and holistic literacy activities like reading authentic literature and writing responses to texts (Pressley et al.; Johnson as cited by Frey, Lee, Tollefson, Pass, & Massengill, 2005). A balanced literacy program can be both appropriate and beneficial to students who are struggling with learning to read and write (Pressley et al., 2002).

In response to low reading scores on national exams the state of California implemented curriculum called balanced reading instruction, hence the origination of balanced literacy in 1996 (California Department of Education; & Honig as cited by Frey et al., 2005). The philosophy of balanced literacy assumes that reading and writing are developed through instruction and support that take place in a variety of environments and with differing approaches. The community, home, and library as well as activities such as read alouds, guided reading, shared reading and independent reading and writing are all part of the this approach called balanced literacy (Frey et al., 2005).

According to Scholastic (2002, 2004b) studies have shown that “intensive, comprehensive instruction from scientifically research-based programs” significantly improve reading achievement (as cited by Fleishman, n.d.). READ 180 is just one of the programs that is

classified as a mixed method approach (Kim, Samson, Fitzgerald, & Hartry, 2009). READ 180 is a research-based reading intervention program based on ten years of research by experts at Vanderbilt University. The program is designed to offer struggling readers in grades 4-12 with a combination of instructional, modeled, and independent reading opportunities. (Fleishman, n.d.; Papalewis, 2004; WWC Intervention Report, 2009; Nave, 2007)

Research conducted on READ 180 has shown a positive effect on reading achievement in middle school students. In seven studies there was the potential for positive effects on comprehension and general literacy achievement (WWC Intervention Report, 2009). The READ 180 students gained approximately 3+ normal curve equivalents in reading and 2+ in language arts during the one year program study. (Papalewis, 2004; Fleishman, n.d.; Haslam, White, & Klinge, 2006) In the Papalewis study even though the district percentile ranks remained equal the READ 180 students gained four percentile ranks in reading and three in language arts. When a ‘t’ test was conducted to compare the READ students and comparison students there was a significant difference in NCEs for reading and language arts.

Table 10

Comparison READ 180 and Comparison Group for Reading and Language Arts NCEs Final

	Reading and Language Arts NCEs Final							
	Reading NCEs				Language Arts NCEs			
	1999-2000		2000-2001		1999-2000		2000-2001	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
READ 180	32.10	17.9	35.24	19.1	33.29	21.8	35.08	21.1
Comparison Group	32.44	16.3	25.78	14.3	33.10	17.8	30.44	18.1

Note from page 24. SD = Standard deviation. Adapted from Papalewis, R. (2004). Struggling middle school readers: Successful, accelerating intervention. *Reading Improvement*, 41(1), 24.

In a comparison of READ 180 group students and control group students looking at beginning and ending scores, there was a significant difference. Nave (2007) found that the READ 180 program is effective in improving reading-language art scores for both fifth and seventh graders, thus helping to close the achievement gap between struggling readers and their peers. READ 180 ending scores for fifth graders were on average 24.09 points higher while the control group had ending scores on average 2 points lower. READ 180 ending scores for seventh graders were on average 23.85 points higher while the control group had ending scores on average 8.27 points lower.

A positive correlation between READ 180 as an intervention and student achievement can be seen in several studies, but does the program duration have an effect on the scores of students participating? Two groups of students participating in the READ 180 program, one group who received the full ninety minute program and one group who received a modified sixty minute program, were used to examine the effect of program duration on achievement. Both groups were found to have improved achievement scores from pre- to post-test, thus showing that the program is effective in improving achievement scores even with a modified program. Table 8 shows pre- and post-test scores for the two groups on the TOWRE and GRADE reading tests. (Kim et al., 2010)

Table 11

READ 180 and District After-school comparison of pre- and post-test scores

Pre- and Post-test Total Scores on TOWRE and GRADE				
	TOWRE		GRADE	
	Pre-test	Post-test	Pre-test	Post-test
READ 180	89.32	95.92	90.99	92.54
District After-school	90.97	97.21	90.32	92.53

Note. READ 180 Group = full 90 minute READ 180 program. District After-school Group = modified 60 minute READ 180 program. TOWRE = word reading efficiency. GRADE = reading vocabulary and comprehension. Adapted from Kim, J. S., Samson, J. F., Fitzgerald, R., Hartry, A. (2010). A randomized experiment of a mixed-methods literacy intervention for struggling readers in grades 4-6: Effects on word reading efficiency, reading comprehension and vocabulary, and oral reading fluency. *Reading and Writing: An Interdisciplinary Journal*, 23(9), 1109-1129. doi:10.1007/s11145-009-9198-2

Finally, a look at how READ 180 affects the scores of special education students with goals in reading. In a professional paper sponsored by Scholastic, Fleishman (n.d) reported a positive finding after comparing the reading gains before and after using the program. The students were making an average of two to three months progress per year in reading achievement previous to using the program. After using the program 25 percent of the students made significant gains, and approximately eighteen percent of the students progressed enough to be exited from reading service in special education.

Conclusions and Recommendations

The purpose of this review is to examine research on reading programs meant to improve reading achievement in middle school students in grades 6-8. This review specifically examined the effects of Accelerated Reader on middle school students, effects of computer-based programs on at-risk students, and the effects of a balanced literacy program on reading achievement. There were inconsistent findings in the research review for the effects of AR on middle school students. A positive correlation between AR and improvements in reading achievement were found in studies conducted by Vollands et al., (1999) and Ross and Nunnery (2005), whereas Huang, (2012) and Melton et al., (2004) found no improvement in achievement. AR is intended to be a supplemental tool (Grenawalt, 2004; Solley, 2011; Stefl-Mabry, 2005) that provides teachers with information that allows them to make instructional decisions for individual students.

Teachers should question programs that use rewards and punishments as control devices according to McLaren (as cited in Biggers, 2001). AR is such a program, focusing on external motivation by rewarding students with points for books read and questions answered correctly that can be exchanged for tangible rewards. The literature published by Advantage Learning Systems (as cited by Biggers, 2001) suggests not praising students for the effort, even though this could benefit the student more than the points earned. Not acknowledging effort can cause students to be discouraged and avoid reading (Biggers, 2001). Often times the students who are earning the most points are those who are high achievers already. These students would earn the most points either way, proving Carter (as cited in Groce & Groce, 2005), that rewards devalue reading and lessen motivation to read. Also reward system like AR's is creating a learning system that is threatened by the withdrawal of such rewards. So if extrinsic motivators reduce internal motivations to read as Cameron and Pierce; Gambrell and Marinak; Sweet (as cited in

Biggers, 2001) suggest, when those external motivators are removed the internal motivation will also cease to exist. There have been studies conducted that show when students become dependent on the rewards they read less frequently and need more pushing to read when the reward is removed (Biggers, 2001; Huang, 2012).

Computer-based reading programs are not intended to be a “stand alone” program. Grenawalt (2004) recommends the importance of combining reading skills instruction with a computer-based reading program, such as a balanced literacy program to improve learning. The research conducted by Khan and Gorard (2012) on effectiveness of computer-based programs suggests that it may be hard to know the level of effectiveness the program has on “all” students because effectiveness was not conducted on individuals. The positive effects of READ 180 were found in studies conducted or reviewed by WWC Intervention Report, Papalewis (2004), Fleishman (n.d.), and Haslam et al., (2006). The research found that the READ 180 students gained approximately 3+ normal curve equivalents in reading and 2+ in language arts during the one year program study (Fleishman, n.d.; Haslam, White, & Klinge, 2006; Papalewis, 2004). A few of the READ 180 studies contained anecdotal information and were sponsored by the distributor, therefore empirical studies should be conducted for the balanced literacy program to confirm the results.

Since the accessibility of computers in schools is greater, educators are implementing computer-based programs to supplement the need for additional assistance for struggling readers (Stetter & Hughes, 2010). Mixed results were found for students that are in the category of at-risk. AR and RR were found to have positive effects on the reading achievement of at-risk students; this effect was greater in early grades and declined through the upper grades (Nunnery et al., 2006). However, no significant difference was found between the use of paper and

computer conditions for TLD and LLD students. This may mean that computer-based programs may not be a main factor in the success or failure of LLD students (Srivastava & Gray, 2012).

Concerns about the use of supplemental programs came up during the review of the research, making this researcher question their use. Supplemental programs such as AR award students prizes for meeting goals or receiving points on books tested over, these prizes can put unwanted pressure on students to read in ways that do not cultivate an avid reader (Lamme, 2003). Students have begun to cheat to receive these prizes making it difficult to know whether the results from the studies conducted were reliable and a true reflection of the student's ability (Huang, 2012). According to research reviewed by Stephen Krashen (2005) there is no way to know for sure which aspects of the AR program brought on gains in achievement. Was it the books and time to read or the quizzes and prizes (2005)? Mixed results of motivation were found in the studies reviewed; Mallette et al., (2004) as well as Vollandts et al., (1999) found that AR resulted in positive attitudes toward reading. Unlike others Huang (2012) found that AR resulted in negative results with students claiming that the reading requirements were unmanageable. Pavonetti et al., (2003) research found that being exposed to AR did not make it more likely that students would read once AR stopped therefore not upholding the notion that AR creates life-long readers. Understanding what drives a student to read is important in understanding what types of programs will be best for students. Each student is different and there is not one program that can be totally effective for all students. A supplemental program cannot be effective if the participants are unwilling to participate (Johnson & Howard, 2003).

Using a computerized reading tool has never been cited as a determining factor in the performance of students and schools with high achievement rates (Biggers, 2001), therefore one should be cautious when exploring the idea of implementing such programs. Caution should

also be placed on programs with unknown or varying effects (Mallette et al., 2004) because the effects may be longer last than we assume. Educators must not be distracted by promises of what can be short-term gains. The focus tends to be on year-to-year comparisons of state and national assessments instead of students' ability to think critically and creatively for the joy of learning (Pavonetti et al., 2003).

People in children's lives that are readers and discuss books are those who influence and transform young children into avid, lifelong readers (Pavonetti et al., 2003). According to Rosenblatt (1995) there are two types of reading a text, efferent and aesthetic. Aesthetic reading is becoming absorbed in a book and living vicariously through the characters, creating a life-long reader. Efferent reading is seeking information from what you read. The concentration level of students declines when they know they have to take a test when they finish reading, changing the type of reading. AR tests examine the memorization of facts, not the deeper themes or issues. These types of tests turn reading from an aesthetic experience to an efferent one. Therefore, tests such as those of a reading incentive program like AR negatively affect becoming an avid reader (Pavonetti et al., 2003).

From the information presented one could conclude that the one thing that seems to be missing is the direct reading instruction. The teacher's role appears to only be that of a monitor, even though the developers argue that the teachers modify the instruction based on the data they receive about the student and instruction is adjusted accordingly, but is not to take place during the independent reading time (Mallette et al., 2004; Nunnery et al., 2006).

When looking to implement reading programs educators need to examine all available research and consider the credibility of the author(s). Take the AR research for example, there are 155 studies posted on the Renaissance Learning website and of those, 26 were conducted by

Renaissance Learning themselves or researchers associated with the company (Luck, 2010). The What Works Clearinghouse of the U.S. Department of Education (2010) reviewed 318 studies on the effects of AR on adolescent learners. Of those studies only one meets the WWC's evidence standards and another meets the WWC's evidence standards with reservations. One should be cautious of the results reported by researchers reviewed in this literature review as the studies may not be well organized and report misleading results.

The results of this review indicate that further studies should be conducted to examine the effects reading programs have on student achievement. Additional studies could look for what motivates students to read and whether one motivational factor outweighs others in increasing reading achievement. Studies that explore the reasons for a decline in achievement of upper grade level students using AR would be helpful to educators looking for evidence to support the use or not of AR. The use of balanced literacy and AR programs to improve achievement continue to be an area of that needs more studies conducted. More qualitative studies should be conducted to explore the effects of computer-based learning programs on individual students.

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